Aug. 5, 1952 G. STERN 2,605,949

CONTROL HEAD FOR DEVICES FOR FILLING BOTTLES UNDER COUNTERPRESSURE

Filed Feb. 1, 1946 3 Sheets-Sheet 1

FIG. 1.

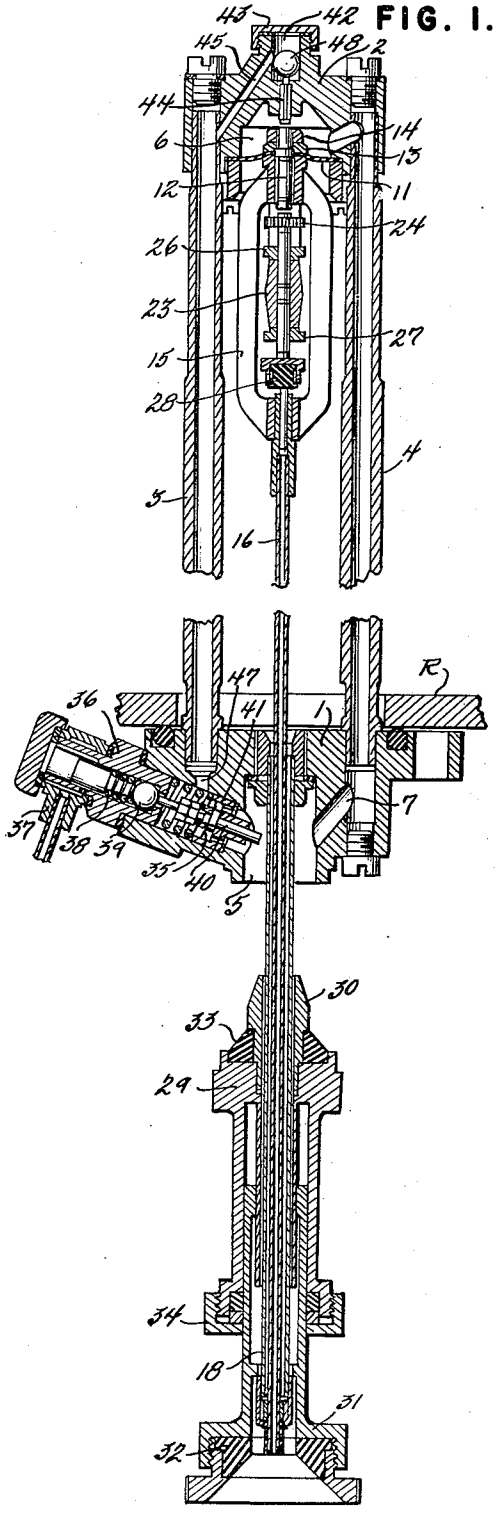

FIG. 2.

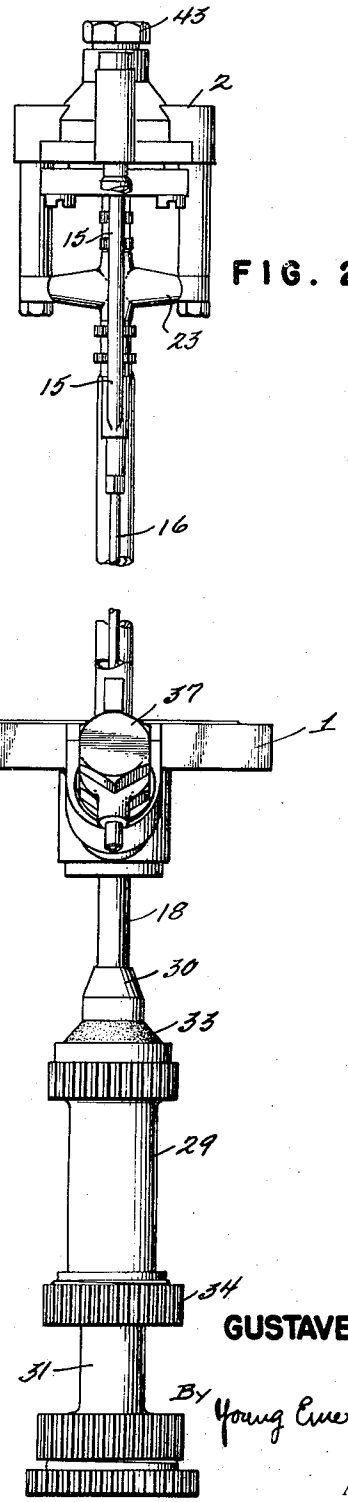

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FIG. 3.

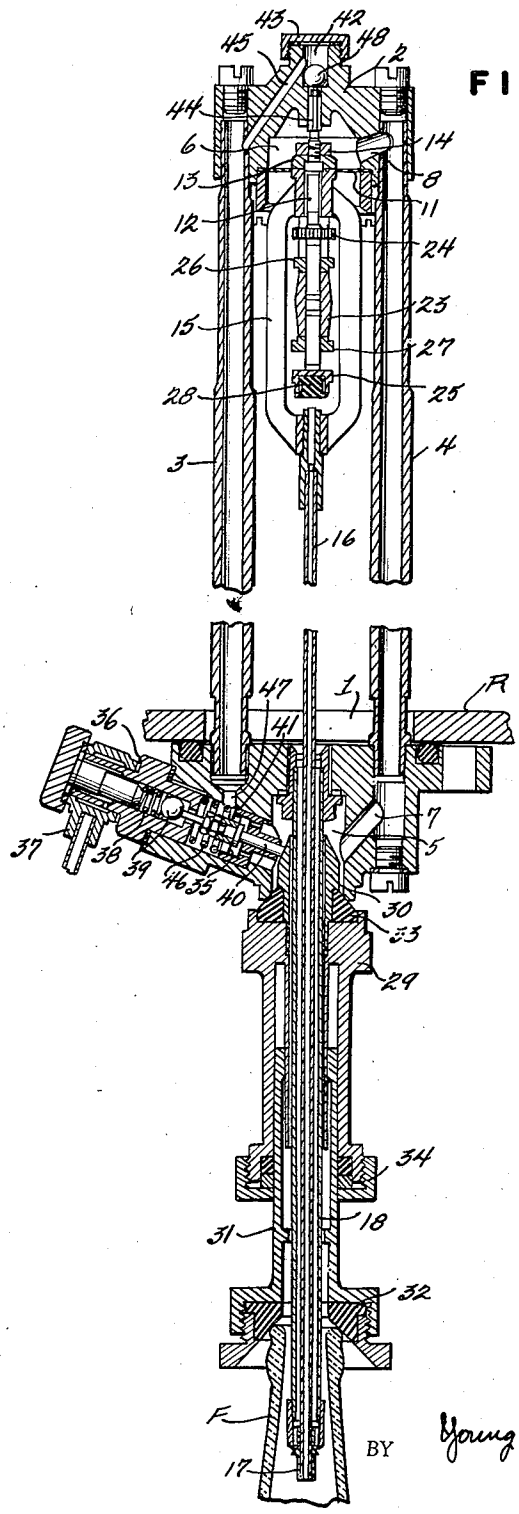

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FIG. 4.

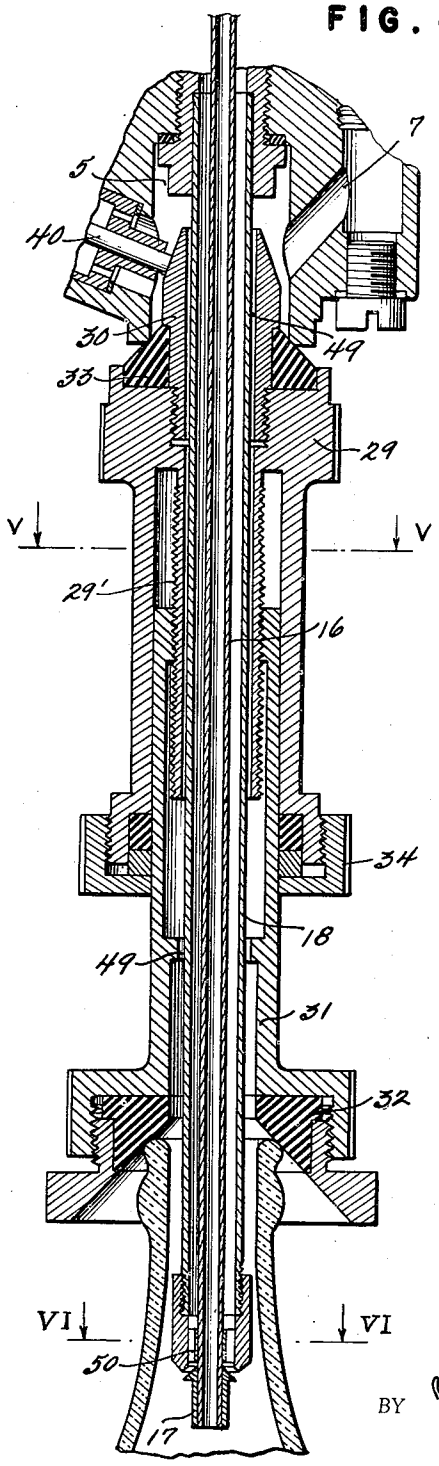


FIG. 5.

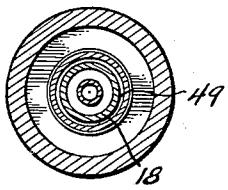
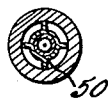


FIG. 6.



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CONTROL HEAD FOR DEVICES FOR FILLING BOTTLES UNDER COUNTERPRESSURE

Gustave Stern, Paris, France

Application February 1, 1946, Serial No. 644,915
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6 Claims. (Cl. 226—111)

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The object of the present invention is a control head for devices for filling bottles, or other like containers, with gaseous or non-gaseous liquids, under counter-pressure, said head previously placing the bottles under compressed air.

The purpose of the invention is essentially to increase the automatic operation of the device, thereby enabling the rate of filling to be considerably accelerated, thus increasing the efficiency.

The invention ensures the satisfactory operation of the device when the pressure of the supply of compressed air is higher than the pressure in the filling tank which contains the liquid to be drawn off. Owing to this fact, it permits the elimination of the complicated and costly apparatus intended to ensure the regularity of the air pressure.

Finally, the invention relates to the provision of means for enabling the level of the liquid inside the bottles to be adjusted accurately and at will.

In order to facilitate explanation, reference will be made hereinafter to the general characteristics of the control head to which the invention relates.

Said head, which is mounted in known manner on the bottom of the liquid tank, comprises a pressure chamber which is closed by a diaphragm, and which is filled with compressed air after the lifting movement of the bottle has been effected. The diaphragm controls the introduction by gravity of the liquid into said bottle, as soon as a pressure equal to that prevailing in the air space of the liquid tank has been reached in the pressure chamber. The control device for the liquid valve which is introduced into the neck of the bottle, effects, at the same time, the exhausting of the residual air, during the introduction of the liquid into the bottle.

The control of the compressed air is effected by the action of the bottle itself and through the intermediary of a sleeve sliding on the filling tube.

The advantage is thus obtained, relatively to the other known arrangements, of totally eliminating a mechanical operation of stop-cocks and valves; the filling being effected in an absolutely automatic manner. The correct sequence of operations—viz: placing under pressure the filling and the exhausting of the air—are obtained merely by the lifting movement of the bottle or other container to be filled. The filling level is kept absolutely constant, whatever the shape and the cross-section of the neck of the container may be.

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In view of the fact that the filling is subordinated to the placing of the bottles under pressure, and that such placing under pressure is controlled by the bottles themselves, thus filling becomes impossible for damaged or broken bottles, and the operation is immediately stopped when a bottle breaks; it commences only when the pressure in the bottle is equal to that which prevails in the liquid tank. In this manner, the liquid is effectively prevented from frothing or from losing its gas content during the filling operation. During the filling operation, the liquid runs along the wall of the bottle, thereby preventing the breakage of the bottles owing to differences of temperature between their walls and the liquid.

The arrangement is such that the liquid can never rise in the tube for exhausting the residual air and cause the obstruction thereof.

The liquid and residual air tubes, being all straight and readily removable, permit of easy and quick cleaning.

Furthermore, no member dips in the liquid within the bottle. Owing to this fact, there is no lowering of the liquid level when the bottle is removed from the device.

Finally, the device is particularly well adapted to sterile filling, owing to the fact that the compressed air can be replaced by carbonic acid, or by sulphur dioxide, a fact which, for beer for example, is of great advantage.

The accompanying drawings illustrate a control head for a filling device using gaseous liquids, in which:

Figure 1 is a vertical longitudinal section; and shows the control head in the closed position.

Figure 2 is a corresponding side view.

Figure 3 is a similar section through the head in the open or filling position.

Figure 4 is a partial vertical longitudinal section of the lower part of the device.

Figure 5 is a transverse section through line V—V of Figure 4.

Figure 6 is another transverse section through line VI—VI of Figure 4.

Under the liquid tank, which is equipped in the known manner and which is diagrammatically represented by its base R in Figures 1 and 3, is fixed a lower member 1 connected to a head member 2. Said head member is carried by the hollow columns 3 and 4, and is provided with a valve housing 42 which is closed by a cap 43. Inside said housing is a ball 48, which can be lifted from its seat by a push rod 44 (see Fig. 1). A duct 45 places the housing 42 in communication with the hollow column 3, and column 4

places a housing 5, formed in the base member 1, in communication with the pressure chamber 6 in the head member 2, through the ducts 7 and 8. The pressure chamber 6 is closed, relatively to the air space of the liquid tank, by means of a diaphragm 11 which controls a rod 12 secured to the said diaphragm by means of the ring 13 and nut 14. To the rod 12 is fixed a stirrup 15, on which is mounted the small residual air exhaust tube 16. Said tube carries at the lower end thereof centered by the guide 50 (see Fig. 6), a liquid valve 17 (see Fig. 4) which opens downwardly and which closes the filling tube 18 so long as the pressure in the air space of the liquid tank is greater than that in the pressure chamber 6. In such a case, the diaphragm 11 is forced in an upward direction (see Figure 1).

A spider 23 (see Fig. 2), which is fixed to the head member 2, passes through the stirrup 15. Said spider carries adjusting screws 24 and 25 which are locked by lock-nuts 26 and 27. In the head of the screw 25 is mounted a rubber seat 28. The screws 24 and 25 are so adjusted that in the closed position (Figure 1) the orifice of the residual air exhaust tube is closed, whereas between the lower face of the rod 12 and the upper face of the adjusting screw 24 there remains a clearance corresponding to the travel of the lower liquid valve 17.

In the filling position (Figure 3) on the other hand, the lower face of the rod 12 bears against the upper face of the adjusting screw 24; the residual air exhaust tube 16 is moved away from the rubber seat 28 and is consequently open. In order to obtain an air-tight closure of the tube 16, the clearance provided between said tube and its seat 28 should be slightly less than that existing between the rod 12 and the adjusting screw 24, so that the end of the tube 16 can penetrate into said rubber seat.

On the filling tube 18 a sleeve 29 is provided, which is extended upwardly by a cone 30. Between the tube 18 and the sleeve 29 a sleeve 31 is adjustable by screwing on the thread formed on the internal part 29' of the sleeve 29. The sleeve 31 forms slides carrying at its lower end an inverted funnel-shaped member. Said sleeve is tightened by means of a stuffing box 34. The sleeve 29 and the funnel-shaped member 31 are provided with rubber annular joints 32 and 33.

In the base member 1 is mounted a valve body 36 carrying the air inlet nozzle 37. The body 36 contains a ball 39 which is loaded by a spring 38. An actuating rod 40, which projects into the housing 5 of the base member, effects the opening of the ball valve 39.

Air-tight condition between the housing 5 and the valve body 36 is obtained by clamping the rod 40 on a diaphragm 35, by means of a ring 41 and a spring 46. The compressed air issuing from the valve body 36 reaches the column 3, through an orifice 47 (see Figures 1 and 3).

The method of operation is as follows:

When the bottle F is lifted and centered by the conical member 32 it pushes the group of elements 29, 31 and 30 upwardly and the cone 30 enters the housing 5.

Cone 30 engages the actuating rod 40 of valve 39 and opens said valve. Upon opening valve 39 compressed air flows into the bottle F. The air in flowing from valve 39 to the bottle, passes through the orifice 47, the column 3, duct 45, and about the valve 48 which is still lifted by the push rod 44 because the chamber 6 being then at atmospheric pressure, the diaphragm is still deformed by the internal pressure of the reservoir as shown in Fig. 1. After passing through valve 48 into chamber 6 the compressed air flows through duct 8 into column 4 then through duct 7 into the housing 5. Since the lower portion of housing 5 is closed the compressed air flows into and through the annular space or clearance 49 provided between the exterior surface of tube 18 and the interior surfaces of elements 30, 29 and 31, finally into the bottle.

As soon as the same pressure exists in the bottle F as in the liquid reservoir, the diaphragm 11 returns to its normal plane position as shown in Fig. 3 which lowers the push rod 44. Ball 48 then drops onto its seat and stops the flow of compressed air. The downward movement of the stirrup 15 and the residual air discharge tube 16 which are freely supported by the diaphragm 11, simultaneously opens the liquid control valve 17 at the lower end of tube 18, and the orifice at the upper end of the air discharge tube 16 since the latter leaves the fixed rubber seat 28 which serves as a closure member.

With the parts in this position the air in the bottle can escape through the tube 16 as the liquid flows into the bottle through tube 18 about valve 17 and flows down over the inside surface of the wall of the bottle. This flow of the liquid into the bottle along the wall thereof avoids frothing and also avoids breakage since the temperature of the bottle is uniformly changed until the temperature of the bottle and liquid are in equilibrium. Usually the empty bottles are at the ambient temperature and the liquid is colder.

The liquid flows into the bottle until the level therein reaches the orifice at the lower end of tube 16. The exhaust of the air from the bottle is then stopped, thereby stopping the continuation of the flow of liquid into said bottle.

When the bottle moves downwards, the air and liquid supply pipes simultaneously close; all dripping is thus avoided.

The upper face of the diaphragm 11 is then in communication with the atmosphere through 8, 4 and 7, and its lower face is subjected to the pressure prevailing in the tank. Owing to this fact, the said diaphragm returns to the convex position as shown in Figure 1, in which position the ball 48 is again lifted. The cycle described is then repeated.

Accurate adjustment of the level of the liquid in the full bottles is a simple matter. For this purpose, the stuffing box 34 is loosened and the sleeve 29 is adjusted relatively to the member 31. The relative position of these two parts determines the amount of empty space which will remain in the neck of the bottles.

It will be understood that numerous modifications of detail in the device described and illustrated, are possible without departing from the scope of the invention.

This device, although mainly designed for bottling gaseous liquids, can equally well be used for bottling non-gaseous liquids (milk or wine, for example). In this latter application, the purpose of the counter-pressure is to prevent the filling of damaged bottles.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. In a control head for devices for filling bottles and other similar receptacles with gaseous and non-gaseous liquids under counterpressure in which the bottles are filled with com-

pressed air before receiving the liquid, a liquid reservoir, an upper head member in said reservoir foming a pressure chamber, a diaphagm closing said chamber and having its outer face exposed to the pressure of air in said reservoir, duct means connecting said pressure chamber with a bottle to be filled, a first valve controlling the supply of compressed air to said chamber, means actuated by said diaphragm for controlling the opening and closing of said valve to control the filling of the bottle with compressed air, a liquid filling tube extending from said reservoir into the bottle, an air evacuation tube extending through the liquid filling tube for evacuating air from the bottle, a second valve controlling the flow of liquid through the liquid filling tube and actuated by the air evacuation tube, said air evacuation tube being connected to said diaphragm for axial displacement thereby to control said second valve to open the same upon closing the first valve, and a third valve controlling the discharge of air from the bottle through the evacuation tube during filling of the bottle with liquid.

2. In a control head for devices for filling bottles and other similar receptacles with gaseous and non-gaseous liquids under counterpressure in which the bottles are filled with compressed air before receiving the liquid, a liquid reservoir, an upper head member in said reservoir forming a pressure chamber, a diaphragm closing said chamber and having its outer face exposed to the pressure of air in said reservoir, duct means connecting said pressure chamber with a bottle to be filled, a first valve controlling the supply of compressed air to said chamber, means actuated by said diaphragm for controlling the opening and closing of said valve to control the filling of the bottle with compressed air, a liquid filling tube extending from said reservoir into the bottle, an air evacuation tube extending through the liquid filling tube for evacuating air from the bottle, a second valve on the lower end of the liquid filling tube and actuated by the air evacuation tube, said air evacuation tube being connected to said diaphragm for axial displacement thereby to control said second valve to open the same upon closing the first valve, and a third valve controlling the discharge of air from the bottle through the evacuation tube during filling of the bottle with liquid formed of a fixed closure cooperating with the upper end of said evacuation tube.

3. In a control head for devices for filling bottles and other similar receptacles with gaseous and non-gaseous liquids under counterpressure in which the bottles are filled with compressed air before receiving the liquid, a liquid reservoir, an upper head member in said reservoir forming a pressure chamber, a diaphragm closing said chamber and having its outer face exposed to the pressure of air in said reservoir, duct means connecting said pressure chamber with a bottle to be filled, a first valve controlling the supply of compressed air to said chamber, means actuated by said diaphragm for controlling the opening and closing of said valve to control the filling of the bottle with compressed air, a liquid filling tube extending from said reservoir into the bottle, an air evacuation tube extending through the liquid filling tube for evacuating air from the bottle, a second valve controlling the flow of liquid through the liquid filling tube and actuated by the air evacuation tube, said air evacuation tube being connected to said diaphragm for axial displacement thereby to control said second valve to open the same upon closing the first valve, a third valve controlling the discharge of air from the bottle through the evacuation tube during filling of the bottle with liquid, a lower head mounted on the exterior of the reservoir, a fourth valve in the lower head controlling the supply of compressed air to said pressure chamber, and means actuated upon elevation of a bottle to filling position to control the operation of said fourth valve.

4. In a control head for devices for filling bottles and other similar receptacles with gaseous and non-gaseous liquids under counterpressure in which the bottles are filled with compressed air before receiving the liquid, a liquid reservoir, an upper head member in said reservoir forming a pressure chamber, a diaphragm closing said chamber and having its outer face exposed to the pressure of air in said reservoir, duct means connecting said pressure chamber with a bottle to be filled, a first valve controlling the supply of compressed air to said chamber, means actuated by said diaphragm for controlling the opening and closing of said valve to control the filling of the bottle with compressed air, a liquid filling tube extending from said reservoir into the bottle, an air evacuation tube extending through the liquid filling tube for evacuating air from the bottle, a second valve controlling the flow of liquid through the liquid filling tube and actuated by the air evacuation tube, said air evacuation tube being connected to said diaphragm for axial displacement thereby to control said second valve to open the same upon closing the first valve, a third valve controlling the discharge of air from the bottle through the evacuation tube during filling of the bottle with liquid, a lower head mounted on the exterior of the reservoir, a fourth valve in the lower head controlling the supply of compressed air to said pressure chamber, means actuated upon elevation of a bottle to filling position to control the operation of said fourth valve, and a second diaphragm separating the fourth valve from the bottle to prevent the escape of air passing to the upper head.

5. In a control head for devices for filling bottles and other similar receptacles with gaseous and non-gaseous liquids under counterpressure in which the bottles are filled with compressed air before receiving the liquid, a liquid reservoir, an upper head member in said reservoir forming a pressure chamber, a diaphragm closing said chamber and having its outer face exposed to the pressure of air in said reservoir, duct means connecting said pressure chamber with a bottle to be filled, a first valve controlling the supply of compressed air to said chamber, means actuated by said diaphragm for controlling the opening and closing of said valve to control the filling of the bottle with compressed air, a liquid filling tube extending from said reservoir into the bottle, an air evacuation tube extending through the liquid filling tube for evacuating air from the bottle, a second valve controlling the flow of liquid through the liquid filling tube and actuated by the air evacuation tube, said air evacuation tube being connected to said diaphragm for axial displacement thereby to control said second valve to open the same upon closing the first valve, a third valve controlling the discharge of air from the bottle through the evacuation tube during filling of the bottle with liquid, a lower head mounted on the exterior of the reservoir beneath the upper head, a compartment in the lower head, a hollow column

connecting the compartment in the lower head through the first valve with upper head, a fourth valve in the lower head controlling the supply of compressed air to said compartment, means actuated upon elevation of a bottle to filling position to control the operation of said fourth valve, a second diaphragm separating the fourth valve and compartment from the bottle, and a second hollow column connecting the chamber in the upper head with the lower head and thence with the bottle.

6. In a control head for devices for filling bottles and other similar receptacles with gaseous and non-gaseous liquids under counterpressure in which the bottles are filled with compressed air before receiving the liquid, a liquid reservoir, an upper head member in said reservoir forming a pressure chamber, a diaphragm closing said chamber and having its outer face exposed to the pressure of air in said reservoir, duct means connecting said pressure chamber with a bottle to be filled, a first valve controlling the supply of compressed air to said chamber, means actuated by said diaphragm for controlling the opening and closing of said valve to control the filling of the bottle with compressed air, a liquid filling tube extending from said reservoir into the bottle, an air evacuation tube extending through the liquid filling tube for evacuating air from the bottle, a second valve controlling the flow of liquid through the liquid filling tube and actuated by the air evacuation tube, said air evacuation tube being connected to said diaphragm for axial displacement thereby to control said second valve to open the same upon closing the first valve, a third valve controlling the discharge of air from the bottle through the evacuation

tube during filling of the bottle with liquid, a lower head mounted on the exterior of the reservoir beneath the upper head, a compartment in the lower head, a hollow column connecting the compartment in the lower head through the first valve with the upper head, a fourth valve in the lower head controlling the supply of compressed air to said compartment, means actuated upon elevation of a bottle to filling position to control the operation of said fourth valve, a second diaphragm separating the fourth valve and compartment from the bottle, a second hollow column connecting the chamber in the upper head with the lower head and thence with the bottle, a sleeve slidably mounted on the liquid filling tube with play between the same to form an air passage, means on the lower end of the sleeve for connection with the mouth of a bottle, means on the upper end of the sleeve to form a connection with the lower head, and means carried by the upper portion of said sleeve to actuate the fourth valve.

GUSTAVE STERN.

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