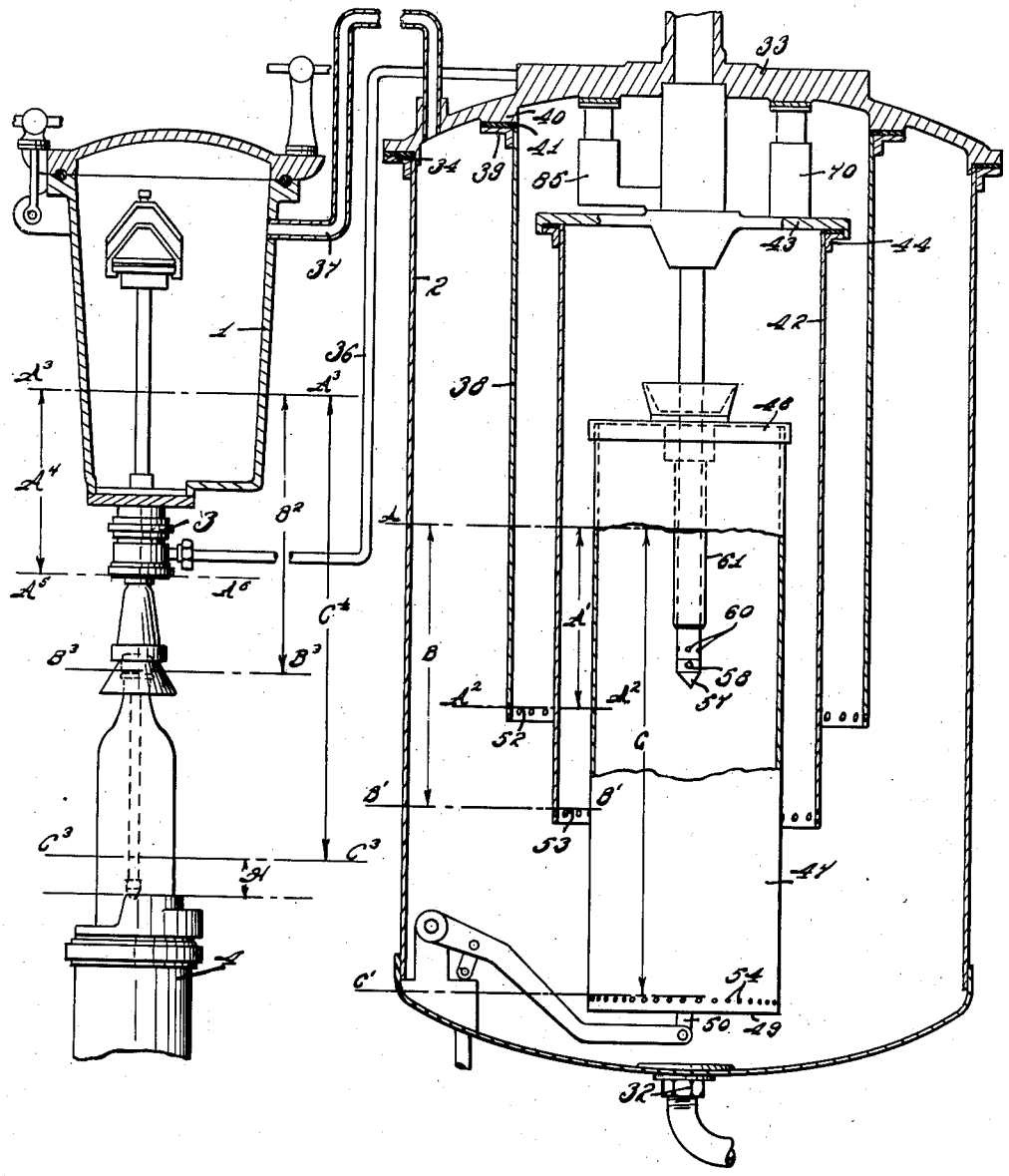
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BOTTLE FILLING MACHINE

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Fig. 1.



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Fig. 2.

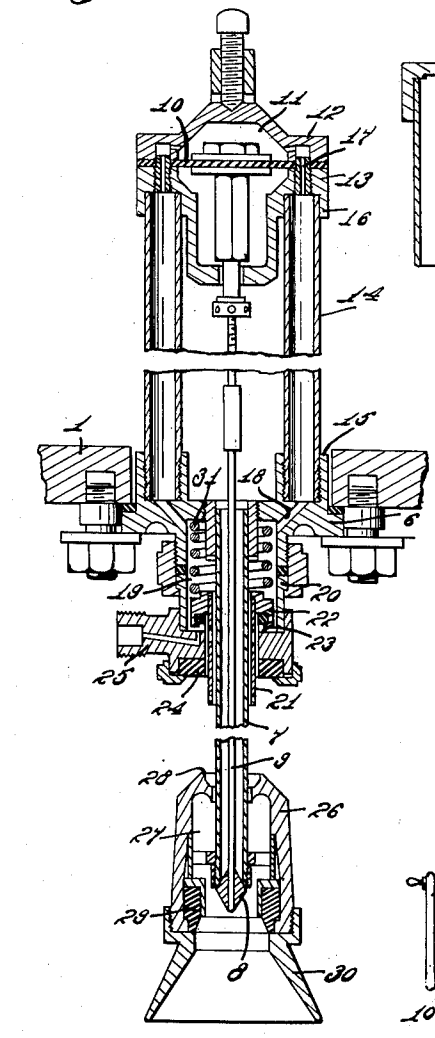


Fig. 10.

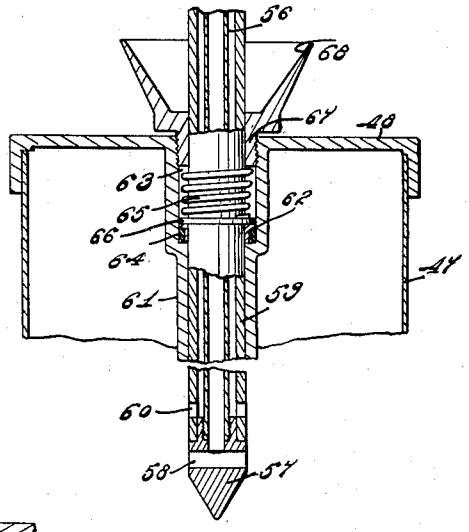
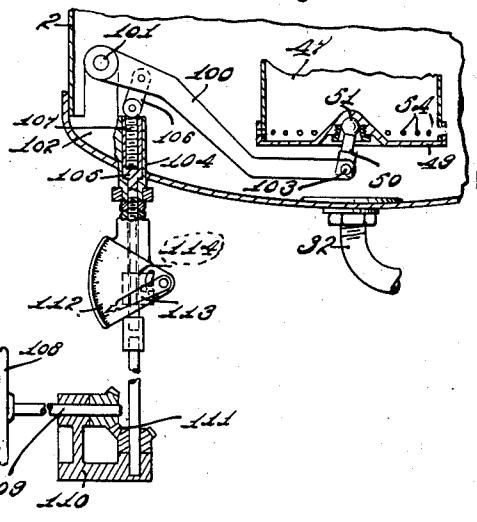


Fig. 11.



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BOTTLE FILLING MACHINE

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Fig. 3.

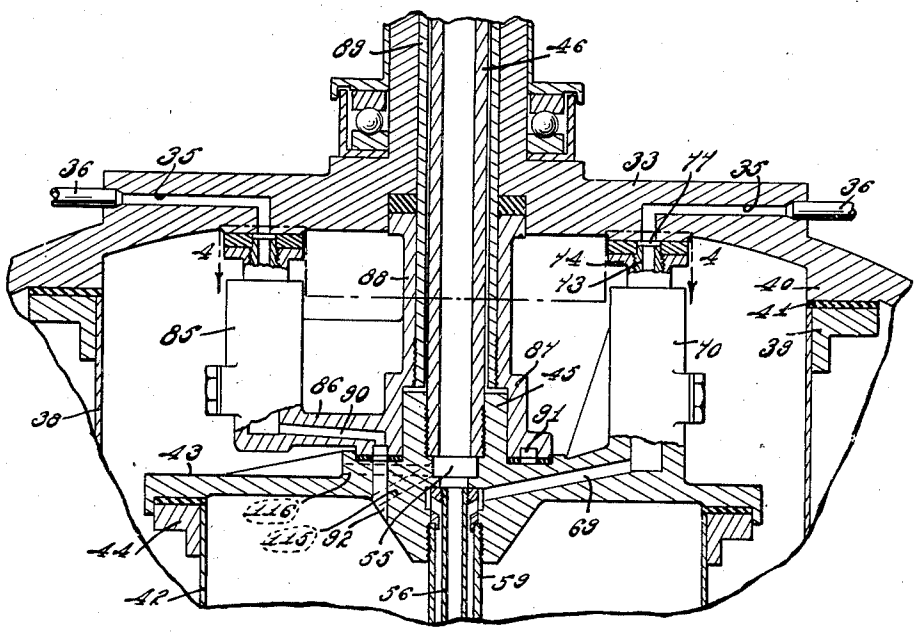
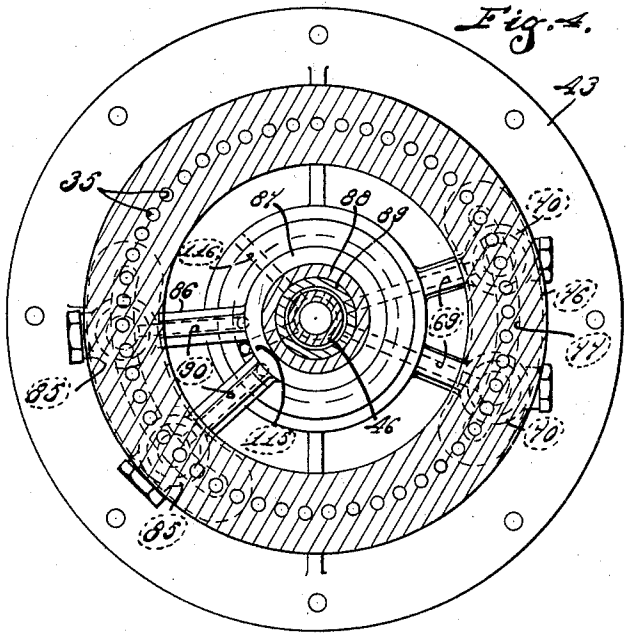


Fig. 4.



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BOTTLE FILLING MACHINE

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Fig. 5.

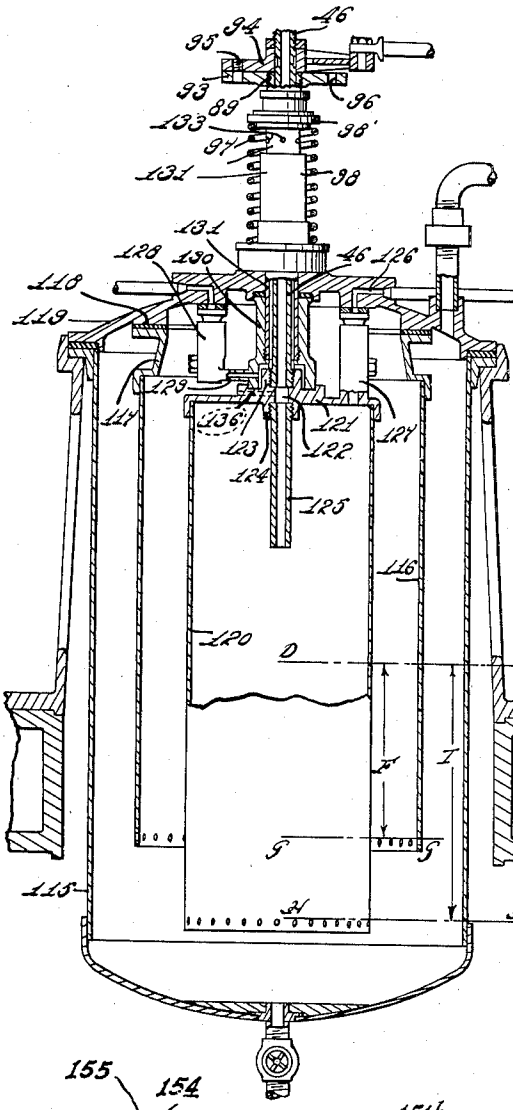
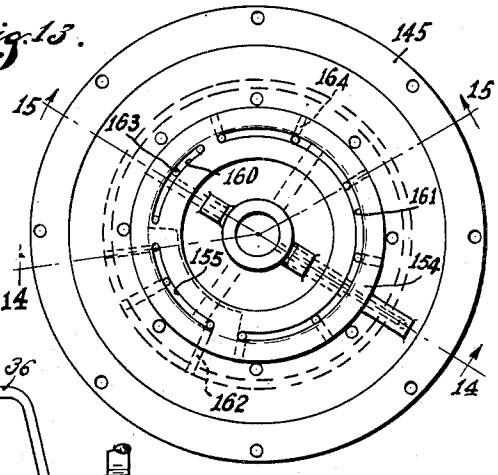
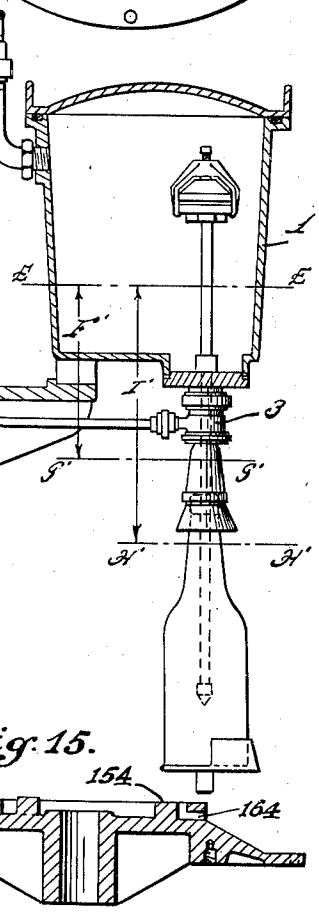


Fig. 13.





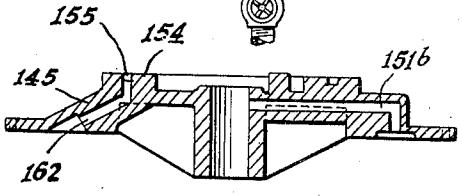


Fig. 14.

Fig. 15.

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BOTTLE FILLING MACHINE

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Fig. 6.

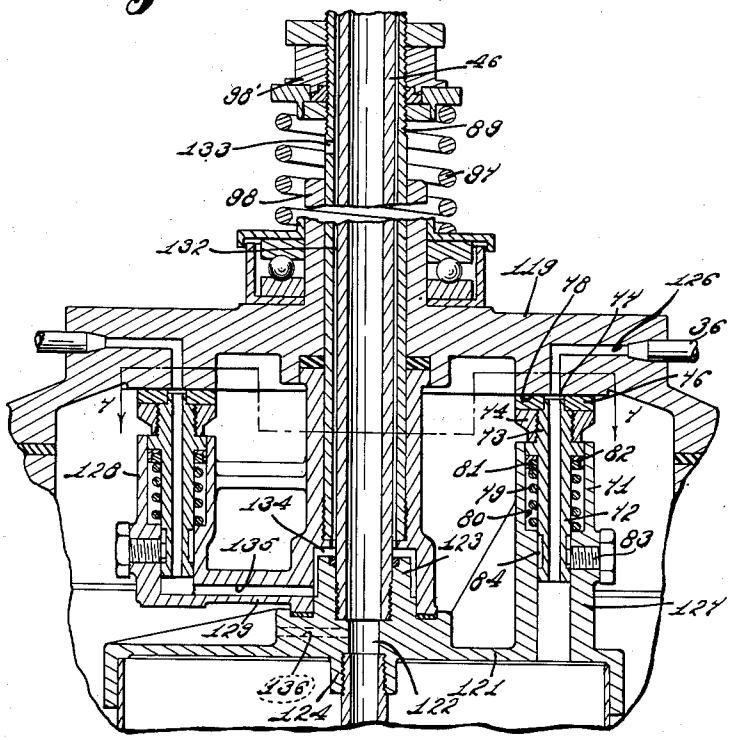


Fig. 7.

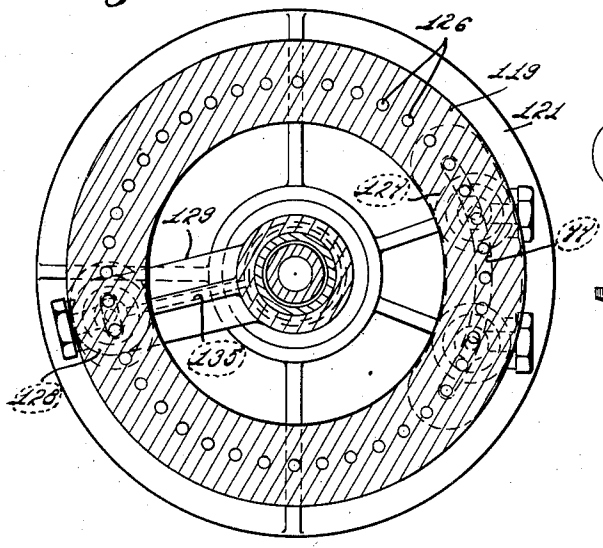


Fig. 8.

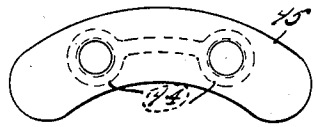
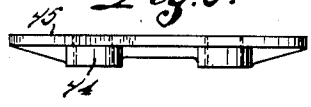


Fig. 9.



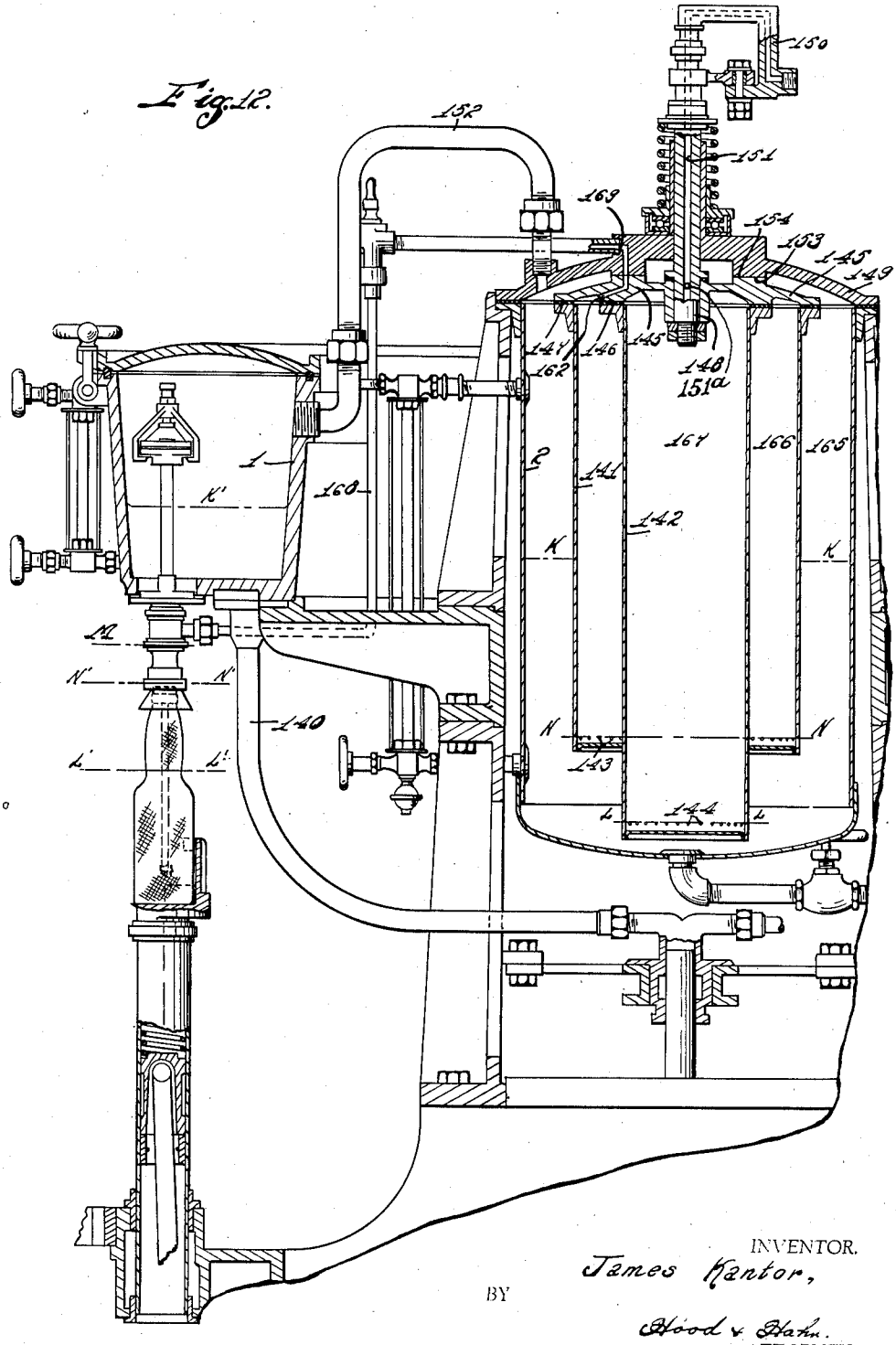
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BOTTLE FILLING MACHINE

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Fig. 12.



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Patented Apr. 22, 1941 2,239,364

UNITED STATES PATENT OFFICE

2,239,364

BOTTLE FILLING MACHINE

James Kantor, Chicago, Ill., assignor to The Liquid Carbonic Corporation, Chicago, Ill., a corporation of Delaware

Application April 22, 1939, Serial No. 269,334

25 Claims. (Cl. 226—115)

My invention relates to improvements in container filling machines and particularly to that type of filling machine adapted to fill containers with carbonated beverages.

More specifically, my invention relates to that type of container filling machine wherein a counter-pressure is provided for controlling the flow of the liquid into the container. In this type of machine, there is usually provided means for supplying the container with air or CO_2 or some other similar fluid with an initial pressure sufficient to permit a very slow flow of the liquid into the container. After a predetermined amount of liquid has been permitted to flow into the container, the counter-pressure is reduced to permit the liquid to flow into the container at a more rapid rate until the liquid has reached the predetermined filling level for the container.

The present invention relates to the above type of filling machine and has for one of its objects that of providing a filling machine whereby the liquid may be flowed into the container at a more rapid rate, than has heretofore been possible, without the heretofore accompanying danger of foaming on the part of the liquid.

A further object of my invention is to provide an improved valve control means for controlling the flow of counter-pressure to the container to be filled.

For the purpose of describing my invention, I have illustrated certain embodiments thereof in the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional view, more or less diagrammatic, of a filling apparatus embodying my invention;

Fig. 2 is a longitudinal view of one of the filling valves;

Fig. 3 is an enlarged sectional detail view of the top of the water check tank illustrated in Fig. 1;

Fig. 4 is a horizontal sectional view taken on the lines 4—4 of Fig. 3;

Fig. 5 is a longitudinal sectional view, more or less diagrammatic, of a modification of a filling apparatus;

Fig. 6 is an enlarged detail sectional view of the top of the water check tank illustrated in Fig. 5;

Fig. 7 is a sectional view taken on the lines 7—7 of Fig. 6;

Figs. 8 and 9 are respectively a plan and side elevation of the valve shoes;

Fig. 10 is an enlarged detail sectional view of the top of the first stage cylinder illustrated in Fig. 1;

Fig. 11 is a detail view showing the adjusting mechanism of the first stage cylinder illustrated in Fig. 1.

Fig. 12 is a longitudinal sectional view of a modification of my invention;

Fig. 13 is a plan view of the pressure control valve plate of Fig. 12;

Fig. 14 is a detail section on the line 14—14 of Fig. 13; and

Fig. 15 is a detail section on the line 15—15 of Fig. 13.

In the structure illustrated, I provide a filler tank 1 which may be annular, and is associated with a water check tank 2. These two tanks are preferably supported from and rotate with the same base so that the tank 1 and the tank 2 rotate in unison. The tank 1 is provided with a number of filler valves 3 and associated with each of the filler valves is a bottle platform 4 adapted to be raised and lowered by suitable cam mechanism for the purpose of projecting the bottle into filling positions relative to the filler valve 3 and retracting the same therefrom for delivery from the machine.

Each of the filler valves 3 comprises a base 6 adapted to be secured in position coincident with an opening in the bottom of the tank 1. This base supports a filler tube 7 adapted to communicate with the interior of the tank 1 and project into the container to be filled. This tube 7 carries, at its lower end, a pear valve 8 normally adapted to close the lower end of the tube and operated through the medium of a stem 9 extending upwardly to and connected with a diaphragm 10 mounted in a chamber 11 formed between a cap 12 and a top casting 13. A plurality of pressure tubes 14 extend upwardly from the base 6 being seated in bosses 15 in the base and corresponding bosses 16 in the top 13. These tubes communicate through passages 17 with the top of the diaphragm chamber 11 and at their lower end through passages 18 with a chamber 19 in the neck 20 of the lower end of the base 6. The neck 20 telescopically carries a secondary tube 21 having at its upper end a valve 22 adapted to engage a seat 23. The neck 20 at its lower end is provided with a sealing gasket 24 adapted to cooperate with a bell top 26 slidably mounted on the tube 7. The chamber 19 communicates with a threaded stem 25 through the medium of which the valve is connected with the water check tank 2.

Slidably mounted on the filler tube 7 is a bottle sealing bell 26 having a chamber 27 formed therein and provided with a seat 28 adapted to

cooperate with the sealing member 24, when the bell is raised to its uppermost position. The sealing bell is provided with a sealing gasket 29 and with a bell shaped mouth 30 adapted to engage over the top of the neck of the container and seal the container against atmospheric pressure. A coiled spring 31 biases the valve 22 in its closed position. When the sealing bell is engaged by the neck of the container, as the container is raised, this bell moves upwardly on the filler tube 7 so that the filler tube is projected into the bottle and the top of the bell engages the bottom of the tube 21 moving this tube upwardly until the seat 28 engages the washer 24, thereby sealing the bell against the entrance of atmospheric pressure and at the same time sealing the bottle against atmospheric pressure. The raising of the valve 22 admits pressure into the chamber 19 and thence through the tube 21 into the container. As the container becomes filled with fluid under pressure, this fluid continues to flow upwardly through the tubes 14 into the chamber 11 thereby operating the diaphragm 10 and opening the valve 8, permitting the liquid from the tank 1 to flow into the container.

The water check tank 2 preferably comprises a cylindrical tank adapted to be supplied with water to the desired level through a water inlet opening 32. The top of this tank is sealed by a head or cover 33 clamped upon an annular flange 34 surrounding the upper end of the tank. This head or cover 33 has a series of ports 35 therein, one for each of the valves 3 and each of the ports 35 is connected with its accompanying valve 3 by a pipe 36 extending to and connected with the stem 25 of the valve 3. The top of the water check tank 2 is also connected through the medium of the pipe 37 with the upper portion of the filler tank 1 so that the pressures in the water check tank and in the filler tank may be equalized.

Arranged within the water check tank 2 is a pressure cylinder 38 having an annular rim 39 by which it is secured to an annular shoulder 40 on the underface of the head 33. Between the rim 39 and shoulder 40 a suitable gasket 41 is provided.

A second cylinder 42 is mounted within the cylinder 38 and this cylinder is provided with a head 43 which is secured to the top of the cylinder 42 by an annular flange 44 surrounding the top edge of the cylinder. This head 43 is provided with a neck 45 screw-threaded upon the bottom end of the air inlet tube 46 which tube extends upwardly and is adapted at its upper end to be connected with a suitable air pressure supply means or suitable means for supplying CO_2 under pressure.

A third cylinder 47 is arranged within the cylinder 42, this cylinder having a closing head 48. This cylinder is provided with a supporting bottom 49 adapted to rest upon a supporting pin 50 having a ball and socket connection 51 with the bottom 49. The cylinders 38 and 42 are both open bottom cylinders, each also being provided with a series of openings respectively 52 and 53 at their lower ends, and the cylinder 47 is likewise provided with escape openings 54 at its bottom end.

Air is supplied to the cylinders through the air supply tube 46 which, as before stated, is threaded into the neck 45 of the head 43. This head 43 is provided with an opening 55 which has threaded into it an extension air supply tube 56 passing down through the head 43 of cylinder 47 and terminating in a discharge nozzle 57 having lateral discharge openings 58. An outlet tube 59 is threaded into the head 43 having inlet openings 60 at its lower end. The concentric tubes 56 and 59 pass through an internal neck 61 in the head 48. In order to make a tight joint between the tube 59 and the neck 61 and therefore prevent the escape of air from the cylinder 47 except through the tube 59, a leather cup 62, within a recess 63 in the neck 61, surrounds the tube 59. This leather cup is provided with a soft rubber band 64 which tends to hold the cup snugly against the tube and the top surface of the cup is pressed on this band by a coiled spring 65 bearing upon the top of the cup, a metal washer 66 being interposed between the spring and the cup. The top of the neck 61 is closed by a plug 67, the bottom end of which forms a shoulder against which the spring 65 bears and this plug is provided with a bell mouth 68 adapted to help guide the tube assembly into the top of the cylinder 47 when the parts are assembled. The outlet tube 59, at its upper end, communicates with a port 69 in the head 43, which port in turn is connected with a valve structure 70 mounted on the head. This valve structure is similar to that illustrated in Fig. 6 and comprises a pair of hollow posts 71 extending upwardly from the head and each adapted to receive a hollow valve stem 72 reciprocably mounted in the post and having a threaded neck 73. Each of these necks threads into a boss 74 on a segmental valve member 75. The top face of this valve member carries a facing 76 of hard rubber which is provided with an arcuate groove 77 adapted, when the valve structure is in certain positions, to coincide with the openings 35 in the head 33, and communicating with openings coinciding with the openings in the bosses 74. The facing 76 is maintained in sliding contact with a faced portion 78 on the underside of the head through the medium of coiled springs 79 surrounding the stems 72 and arranged within a recess 80 in the hollow stems 71. These springs bear upon a soft rubber sleeve 81 surrounding the stem member 72 and in turn fitting within a sealing leather cup 82, which effectually prevents the escape of air except through the center opening of the stem. The vertical movement of the stem 72 is limited by the set screw 83 operating in an annular groove 84.

A second valve 85 controls the passage of pressure from the cylinder 42. This valve is of the same construction as the valve 70. However, the hollow posts are mounted on radial arms 86 extending from the hub 87 of a sleeve 88 threaded upon the lower end of a non-rotating stationary tube 89. The arms 86 have passages 90 therein terminating in a groove 91 in the hub 87 and this groove communicates with a passage 92 in the head 43. The tube 89, at its upper end, threads into a quadrant 93 which is locked against rotation. To this end, the upper end of the air inlet tube 46 is keyed to a non-rotating quadrant 94 and the quadrant 93 is locked thereto by a bolt 95 which passes through a slot 96 in the quadrant 93 and into the quadrant 94. This permits of relative adjustment of the quadrants 93 and 94 and likewise relative adjustment of the valves 70 and 85.

For supporting the cylinder 42 and holding the various parts in a clamped assembled position, I provide a coiled spring 97 (see Figs. 5 and 6) surrounding a hub 98 extending upwardly from

the head 33 and having its upper end abutting against a collar 98' threaded on the tube 89. Due to the fact that the hub 98 is stationary relative to the head 33, the lower end of this spring has interposed between it and the head 33 a suitable ball bearing.

Vertical adjustment of the cylinder 47 is accomplished by an adjusting lever 100 pivoted at 101 to a bracket 102 at one end and pivotally connected at 103 to the bottom of the supporting post 50. This bracket 102 extends from a post 104 projecting through the bottom of the water check cylinder 2. Passing through this member 104 is an adjusting rod 105 connected by the link 106 at its upper end to lever 100. The link 106 is connected to the rod 105 through the medium of a threaded pin 107 so that as the rod is rotated, the pin 107 through its threaded engagement therewith will be raised or lowered. For rotating the rod, I provide a hand wheel 108 mounted on a shaft 109 carried in a suitable stationarily mounted bearing 110. This shaft has a gear drive 111 with the rod 105 so that the rod may be rotated with a minimum of effort and in order to indicate the height of the cylinder 47, I provide an indicator 112 having an indicator hand 113 driven by a worm gear drive 114 from the rod or shaft 105.

In operation, it is to be remembered that the water tank 2 rotates and accordingly the head 33 rotates with it. The valve 85, due to the fact that it is secured to the non-rotatable sleeve 89 remains stationary and the valve 70, due to the fact that the head 43 of the cylinder 42 is secured to the stationary air inlet tube 46 remains stationary. There is therefore a relative movement between these valves and the head 33 so that the ports 35 connected through the pipes 36 with the filling valves 3 are respectively connected through the valve first with the cylinder 47, the first stage cylinder, then directly through the passages 35 with the cylinder 38, the second stage cylinder and then through the medium of the valve 85 with the third stage cylinder 42.

In operation, the water check tank is filled with water to the line A. Air or CO_2 under pressure is admitted through the air inlet tube 46 to the opening 55. From thence, it passes through the air inlet tube 56 into the first stage cylinder 47. Likewise, it passes through the passages 115 and 116 into respectively the third stage cylinder 42 and the second stage cylinder 38. The pressure admitted to each of the cylinders is sufficient to force the water out of the cylinders and into the water check tank. Therefore, there is sufficient pressure established in the first stage cylinder 47 to support a column of water represented by the height C, that is a column of water from the escape point C' for the air in the bottom of the cylinder 47 to the liquid level A. Likewise, in the second stage cylinder 38, there is developed a sufficient pressure to support a column of water equal to A' and in the third stage cylinder, there is developed sufficient pressure to support a column of water equal to B or, referring to the second stage cylinder, a column of water equal to the distance between the liquid level A in the water check tank to the escape opening point A^2 in the second stage tank 38 and equal to the distance between the water level A in the water check tank and the level B' of the escape openings in the third stage cylinder 42.

The beer level in the filler tank is indicated by the line A^3; therefore, when the pressure is admitted to the container from the first stage tank 47 through the valve 70 to the filling valve and container and upon the opening of the filling valve, as heretofore described, there will be established in the container a pressure sufficient to support a column of beer equal to the distance between A^3 and C^3, that is, a column equal in height to C^4 and the difference between C^4 and the end of the filling tube constitutes the head for flowing the beer into the bottle. This head is indicated by the distance H. Consequently, the beer will flow into the bottle under a very small head and, therefore, very slowly, until it reaches the level C^3, at which time the column C^4 is equal to the column C and equilibrium will be established so that the beer will stop flowing. At this time, however, the second stage cylinder 38 is placed in communication with the filling valve through one of the passages 35, it being remembered that by this time, the passage 35 has passed out of communication with the first stage cylinder through the valve 70. Therefore, pressure is admitted to the container sufficient only to support a column of beer equal to A^4 or the distance between A^3 and A^5, this column being equivalent to the column A'. With this increased head, the beer will rapidly flow into the filling tube and container until it reaches the level A^5 which, it will be noted, is just below the air inlet in the filling valve. By the time the beer reaches this point, equilibrium will have been established and the beer will have ceased to flow. Also, it will be noted that the beer will have ceased flowing below the inlet nozzle or stem 25. Therefore, there will be no danger of the beer flowing back into the tube 36. At about the time this equilibrium is established, the container will have been placed into communication with the third stage cylinder 42 through the valve 85. The pressure in the third stated cylinder, as before staged, supports a column B, therefore establishing in the container a pressure sufficient to support column B^2 which is the distance between the beer level A^3 and the level B^3 which is the final filling level of the container. This pressure, being greater than the pressure A^4, will force some of the beer in the bottle back up through the filling tube into the filling tank and equilibrium will have again been established. At this point, the bottle commences to lower away from the filling valve, thus shutting off the filling valve and leaving the bottle filled to the filling point. Due to the fact that the third stage cylinder 42 causes an excess pressure to be established in the container, there will be a pressure exerted upon the beer in the container and in the filling tube which has a tendency to check any liberation of gas from the beer, thus materially aiding in preventing foaming.

Due to the fact that the cylinder 47 may be vertically adjusted through the adjusting mechanism and therefore the length of the column C adjusted, the column C may be likewise adjusted to obtain the proper head H. Furthermore, through the elevating mechanism, the cylinder 47 may be raised sufficiently as to render the same ineffective so that cylinders 42 and 38 become the only effective cylinders and the first stage cylinder therefore is eliminated. This is particularly advantageous where the filling apparatus is used for filling extremely short and thick containers of the "Steine" type.

In Figs. 5 to 7, I have more specifically illustrated a filler or a filling apparatus which is particularly adapted for handling carbonated beverages other than beer. In the handling of beer,

due to the characteristic of the beer and the manner in which it flows into the container, the beer must be initially flowed into the container at a very slow rate. In handling other carbonated beverages, wherein the container is partially filled with syrup and carbonated water is admitted to the container to fill the same, the carbonated water can be flowed into the container at a much more rapid rate without causing the contents of the container to excessively foam.

In this structure, the filling tank 1 and the filling valve 3 are of the same construction as that illustrated in Fig. 1. The water check tank 115 is somewhat different. In this structure illustrated in Figs. 5, 6 and 7, the water check tank is provided with a first stage cylinder 116 secured through the medium of a mounting ring 117 to a flattened shoulder 118 on the top 119 of the water check tank. Within this first stage cylinder 116 is mounted a second stage cylinder 120 having a head 121 provided with a central opening 122 surrounded by upper and lower bosses 123 and 124. An air inlet tube 46 similar in construction to the air inlet tube for the structures heretofore described is threaded into the upper boss 123 and a secondary air inlet tube 125 is threaded into the lower boss and projects down into the cylinder 120. The head 119 is provided with a series of ports or passages 126, each one of which is adapted to be connected by a connector pipe 36 to a filling valve 3, as is the case in the three stage filler heretofore described. The head 121 on the cylinder 120 is provided with a valve 127 identical in construction to the valve 70 described in connection with the structure illustrated in Figs. 1, 2 and 3, which valve controls the passage of air or CO_2 under pressure from the cylinder 120 to the filling valve. Communication between the filling valve 3 and the cylinder 116 is, of course, established through the passages 126 when they are uncovered by the valve 127.

Each of the passages 126 and therefore each of the filler valves 3 is adapted to be connected to the atmosphere through the medium of a snifter valve 128. This valve is of the same construction as the valves 70 and 35 heretofore described, with the exception that the valve shoe is considerably smaller and therefore a single cylinder valve member only is required, this member being mounted on an arm 129 which extends from the hub of a sleeve 130 threaded on a supporting tube 131 similar in construction and mounting to the tube 39. It will be noted, however, that in the structure illustrated in Figs. 5 and 6, the supporting tube 131 is slightly spaced from the air inlet tube 46 to leave a passage 132 between these tubes which passage communicates to the atmosphere through an opening or openings 133 in the supporting tube. The lower end of this tube through the passage 134 formed between the sleeve 130 and the boss 123 communicates with the passage 135 in the arm 129. Therefore, when the valve 128 is in communication with one of the passages 126, the filling valve and container are placed in communication with the atmosphere to "snift" any gas or CO_2 which may have accummulated in the top of the container after the filling operation has been completed.

In operation, the water check tank 115 is filled to the liquid level indicated by the line D. The filling tank 1 is filled to the liquid level indicated by the line E. As the bottle is elevated to cooperate with the filling valve 3, this valve is opened in the manner heretofore described with respect to the structure illustrated in Fig. 2 and due to the rotative position of the bottle or container, the filling valve and container is placed in communication with the first stage cylinder 116. Pressure, either in the form of compressed air or compressed CO_2 has been admitted to the cylinder 120 through the air inlet pipe 125 and to the cylinder 116 through the branch opening 136 until all of the water has been forced out of the cylinders 116 and 120. Therefore the pressure in the cylinder 116 will be sufficient to support a column of water F equal to the distance from the bottom openings in cylinder 116 or from the line G to the liquid level D. This pressure, when admitted to the container, will support an equal column of water F' in the filling tube and container. It will be noted that this column ends at the point G' which is slightly below the pressure inlet to the filling valve. Therefore, the difference between the level G' and the bottom of the filling tube will be the head which will cause the liquid in the tank 1 to flow into the bottle and the liquid will flow into the bottle at a fairly rapid rate until the level G' has been reached, that is, until the column F and the column F' become equal, at which time equilibrium will have been established and the liquid from the filler tank 1 will cease to flow into the container and the filling tube, stopping at the level G'. This level, as is obvious, is considerably above the level of the liquid desired to be maintained in the container. However, as the parts continue to rotate, the container will be placed in communication with the second stage cylinder 120. The pressure in this cylinder, with the liquid forced out of the cylinder, will be sufficient to support a column of liquid equal to the distance from the line H to the liquid level, that is a column equivalent to I. This pressure, when admitted to the container, will support a corresponding column I' which extends from the liquid level in the filling tank to the level H' which is the filling level of the container. Therefore, also it will be noted that this pressure is greater than the pressure developed in the cylinder 116. Therefore, when the container is placed in communication with the second stage cylinder 120, the pressure admitted into the container will force a portion of the water in the container back up through the filling valve until the level H' has been reached. At this point equilibrium has again been established and the bottle will have been filled to the desired level. A continued rotation of the parts will place the filling valve and container in communication with the atmosphere through the valve 138. Therefore, any gas which may have accumulated in the top of the bottle above the liquid level will be "snifted" to the atmosphere and with the release of the pressure in the filling valve and consequent closing of this valve, together with the descent of the bottle or container from the valve, the container will be delivered from the machine, with any accumulated gas exhausted from the container and the container filled to the proper level.

Due to the fact that the snift valve is rotatably adjustable to operate any point in the circle, the snifting of the container may take place at any point in the filling operation. In actual practice, the snift valve is frequently so adjusted that it will function when the bottle is about three-fourths full. Due to the fact that the snift valve brings about a direct connection between the container and the atmosphere, for releasing the top pressure within the bottle, the

valve controlling the flow of liquid through the filling tube is momentarily closed during the operation of the snift valve because, as it is obvious, with a connection to the atmosphere established, the pressure in the chamber 11 will be reduced to the point where the valve 8 will close. The closing of the valve 8, however, is only momentary because of the fact that the snift valve functions only momentarily. However, as a result of the closing of the valve 8, there will be no rush or flow of liquid into the bottle during the time that the top pressure of the bottle is being snifted to the atmosphere.

In Figs. 12, 13, 14 and 15, I have disclosed a modification of the invention disclosed in Figs. 1, 2, 3 and 4. Referring to the structure illustrated in Figs. 12 to 15, inclusive, the filling tank 1, the filling valve 3 and the water check tank 2 are substantially the same as that disclosed in Fig. 1. The filling tank 1 is supplied with beer or other liquid by the supply pipe 140 connected with a suitable source of supply and the admission of beer to the tank is controlled by any suitable means, as for instance, a float control check valve (not shown) which is adapted to be opened when the liquid level in the tank falls below a predetermined point and closed when the liquid level rises above a predetermined point so that the liquid level in the beer tank is maintained substantially constant. This arrangement is also used in connection with the structures heretofore described. Within the water check tank 2, I mount pressure cylinders 141 and 142. These cylinders may be open at their bottoms or, as is illustrated in the drawings, closed at their bottoms and provided respectively with openings 143 and 144 so that the bottoms of the cylinders are placed in communication with the water check tank. The cylinders are arranged one within the other, the cylinder 142 being longer and mounted within the cylinder 141, and are supported at their upper ends from a valve head 145. This head is provided with annular flattened portions 146 and 147 to which flanges on the cylinders may be attached, suitable gaskets being interposed between the flanges and the flattened portions. The head 145 comprises a valve member and is supported upon a rotatably stationary stem 148 extending through the top 149 of the water check tank and connected by a suitable pipe 150 with the source of air or other pressure supply. Due to the fact that this stem 148 is provided with a central opening 151, air under pressure is admitted to the cylinders 141 and 142. The air under pressure, in addition to passing directly into cylinder 142 also passes by way of opening 151*a* in the tube and passage 151*b* in the head, to the cylinder 141. The top of the water check tank is connected with the top of the liquid tank through the medium of a suitable conduit 152 so that the pressure in the top of the liquid tank will be maintained equal to the pressure in the top of the water check tank. The under side of the cover or top of the water check tank 149, which rotates with the liquid tank 1, has a ground face 153 adapted to rotate on a ground face 154 on the valve head 145. The valve head, on its upper face, is provided with three separate grooves 155, 160 and 161, respectively communicating with openings 162, 163 and 164. The opening 164 extends to and communicates with the chamber 165 in the top of the water check tank. The opening 162 communicates with the chamber 166 and the opening 163 communicates with the chamber 167. Therefore, as the water check tank rotates relatively to this valve head 145, the pressure supply pipe 168, corresponding to the pressure supply pipe 36, connected to the opening 169 in the head 149 is placed first in communication with chamber 167 which may be termed the high pressure chamber or the first stage chamber. The continued rotation of the water check tank places the pipe 168 in communication with the chamber 165 which is the low pressure or second stage chamber and the further rotation places the pipe 168 in communication with the chamber 166 which is the intermediate pressure chamber or the third stage chamber.

In the operation of this device, with the air pressure entering through the air tube 151 and passing from thence to the chambers 166 and 167 and producing enough pressure in these chambers to maintain these chambers empty of water, there will be established sufficient pressure in chamber 167 to support a water column extending from the level K in the water check tank to the level L which corresponds to the openings 144 in the chamber 167. Correspondingly, with this pressure admitted to the container, there will be established in the container a pressure sufficient to support a column of liquid extending from the level K' to the level L' in the container and, as a result, the liquid will flow from the filling tank into the container, assuming that the valve 3 has been opened in the manner heretofore described with respect to Fig. 2, until it reaches the level L'. This flow of liquid, due to the comparatively low head, will be comparatively slow and will therefore not agitate the beer or other liquid.

By the time the filling level L' has been reached, the rotation of the head 149 will place the filling valve 3 into communication with the chamber 165. It will be remembered that the pressure in this chamber 165 is equivalent to the pressure in the filling tank above the liquid. Therefore, the beer will flow into the container under a full head and at a very rapid rate. The beer continues to flow into the container until by the time it has reached the level M, the continued rotation of the head 149 will have disconnected the filler valve and container from the chamber 165 and established a connection between chamber 166 and the filler valve. It is to be noted that this pressure in chamber 166 which is sufficient to support a column of liquid extending from the liquid level K to the point N will correspondingly support in the filling tank a column extending from the point K' to the point N'. This pressure is greater than the pressure in the chamber 165 and accordingly the beer in the container will be forced back out of the container through the filling valve into the filling tank until the level N' has been reached. This is the filling level of the container and at this time the container will commence to descend, thereby closing the filling valve and shutting off any further pressure to the container.

It is thus seen that in this structure there is established, as in the structure illustrated in Fig. 1, for instance, means whereby there is admitted to the container an initial counter-balancing pressure. Subsequently there is admitted to the container a pressure considerably lower than the initial counter-balancing pressure, which pressure permits the beer or other liquid in the filling tank to flow comparatively

rapidly into the container. Thereafter there is admitted to the container a pressure less than that admitted initially but greater than that admitted at the second stage, whereby the filling level of the container is eventually established.

The present application is a continuation in part and, for so much as is disclosed therein, of my copending application filed October 21, 1938, Serial No. 236,236 for Bottle filling machine.

I claim as my invention:

1. In a container filling machine, the combination with a filling tank supplied with liquid to be delivered to the container, of a filling valve associated with said tank for controlling the flow of liquid to the container and having a pressure inlet passage for delivering counter-balancing pressure to the container, a water check tank having a plurality of air pressure cylinders therein communicating at their bottoms with the water check tank, means for supplying said cylinders with air under pressure, the air pressure in said cylinders being balanced by the water in said water check tank, the pressure in one of said cylinders being such as to counter-balance a column of liquid in said filler tank extending from the liquid level therein to a point above the container to be filled and below the pressure inlet in said filler valve, the pressure in a second cylinder being greater than the pressure in said first-mentioned cylinder, and means for successively connecting said cylinders with the filling valve.

2. In a container filling machine, the combination with a filling tank supplied with liquid to be delivered to the container, of a filling valve associated with said tank for controlling the flow of liquid to the container and having a pressure inlet passage for delivering counter-balancing pressure to the container, a water check tank having a plurality of air cylinders therein communicating at their bottoms with the water check tank, said water check tank and filling tank communicating with one another above the liquid level in each, means for supplying said cylinders with air under pressure, the air pressure in said cylinders being balanced by the water in said water check tank, the pressure in one of said cylinders being such as to counter-balance a column of liquid in the filler tank extending from the liquid level therein to a point above the container to be filled and below the pressure inlet in said filler valve, the pressure in a second cylinder being greater than the pressure in the first-mentioned cylinder, and means for successively connecting said cylinders with the filling valve and container.

3. In a container filling machine, the combination with a rotatable filling tank supplied with liquid to be delivered to the container, of a filling valve associated with said tank for controlling the flow of liquid to the container and having a pressure inlet passage for delivering counter-balancing pressure to the container, a water check tank having a closure head and rotatable with said filling tank, said head having a passage therein connected with the pressure inlet passage of the filling valve, a pressure cylinder arranged within said water check tank communicating at its bottom with said water check tank and at its top with the passage in the head of the tank, the pressure in said cylinder being balanced by the water in said water check tank and said pressure being such as to counter-balance a column of liquid in said filler tank extending from the liquid level thereof to a point above the container to be filled and below the pressure inlet in said filler valve, a second pressure cylinder in said water check tank communicating at its bottom with said tank, the water in said water check tank balancing the pressure in said second-mentioned cylinder, means for supplying pressure to said cylinder and the pressure in said cylinder being greater than the pressure in said first-mentioned cylinder and a valve associated with said second-mentioned cylinder for respectively shutting off communication between said passage in the head of the water check tank and said first-mentioned cylinder and establishing communication between said second-mentioned cylinder and said passage.

4. In a container filling machine, the combination with a filling tank supplied with liquid to be delivered to the container, of a filling valve associated with said tank for controlling the flow of liquid to the container, a pressure chamber adapted to furnish pressure to the container slightly less than the pressure above the liquid in the filling tank and the liquid head in said tank, a second pressure chamber adapted to supply pressure in the container less than said first-mentioned chamber, a third pressure chamber adapted to supply pressure in the container greater than said second-mentioned chamber and less than said first-mentioned chamber, and means for successively connecting said chambers with the container to be filled, the pressure supplied by all of said chambers being greater than atmospheric pressure.

5. In a container filling machine, the combination with a filling tank supplied with liquid to be delivered to the container, of a filling valve associated with said tank for controlling the flow of liquid to the container, a pressure chamber adapted to furnish pressure to the container slightly less than the pressure above the liquid in the filling tank and the liquid head in said tank, a second pressure chamber adapted to supply pressure in the container, less than said first-mentioned chamber, a third pressure chamber adapted to supply pressure in the container greater than said second-mentioned chamber and less than said first-mentioned chamber, means for supplying equal pressure to all of said chambers, means for maintaining the pressure differentials in said chambers, means for varying the pressure in said first-mentioned chamber without affecting the pressure in the remaining chambers and means for successively connecting said chambers with the container.

6. In a container filling machine, the combination with a filling tank supplied with liquid to be delivered to the container, of a filling valve associated with said tank for controlling the flow of liquid to the container and having a pressure inlet passage for delivering counter-balancing pressure in the container, a pressure chamber adapted to furnish pressure to the container sufficient to counter-balance a column of liquid extending from the liquid level in the filler tank to a point slightly above the bottom of the container, a second pressure chamber adapted to supply pressure to the container to be filled to support a column of liquid extending from the liquid level in the filler tank to a point above the top of the container and below the pressure inlet passage of the filler valve, a third pressure chamber adapted to furnish pressure in the container sufficient to support a column of liquid extending from the liquid level of the filler tank to the predetermined filling level of the con-

tainer, and means for successively connecting said pressure chambers with the container.

7. In a container filling machine, the combination with a filling tank supplied with liquid to be delivered to the container, of a filling valve associated with said tank for controlling the flow of liquid to the container and having a pressure inlet passage for delivering counter-balancing pressure to the container, a water check tank having a plurality of air pressure cylinders therein communicating at their bottoms with said water check tank, a common means for supplying air pressure to said cylinders, the air pressure in said cylinders being balanced by the water in said water check tanks, the effective length of one of said cylinders being such as to establish an air pressure therein sufficient to support a column of liquid extending from the liquid level in the filler tank to a point slightly above the bottom of the container to be filled, the effective length of a second of said cylinders being such as to establish an air pressure therein sufficient to support a column of liquid extending from the liquid level in the filler tank to a point above the top of the container and below the air passage in said filler valve, the effective length of a third cylinder being such as to establish an air pressure therein to support a column of liquid extending from the liquid level in the filler tank to the filling level in the container means for successively connecting said cylinders with the filler valve and container, and means for adjusting the effective length of said first-mentioned cylinder.

8. In a container filling machine, the combination with a filling tank supplied with liquid to be delivered to the container, of a filling valve associated with said tank for controlling the flow of liquid to the container and having a pressure inlet passage for delivering counter-balancing pressure to the container, a water check tank, a plurality of cylinders communicating at their bottoms with the water check tank and projecting below the water level in the water check tank, means for supplying air under pressure to said cylinders to maintain the water out of the same, the distance one of said cylinders projects below the level in the tank being such as to establish an air pressure in said cylinder sufficient to support a column of liquid in the filler tank extending from the liquid level in the filler tank to a point above the container top and below the air passage in the valve, the distance the second cylinder extends below the water level in the water check tank being sufficient to establish sufficient pressure therein to support a column of liquid in the filler tank extending from the liquid level therein to a predetermined filling level in the container, the pressure in said filler tank and in said water check tank above the liquid contained therein being equalized, and means for successively connecting said cylinders to the container.

9. In a container filling machine, the combination with a filling tank supplied with liquid to be delivered to the container, of a filling valve associated with said tank for controlling the flow of liquid to the container and having a pressure inlet passage for delivering counter-balancing pressure to the container, a water check tank communicating with said filling tank above the liquid levels in said tanks, a plurality of cylinders communicating at their bottoms with the water check tank and projecting below the water level in the water check tank, means for supplying air under pressure to said cylinders to maintain the water out of the same, the distance one of said cylinders projects below the water level in the water check tank being such as to establish an air pressure therein sufficient to support a column of liquid in the filler tank extending from the liquid level therein to a point above the container top and below the air pressure in the filling valve, the distance the second cylinder extends below the water level in the water check tank being sufficient to establish sufficient pressure therein to support a column of liquid in the filler tank extending from the liquid level in the filler tank to a predetermined filling level in the container, and means for successively connecting said cylinders to the container.

10. In a container filling machine, the combination with a filling tank supplied with liquid to be delivered to the container, of a filling valve associated with said tank for controlling the flow of liquid to the container and having a pressure inlet pressure for delivering counter-balancing pressure to the container, a water check tank having the pressure therein equalized with the pressure in the filling tank above the liquid therein, a plurality of cylinders communicating at their bottoms with the water check tank and projecting below the water level in the water check tank, means for supplying air under pressure to said cylinders to maintain the water out of the same, the distance one of said cylinders projects below the water level in the tank being sufficient to establish an air pressure therein sufficient to support a column of liquid in the filler tank extending from the liquid level therein to a point a slight distance above the bottom of the container, the distance a second cylinder extends below the water level in the water check tank being sufficient to establish sufficient air pressure therein to support a column of liquid in the filler tank extending from the liquid level therein to a point above the container top and below the air passage in the filler valve, the distance a third cylinder projects below the water level in the water check tank being sufficient to establish an air pressure therein sufficient to support a column of liquid in the filler tank extending from the liquid level therein to a predetermined filling level in the container, and means for successively connecting said cylinders to the container.

11. In a container filling machine, the combination with a filling tank supplied with liquid to be delivered to the container, of a filling valve associated with said tank for controlling the flow of liquid to the container and having a pressure inlet passage for delivering counter-balancing pressure to the container, a water check tank having the pressure therein equalized with the pressure in the filling tank above the liquid therein, a plurality of cylinders communicating at their bottoms with the water check tank and projecting below the water level in the water check tank, means for supplying air under pressure to said cylinders to maintain the water out of the same, the distance one of said cylinders projects below the water level in the tank being sufficient to establish an air pressure therein sufficient to support a column of liquid in the filler tank extending from the liquid level therein to a point a slight distance above the bottom of the container, the distance a second cylinder extends below the water level in the water check tank being sufficient to establish sufficient air pressure therein to support a column of liquid in the filler tank ex-

tending from the liquid level therein to a point above the container top and below the air passage in the filler valve, the distance a third cylinder projects below the water level in the water check tank being sufficient to establish an air pressure therein sufficient to support a column of liquid in the filler tank extending from the liquid level therein to a predetermined filling level in the container, means for successively connecting said cylinders to the container, and means for vertically adjusting one of said cylinders.

12. In a container filling machine, the combination with a filling tank supplied with liquid to be delivered to the container, of a filling valve associated with said tank for controlling the flow of liquid to the container and having a pressure inlet passage for delivering counter-balancing pressure to the container, a water check tank having the pressure therein equalized with the pressure in the filling tank above the liquid therein, a plurality of cylinders communicating at their bottoms with the water check tank and projecting below the water level in the water check tank, means for supplying air under pressure to said cylinders to maintain the water out of the same, the distance one of said cylinders projects below the water level in the tank being sufficient to establish an air pressure therein sufficient to support a column of liquid in the filler tank extending from the liquid level therein to a point a slight distance above the bottom of the container, the distance a second cylinder extends below the water level in the water check tank being sufficient to establish sufficient air pressure therein to support a column of liquid in the filler tank extending from the liquid level therein to a point above the container top and below the air passage in the filler valve, the distance a third cylinder projects below the water level in the water check tank being sufficient to establish an air pressure therein sufficient to support a column of liquid in the filler tank extending from the liquid level therein to a predetermined filling level in the container, means for successively connecting said cylinders to the container, and means for vertically adjusting said first-mentioned cylinder.

13. In a container filling machine, the combination with a filling tank supplied with liquid to be delivered to the container, of a filling valve associated with said tank for controlling the flow of liquid to the container and having a pressure inlet passage for delivering counter-balancing pressure to the container, a water check tank having a plurality of air pressure cylinders therein communicating at their bottoms with the water check tank, means for supplying said cylinders with air under pressure, the air pressure in said cylinders being balanced by the water in said water check tank, the pressure in one of said cylinders being such as to counter-balance a column of liquid in said filler tank extending from a liquid level therein to a point above the container to be filled and below the pressure inlet in said filler valve, the pressure in said second cylinder being greater than the pressure in said first-mentioned cylinder, means for successively connecting said cylinders to the filling valve and means for connecting the container above the contents thereof with the atmosphere during its filling operation.

14. A valve for filling machines, comprising a member having a circular face thereon and a plurality of ports terminating in said face, a second valve member comprising a sleeve having a passage opening at one end thereof, a piston member operating in said sleeve comprising a stem threaded at one end and having an annular shoulder fitting within said sleeve, said piston member having a passage extending axially therethrough, a shoe having an opening threadedly receiving the threaded end of said piston, a facing for said shoe formed of friction reducing material, said facing and shoe having openings therein communicating with the axial opening in the piston and a coiled spring interposed between the shoulder on said piston and a shoulder within said sleeve for biasing said shoe into sliding engagement with the first-mentioned face.

15. In a container filling machine, the combination with a filling tank, of a filling valve associated therewith for delivering the liquid from the tank to the container to be filled, a pressure chamber adapted to furnish pressure to said container slightly less than the pressure above the liquid in the filling tank and the liquid head in said tank, a second pressure chamber adapted to supply pressure to the container substantially equal to the pressure above the liquid in the tank, a third pressure chamber adapted to supply pressure to the container greater than said second-mentioned chamber, and means for successively connecting said chambers with the container to be filled.

16. In a container filling machine, the combination with a filling tank, of a filling valve associated therewith to deliver the liquid from the tank to a container to be filled, a pressure chamber adapted to furnish pressure to said container slightly less than the pressure above the liquid in the filling tank and the liquid head in said tank, a second pressure chamber adapted to supply pressure to the container substantially equal to the pressure above the liquid in the tank, a third pressure chamber adapted to supply pressure to the container less than said first-mentioned chamber and greater than the second-mentioned chamber, and means for successively connecting said chambers with the container to be filled.

17. In a container filling machine, the combination with a filling tank, of a filling valve associated therewith for delivering liquid from the tank to the container to be filled, a pressure chamber adapted to deliver pressure to the container slightly less than the combined liquid head and pressure above the liquid in said tank, a second pressure chamber communicating with the filling tank above the liquid therein, a third pressure chamber adapted to deliver pressure to the container less than said first chamber and greater than the second chamber, and means for successively connecting said chambers with the container.

18. The combination with a liquid filler tank, of a filler valve associated with said tank and having a filler tube adapted to project into the container to be filled, a water check tank having a pressure cylinder therein having a pressure therein supporting a column of liquid equal to a column of liquid in the liquid tank and filler valve from a point above the discharge end of the filling tube to the liquid level in the tank, the pressure in said water check tank being equal to the pressure in the liquid tank above the liquid therein, a second pressure cylinder in said water check tank having a pressure therein sufficient to support a column of liquid in the liquid tank and valve extending from the liquid level to the top of the container and means for successively connecting said first pressure cylinder, the water

check tank and the second pressure cylinder to the container to be filled.

19. In a container filling machine, the combination with a filling tank, of a filling valve associated therewith for delivering liquid from the tank to the container to be filled, a pressure chamber adapted to deliver pressure in the container slightly less than the combined liquid head and pressure above the liquid in said tank to permit liquid to flow from said tank into said container at a slow rate, a second pressure chamber communicating with the filling tank above the liquid and adapted to deliver pressure to the container equal to the pressure above the liquid into the tank to permit the liquid to flow into the bottle under the weight of its own head, a third pressure chamber adapted to deliver pressure to the container sufficient to force out of said container liquid delivered thereto until the liquid level in the container is at the top of the container, and means for successively connecting said chambers with the container.

20. In a container filling machine, the combination with a filling tank supplied with liquid to be delivered to the container, of a filling valve associated with said tank for controlling the flow of liquid to the container, a pressure chamber adapted to furnish pressure to the container slightly less than the pressure above the liquid in the filling tank and the liquid head in said tank, a second pressure chamber adapted to supply pressure in the container less than said first-mentioned chamber, a third pressure chamber adapted to supply pressure in the container greater than said second-mentioned chamber and less than said first-mentioned chamber, and means for successively connecting said chambers with the container to be filled.

21. In a container filling machine, the combination with a filling tank supplied with liquid to be delivered to the container, of a filling valve associated with said tank for controlling the flow of liquid to the container, a pressure chamber adapted to furnish pressure to the container sufficient to support a column of liquid extending from the liquid level in the filling tank to a point considerably below the filling level in the container, a second pressure chamber adapted to supply pressure to the container less than that of the first-mentioned chamber, a third pressure chamber having a pressure therein sufficient to support a column of liquid in the filling tank extending from the level of the liquid therein to the filling level of the container said pressure being greater than that supplied by the second pressure chamber, and means for successively connecting said chambers with the container to be filled.

22. In a container filling machine, the combination with a filling tank supplied with liquid to be delivered to the container, of a filling valve associated with said tank for controlling the flow of liquid to the container, a water check tank having a plurality of pressure cylinders therein, means for supplying said cylinders with air under pressure, one of said cylinders extending into the water in said water check tank a sufficient distance to establish a pressure in said cylinder sufficient to support a column of liquid extending from the liquid level in the filling tank to a point below the filling level in the container, said water check tank being adapted to supply pressure to the container less than that provided by said cylinder, another cylinder in said water check tank extending into the water of said tank to establish a pressure sufficient to support a column of liquid extending from the liquid level in the filling tank to the filling level in the container which pressure is greater than that supplied by the water check tank, and means for successively supplying said pressures to the container.

23. A valve for filling machines, comprising a member having a circular face thereon and a plurality of ports terminating in said face, a second valve member comprising a sleeve having an axial bore therein, said axial bore for a portion of its length being enlarged to the top of said sleeve, a sliding valve member fitting the restricted portion of the axial bore in said sleeve and having an annular flange closing the top of said enlarged portion, said sliding valve member having an axial opening extending therethrough, that portion of the sliding member above said flange being externally screw-threaded, and a shoe having its face formed of frictional reducing material provided with an internally screw-threaded opening to receive the threaded portion of the sliding member and a coiled spring surrounding said sliding member arranged within said large portion between the annular flange on the sliding member and the base of the enlarged portion of the axial bore.

24. A valve for filling machines, comprising a member having a circular face thereon and a plurality of ports terminating in said face, a pair of valve members each comprising a sleeve having an axial bore therein and an axially sliding valve member movable within said bore and having an axial opening extending therethrough, means for biasing said sliding valve member outward, the upper ends of each of said sliding valve members being externally screw-threaded, an arcuate shoe having a friction reducing surface provided with an arcuate groove therein and having a pair of internally screw-threaded sockets for receiving the ends of said sliding valves, the groove in said shoe being adapted to communicate with the axial opening in each of said sliding members.

25. A valve for filling machines, comprising a member having a circular face thereon and a plurality of ports terminating in said face, a pair of valve members each comprising a sleeve having an axial bore therein, the upper portion of said bore being enlarged to the top of the sleeve, a sliding valve member operating in said bore having an opening extending therethrough, an annular flange on said valve member closing the enlarged portion of the sleeve bore, that portion of each of the sliding valve members being externally screw-threaded above the annular flange, an arcuate shoe having the surface thereof formed of friction reducing material and provided with a pair of internally threaded sockets for receiving the ends of the sliding valve members, said shoe having an arcuate groove in the face thereof communicating with the axial openings in each of said sliding valve members, and means for biasing each of said sliding valve members outwardly.

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