

June 1, 1937.

C. W. BONDURANT

2,082,534

APPARATUS FOR FILLING LIQUID RECEPTACLES

Filed March 6, 1934

4 Sheets-Sheet 1

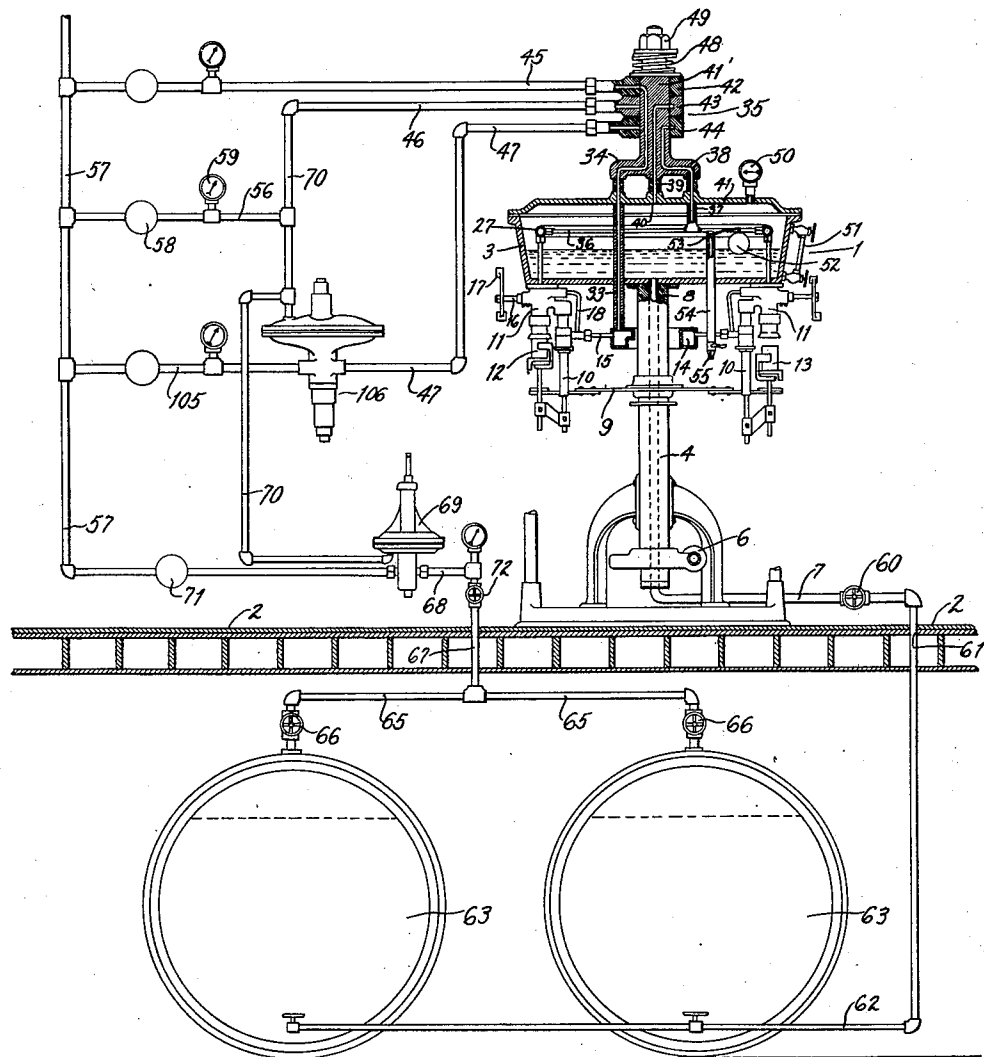


Fig. 1.

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4 Sheets-Sheet 2

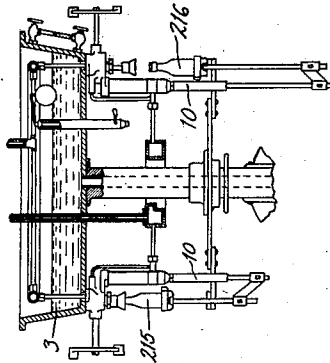


Fig. 2.

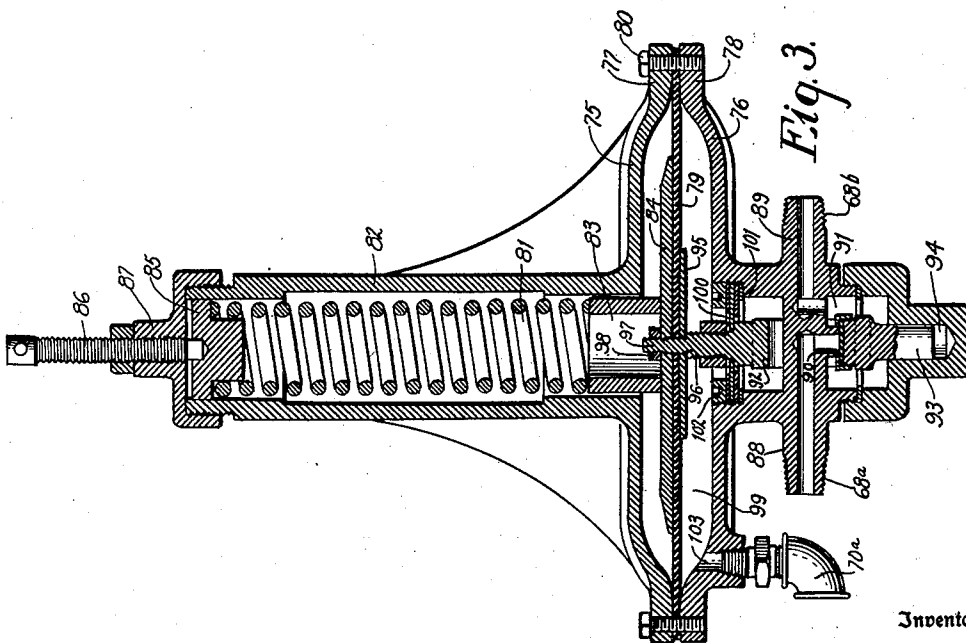


Fig. 3.

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4 Sheets-Sheet 3

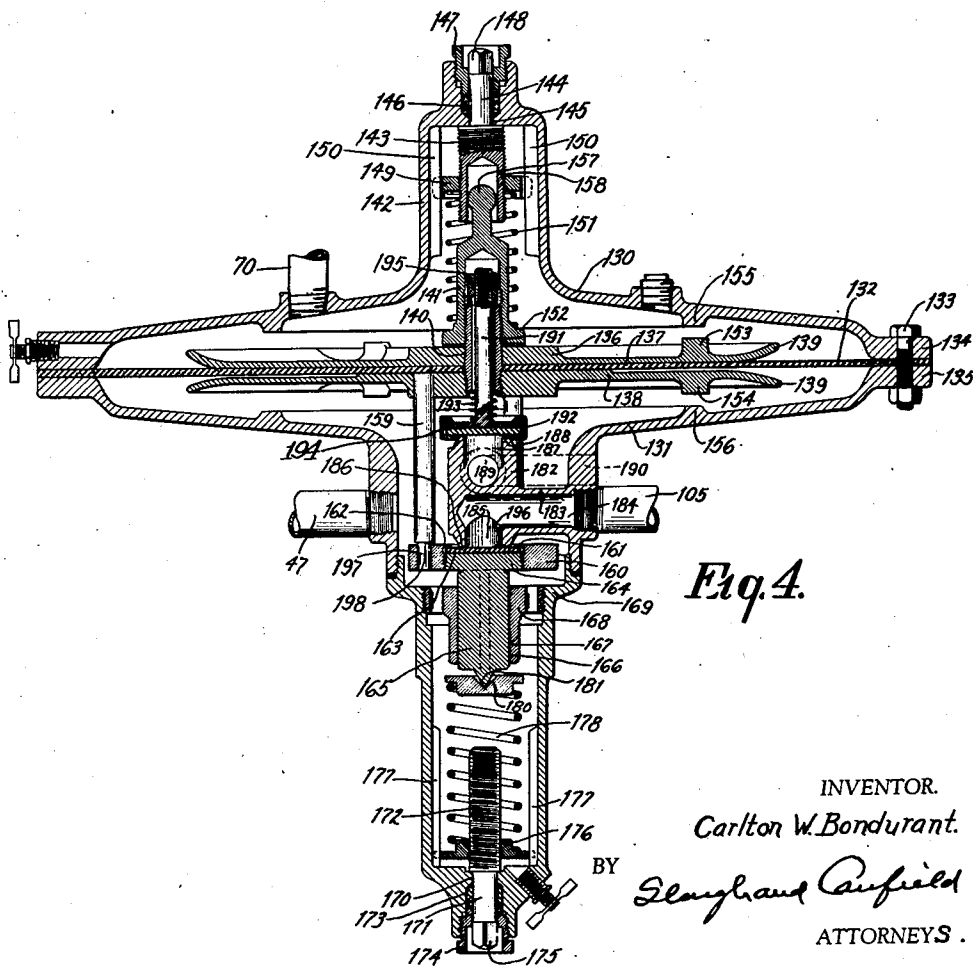


Fig. 4.

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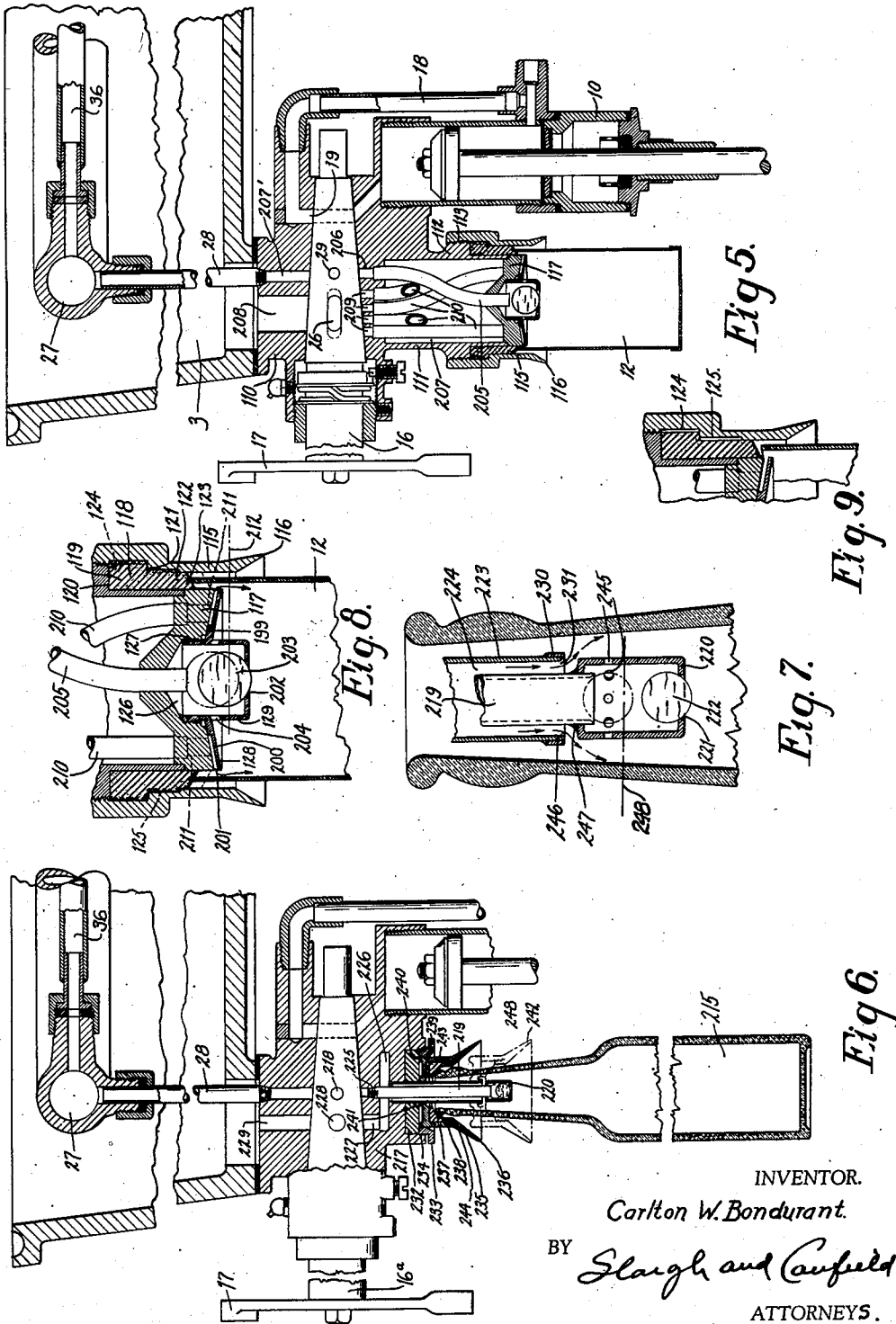
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APPARATUS FOR FILLING LIQUID RECEPTACLES

Filed March 6, 1934

4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,082,534

APPARATUS FOR FILLING LIQUID
RECEPTACLES

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Application March 6, 1934, Serial No. 714,288

16 Claims. (Cl. 226—114)

This invention relates to methods and apparatus for filling receptacles, such as bottles, cans and the like, with a gas contained beverage, and particularly to methods and apparatus for this purpose of the type wherein a plurality of bottles, cans or the like, continuously fed to a machine, are automatically and successively filled with a gas contained beverage such as beer, carbonated beverages or the like.

Prior to my invention filling of bottles and the like has been accomplished in a well known manner involving the application of counter-pressure gas to the receptacle in advance of the introduction of the beer or carbonated beverage in order to achieve the filling of the bottle under conditions of pressure which minimizes the tendency of gas previously absorbed in the beverage to escape therefrom at the surface causing in the case of beer undesirable foaming.

Also in the prior patent to Frederick W. Muller, No. 1,919,665, dated July 25, 1933, there is disclosed a prior method of filling bottles to a predetermined height involving the balancing of the gravitational and pressure forces inducing flow of the beverage into the bottle by the counter-pressure gas admitted to the bottle in advance of the filling.

I find that the filling of bottles accomplished in his manner is undesirably slow, since the filling is accomplished at a progressively lower rate as the balance in pressures is approached toward the end of the filling period.

In the prior constructions the beverage is commonly introduced into the bottle or other container through a long filling tube having its discharge mouth disposed adjacent the bottom of the bottle in order to minimize agitation of the beverage during filling. The introduction and removal of the relatively long filling tube involves a relatively great vertical movement of the bottle and filling tube, which is objectionable from the standpoint of cost of construction, additional vertical space required for the mechanism, and additional time added to the operation.

It is an object of my invention to provide an improved method and apparatus adaptable to fill bottles, cans, and other liquid receptacles to a predetermined height of gas contained liquid in the receptacle.

Another object is to provide an improved method and apparatus for filling liquid receptacles with gas contained beverage more rapidly than heretofore has been possible whereby the maximum number of receptacles may be filled

in the minimum of time and all to the same height of liquid in the receptacle.

Another object is to provide a method and apparatus particularly adapted to the filling of large-mouthed receptacles, such for example as cans, with liquid containing absorbed gas and with the minimum loss of gas from the liquid.

Another object is to provide a method and apparatus for filling with gas contained beverage, receptacles such as bottles, cans and the like, of the type in which the mouth of the receptacle is moved to seal it upon a filling head construction before introducing the liquid therein, having improved means whereby the minimum of movement of the receptacle toward and from the filling head will suffice, in order to shorten the time consumed by this operation.

Another object is to provide, in a method and apparatus for filling receptacles with liquid containing gas absorbed therein, such for example as beer, improved means for introducing the liquid into the receptacle with the minimum of agitation thereof to substantially prevent escape of gas from the liquid.

Another object is to provide, in an apparatus for filling receptacles such as bottles, cans and the like, with gas contained liquid, improved filling means for introducing the liquid into the receptacle along the inner wall thereof whereby to prevent undue agitation of the liquid.

Another object is to provide, in an apparatus and method of the class referred to, improved means for maintaining the liquid flow inducing pressure at a substantially constant value relative to the flow retarding counter-pressure even under the tendency for it to vary, due to leakage of receptacle counter-pressure occasioned by broken or chipped or leaking bottles, cans or like receptacles.

Another object is to provide, in a liquid receptacle filling method an apparatus of the class referred to, improved means whereby the receptacle may be filled completely or to any predetermined level as closely proximate to the mouth of the receptacle as may be desired.

Another object of my invention is to provide for filling of receptacles of the class described with beer or other gas contained liquid in a manner whereby the introduction or removal of the filling head to the receptacle may be accomplished in an improved manner without undue waste or agitation of the beverage.

Other objects will be apparent to those skilled in the art to which my invention appertains.

My invention is fully disclosed in the following

description taken in connection with the accompanying drawings, in which:

Fig. 1 is a view illustrating, partly diagrammatically, a liquid receptacle filling machine or apparatus and a reservoir beverage supply and conduit connections and controlling apparatus associated therewith embodying my invention and whereby the method of my invention may be practiced when the receptacle to be filled is a can or other large-mouthed receptacle;

Fig. 2 is a view similar to Fig. 1 illustrating, fragmentarily, an embodiment of my invention applied to the filling of bottles;

Fig. 3 is a cross-sectional view of a compensator valve mechanism which I may employ in connection with the apparatus of Figs. 1 and 2 and which is shown in Fig. 1 to a smaller scale;

Fig. 4 is a longitudinal sectional view to an enlarged scale of a counter-pressure regulating valve mechanism embodying a part of my invention and which I may employ in connection with the apparatus of Figs. 1 and 2 and which is illustrated in Fig. 1 to a smaller scale;

Fig. 5 is a fragmentary sectional view of a part of the machine of Fig. 1 drawn to a larger scale and illustrating a valve mechanism shown in elevation in Fig. 1 and which I may employ to control the flow of liquid to the receptacle to be filled when it is a can or large-mouthed receptacle;

Fig. 6 is a view similar to Fig. 5 but illustrating the valve mechanism when the receptacle to be filled is a bottle;

Fig. 7 is a fragmentary view to an enlarged scale of a part of Fig. 6;

Fig. 8 is a fragmentary view, to an enlarged scale, of a part of Fig. 5; and

Fig. 9 is a fragmentary view similar to part of Fig. 8, but with parts thereof in different positions.

My invention will in the following first be described as applied to the filling of cans or other large-mouthed liquid receptacles. Referring to the drawings, I have shown generally at 1 a can filling machine standing upon a floor 2, the machine comprising a beverage liquid supply tank 3 in the upper portion thereof. The tank 3 is rotatable with and supported upon a central tubular column 4 and rotating power therefor is supplied by a worm and gear mechanism 5.

A conduit 7 communicates with the interior of the tubular column 4 and interiorly thereof joins with a conduit 8 discharging into the tank 3 and a suitable rotary coupling (not shown) connects the conduit 7 with the conduit 8 whereby the tank 3 and conduit 8 may rotate relatively to the conduit 7.

A disc 9 rotates with the column 4 and supports a plurality of annularly disposed can lift devices 10—10 and can filling valve devices 11—11, the latter being shown separately and to a larger scale in Fig. 5. By the construction thus briefly described, it will be apparent that the tank 3 and the entire superstructure including the disc 9, can lift devices 10 and valves 11 may all be rotated as a unit with the tubular column 4.

The operations of the machine, generally, with respect to the mechanical movement transmitted to the cans, the operation of the valve devices 11 and filling of the cans from liquid in the tank 3 are similar to the operations described in the aforementioned Muller patent and need not be described in complete detail here.

It may suffice to say that generally the cans, two of which are indicated at 12 and 13, are

placed on the can lift devices 10—10, a relatively large number of which is provided. The lift devices are arranged to travel in a circular path as described above about the axis of the tubular column 4. The cans start in their movements from a depressed position such as that illustrated for the can 13 wherein filling has not yet been started and are moved to an elevated position illustrated for the can 12 wherein filling may be accomplished.

The different cans are progressively moved from the preliminary position 13 to the ultimate position 12 and are then filled and thence moved to a discharge position on the other side of the machine where they are again depressed from the filling position and are removed from contact with the filling valve structure 11, which will be described, and are then closed and sealed in any suitable manner well known in the art.

The form of the machine shown in the drawings is one adapted to continuously operate in connection with a continuous succession of cans, the operations being successive, overlapping and continuous from the time the cans are placed on the lift until they are removed therefrom after being carried in a rotative path around the machine.

In the following description of parts of the machine and their mode of operation more pertinent to the instant invention, reference will be had chiefly to the filling of a single can considering it as entering the apparatus as indicated at 12 and continuing until the can has been filled and removed from its supporting lift 10.

The lift devices 10 are operated by compressed air supplied, from a source and in a manner to be described, to a header 14 rotatable with the other parts of the superstructure described and connected by a conduit 15 to the lift device.

The valve device 11, shown separately in Fig. 5, comprises a rotatable valve element 16 rotatable to different successive positions by a crank 17 as the latter engages stationary abutments during the rotation of the machine superstructure, and may admit air from the header 14, the conduit 15 and branch conduit 18, (Figs. 1 and 5) through a valve port 19 either directly to the lift device 10 or to the atmosphere through a duct, not shown, to operate the lift device.

A valve and lift device like that herein briefly described and illustrated in simplified form is shown and described more completely in the above-mentioned Muller patent to which reference may be had for a more complete description.

It will be observed, however, that whereas in the said Muller patent, due to the fact that the receptacle is a bottle and that a filling tube is inserted in the bottle by the upward movement of the lifts, the upward and downward strokes of the lifts must effect a relatively great movement, in the machine under consideration here, the can being relatively short and no tube being inserted thereinto as will appear later, the stroke of the lift may be relatively short and therefore operated with only a fraction of the time required for the bottle lifts of the said patent.

The valve device 11, (see Fig. 5) comprises a main frame or body 110 within which the rotatable valve element 16 is rotatably mounted. Depending from the body 110 is a generally cylindrical chamber 207 having a wall 111 provided intermediately with an external flange 112 peripherally threaded at 113. A depending skirt 115 of generally tubular form is threaded

on the flange 112 and at its lower end is flared outwardly as at 116 to serve as a guiding bell to center cans or the like therein when elevated thereto in a manner to be described. The lower end of the chamber wall 111 is closed by a transverse head 117 of approximately the same outside diameter as the skirt wall 111. There is thus provided an annular space between the wall 111 and the skirt 115 in which is placed a packing 118 comprising an annular upper portion 119 disposed between vertically spaced shoulders 120 and 121 respectively on the underside of the flange 112 and on the inner wall of the skirt 115. The packing 118 is thus fixed against axial movement in either direction. The lower part thereof is elongated axially into a relatively thick walled tube 122, the lower end of which is of frusto-conical form as at 123. An annular chamber 124 is provided in the inner wall of the skirt 115 above the lower end of the tubular portion 122 of the packing into which the material of the packing may expand in a manner and for a purpose to be described.

The head 117 is relatively thick axially and has a downwardly open recess 126 axially thereof, the wall of which is threaded as at 127. The lower face of the head 117, outwardly radially of the recess 126, is of frusto-conical form downwardly outwardly flaring as at 128. A nozzle piece 129, generally in the form of an upwardly open cup, has its outer wall threaded on the upper portions thereof and screwed onto the threads 127 to secure it rigidly to the head 117. An annular flange 199 surrounds the nozzle piece 129 externally thereof and in an intermediate portion thereof, which, when the nozzle piece is screwed into the threaded cavity 126, engages and seats upon adjacent portions of the frusto-conical surface 128 of the head. The flange 199 has an outer portion 200 thinner than the main flange 199 providing a space 201 between the flange 200 and the surface 128. The space 201 as shown in the drawings is annular and is relatively thin axially of the head 117 and on radial sections is downwardly outwardly inclined.

The bottom of the cup-form nozzle piece 129 has a perforation 202 therein upon the periphery of which is normally seated a float valve ball 203 of a size to only partly fill the cup-form nozzle piece. A plurality of perforations 204-204 is provided in an annular series in the lateral wall of the cup-form nozzle piece 129 immediately under the flange 199 and preferably on downwardly outwardly inclined axes.

A counter-pressure gas tube 205 is projected through the upper portion of the head 117 and opens into the cavity 126 directly above the ball 203, and the cavity has guiding wall portions adjacent the ball so that the ball 203, when it floats upwardly in a manner to be described, may invariably seat itself upon the lower end of the tube 205 to close and seal the same. The tube extends upwardly through the chamber 207 and at its upper end is sealed in the body 110 in communication with a duct 206. The valve rotary member 16 has a valve port 29 there-through which, when the valve element 16 is rotated to a suitable position in the operation of the machine, connects the duct 206 with a duct 207 sealed upon the end of a conduit 28 connected to a counter-pressure header 27 to be described.

The body 110 has also a large duct 208 com-

municating with the interior of the filling tank 3. The valve element 16 has a relatively large valve port 26 therein which, when the valve element is rotated to a suitable position, effects communication between the duct 208 and a plurality such as four ducts 209-209. A corresponding plurality of tubes 210 sealed to the ducts 209 extends downwardly through the chamber 207 and are sealedly connected to a corresponding plurality of ducts 211-211 extending through the head 117 and opening into the space 201, the ducts 211 being distributed symmetrically around the head 117.

In the operation of the parts just described, when the can is lifted as above referred to, the upper or mouth end thereof is guided by the shape of the bell 116 into engagement with the lower annular edge of the thick walled packing 118, and by continued movement compresses this packing axially, causing it to expand into the annular chamber 124. Preferably, a packing of highly compressible rubber is employed and thus the open end of the can after engagement with the packing to seal it thereon, may have considerable upward or axial movement due to the compressible yielding of the packing which, as will now be clear, causes the lower portions of the head 117 and nozzle piece 129 to extend into the can and displace a substantial part of the volume thereof.

The can in this position is indicated in Fig. 5 in broken lines.

The can is now ready to be filled and the valve 16 is turned another part of a revolution which opens the port 26 in the valve, effecting communication between the interior of the tank and the filling tubes 210-210, allowing liquid in the tank to flow through the tubes 210, and outwardly radially through the space 201, into the can, the liquid being directed by the inclination of the said space to impinge upon the inner wall of the can and flow downwardly thereover. At the same time, air or other gas is admitted from a header 27 through the conduit 28, duct 207, through a second valve port 29 and thence through the duct 206, tube 205 into the nozzle piece 129 and thence through the perforations 204-204 and into the can.

As will be more fully described, liquid in the supply tank 3 is under pressure of gas above the level of the liquid. The air or gas pressure applied to the interior of the can 12 from the header 27 as just described is, in a manner to be described, adjustable in value. In the preferred practice of my invention, the pressure is substantially the same as the pressure in the tank 3 above the liquid but may be slightly in excess of that pressure by any desired amount. Thus the resulting motivating force which causes liquid to flow from the tank into the can through the space 201, is the hydraulic head of liquid in the space 201, tubes 210 etc., or is this head minus the excess of pressure of the air or other gas applied to the can interior over and above the pressure in the tank above the liquid.

Whether the pressure applied to the can interior from the header 27 is to be adjusted to be the same as the pressure in the tank above the liquid or in excess of the same or less than the same, will be determined by the nature of the liquid with which the can is to be filled and the rapidity with which it may be allowed to flow into the can without agitating the same unduly and causing an undue amount of absorbed gas to escape from the liquid.

In order that the cans may be filled in the shortest time permissible, the pressure in the header 27 is adjusted to be as low as permissible and at the same time avoid undue agitation and loss of gas referred to. I have found in practice that with beverages such as beer, the header pressure may be adjusted to be substantially equal to that in the tank above the liquid, which in practice may be about six pounds per square inch, so that the liquid flows into the can through the filling conduit system described by the unopposed hydraulic head thereof.

The beverage liquid thus flows rapidly into the can, filling it, and the air or other gas therein under the applied pressure is forced out of the can back up through the perforations 204—204 into the nozzle piece 129, tube 205 and back through the valve port 29 into the header 27.

The rising level of liquid in the can finally reaches the perforation 202 and flows into the nozzle piece 129 and lifts the valve ball 203 and finally causes the ball to close the mouth of the tube 205, thus shutting off further escape of air from the can and thereby stopping further flow of liquid into the can. The height of level in the can will now be that indicated approximately by the line 212, the height depending upon the size and proportion of the parts as will be understood and upon the depth to which the float ball 203 floats in the liquid as it rises. It is to be particularly noted that during the filling operation above described, the liquid moves from the annular outlet at the periphery of the annular space 201 with only a short movement until it impinges upon the inner wall of the can and the stream of liquid is, by the inclination of the space 201, directed generally downwardly; and that for a relatively thin space 201, a relatively large cross-sectional stream of beverage may discharge from the periphery of the space whereby the velocity of the beverage leaving the space may be relatively slow although the quantity thereof and total rate of flow may be large; all of these features additively providing for a rapid flow of liquid into the can with the minimum of agitation thereof and loss of gas thereby.

Furthermore, it is to be noted that the perforations 204 incline upwardly inwardly and are disposed under the upwardly inwardly inclined flange 200 whereby air is not trapped in the device by the upwardly rising level of liquid and may flow without obstruction back into the header system as described, the stream of air being directed toward the perforations 204 by the upwardly inwardly inclining flange 200. In practice I have found that the space 201 may suitably be about $\frac{1}{16}$ " in the vertical dimension.

The valve 16 may now be turned to shut off the ports 26 and 29 and to open the port 19 above referred to to operate the can lift device 10 to lower the can. At this time as will be understood, the space above the liquid in the can is under the pressure of the counter-pressure air or gas supplied thereto which may be, as stated, six pounds per square inch. If therefore the upper edge or mouth of the can be suddenly withdrawn from the packing 18, the sudden expansion of the air or gas in the can would be in the nature of an explosion and would cause beer or foam therefrom to be blown out of the can. By the construction above described, however, as the can is moved downwardly, the lower annular edge 123 of the packing follows the can downwardly, maintaining the seal thereof while the material of the packing moves out from the annular chambers 124 and 125, restoring the pack-

ing to its normal form and relatively withdrawing the head 117 and nozzle piece 129 out of the can and thereby increasing the volume of the space in the can above the liquid and consequently reducing the pressure therein. By suitably proportioning the parts and the relative retractive movement of the filling parts within the can as just referred to, the pressure in the can may be restored substantially to atmospheric pressure at the time the can edge leaves the edge 123 of the packing whereby loss of liquid will be completely prevented.

Liquid in the nozzle piece 129 will flow outwardly into the can as it is withdrawn through the perforation 202. But liquid in the space 201 will not flow thereout of, being retained therein and in the tubes 210 inasmuch as the upper ends of the tubes are closed off and the tubes and the space 201 are filled with liquid and the annular peripheral mouth of the space 201 is subjected to atmospheric pressure.

When the can reaches the bottom of its movement, it will be slightly below the lower end of the bell 116 and may be removed in the operation of the machine.

As will now be apparent, in the filling of the can liquid will flow very rapidly thereinto, not only at the beginning of the filling operation, but at the end thereof as distinguished from those receptacle-filling methods in which counter pressure in the receptacle balances the hydraulic head and the tank pressure at the attainment of the final level in the can, the rate of filling in such systems becoming slower and slower and ultimately stopping when the receptacle is filled.

Furthermore, as will now be clear, cans filled as above described may have the liquid level therein as near to the mouth of the can as desired. Preferably, however, a small air space is left at the top of the can to facilitate closing and sealing the same for well known reasons.

The compressed air header 14 is supplied with compressed air through a conduit 33 carried through the tank 3 and communicating with a radial arm 34 on a rotary coupling device shown generally at 35, to be described. The header 27 45 in the tank 3 communicates by a conduit or pipe 36 with a vertical pipe 37 in the tank 3, which passes outwardly through the tank and communicates with a radially disposed arm 38 on the device 35. A third arm 39 on the device communicates with the interior of the tank 3 by a short conduit 40 at the top or cover 41 of the tank.

The rotary coupling device 35 comprises a cylindrical body 41' adapted to rotate with the tank within stationary couplings 42, 43, 44 telescoped and sealed thereon, and each of the couplings communicating interiorly with external stationary conduits 45, 46, 47 respectively. An internal duct in the body 41' communicates at one end with the coupling 42 and through the arm 34 with the conduit 33; and an internal duct communicates with the coupling 43 and the duct 40; and an internal duct communicates with the coupling 44 through the arm 38 with the conduit 37.

Thus, open communication is at all times maintained between the conduits 45, 46 and 47, and the conduit 33 supplying compressed air to the head 14, and the conduit 40 communicating with the tank 3 and the conduit 37 supplying air or gas under pressure to the head 27 respectively; and during rotation of the tank and its superstructure as described relative to the conduits 45, 46 and 47.

The couplings 42, 43 and 44 may be sealed on the cylindrical body 41 in any suitable manner as for example by pressing the couplings together by a compression spring 48 under a nut 49 on the body. This construction may be variously modified and does not constitute an essential part of my present invention.

The foregoing description applies particularly to the can filling machine proper and there will now be described means for continuously supplying liquid to the tank 3 to replace that which flows into the can and for maintaining the liquid in the tank 3 at substantially a constant level and at a predetermined pressure of gas above the liquid surface in the tank; and for establishing the liquid level and tank pressure upon starting up the machine.

The tank 3 at a point well above the desired level of liquid and preferably in the cover 41 thereof is provided with a pressure gauge 50. Laterally of the tank 3 a liquid level indicating gauge 51 of the conventional glass tube type is provided communicating with the interior of the tank above and below the desired level. Within the tank a float valve is provided comprising a float 52 in the liquid, adapted, upon rising with a rise of liquid level, to close a valve port at 53 in the upper end of a pipe 54 which pipe extends downwardly through the bottom of the tank, and below the tank is provided with a vent valve 55 manually operable.

The conduit 46 which communicates with the interior of the tank through the conduit 40 as described, connects by a conduit 56 with a conduit 57 which is connected to a source of gas pressure supply. The pressure supply may be a supply of compressed air provided by a pump or other means; or it may be a supply of other gas under pressure, such for example as carbon-dioxide. The conduit 56 may be manually controlled by a valve 58 and a supplemental gauge 59 may be provided in the line of the conduit 56 if desired.

The conduit 7 above described has in the line thereof a manually operable valve 60. The conduit 7 continues along the floor 2, downwardly therethrough as at 61, to a basement or lower floor of the building in which the machine is installed and connects to a conduit 62 which communicates with the interior of a plurality such as two or more large capacity reservoirs or tanks, commonly known in this art as government tanks, 63-63. The communication with the tanks 63 is effected preferably at a point relatively low in the reservoir but not at the bottom thereof whereby dregs may accumulate on the bottom of the tank without being discharged out through the conduit 62.

At an upper portion of each reservoir 63, a conduit 65 is connected, communicating with the interior of the tank through a manually operable valve 66; and connected with the conduit 65 is a conduit 67 passing upwardly through the floor 2 and joining a conduit 68, which is connected to the conduit 57.

In the line of the conduit 68 is connected a compensator valve device, indicated generally at 69. Communicating with the device 69 is also a counter-pressure conduit 70 joining the conduit 46 and thus communicating with the interior of the tank 3 at 40. The compensator valve device 69 will be more fully described later.

The reservoirs or government tanks 63-63 are filled, or substantially filled, with beer or liquid to be canned, and when the liquid has all been discharged therefrom and canned in a manner

to be described, these tanks are disconnected from the system and cleaned out to remove the dregs from the bottom thereof and are then re-filled from a manufactured supply. A cycle of operations for the bottle filling machine is thus established determined by the joint capacity of the tanks 63. At the end of this cycle, the bottling machine must either be shut down or the conduits 7 and 67 must be disconnected and connected to another set of tanks 63 to start a new cycle.

At the beginning of each cycle it is necessary or desirable to establish initially or reestablish the liquid level and pressure in the tank 3, and this operation will now be described in connection with the apparatus above referred to.

The rotation of the tank 3 is stopped and all of the valves 16 are turned to the off position manually. The valve 60 in the conduit line 7 is closed and the pressure supplied to the tank 63 is closed, either by a valve 71 or a valve 72 in the conduit line 68.

After the tanks 63 have been cleaned out and re-filled or connections have been made to a supplemental set of tanks, the valve 58 in the conduit line 56 is opened admitting the pressure of a supply of air or gas therethrough the conduit 70 whereby the pressure is communicated to the conduit 46 and the conduit 40 to the interior of the tank 3. The pressure in the tank is thus permitted to increase until it indicates a predetermined pressure such as six pounds on the gauge 50. The valve 58 may then be closed. The valve 71 or 72, or both, are then opened to admit the supply pressure to the tanks 63 above the liquid therein. The valve 60 is then slowly opened and beer is forced out of the tank 63 upwardly through the conduits 7 and 8 into the tank 3.

It is assumed that at this time the level of the liquid in the tank 3 is below the normal predetermined desired level and therefore the float 52 is in a lowered position which holds open the valve port 53. As the liquid flows into the tank 3 its rising level is indicated on the gauge 51. To insure that it will rise to the correct level, the vent 55 is partly opened manually to allow some of the gas in the tank to escape and to be replaced by liquid. When a desired level has been reached, the float 52 closes the valve port 53 and then the vent 55 is opened its full amount for subsequent release purposes. Venting at the vent 55 ceases when liquid has reached its correct level. The rising level of liquid in the tank 3 tends to increase the pressure above its surface as indicated on the gauge 50. Until the predetermined level is reached, the gas above the liquid may escape through the vent 55 so that regardless of the pressure above the liquid, the liquid will continue to rise to the predetermined level. But in all cases and at all times, the pressure in the tank above the liquid is prevented from rising from the predetermined value such as six pounds regardless of the value of the pressure externally applied to the reservoirs 63, by the compensator valve device which will now be described.

Upon establishing the predetermined level in the tank and at the predetermined pressure, the machine may be revolved and the canning process resumed. As the liquid rises in the tank 3, the air which was introduced therinto is displaced by gas emanating from the beer, carbonated beverage or like liquid supplied to the tank. Thus the space in the tank above the liquid is cut off from contact with contaminating air,

when the source of pressure supply is compressed air.

The compensator valve device 69, shown separately in Fig. 3, comprises an upper housing 75 and a lower housing 76 having confronting annular flanges 77 and 78 between which is clamped a circular diaphragm 79 by bolts 80 projected through the flanges and the diaphragm.

The diaphragm 79 is normally flexed downwardly by a compression spring 81 in a tubular portion 82 of the housing 75, the lower end of the spring 81 communicating thrust to the diaphragm through a tubular head 83 upon which its lower end abuts and which rests upon a plate 84 on the upper side of the diaphragm. The upper end of the spring 81 abuts upon a head 85 axially adjustably movable in the tubular portion 82 by an adjusting screw 86 threaded in a cover 87 on the upper end of the tubular portion 82.

The lower housing 76 has ducts 88 and 89 leading thereinto through conduit connecting threaded nipple elements 88a and 88b whereby the ducts 88 and 89 may be connected in the line of the conduit 68 above described. Inwardly the duct 88 communicates with a ported valve seat 90 opening into a chamber 91 and the duct 89 communicates with the chamber 91.

A vertically movable valve element 92 guided on a lower portion thereof by a cylindrical extension 93 movable in a bore 94 of the lower housing engages the valve seat 90 in its upper position to close the duct 88. An upper portion of the valve element 92 is connected to the diaphragm 79, preferably by clamping the plate 84 on the upper side of the diaphragm and a plate 95 on the lower side thereof between a shoulder 96 at a reduced portion 97 of the valve element and a nut 98 threaded on the reduced portion. The valve element is thus movable with the diaphragm.

A chamber 99 in the lower housing 76 below the diaphragm 79 is sealed from the chamber 91 by a diaphragm 100 sealed at its central portion upon the valve element 92 and at its periphery sealed upon the housing 76, preferably being clamped between a shoulder 101 provided on the housing 76 and an annular nut 102 threaded into a suitable threaded bore in the housing 76.

A conduit connection 70a provides communication with the chamber 99 through a duct 103 and is adapted to be connected to the conduit 70 above described.

Pressure on the lower side of the diaphragm applied through the duct 103 from the conduit 70 may compress the spring 81 and lift the valve element 92 and close the duct 88. The reduction of said pressure will permit the spring 81 to move the diaphragm downwardly and open the duct 88 and effect communication from the duct 88 through the ported valve seat 90 into the chamber 91 and thence out through the duct 89.

In operation, the spring 81 is adjusted so that if the pressure in the tank 3 above the liquid, which pressure is transmitted from the tank through the conduit 40, conduit 70 and connection 70a, Fig. 3, to the lower side of the diaphragm, exceeds the predetermined pressure such as six pounds, the diaphragm 79 will be lifted against the tension of the spring 81 and close the communication through the conduit 68 and ducts 88 and 89 by closing the ported valve seat 90. This, as will now be understood, cuts off the supply of pressure from the conduit 57 to the reservoirs 63-63 and stops further supply of liquid to the

tank 3. If the pressure in the tank 3 correspondingly should fall, the spring 82 will effect opening of the ported valve seat 90 and admit pressure to the reservoirs 63 and admit more liquid to the tank 3 which, in turn, tends to compress the gas above the liquid and raise the pressure thereof to correspondingly prevent the addition of more liquid when the predetermined desired level has been reached.

The drawing of liquid from the tank 3 to fill the cans in the operation of the machine tends to reduce the pressure above the liquid in the tank and this, by means of the compensator valve described, effects the application of pressure to the reservoirs 63-63 to elevate more liquid into the tank 3 and restore the pressure therein. In practice the regulation is accomplished continuously so that the level in the tank and the pressure thereabove are maintained substantially constant.

If, due to any extraneous cause, pressure in the tank 3 above the liquid should increase in spite of the fact that outside pressure was cut off from the reservoirs 63 by the compensator valve, the liquid would tend to fall slightly, and, through the action of the float 52, would open the valve port 53 and vent some of the pressure through the vent valve 55 to restore the predetermined pressure. If, similarly, due to any extraneous cause, the pressure in the tank above the liquid should decrease, the compensator valve would effect application of pressure to the reservoirs 63-63 to restore the pressure in the tank 3 but at a higher level than the desired level. This could be counteracted by admitting gas under pressure into the conduits 56-70 by momentarily opening the valve 58 to restore the liquid to its former predetermined level and then again shutting off the valve 58 after which the apparatus will operate as described to maintain the level and pressure in the tank 3.

The change of pressure in the tank 3 by the referred to extraneous causes do not occur in the ordinary operation of the apparatus and when once the system is put into operation, it will operate over long periods of time maintaining the pressure and level in the tank 3 substantially constant. They are only mentioned here to show that the apparatus and system are operable to correct abnormal conditions which might arise.

The elements of the system and apparatus for applying counter-pressure to the interiors of the cans will now be described. A regulator device, shown generally at 106 in Fig. 1 and illustrated separately to a larger scale in Fig. 4, is connected to the conduits 70 and 47 and to a conduit 105 communicating with the pressure supply of air or other gas 57 in connection with the following construction.

The regulator valve device 106 comprises an upper housing portion 130 and a lower housing portion 131. A diaphragm 132 is clamped by bolts 133 between peripheral flanges 134 and 135 on the upper and lower housing portions respectively. The conduit 70 communicates with the interior of the housing portion 130 above the diaphragm 132 and the conduit 105 communicates with the interior of the housing portion 131 below the diaphragm. A head, indicated generally at 136, is secured to the central portion of the diaphragm 132 and comprises a pair of preferably circular plates 137 and 138 on the upper and lower sides respectively of the diaphragm, peripheral portions of the plates being flared away from the diaphragm as shown at 139-139

to permit large radius bending of the diaphragm around the edges of the plates. The central portions of the plates are thickened, and a tubular stud 140 is projected downwardly through the upper plate and threaded into the lower plate and a cup-form nut 141 is threaded on the stud 140 above the upper plate whereby the two plates may be clamped rigidly together on opposite sides of the diaphragm.

The upper housing portion 130 has an upwardly extending tubular extension 142. A rotary stud 143 within the extension 142 has a cylindrical shank 144 extending upwardly through a perforation 145 in the closed end of the tubular extension 142 and is sealed therein by a packing 146 and a gland nut 147, the shank 144 having a square or hexagonal end 148 projecting out of the nut 147 whereby the stud 143 may be rotated with a suitable wrench. The stud 143 has a traveling nut 149 thereon, peripheral portions of which are splined on a plurality of splines 150—150 whereby on rotation of the stud 143, the nut may be propelled longitudinally without rotation.

A compression spring 151 is disposed to abut at opposite ends upon the nut 149 and on a flange 152 of the cup-form nut 141. By this construction upon turning the stud 143, the tension of the spring 151 may be adjusted to adjust the resilient thrusts downwardly thereof upon the diaphragm 132.

The diaphragm plates 137 and 138 are provided with a plurality such as three elevated bosses 153 and 154, and the upper and lower housing portions 130 and 131 are provided with annular head portions 155 and 156 confronting the bosses 153 and 154 and adapted to be engaged by the bosses at extreme movements of the diaphragm 132 to suitable limit and stop the movements thereof.

The upper end of the nut 141 is of reduced diameter and has a ball 157 formed on the end thereof and axially slidably fitted in a suitable bore 158 in the stud 143 to guide the movements of the diaphragm. Depending from the plate 138 is a plurality such as three posts, 159, screw-threaded at their upper ends into the plate, and at their lower ends reduced in diameter as at 197 providing shoulders 198. The reduced portions 197 have free sliding movement in corresponding bores in a valve plate 160 having a central perforation 161 therethrough provided with an interior shoulder 162 against which is seated a sealing washer 163, the washer being retained in place against the shoulder by a head 164 screw-threaded into the perforation 161 to clamp the washer against the shoulder, the head 164 having an extension 165 axially slidably movable in a bore 166 formed in a guide 167 which, cooperating with the ball 157 and bore 158 above described, jointly guides the movements of the diaphragm.

The guide 167 may be provided in the form of a tube having a flange 168 screw-threaded into a downwardly extending co-axial tubular extension 169 of the lower housing portion 131. The lower end of the tubular extension 169 is generally closed but has a central perforation 170 through which extends the shank 171 of a rotatable stud 172 disposed in the extension. The shank 171 is sealed in the perforation by a packing 173 and the gland nut 174, the shank 171 projecting outwardly through the nut 174 and provided with a wrench-receiving end 175 for turning the stud 172.

A travelling nut 176 is threaded on the stud 172 and peripheral portions thereof are splined on a plurality of splines 177—177 whereby on turning the stud 172, the nut 176 may travel longitudinally without rotating. A compression spring 178 abuts at one end upon the nut 176 and on the other end abuts upon a head 179, the upper surface of which is provided centrally with a recess 180 into which projects a pointed projection 181 on the extension 165.

By this construction, the spring 178 exerts adjustable resilient thrust upon the lower side of the diaphragm through the extension 165, valve plate 160 and posts 159.

A valve seat head 182 is disposed under the diaphragm and within an adjacent portion of the tubular extension 169, supported by a stem 183 connected to the wall of the extension. The stem 183 has a duct 184 therein and the conduit 105 above referred to is threaded into the wall of the extension to communicate with the duct 184. Inwardly of the head 182 the duct 184 communicates with a valve port 185 having an annular valve seat 186 engaged by the sealing washer 163 above referred to and adapted to be opened and closed by downward and upward movements of the valve plate 160 in a manner to be described.

The upper end of the head 182 is provided with a similar opposite valve port 187 having an annular valve seat 188, and the port 187 communicates with a duct 189 which communicates through the metal of the tubular extension 169 with the atmosphere as at 190.

A valve comprising a stem 191 axially slidably guided in the bore of the tubular stud 140 carries on its lower end a valve 194 having a sealing washer 192 for sealing the valve seat 188 to close the port 187 and is normally resiliently pressed upon the seat by a spring 193 abutting at one end upon the lower end of the tubular stud 140 and at its other end upon the valve. The upper end of the stem 192 is threaded and carries a nut 195 adapted to engage the upper end of the threaded stud 140 to limit downward movement of the valve, the movement being adjustable by adjusting the nut.

According to the foregoing construction, movement of the diaphragm downwardly as viewed in the drawings will open the valve port 196 at the valve seat 186 by withdrawing the valve plate 160 and sealing washer 163 and establish communication from the conduit 105 to the interior of the housing portion 190 and apply the pressure in the conduit 105 to the lower side of the diaphragm 132. During this movement of the diaphragm, the spring 193 retains the valve 194 on the seat 188 and maintains the port 187 closed, the stem 191 sliding in the tubular stud 140. Upon downward movement of the diaphragm, the shoulders 198 on the posts 159 engage the upper side of the valve plate 160 and move it downwardly to open the port 196; and upon upward movement of the diaphragm, the valve plate 160 is stopped upon the valve seat 186, closing the port 196, and the shoulders 198 are withdrawn from the plate, the reduced portions 197 sliding in their bores in the plate. Thus the diaphragm may have a limited vertical up and down movement without disturbing the seal of the port 187.

Upon sufficient movement upwardly of the diaphragm, however, the upper end of the tubular stud 140 will pick up the nut 195 and therewith the stem 191, opening the valve port 189.

The conduit 70 is connected to the housing portion 130 to communicate with the interior thereof above the diaphragm 132.

In the operation of the regulator device above described in connection with the apparatus of Fig. 1, it will be observed that at all times the upper side of the diaphragm 132 is subjected to the pressure of the gas above the liquid of level in the filling tank by means of the conduit 70, tending to move the diaphragm downwardly. The spring 151 assists this gas pressure. At the time of starting up the apparatus, there is no opposing pressure on the lower side of the diaphragm 132 and therefore the diaphragm assumes its lowermost position closing the valve port 100 and opening the valve port 106.

Air or other gas under pressure from the conduit 57 is then admitted to the conduit 105 and it flows through the valve port 106 and into the housing below the diaphragm, and flowing also into and through the conduit 47 to the header 27 for application of pressure to can interiors as above described. The incoming gas or air causes an accumulation of pressure in the counter-pressure system just referred to and reaches a value sufficient to raise the diaphragm 132, permitting the valve port 106 to be closed by the spring 178, shutting off further increase of counter-pressure.

In as much as the counter-pressure on the diaphragm must oppose both the tank pressure in the conduit 70 and the spring 151, it may continue to increase until it is in excess over the gas pressure above the diaphragm by a predetermined amount necessary to compress the spring. In this way, the counter-pressure may always be greater than the tank gas pressure by any predetermined amount which can be varied by adjusting the tension of the spring 151.

Where it is desired to employ a can counter-pressure equal to the gas tank pressure, the tension of the spring 151 may be weakened until it is substantially ineffective.

In the operation of the can filling machine above described, when the liquid flowing into the cans forces the counter-pressure gas out of the cans, the air or gas in the counter-pressure system being discharged thereinto from a succession of cans, accumulates and causes the counter-pressure to increase. This, as will now be understood, causes the diaphragm 132 to be gradually moved upwardly and ultimately to open the valve port 100 whereupon counter-pressure or can air is vented through the port 100 and duct 100 to the atmosphere to lower or restore the counter-pressure to its desired predetermined value.

Normally the can filling machine may operate over substantial periods of time without the admission of additional counter-pressure air through the valve port 106 and may continuously or intermittently discharge excess can air through the conduit 100 to the atmosphere. Should the tank pressure above the liquid therein increase due to any extraneous cause, it will lower the diaphragm 132 from its normal position and admit more air to the counter-pressure system to maintain the predetermined pressure therein. Similarly, should the tank gas pressure decrease due to any extraneous cause, the diaphragm 132 will be raised by the excess of counter-pressure and vent a part thereof to establish the predetermined counter-pressure.

The spring 178 may be adjusted to counter-balance the weight of the parts and to prevent opening of the valve port 106 by pressure applied

through the conduit 105. Furthermore, adjusting the spring 151 alone would adjust the venting counter-pressure, and adjusting the spring 178 alone will adjust the value of counter-pressure at which more gas or air is admitted to the system. By adjusting either or both springs in the direction to assist the counter-pressure in moving the diaphragm upwardly, will reduce the predetermined pressure difference between the tank gas pressure and the can counter-pressure, if any, and therefore will cause the cans to fill more rapidly and vice versa, whereby the rate of filling may be adjusted.

As will now be understood from the foregoing description, in the operation of the machine as a whole, the interior of a can such as the can 12 is first subjected to pressure of air or other gas in the header 27 and then, as the liquid flows from the tank 3 into the can, the gaseous contents of the bottle are forced out and back into the header 27. Thus there is a tendency for pressure to accumulate in the conduit system 27-47 and a tendency for the can pressure to increase. This will tend to close the valve port 106 in the regulator device 100 and then to stop the supply of pressure through the conduit 105 from the outside source. To prevent the accumulation of pressure occasioned by adding the can air to the system, it may be vented to the atmosphere from the device 100 through the valve port 100 and duct 100. On the other hand, to maintain the can pressure to prevent its decreasing, the regulator 100 may admit pressure from the outside source. By adjusting the regulator 100, the counter or can pressure may be adjusted to regulate the rate at which the liquid flows into the can to thereby regulate the time of filling.

Both the regulator 100 and the compensator device 60 are controlled in their operation by pressure from the tank 3 in the conduit 7 to maintain the said relation between the counter-pressure and the pressure in the tank 3.

It will further appear that not only can the rate of flow of liquid into the can be adjustably regulated, but when once predetermined will remain fixed so that all cans successively will be filled in the same length of time, whereby the machine as a whole may be operated at the maximum rate without danger that some cans will be insufficiently filled and others filled too full.

In Figs. 2 and 6 I have illustrated a modification of my invention adapting it to the filling of bottles instead of cans. Referring to Fig. 2, a part of the apparatus of Fig. 1 is shown. At 215 and 216 are bottles in positions corresponding respectively to the cans 12 and 13 of Fig. 1, that is to say, at the bottom and at the top of the strokes of the lift device 10-10 and it will be understood that the lift devices as shown in Fig. 1 in connection with Fig. 5, may be employed in the arrangement of Fig. 2 by suitably providing a longer stroke. In Fig. 6 is illustrated a preferred construction of valve device and filling head which may be substituted for that of Fig. 5 when bottles instead of cans are to be filled.

Referring to Fig. 6, I have shown at 217 the main frame or body of the filling head in which a rotatable valve 16a is mounted rotatable by the crank 17. The conduit 28 communicating with the header 27 as hereinbefore described, may, when a valve port 218 is turned to a suitable position with the valve element 16a, effect communication with and supply counter-pressure to a tube 219 depending from the body 217 upon the

lower end of which is secured a ball housing 220 in the form of a cylindrical chamber disposed coaxially of the tube 219, the upper end wall of the cylindrical chamber being perforated and telescoped over the lower end of the tube and secured thereto, the lower end wall of the chamber being perforated as at 221. A float ball 222 is trapped in the ball housing 220 and normally may rest on the lower wall but may float upwardly in a manner to be described on liquid in the bottle to engage and close the lower end of the tube 219 in the nature of a valve. A circular series of perforations 245—245, see Fig. 7, is provided in the wall of the ball housing 220 adjacent the upper end thereof.

A filling tube 223 is telescoped over the counter-pressure tube 219 and is of sufficiently larger diameter to leave a substantial tubular space 224 around the tube 219. The upper end of the tube 223 is rigidly secured, for example as by threads 225 to the head 217 and at its upper end opens into a cavity 226 which communicates with a duct 227 so disposed that when a valve port 228 in the valve element 16a is rotated to a suitable position, communication will be established from the duct 227 and valve port 228 to a duct 229 open to the liquid contents of the filling tank 3.

The lower end of the filling tube 223 is provided with an exterior annular flange 230 on the lower end thereof, and the lower end of the filling tube 223 is spaced upwardly axially a small distance such as $\frac{1}{8}$ " from the upper outer end wall of the cylindrical ball housing 220, thus providing an annular laterally or radially directed discharge outlet 231 from the lower end of the filling tube 223. A packing in the form of a relatively thick highly compressible disc 232 is provided in the body 217 surrounding the filling tube 223 and is held in normal expanded condition and retained in place in the body by a gland nut 233 threaded into the body at 234.

A filling cap 235 comprising a downwardly outwardly flaring bell 236 and a downwardly open cup-form portion internally screw-threaded to an upper portion of the bell at 238 has in the cup bottom a perforation 239 through which the tube 223 is projected whereby the cap 235 as a whole may slide vertically longitudinally on the tube.

Externally the bottom of the cup-form portion 237 is formed to provide an annular bead 240 engageable with the lower surface of the packing disc 232, and internally the cup-form portion 237 is provided in the bottom thereof with an annular shoulder 241 which, when the cap device 235 is moved downwardly on the tube 223, may engage the annular flange 230 on the tube to limit the downward movement of the cap and provide a support therefor, the lowermost position of the cap being indicated in broken lines as at 242.

A bottle mouth sealing packing 243 is seated in the bottom of the cup-form portion 237, being retained in position by a shoulder 244 on the bell 236 and is centrally perforated to permit the flange 230 on the tube 223 to engage the shoulder 241 as above described.

In the operation of the form of my invention as shown in Figs. 2 and 6, when the bottle is at the bottom of the stroke or in the position 216 of Fig. 2, the bell 236 is in the position 242 of Fig. 6, being suspended by the engagement of the shoulder 241 with the flange 230 on the filling tube 223. When the bottle is lifted to move into the position 215 of Fig. 2, the upper end of the

bottle is guided by the bell 236 to axially align its mouth with the filling tube 223 and the upper end of the bottle engages the sealing packing 243 and thereby, by the upward movement of the bottle, lifts the cap 235, finally sealing the bead 240 thereof on the packing 232, the last part of the movement compressing this latter packing.

The rotatable valve element 16a is now turned another part of a revolution to turn the valve ports 228 and 218 to effect communication respectively as above described with the filling tank 3 and the header 27. Air or other gas under counter-pressure in the header 27 flows through the tube 219 and out of the perforation 245 into the bottle interior, and beer or other beverage in the tank 3 flows downwardly through the filling tube 223 and into the bottle. As the bottle fills with the liquid, the counter-pressure gas is forced upwardly above the liquid level back through the perforations 245 or the perforations and the perforation 221 and through the tube 219 back into the header 27. To this end the perforations 245 are preferably disposed at a higher level than the uppermost tube closing position of the ball 222, so that liquid will in no case be forced up into the tube 219. Furthermore, the central disposition of the perforations 245 and the direction of the flow of counter-pressure gas therethrough tends to draw this gas toward the center or axis of the bottle and to prevent it from interfering with the flow or agitating the flow of liquid into the bottle.

The outlet 231 as stated, due to the shape of the parts, directs the liquid laterally from the lower end of the tube 223 against the interior wall of the bottle. To facilitate this movement and to prevent undue agitation of the liquid, the lower end of the tube 223 may be rounded as at 246, Fig. 7, and the juncture of the lower end of the tube 219 and the upper end of the cylindrical ball housing 220 may likewise be rounded as at 247, thus effecting smooth flow without turbulence of the liquid downwardly and then outwardly laterally against the inner wall of the bottle, resulting in the minimum of agitation and minimum loss of gas from the liquid.

The annular periphery of the outlet 231 is of large circumference and although it may be only $\frac{1}{8}$ " thick or substantially the same thickness as the clearance space 224 between the inner and outer tubes 219 and 223, the area of such an outlet as will be understood is relatively large whereby, although the liquid may flow rapidly downwardly through the tubes, it will flow gently and slowly for the same volumetric rate of flow, against the wall of the bottle. The level of liquid in the bottle thus rises and when it reaches the lower end of the ball housing 220, it flows thereinto through the perforation 221 and picks up the ball 222 and finally seals it on the lower end of the tube 219, thereby shutting off further escape of counter-pressure gas from the bottle and consequently preventing further flow of liquid thereinto. The level of liquid will now be approximately at the line 248 which height of liquid in the bottle may be predetermined where desired, by the size and proportion of the parts, and the extent to which the tubes project into the bottle, and may in every case be below the perforations 245.

As stated in the description of filling cans, the pressure of the counter-pressure gas may be adjusted to the desired value, preferably approximately equal to the pressure in the tank 3 above the liquid whereby the liquid is caused to flow

into the bottle very rapidly and to fill it rapidly, the flow being rapid from the start to the completion of the filling.

When the bottle has been filled to the desired level, it is lowered by the lift device 10. Where a relatively thick and highly compressible packing 232 is employed, there will be a substantial downward movement of the bottle before seal is broken at the bead 240, so that when continued downward movement of the bottle and the cap 235 breaks the seal at the bead 240 thus admitting atmospheric pressure to the bottle interior through the perforation 239, the volume of the space above the liquid level will have been substantially increased by the relative withdrawal of the filling parts in the bottle, so that the sudden admission of outside air under atmospheric pressure will not cause the slight explosion which would otherwise occur and will not cause beer or foam to be blown out of the bottle.

Continued lowering of the bottle will deposit the cap 235 on the end of the tube 223 and will lower the end of the bottle below the bell 236, and the bottle may then be removed for capping in the well known manner.

In connection with the form of Figs. 2 and 6, control of pressure in the tank 3 and of counter-pressure in the header 27 may be effected in the same manner and by the same means as that described for the can-filling form.

In both the can filling and bottle filling apparatus described, undue agitation and loss of gas from the liquid is prevented both by the application of the counter-pressure to the receptacle interior and by directing the liquid upon the wall of the receptacle in a downwardly outwardly inclined direction in an unbroken stream.

My invention comprehends all modifications and changes which may be made within the scope of the appended claims.

I claim:

1. A filling head for the introduction of liquid to a receptacle comprising guide means for guiding the receptacle mouth to a suitable position for filling the receptacle from said head, a sealing ring engaged by the receptacle mouth surfaces, said head comprising fluid conducting passages, one of said passages provided for the introduction of liquid into an associated receptacle, and another of said passages permitting the escape of gas displaced by liquid supply to the receptacle through said first passage, a fitting on said head comprising a perforate float cage, and an outwardly directed peripheral flange, a float within the cage, said float having at least a substantial portion disposed below the level of the mouth of an associated receptacle when the receptacle is in sealed filling relation with said head, said float being adapted to stop gas escape through the said other passage when lifted by liquid rising within the receptacle to a predetermined level, said liquid passage terminating above said fitting flange so as to direct supplied liquid upon said flange, intraperipherally thereof, said flange deflecting introduced liquid outwardly against adjacent inner walls of the receptacle to restrain agitation of the liquid within the receptacle.

2. In a receptacle filling apparatus, a filler head provided with sealing means engageable and disengageable with the receptacle mouth upon movement thereof toward and from the sealing means to seal and unseal it, means including a passage in the head and a source of liquid for introducing liquid to the interior of the receptacle, a source of counter-pressure gas, a second

passage in the head for communicating counter-pressure to the receptacle interior and through which gas under pressure in the receptacle may escape during filling thereof, valve means on the head operable responsive to rise of liquid in the receptacle to a predetermined level therein below the mouth thereof, to stop further flow of liquid into the receptacle, means for cutting off communication from the source of counter-pressure gas to the receptacle interior leaving the receptacle interior under counter-pressure, a displacement element on the head extending into the receptacle during filling thereof and removable therefrom after filling by withdrawal of the receptacle, the sealing means being yieldable in the direction of movement of the receptacle mouth to cause the sealing means to maintain seal with the receptacle mouth during removal of the displacement element to cause the pressure in the receptacle to be reduced substantially to atmospheric pressure before unsealing of the receptacle mouth.

3. In a receptacle filling apparatus, a filler head, means for sealing a receptacle mouth upon the head, a source of liquid, said head having a plurality of liquid conduit passages for conducting liquid from the source into the receptacle, said conduit passages terminating at spaced points intraperipherally of a laterally directed narrow annular peripheral outlet so disposed adjacent the inner wall of the receptacle when the receptacle mouth is sealed upon the head, that liquid supplied through said conduit passages will be directed outwardly downwardly through said outlet in a thin stream against the wall of the receptacle to flow downwardly thereover, said head also having a conduit passage therethrough for the escape of gas from the receptacle during filling thereof, said gas passage terminating in a port on the head within the receptacle generally centrally of the annular outlet adjacent the receptacle mouth, means controlled by rise of liquid to a predetermined level to close the port and valve means to simultaneously open and simultaneously close the gas and liquid passages.

4. In a receptacle filling apparatus, a filler head, means for sealing a receptacle mouth upon the head, a source of liquid, said head having a plurality of passages therethrough for conducting liquid from the source into the receptacle, said passages when a receptacle is sealingly engaged with said head terminating at spaced points intraperipherally of a thin annular discharge outlet disposed so as to effect discharge of the liquid against the inner side walls of an associated receptacle to flow downwardly thereover, said head having a gas escape passage therethrough, terminating in a gas admission port therefor generally surrounded by said annular liquid discharge port and a valve for simultaneously opening and simultaneously closing the liquid and gas passages.

5. In a receptacle filling apparatus of the counter-pressure type, a filler head upon which the mouth of a receptacle to be filled may be sealed, nozzle means comprising a passageway for introducing liquid to the receptacle interior and a second separate passageway having no communication with the first passageway except through the bottle interior for applying counter-pressure gas to the receptacle interior and through which gas in the receptacle may escape during filling thereof, the nozzle means having an outwardly radially downwardly directed annular capillary outlet of frusto-conical form com-

communicating with the liquid passageway on an intermediate portion of the frusto-conical form for directing liquid upon the wall of the receptacle and the nozzle means supporting a ball valve cage within the annular outlet, the second passageway opening into the cage and being closable by the ball upon rise of liquid substantially to the said outlet.

6. A filling head for receptacles comprising a head body, annular sealing means surrounding the head body, outwardly flaring receptacle guide means projecting downwardly from said head body and embracing said sealing means, a disc-like deflector disposed at a fixed distance below the end of the head body and having a laterally extending skirt portion, and providing between the head body and the skirt portion an annular capillary discharge outlet, and conduit means to communicate liquid to the upper surface of said disc, said disc deflecting the liquid outwardly to discharge it upon the inner walls of the mouth of a receptacle when disposed in filling position in sealed relation with the sealing means below said head body.

7. In a receptacle filling apparatus, a filler head comprising sealing means upon which a mouth portion of a receptacle to be filled may be sealed, nozzle means on the head comprising conduit means for introducing liquid to the receptacle interior, means for introducing gas into the receptacle under pressure, means for shutting off flow of liquid into the receptacle when filled leaving the liquid in the receptacle under gas pressure, the sealing means surrounding the nozzle means, and the sealing means being contractible and expansible whereby upon relative movement of the receptacle and nozzle means, the receptacle may be sealed upon the sealing means and the nozzle means may be projected into the receptacle, maintaining the seal, said sealing means comprising a substantially tubular element of inherently resilient material adapted to be longitudinally compressed during the bottling operation by pressure engagement effected upon an end thereof by the mouth of the receptacle, compression of said sealing means adapted to increase the projection of said nozzle means into the receptacle and the sealing means adapted to maintain the seal upon withdrawal movement of the nozzle means after shutting off of liquid flow substantially until atmospheric pressure is attained in the receptacle.

8. In a receptacle filling apparatus, a filler head comprising sealing means upon which a mouth portion of a receptacle to be filled may be sealed, nozzle means on the head comprising a passageway for introducing liquid into the receptacle, and for introducing gas thereinto under pressure, means for shutting off liquid and gas after the receptacle is filled leaving the liquid in the receptacle under pressure, the sealing means surrounding the nozzle means and the nozzle means projecting into the receptacle, said sealing means comprising a substantially tubular element of inherently resilient material adapted to be longitudinally compressed during the bottling operation by pressure engagement effected upon an end thereof by the mouth of the receptacle, compression of said sealing means adapted to increase the projection of said nozzle into the receptacle and to maintain the seal upon withdrawal movement of the nozzle to cause pressure in the receptacle to be reduced

substantially to atmospheric pressure before breaking of the seal.

9. In a receptacle filling apparatus, a filler head comprising sealing means upon which the mouth of a receptacle to be filled may be sealed, nozzle means on the head comprising a passageway for introducing liquid to the receptacle interior, the sealing means being formed from resiliently yieldable material, means for effecting relative movement of the receptacle and head to first seal the receptacle and subsequently compress the sealing means, and the head having recess means into which the compressed sealing material may expand.

10. In a receptacle filling apparatus, a filler head comprising sealing means upon which the mouth of a receptacle to be filled may have butt engagement to seal it, nozzle means on the head comprising a passageway for introducing liquid to the receptacle interior and a second passageway through which gas in the receptacle may escape during the filling thereof, means for discontinuing flow of liquid into the receptacle leaving the interior thereof above the liquid therein under pressure, the nozzle means comprising a displacement element adapted to be relatively projected into and relatively withdrawn from the receptacle to provide when withdrawn an unfilled space substantially at atmospheric pressure above the liquid in the receptacle, and means rendering the sealing means yieldable in the direction of relative withdrawal movement to effect seal during said relative movement of the receptacle and displacement element and to thereafter effect free butt disengagement of the receptacle mouth and sealing means.

11. In a receptacle liquid filling head construction, seal means for sealing the open mouth of a receptacle to be filled, liquid conducting receptacle filling supply conduit means, means for cutting off liquid flow through the conduit means, conduit means for the escape of gas from the receptacle, a float valve cage, the escape conduit means comprising a tube extending into the cage and at its end providing a valve seat for the float valve to close the tube, the cage having a laterally extending annular flange thereon, the supply conduit means disposed to direct liquid upon the flange, and the flange disposed to direct liquid laterally radially therefrom to discharge the same upon the inner wall of a sealed receptacle, means associated with the supply conduit means providing a liquid discharge outlet at the periphery of the flange of sufficiently small cross-section to prevent dribbling of liquid out of the supply conduit means upon shutting off of supply flow therethrough.

12. In a receptacle filling head construction, sealing means for sealing the open mouth of a receptacle to be filled, a filling tube, an inner tube within the filler tube carrying a float valve cage beyond the end of the filler tube, a float valve in the cage, the cage having an annular stream-lined flange adjacent the end of the filler tube providing jointly with the end of the filler tube, an annular outlet for the filler tube directing fluid laterally therefrom substantially without agitation, the inner tube projecting into the cage and its end disposed to be closed by the float valve, the outer and inner diameters of the tubes being proportioned to provide a restricted filling passageway through the filling tube.

13. In a receptacle filling head construction, 75

sealing means for sealing the open mouth of a receptacle to be filled, a filling tube, a receptacle mouth guide reciprocable on the tube, means on the end of the tube to normally retain the guide thereon, an inner tube within the filler tube carrying a float valve cage beyond the end of the filler tube, a float valve in the cage, the cage having an annular stream-lined flange adjacent the end of the filler tube providing jointly with the end of the filler tube, an annular outlet for the filler tube directing fluid laterally therefrom substantially without agitation, the inner tube projecting into the cage and its end disposed to be closed by the float valve, the outer and inner diameters of the tubes being proportioned to provide a restricted filling passageway through the filling tube.

14. A filling head for the introduction of liquid to a receptacle comprising a sealing means engageable by the receptacle mouth surface, the head comprising fluid conducting passages, one of said passages provided for the introduction of liquid into an associated receptacle, another of said passages permitting the escape of gas displaced by liquid supplied to the receptacle through said first passage, a perforate float cage, an outwardly radially directed flange associated with the head, a float within the cage, said float having at least a substantial portion disposed below the level of the mouth of an associated receptacle when the receptacle is in sealed filling relation with said head, said float being adapted to stop gas escape through the said other passage when said float is lifted by liquid rising within the receptacle to a predetermined level, said liquid passage terminating above said flange so as to direct supplied liquid upon said flange, said flange deflecting introduced liquid outwardly radially against adjacent inner walls of the receptacle to restrain agitation of the liquid in the receptacle.

15. A filling head for the introduction of liquid to a receptacle comprising a sealing means engageable by the receptacle mouth surface, the head comprising fluid conducting passages, one of said passages provided for the introduction of liquid into an associated receptacle, another of

said passages permitting the escape of gas displaced by liquid supplied to the receptacle through said first passage, a perforate float cage, an outwardly radially directed flange associated with the head, a float within the cage, said float having at least a substantial portion disposed below the level of the mouth of an associated receptacle when the receptacle is in sealed filling relation with said head, said float being adapted to stop gas escape through the said other passage when said float is lifted by liquid rising within the receptacle to a predetermined level, said liquid passage terminating above said flange so as to direct supplied liquid upon said flange, means providing on said flange a thin annular peripherally open outlet, said outlet deflecting introduced liquid outwardly radially against adjacent inner walls of the receptacle to restrain agitation of the liquid within the receptacle.

16. A filling head for the introduction of liquid to a receptacle comprising a sealing means engageable by the receptacle mouth surface, the head comprising fluid conducting passages, one of said passages provided for the introduction of liquid into an associated receptacle, another of said passages permitting the escape of gas displaced by liquid supplied to the receptacle through said first passage, a perforate float cage, an outwardly radially directed flange associated with the head, a float within the cage, said float having at least a substantial portion disposed below the level of the mouth of an associated receptacle when the receptacle is in sealed filling relation with said head, said float being adapted to stop gas escape through the said other passage when said float is lifted by liquid rising within the receptacle to a predetermined level, said liquid passage terminating above said flange intra-peripherally thereof, means providing on said flange a thin annular peripherally open outlet, said outlet deflecting introduced liquid outward radially against adjacent inner walls of the receptacle to restrain agitation of the liquid within the receptacle.

CARLTON W. BONDURANT.