Nov. 12, 1935. F. W. MULLER 2,020,849

BOTTLE FILLING MACHINE

Filed May 25, 1933 2 Sheets-Sheet 1

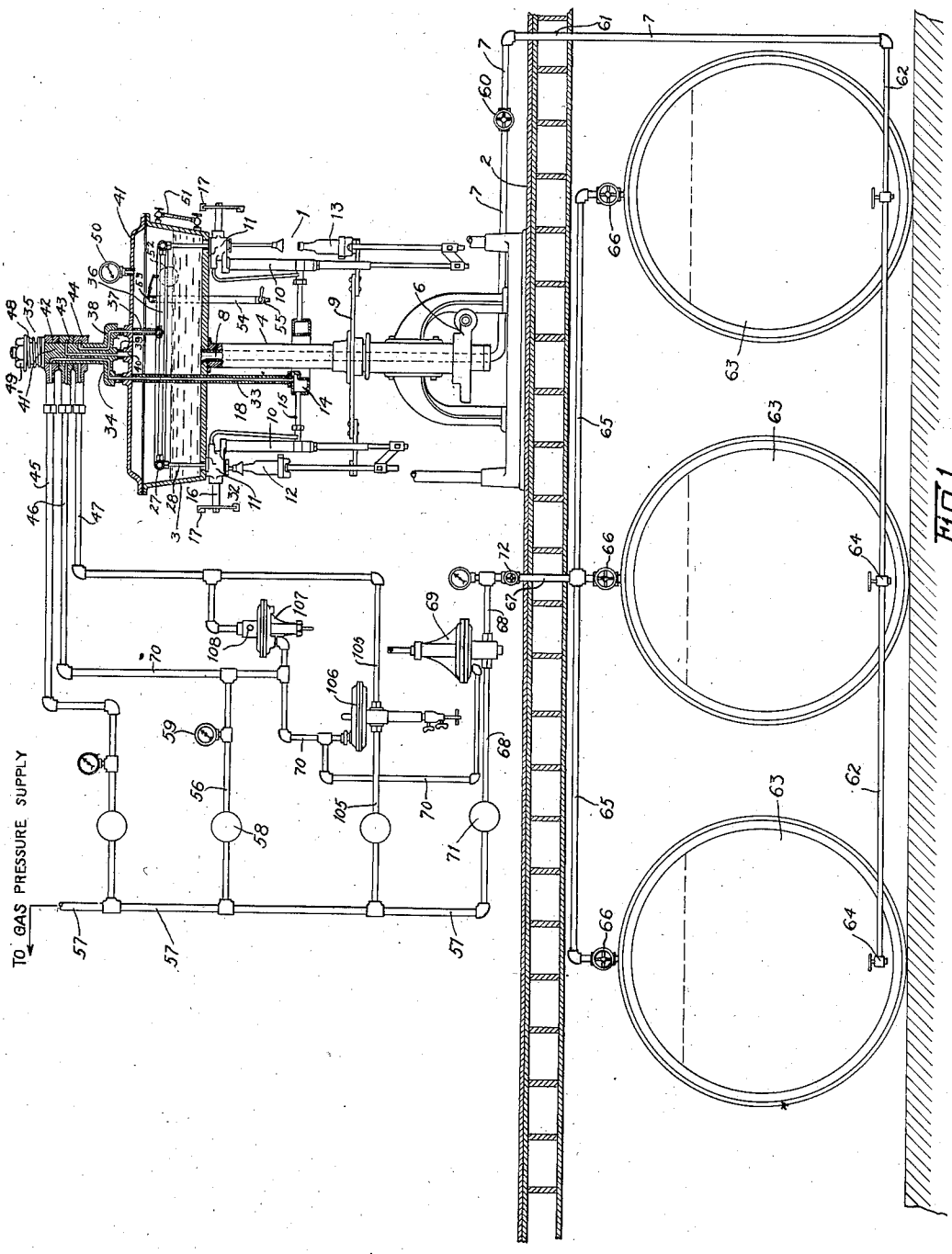


FIG 1

INVENTOR.
Frederick W. Muller.
BY
Elmghand Canfield
ATTORNEY.

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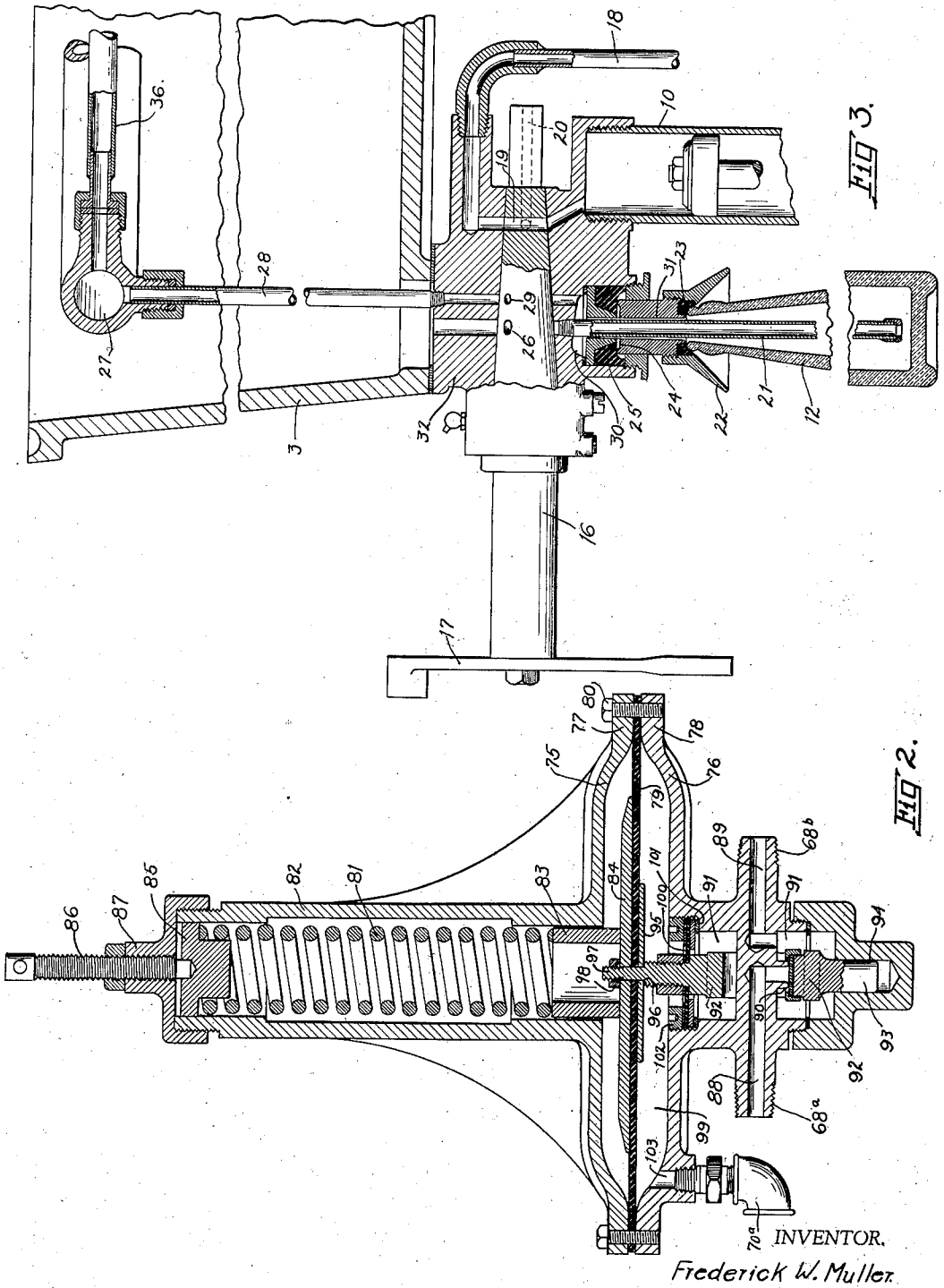


FIG 3.

FIG 2.

INVENTOR.
Frederick W. Muller
BY
Sleigh and Canfield
ATTORNEY.

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UNITED STATES PATENT OFFICE

2,020,849

BOTTLE FILLING MACHINE

Frederick W. Muller, Hoboken, N. J., assignor to The Bishop & Babcock Manufacturing Company, Cleveland, Ohio, a corporation of Ohio

Application May 25, 1933, Serial No. 672,847

15 Claims. (Cl. 226—115)

This invention relates to methods and machines for filling bottles and particularly to methods and machines for this purpose of the type wherein a plurality of bottles continuously fed to the machine are automatically and successively filled with a beverage such as beer, carbonated syrup, and the like.

My invention comprises certain features of improvement over the machine illustrated in United States Letters Patent No. 956,285 and No. 956,286, issued to J. H. Champ, April 26, 1910, to which patents reference may be had for a fuller description of the auxiliary parts of the mechanism not herein described in detail.

It is an object of my invention to provide for the filling of bottles with liquid to a predetermined height of liquid in the bottle, rapidly and successively, so that a large number of such bottles may be successively filled, each having the same height of liquid in the bottle.

Another object of my invention is to provide for the efficient successive filling of a large number of bottles by mechanism accomplishing the filling in such a way that agitation of the liquid applied to the bottles is avoided, thereby, in the case of carbonated or like liquids, avoiding loss of gas in solution.

Another object is to provide a bottle filling machine of the type referred to in which the liquid may flow into the bottles by gravity and in which the weight of the liquid flowing into the bottles is counter-balanced in an improved manner to overcome or counter-balance a part of the force of gravity on the flowing liquid to cause the liquid to flow into the bottles relatively slowly and therefore with the minimum of agitation.

Another object is to provide a mechanism for filling bottles with liquids containing carbonating gas and in which all of the gas may be retained in the bottles or in the supply tank without losses attending the venting of the same which has been found necessary in prior mechanisms of this kind.

Another object is to provide a machine of the class referred to in which the air which is in the bottles before filling them with the liquid is suitably discharged therefrom without bringing it into contact with the supply of liquid in the supply tank, thereby keeping the liquid uncontaminated with impurities which may have been in the bottle and thereby keeping the supply of liquid for the bottles sanitary, clean and sterile.

Another object is to provide in a bottling machine of the class referred to, an improved means for maintaining pressure in the bottles to be filled opposing the pressure of the liquid in the supply tank for filling the bottles and in which the supply tank pressure may be maintained substantially constant.

Another object is to provide in a bottle filling machine of the class referred to, means for maintaining pressure in the bottles being filled slightly in excess of the pressure in the filling tank above the liquid therein and improved means for maintaining this difference of pressure substantially constant.

Another object is to provide in a machine of the class referred to, means for maintaining said difference of pressure substantially constant even under the tendency for it to vary due to leakage of bottle air pressure occasioned by broken or chipped bottles.

Another object is to provide in a machine of the class referred to, comprising a supply tank from which the beverage is supplied to fill the bottles, means to maintain the level of liquid in the tank substantially constant by keeping it under substantially constant pressure and by renewing the supply of liquid therein constantly from a main supply or storage reservoir.

Another object is to provide in a bottle filling apparatus of the class referred to comprising a supply tank from which the beverage is supplied to fill the bottles, improved means for maintaining the beverage in the tank at a substantially constant level.

Another object is to provide in a bottle filling apparatus of the class referred to comprising a supply tank from which the liquid is supplied to fill the bottles, improved means for maintaining the liquid in the tank under a substantially constant pressure.

Another object is to provide in a bottle filling apparatus of the class referred to comprising a supply tank from which the liquid is supplied to fill the bottles, a reservoir from which liquid is supplied to the tank and improved means for intermittently or continuously replenishing the supply in the tank from the reservoir.

Another object is to provide in a bottle filling apparatus of the class referred to comprising a supply tank from which liquid is supplied to fill the bottles, a reservoir at a level below that of the tank and improved means for applying pressure to the liquid in the reservoir to effect elevation thereof to the supply tank.

Another object is to provide in a bottle filling apparatus of the class referred to comprising a supply tank from which liquid is supplied to fill

the bottles, a reservoir at a level below that of the tank and improved means for applying pressure to the liquid in the reservoir to effect elevation thereof to the supply tank and for controlling the applied pressure in correspondence with variations of pressure in the tank.

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 bottle filling machine and a reservoir of beverage supply and conduit connections and controlling apparatus associated therewith embodying my invention and whereby the method of my invention may be practiced;

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

Fig. 3 is a view of a valve mechanism which I may employ as a part of the machine of Fig. 1 and illustrated therein to smaller scale.

Referring to the drawings, I have shown generally at 1 a bottle filling machine standing upon a floor 2, the machine comprising a beverage liquid bottle filling 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 is supplied by a worm and gear mechanism 6.

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 bottle lift devices 10—10 and bottle filling valve devices 11—11, the latter being shown separately and to a larger scale in Fig. 3. By the construction thus briefly described it will be apparent that the tank 3 and the entire superstructure including the disc 9, bottle 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 bottles, the operation of the valve devices 11, and the filling of the bottles from liquid in the tank 3, are similar to the operations described in the aforesaid Champ patents and need not be described in complete detail here. It may suffice to say that generally the bottles, two of which are indicated at 12 and 13, are placed on the bottle 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 bottles start in their movements from a depressed position such as that illustrated for the bottle 13 wherein filling has not yet been started and are moved to an elevated position illustrated for the bottle 12 wherein filling may be accomplished.

The different bottles 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 capped.

The form of the machine shown in the drawings is one adapted to continuously operate in connection with a continuous succession of bottles, the operations being successive, overlapping and continuous from the time the bottles 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 bottle considering it as entering the apparatus as indicated at 12 and continuing until the bottle 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 super structure described and connected by a conduit 15 to the lift device.

The valve device 11, shown separately in Fig. 3, 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 super structure, and may admit air from the header 14, the conduit 15 and branch conduit 18, (Figs. 1 and 3) through a valve port 19 either directly to the lift device 10 or to the atmosphere through a duct 20 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 my co-pending Patent No. 1,919,665, filed November 24, 1930, to which reference may be had for a more complete description.

The valve device 11, Fig. 3, has depending therefrom a filling tube 21 upon which is telescopically slidably mounted a sealing cap 22. As the bottle is moved upwardly by the lift device 10, the tube 21 enters the mouth of the bottle 12 and the bottle picks up the cap 22 and carries it upwardly into the position shown in Fig. 3 which is the final upward position of the bottle before filling it. The bottle is sealed on a sealing washer 23 in the cap 22 and the latter is itself sealed as at 24 on a packing 25 on the device.

When the bottle is thus sealed ready for filling, the valve 16 is turned another part of a revolution which simultaneously opens the port 26 in the valve, effecting communication between the interior of the tank 3 and the filling tube 21, allowing liquid in the tank 3 to flow through the tube into the bottle; and admitting air or other gas from a header 27 through a conduit 28 and through a second valve port 29 to a chamber 30 in a housing 32 of the valve device and thence through a space 31 around the tube 21 into the bottle 12.

As will be more fully described, liquid in the supply tank 3 is under pressure of gas above the level of the liquid. In a manner to be more fully described, the air or gas pressure applied to the interior of the bottle 12 from the header 27 is maintained slightly in excess of the pressure in the tank above the liquid so that the remaining force causing liquid to flow from the tank into the bottle through the tube is somewhat less than the hydraulic head of the liquid in the tube 21 and tank 3.

The liquid is thus caused to flow into the bottle filling it with a slow movement which avoids

agitation of the liquid and the escape of gas such as carbonating gas therefrom. As the bottle 12 fills, the air therein under the applied pressure is forced out of the bottle back up through the conduit 29 into the header 27.

After the bottle has been filled the valve 16 is again turned to shut off the ports 26 and 29 and to open the port 19 to operate the bottle lift device 10 to lower bottle, and it may be removed and capped.

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 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 bottle 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 bottles 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 three 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 bottled, and when the liquid has all been discharged therefrom and bottled 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 bottling process resumed. As the liquid rises in the tank 3, the air which was introduced thereinto 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. 2, 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 68*a* and 68*b* 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 70*a* 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 70*a*, Fig. 2, 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 corresponding 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 bottles 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 counter-acted 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 bottle pressure to the interiors of the bottles as referred to forms no essential part of my present invention and will therefore be very briefly described. A conduit 105 is connected to the pressure supply of air or other gas 57 and the conduit 105 connects to the conduit 47, which as described communicates with the header 27 supplying pressure to the bottle interiors. In the line of the conduit 105 is disposed a regulator valve device 106 having a valve element (not shown) controlling flow through the conduit 105. The valve device is controlled by a diaphragm forming part of the regulator 106 which in turn is subjected to the pressure in the conduit line 70, communicating with the tank 3 above the liquid.

A pressure vent valve device 107 is connected to the conduit 47 and is provided with a diaphragm controlled valve (not shown), the diaphragm being subjected to pressure in the conduit 70. The regulator 106 and vent valve device 107 are adjusted by means not shown to maintain a suitable pressure in the header 27 greater than that in the tank 3 by a predetermined amount.

In operation of these devices, if the bottle pressure in the header 27 exceeds a predetermined value, that is, if it becomes greater than the tank pressure by more than a predetermind difference, the pressure in the conduit 47 will oppose the pressure from the conduit 70 in the device 107 and the conduit 47 may vent to the atmosphere through a vent passageway or port 108 in the device 107. On the other hand, if the bottle pressure in the header 27 should become less so that the predetermined difference between it and the pressure in the tank should diminish, the pressure in the conduit 70 acting on the diaphragm of the regulator 106 will admit air or other gas from the pressure supply through the conduit 105 to restore the said difference of pressure.

The regulator device 106 and the vent device 107 are more completely described in the above mentioned copending patent and reference may be had thereto for a fuller description thereof.

As will now be understood from the foregoing description, in the operation of the machine as a whole, the interior of a bottle such as the bottle 12 is first subjected to the pressure of the air or other gas in the header 27 and then, as the liquid flows from the tank 3 into the bottle, 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 28—47 and a tendency for the bottle pressure to exceed the head of the liquid and the pressure thereabove by more than a predetermined difference. This would tend to close the valve in the regulator 106 and tend to stop the supply of pressure through the conduit 105 from the outside source. To prevent the accumulation of pressure occasioned by adding the bottle air to the system, it may vent to the atmosphere from the device 107. On the other hand, to maintain the bottle pressure to prevent its falling below the predetermined difference, the regulator 106 may admit pressure from the outside source.

Both the regulator 106 and the device 107 are controlled in their operation by pressure from the tank 3 in the conduit 70 to maintain the said predetermined difference or excess of pressure in the bottle over that of the head of liquid and pressure in the tank 3.

From the foregoing it will be observed that the entire system supplying pressure to the bottle interiors is maintained distinct and isolated from the gas above the level of the beer or other beverage in the tank 3 so that the more or less foul and/or unsterile air from the bottles cannot contaminate the beer or beverage in the filler tank by contact with it. It will also be observed in the foregoing description that the beer flows from the supply into the bottles at a relatively slow rate and therefore with the minimum of agitation and loss of gas from the beverage. The low velocity of flow into the bottles is, as will now be clear from the foregoing description, effected by maintaining a bottle pressure greater than the pressure in the tank 3 by a predetermined difference whereby a part of the head of the liquid which causes it to flow into the bottle is counter-balanced by the bottle pressure and therefore the liquid flows into the bottle under a relatively small hydraulic head. The rate of flow is maintained constant, first by maintaining a level of liquid and pressure in the tank 3 substantially constant by the compensator above described and by regulating the bottle pressure by the tank pressure.

From the foregoing description it will now be apparent that, in one aspect, the filling tank 3 is in effect a part of the reservoir tank 63. The arrangement is in effect that of a U tube containing liquid, one leg of the tube being sealed and representing the tank, the other end being connected to a source of pressure and subjecting the liquid adjacent the closed end to the pressure of gas above its level at the closed end. Upon withdrawing liquid from a point adjacent the closed end, it is replaced by liquid from a lower portion of the U tube. Thus the liquid in flowing to the tank, in effect merely flows from one part of the reservoir to another part, or from one part of the tank to another part, without opportunity to break the continuity of liquid or agitate it to dissipate gas therefrom; and the application of pressure to the liquid in the reservoir is in effect application of pressure to the liquid in the tank.

This application is a continuation in part of the subject matter of Patent No. 1,919,665, issued July 25, 1933, filed November 24, 1930, for Improvements in bottle filling machines and methods, as to the subject matter claimed herein, the present application being more particularly limited to the improvements disclosed in the said patent which relate to the method, apparatus and system for providing a bottling mechanism filler tank with a constantly replenished source of beverage liquid maintained in the said tank under the desired conditions of gas pressure from one or more beverage reservoirs.

My invention is not limited to the exact method illustrated and described herein nor to the exact details of construction whereby the method may be practiced inasmuch as many modifications and changes may be made within the scope and spirit of my invention without sacrificing its advantages. Furthermore, inasmuch as my invention may be practiced with liquid receptacles other than bottles, my invention is not limited to the filling of bottles but is inclusive of other types of receptacle.

I claim:

1. In a receptacle filling apparatus, a liquid supply tank adapted to contain liquid under pressure of gas above the level of liquid therein, mechanism for withdrawing liquid from the tank to fill a succession of receptacles, a liquid reservoir, a conduit connection between the tank and the reservoir, a gas pressure supply conduit connected to the reservoir and to a source of gas under pressure to force liquid from the reservoir into the tank under pressure, and automatic valve mechanism comprising a valve flow port in the line of flow from the gas source and a movable valve element controlling flow through the port for regulating the application of the pressure from the pressure supply conduit to the reservoir the automatic valve mechanism comprising means rendering the valve element movable responsive to changes of pressure above the liquid in the tank, to maintain substantially constant the level of liquid in the tank during the withdrawal of liquid therefrom.

2. In a receptacle filling apparatus, a liquid supply tank adapted to contain liquid under pressure of gas above the level of liquid therein, mechanism for withdrawing liquid from the tank to fill a succession of receptacles, a liquid reservoir, a conduit connection between the tank and the reservoir, a gas pressure supply conduit connected to the reservoir and to a source of gas under pressure, and automatic valve mechanism comprising a valve flow port in the line of flow from the gas source and a movable valve element controlling flow through the port and the valve mechanism comprising means rendering the valve element movable responsive to changes of pressure above the liquid in the tank to effect the application of an increase of pressure to the reservoir upon a decrease of pressure in the tank and vice versa to maintain a substantially constant level of liquid in the tank.

3. In a receptacle filling apparatus, a liquid supply tank adapted to contain liquid under pressure of gas above the level thereof in the tank, mechanism for withdrawing liquid from the tank to fill a succession of receptacles, a liquid reservoir, a conduit connection between the tank and the reservoir, a pressure supply conduit connected to the reservoir and to a source of gas under pressure for forcing liquid from the reservoir into the tank under pressure, and automatic means for controlling the application of pressure to the reservoir from the source of gas pressure responsive to changes of pressure above the liquid in the tank, the automatic means including a valve device comprising a movable valve element in the line of the pressure supply conduit, a pressure responsive means comprising an expansible and contractible walled chamber having a movable wall portion associated with the valve element for controlling movement thereof and a conduit connection from the tank to the pressure responsive means.

4. A receptacle filling apparatus as described in claim 3 and in which the pressure responsive means is automatically operable upon a decrease of tank pressure to control movement of the valve element to effect an increase of pressure from the pressure source to the reservoir and vice versa.

5. In a receptacle filling apparatus, a liquid supply tank adapted to contain a supply of liquid under pressure of gas above the level of the liquid, mechanism for withdrawing liquid from the tank to fill a succession of receptacles, a liquid reservoir, a conduit connection between the tank and the reservoir, a pressure supply conduit connected to the reservoir and to a source of gas under pressure for forcing liquid from the reservoir into the tank, and automatic means for regulating the application of pressure from the source to the reservoir comprising a pressure responsive expansible and contractible walled chamber having a conduit connection with the tank, a movable valve element connected to a movable wall of the chamber to be moved thereby upon expanding and contracting of the chamber, the valve element controlling flow through the pressure supply conduit and movable to reduce the rate of flow upon a rise of pressure in the tank sufficient to expand the chamber and vice versa to increase the rate of flow upon a decrease of pressure in the tank, and vice versa.

6. A receptacle filling apparatus as described in claim 5 and in which an adjustable means opposes movement of the movable chamber wall to vary the responsiveness of the automatic means to tank pressure.

7. In a receptacle filling apparatus, a liquid container generally of U-form closed at the end of one U leg and provided with means for applying gas pressure to the other leg of the U to force liquid into the closed leg and to subject it to gas pressure above the level of liquid therein, means for withdrawing liquid from the closed U leg, means for controlling the application of pressure to the other leg upon withdrawing liquid to maintain the pressure above the liquid in the closed leg at substantially a constant value, said means comprising a valve construction having a movable element movable responsive to changes of pressure above the liquid level communicated thereto.

8. In a receptacle filling apparatus, a liquid container generally of U-form closed at the end of one U leg and provided with means for applying gas pressure to the other leg of the U to force liquid into the closed leg and to subject it to gas pressure above the level of liquid therein, means for withdrawing liquid from the closed U leg, means for controlling the application of pressure to the other leg upon withdrawing liquid to maintain the level of liquid in the closed leg substantially constant, said means comprising a valve construction having a movable element movable responsive to changes of pressure above the liquid level communicated thereto.

9. In a receptacle filling apparatus, a liquid supply tank adapted to contain liquid under pressure of gas above the level of the liquid in the tank, mechanism for withdrawing liquid from the tank to fill a succession of receptacles, a liquid reservoir, a conduit connection between the tank and the reservoir, a pressure supply conduit connected to the reservoir and to a source of gas under pressure to force liquid from the reservoir into the tank, automatic valve mechanism comprising a port and a movable valve element

controlling flow of gas from the gas source therethrough for regulating the application of pressure from the supply source to the reservoir and the automatic valve mechanism comprising pressure responsive means for moving the valve element to control flow through the port responsive to changes of pressure on the liquid in the tank to maintain the liquid level in the tank substantially constant during withdrawal of liquid therefrom, and means to change the substantially constant level comprising means to adjust the responsiveness of the valve element to the tank pressure.

10. In a receptacle filling apparatus, a liquid supply tank adapted to contain liquid under pressure of gas above the level of the liquid in the tank, mechanism for withdrawing liquid from the tank to fill a succession of receptacles, a liquid reservoir, a conduit connection between the tank and the reservoir, a pressure supply conduit connected to the reservoir and to a source of gas under pressure to force liquid from the reservoir into the tank, automatic valve means comprising a port in the line of flow of gas from the source and a movable valve controlling flow through the port for regulating the application of pressure from the supply source to the reservoir and automatic means for moving the valve responsive to changes of pressure on the liquid in the tank to maintain the tank pressure and the level of liquid in the tank substantially constant during withdrawal of liquid therefrom, and means to change the substantially constant tank pressure and liquid level comprising means to adjust the responsiveness of the valve element to the tank pressure.

11. In a receptacle filling apparatus, a liquid container generally of U-form closed at the end of one U leg and provided with means for applying pressure gas from a source of gas under pressure to the other leg of the U to force liquid into the closed leg and to subject it to gas pressure above the level of liquid therein, means for withdrawing liquid from the closed U leg, means for controlling the application of pressure to the other leg upon withdrawing liquid to maintain the pressure above the liquid in the closed leg substantially at constant value, said means comprising pressure gas flow controlling means operable responsive to changes of pressure above the liquid level communicated thereto.

12. In a receptacle filling apparatus, a liquid container generally of U-form closed at the end of one U leg and provided with means for applying pressure gas from a source of gas under pressure to the other leg of the U to force liquid into the closed leg and to subject it to gas pressure above the level of liquid therein, means for withdrawing liquid from the closed U leg, means for controlling the application of pressure to the other leg upon withdrawing liquid to maintain the level of liquid in the closed leg substantially constant, said means comprising pressure gas flow controlling means operable responsive to changes of pressure above the liquid level communicated thereto.

13. In a receptacle filling apparatus, a liquid container generally of U-form closed at the end of one U leg and provided with means for applying gas pressure to the other leg of the U to force liquid into the closed leg and subject it to gas pressure above the level of liquid therein, means for withdrawing liquid from the closed U leg, means for controlling the application of pressure to the other leg upon withdrawing liquid to maintain the pressure above the liquid in the closed leg at substantially constant value and to maintain the liquid level in the closed leg at substantially a constant level, said means comprising a valve construction having a movable element movable responsive to changes of pressure above the liquid level communicated thereto.

14. In a receptacle filling apparatus, a liquid container generally of U-form closed at the end of one U leg and provided with means for applying pressure gas from a source of gas under pressure to the other leg of the U to force liquid into the closed leg and to subject it to gas pressure above the level of liquid therein, means for withdrawing liquid from the closed U leg, means for controlling the application of pressure to the other leg upon withdrawing liquid to maintain the pressure above the liquid in the closed leg at substantially a constant value and to maintain the level of liquid in the closed leg at substantially a constant level, said means comprising pressure gas flow controlling means operable responsive to changes of pressure above the liquid level communicated thereto.

15. In a receptacle filling apparatus, a liquid supply tank adapted to contain liquid under pressure of gas above the level of liquid therein, mechanism for withdrawing liquid from the tank to fill a succession of receptacles, a liquid reservoir, a conduit connection between the tank and the reservoir, a gas pressure supply conduit connected to the reservoir and to a source of gas under pressure to force liquid from the reservoir into the tank under pressure, and automatic valve means comprising a valve controlled flow port in the line of flow from the gas source for regulating the application of the pressure from the pressure supply conduit to the reservoir automatic means for varying the size of the port responsive to changes of pressure above the liquid in the tank, to maintain substantially constant the level of liquid in the tank and to maintain substantially constant the pressure in the tank above the liquid therein during the withdrawal of liquid therefrom.

FREDERICK W. MULLER.