Jan. 1, 1952 E. E. MARTIN 2,580,567

CONTAINER FILLING SYSTEM

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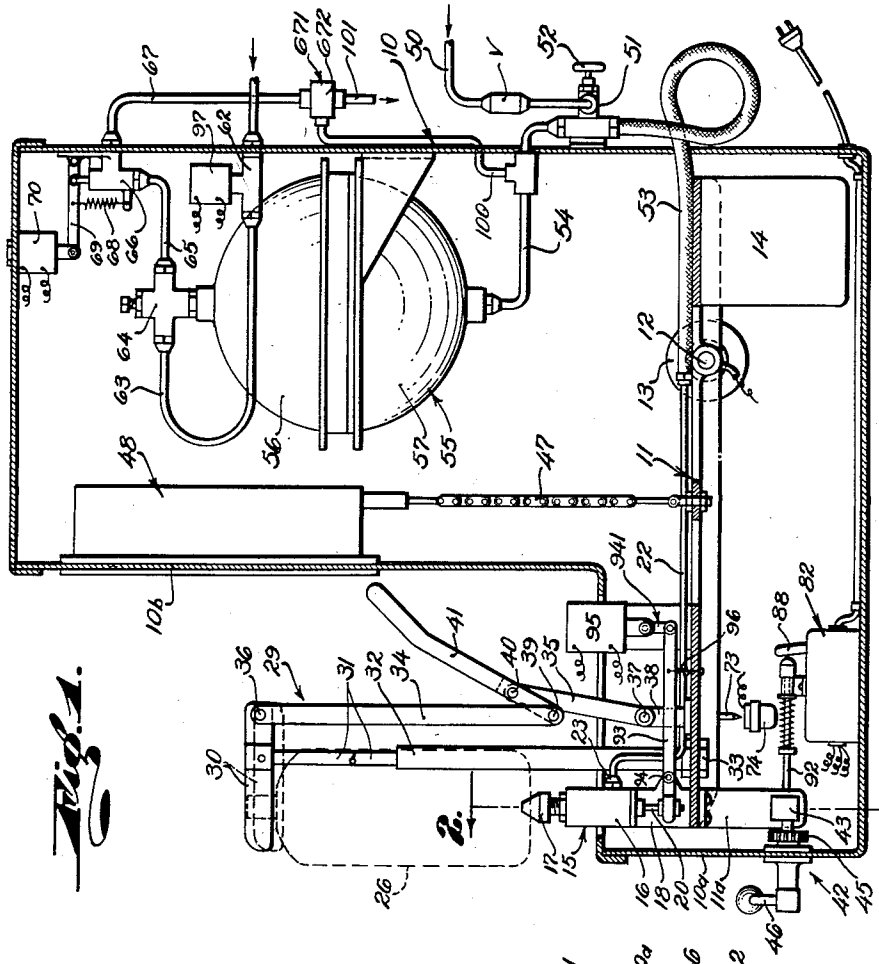


Fig. 1.

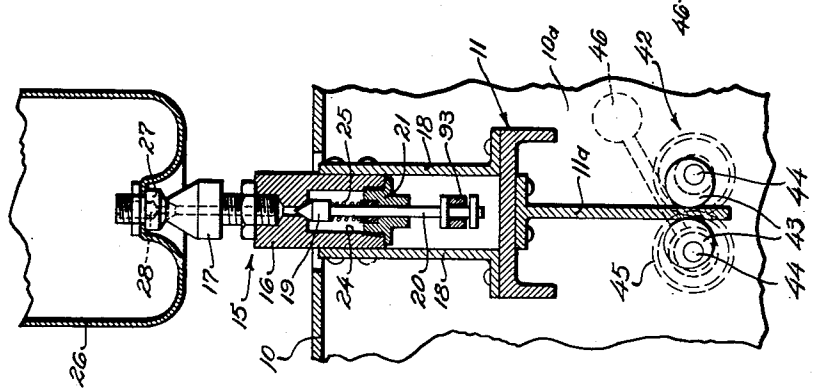


Fig. 2.

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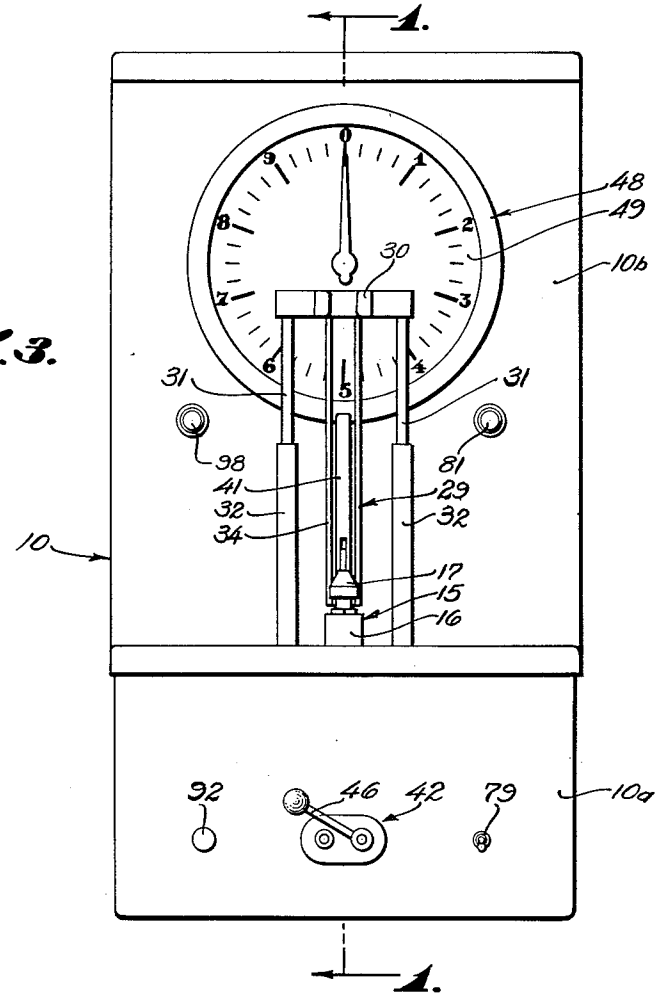
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CONTAINER FILLING SYSTEM

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Fig. 3.



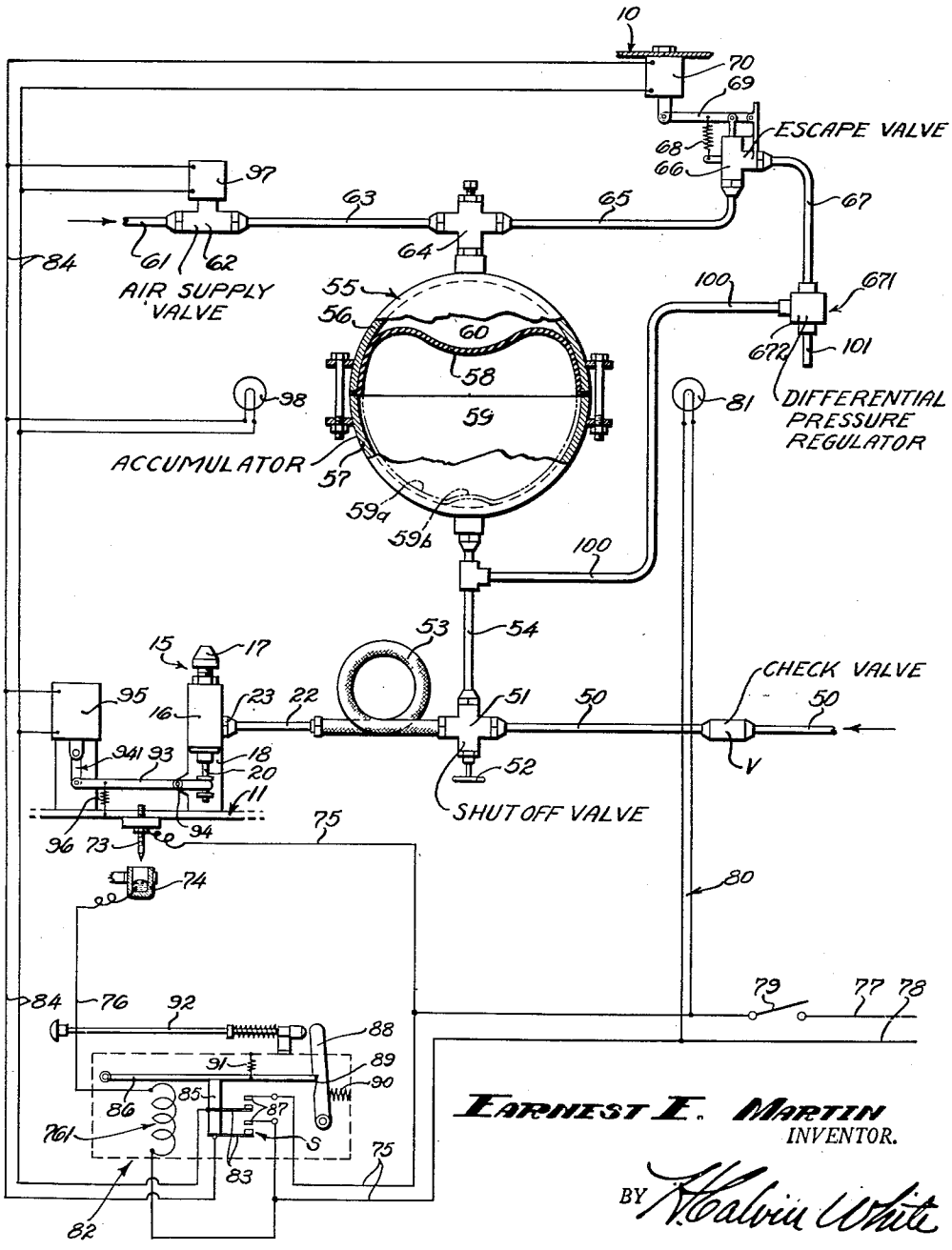
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CONTAINER FILLING SYSTEM

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Fig. 4.



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CONTAINER FILLING SYSTEM

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9 Claims. (Cl. 249—63)

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This invention relates generally to equipment for filling fluid containers, and particularly for charging containers with accurately determinable quantities of high vapor pressure fluids. Typically the invention will be described as embodied in equipment adapted for the filling of hand-size pressure containers for parasiticidal aerosol compositions, comprising a solution of appropriate parasiticide in a liquefied normally gaseous solvent such as dichlorodifluoromethane.

The invention may be further characterized as pertaining to filling equipment by which the quantity of fluid fed into the container is controlled in accordance with the weight of the fluid being charged into the container. In this connection, the invention has among its major objects to provide a simplified filling apparatus whereby in a single rapid operation and short time interval, a container may be charged with an accurately controlled quantity of fluid.

Generally speaking, the invention contemplates the provision of a weight responsive container carrier having a filling head or attachment for association with the filling opening of the container, means for charging pressure fluid into the container while mounted on the carrier, and automatic control means for discontinuing the supply of fluid to the container when the accumulated weight of the charge produces predetermined displacement of the carrier.

I have provided in conjunction with the weight responsive carrier a novel system for forcing the fluid charge into the container by employing a motivating or independently pressurized fluid, all in a manner such that operation of the equipment for the filling of any number of containers requires only the availability of a suitable motivating fluid at proper pressure, and the employment of the hereinafter described controls for automatically governing the charging fluid displacement into the containers.

Of particular importance in the control system is the maintenance of proper relationship between the motivating and charging fluid pressures. Preferably, and in the interests of greatest simplicity in construction and operation of the system, the motivating fluid pressure is communicated to the charging fluid by way of a freely flexible diaphragm. During the charging cycle, the motivating fluid pressure applied to the diaphragm is sufficiently in excess of the charging fluid pressure, or its vapor pressure, to displace the charge into the container at requisite rate. The invention makes particular provision for governing the intake of the charging fluid

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to the diaphragm chamber following its displacement therefrom, in a manner permitting flash vaporization of the charging fluid, by so restricting the rate of motivating displacement by the diaphragm under the influence of the charging fluid pressure, as to assure maintenance of the latter fluid substantially completely in liquid phase.

The invention has various additional features and objects, all of which will be understood to best advantage by reference to the accompanying drawings illustrative of the invention in one of its typical forms. In the drawings:

Fig. 1 is a cross-section side view of the apparatus taken on line 1—1 of Fig. 3;

Fig. 2 is an enlarged fragmentary cross-section on line 2—2 of Fig. 1;

Fig. 3 is a front view of the apparatus; and

Fig. 4 is a diagrammatic layout illustrating the control system.

It is to be understood that the essential parts of the equipment may be arranged and supported in any appropriate manner, and accommodated to housings of any suitable form and construction. Typically, portions of the equipment shown in Fig. 1 are arranged within a housing 10 containing, among other parts, the weighing support, accumulator and scales, all in a manner affording a portable, convenient and compact arrangement easily adaptable for installation and use wherever desired.

The weight-responsive container support preferably comprises an arm or beam 11 pivotally mounted intermediate its ends on shaft or trunnions 12 carried by supports or bearings 13. The rear portion of the lever beyond the trunnions carries the counter-weight 14. The forward end of the arm carries a filling nozzle and control valve assembly, generally indicated at 15, see Fig. 2, comprising a body 16 into the top of which is threaded the adjustable filling nozzle 17. Body 16 is carried on a pair of upright supports 18 attached to the arm 11, and contains a valve 19, the stem 20 of which extends downwardly through the seal fitting 21. As will appear, fluid is admitted to the valve body through line 22 connecting at 23 into the side of the bore 24. Normally, spring 25 closes the valve to prevent fluid discharge to the nozzle 17.

The equipment is adaptable for the filling of aerosol type, hand-size containers 26 having, for example, a bottom or end check valve fitting 27 applicable to the filling nozzle 17 so that the container is charged upwardly through its bottom fitting to a predetermined weight content, the

container fluid pressure acting, upon discontinuance of the fluid intake, to close check valve 28 in the fitting 27 to seal the pressure fluid in the container. Any suitable holding or clamping means may be employed for releasably attaching the container to the weight-responsive lever and for fluid communication with nozzle 17 in the relationship illustrated. Typically, the holding means is shown to comprise a clamp structure 29 which includes a clamping head 30 engageable against the top of the container and carrying rods 31 which depend and slide vertically within a pair of tubular guides 32 attached at 33 to the arm 11. The head is vertically displaceable between the solid (releasing) and dotted line (container clamping) position shown in Fig. 1 by a toggle-type throw comprising links 34 and 35 pivotally connected at 36 and 37, respectively, to the head and arm carried member 38, and pivotally interconnected at 39 and 40 with the handle 41. By swinging handle 41 forwardly from the released position shown, the head may quickly be brought down into engagement with the container, securely clamping its bottom fitting against the nozzle 17.

Suitable means may be provided for holding the arm 11 against movement, or at least downward displacement, while the containers 26 are being applied to and removed from the filling nozzle. A typical holding means 42 may comprise a pair of circular members 43 eccentrically carried on shafts 44 extending through the front wall 10*a* of the housing and carrying intermeshing gears 45 so that the shafts and eccentrics rotate together but in opposite directions. Handle 46 carried by one of the shafts 44 may be thrown to the position illustrated, bringing the eccentrics 43 into holding engagement with web portion 11*a* of the arm, from which position the eccentrics are quickly releasable by throwing the lever 46 to swing them outwardly away from the web 11*a*.

The platform arm 11 is connected by chain 47 or other suitable flexible means, with a spring type weighing scales 48 which may be mounted on the vertical housing wall 10*b* so that the dial or indicator face 49 of the scales is exposed directly back of, and somewhat above the container position, as shown in Fig. 3. Thus the scales provide a visual indicator of the empty container weight, thus enabling the scales to be set at a zero position, and also of the filled container weight, enabling the later described control system to be adjusted in response to an increase of the container fluid weight to any predetermined amount.

Fluid to be charged into the containers, and consisting, for example, of a solution of a parasiticide in a liquefied normally gaseous solvent or carrier, is fed to the system through line 50 leading from a supply source such as a tank containing the high vapor pressure solution. Line 50 leads to a suitable three-way valve 51 having a manual control 52 for purposes later described, and connecting by way of flexible conduit or housing 53 with line 22. Valve 51 also connects through line 54 with a suitable accumulator 55 preferably in the form of a spherical shell between the sections 56 and 57 of which is clamped a flexible diaphragm 58 of rubber or other material capable of distension in either direction into engagement and hemispherical conformity with the inner surfaces of the sections 56 and 57.

Thus diaphragm 58 divides the accumulator into a first chamber 59 communicable through lines 54, 53 and 22 with the filling nozzle 17, and a second chamber 60 to which is supplied an

extraneous or motivating fluid, such as air or any other suitable gas. The air is supplied to chamber 60 from line 61 under control of a motor or solenoid actuated valve 62 and through line 63 to the three-way fitting 64. The latter connects with discharge lines 65 leading to valve 66 which, when open, permits gas to be vented from chamber 60 through line 67 which may open to the atmosphere. Spring 68 attached to the valve arm 69 tends to maintain the valve in open position, from which the valve is closed, as will later appear, upon energization of the solenoid or other type motor 70 connected to the arm 69.

An electrical control system is provided whereby valves 19, 62, and 66 are rendered automatically operable in response to predetermined increase of fluid weight in the container 26, resulting in downward pivotal displacement of the arm 11 a predetermined distance corresponding to the weight increase. In this connection, it is observed that the scales 48 may be of a spring type, i. e. in which one or more of the usual scales-contained springs resist through the chain 47 downward displacement of the platform arm 11. The latter carries a depending contact element 73 cooperable with the stationarily positioned mercury cup 74 to constitute a contact mercury switch in the circuit of conductors 75, 76 and restoring coil 76*l*, connecting with the power supply lines 77 and 78.

Referring to Fig. 4, the circuit includes a manually operated master switch 79 and connections 80 with a signal light 81 indicating the "on" or "off" condition of the control system as a whole. Conductors 75 and 76 connect with a solenoid-type or other suitable relay, conventionally indicated generally at 82, comprising a switch S including a pair of contactors 83 connected in the circuit of conductors 84 and carried on arm 85 of the pivoted lever 86. The contactors 83 normally are maintained in open positions or disengagement from the poles 87 by the pivoted detent 88, the notched portion 89 of which is thrust by spring 90 against the end of lever 86 to resist its upward movement under the influence of spring 91. The lever is releasable to close the switch elements 83, 87 by the manually operable push rod 92 movable against the detent arm 88 to free the end of the lever from its notch.

Referring now to the control for valve 19, stem 20 is engaged by the end of lever 93 pivoted at 94 between the supports 18 and connected at 94*l* with a solenoid or other type motor 95 carried on the platform arm 11. Spring 96 tends normally to maintain the valve 19 in closed position. The solenoid motor 97 for valve 62, and motor 70 actuating the valve 66, are connected in the circuit of conductors 84, as illustrated. A second signal lamp 98, connected in the same circuit and illuminated during filling, is deenergized upon reception of the full predetermined fluid charge in the container, resulting in the closure of the mercury switch 73, 74.

In considering the operation of the equipment, assume first that the system is to be conditioned for initial reception of the container charging fluid. Such fluid, typically a liquefied solution of a parasiticide in normally gaseous solvents such as dichlorodifluoromethane, is admitted from a suitable source or container, not shown, to the system through line 50 past check valve V acting to prevent return flow. At first, valve 52 may be closed to prevent passage of the fluid from line 50 to the filling head or diaphragm chamber 59. By actuating push rod 92 to close

the switch S, the valve 62 opens to admit air or other gaseous motivating fluid through line 63 to the diaphragm chamber 60, deflecting the diaphragm 58 downward into flush engagement with the inner hemispherical surface of the lower shell section 57, to completely displace all air from chamber 59 through line 54 and the filling head. Note that the showing of the four-way fitting assembly 51 is diagrammatic only, and that the valve 52 is operable to open and close communication between line 50 and lines 53 and 54, while leaving lines 53 and 54 at all times in open communication. With the diaphragm thus depressed against the bottom surface of its shell, the beam 11 may be manually depressed to make contact between the poles 73, 74 of the mercury switch and thereby open the switch S to close the filling head valve 19, the air supply valve 62 and open the escape valve 66. Thereupon, valve 52 may be opened to admit the charging fluid through line 54 to the diaphragm chamber.

Provision is made for preventing the escape of air from chamber 60 under control of valve 66, at a rate sufficiently fast to prevent flash vaporization of the charging fluid entering chamber 59. Such control may be effected by using a valve device 66 in the nature of a needle valve, although preferably I place in the air discharge line 67 a regulator 671 which will maintain a predetermined differential between the charging fluid pressure entering chamber 59, and the air escape pressure in chamber 60. For the purposes of control 671 I may use any of known types of differential pressure regulators, conventionally represented at 672, connected by line 100 with line 54. The regulator 672 may be set to pass air to the outlet 101 when and only when the air pressure in line 67 has a predetermined relation or approach to the charging fluid pressure in line 54. As illustrative, assuming the charging fluid pressure to be 75 pounds per square inch gauge, the regulator 672 will pass air to the outlet 101 only when the pressure in line 67 reaches about 70 pounds per square inch gauge. In this manner the air escape from chamber 60 and its displaceability by the charging fluid entering chamber 59, are sufficiently retarded as to prevent excessive or flash vaporization of the charging fluid that might otherwise occur upon sudden release of air from chamber 60. As will be understood, chamber 59 may receive the charging fluid to a full capacity limited by flush engagement of the diaphragm 58 against the hemispherical surface of the shell section 56.

With the beam 11 secured by the locking means 42, the container 26 may be clamped to the filling head in the dotted line position of Fig. 1, the beam lock 42 released, and rod 92 manually actuated to close switch S thus opening the filling valve 19 and the air valve 62 and closing valve 66. The air pressure thus communicated to chamber 60 displaces the charging fluid from chamber 59 through the filling head into the container until the downward displacement of the beam 11 a distance corresponding exactly to the predetermined weight of the charge to be taken into the container, as determined by the setting of the scales 48, closes the mercury switch 73, 74, with resultant energizing of the restoring coil 761, displacement of arm 86 into latched relation with the element 83, and the opening of switch S causing the closing of valves 19 and 62, and the opening of valve 66. After locking the beam 11, the filled container 26 may be removed and a successive or empty container inserted for filling.

As previously indicated, the regulated relief of air from the chamber 60 under control of valve 66 or the regulator 671, permits the charging fluid to fill into chamber 59 at a rate sufficient to permit rapid filling of successive containers, but yet sufficiently slow to prevent flash vaporization that might otherwise occur upon too rapid relief of the opposing pressure in chamber 60. While it is contemplated that chamber 59 may have any desired volume, preferably its dimensions are such that when the diaphragm is deflected to its upper limiting position of flush engagement with the shell section 56, the chamber will accommodate substantially the quantity of charge required to fill a single container. Thus, when the diaphragm is fully depressed, it will assume the dot-dash line position 59*a* closely approaching complete engagement with the hemispherical surface of the lower shell section 57, with perhaps only a relatively small amount of fluid remaining below the central area 59*b* of the diaphragm.

The drawings are to be regarded merely as illustrative of the invention in a typical embodiment, it being understood that various changes and modifications may be made without departure from the invention in its intended spirit and scope.

I claim:

1. Container filling equipment of the character described, comprising a movable weight-responsive container support, a filling nozzle carried by said movable support, an accumulator connected to said nozzle, means for supplying fluid to said accumulator for delivery to a container through said nozzle, means for displacing said fluid from the accumulator to the nozzle, and means responsive to predetermined increase of fluid weight in the container for discontinuing the supply of fluid to the container.

2. Container filling equipment of the character described, comprising a movable weight-responsive container support, a filling nozzle carried by said movable support, an accumulator connected to said nozzle, means for supplying fluid to said accumulator for delivery to a container through said nozzle, said accumulator having a movable wall actuated by an extraneous fluid pressure for displacing said fluid from the accumulator to the nozzle, and means responsive to predetermined increase of fluid weight in the container for discontinuing the supply of fluid to the container.

3. Container filling equipment of the character described, comprising a movable weight-responsive container support, a filling nozzle carried by said movable support, an accumulator connected to said nozzle, means for supplying fluid to said accumulator for delivery to a container through said nozzle, means for displacing said fluid from the accumulator to the nozzle by an extraneous fluid, and valve means responsive to predetermined increase of fluid weight in the container for discontinuing both the supply of fluid to the container and the tendency of said extraneous fluid to displace fluid from the accumulator to said nozzle.

4. Container filling equipment of the character described, comprising a movable weight-responsive container support, a container filling nozzle carried by said movable support, an accumulator containing a diaphragm separating first and second chambers within the accumu-

lator, means connecting said first chamber with said nozzle, means for delivering fluid to said first chamber, means for delivering an extraneous fluid to said second chamber to cause the diaphragm to displace fluid from the first chamber through said nozzle, and means responsive to predetermined increase of fluid weight in the container for discontinuing the flow of fluid from said first chamber to the container.

5. Container filling equipment of the character described, comprising a movable weight-responsive container support, a container filling nozzle carried by said movable support, an accumulator containing a diaphragm separating first and second chambers within the accumulator, means connecting said first chamber with said nozzle, means for delivering fluid to said first chamber, means for delivering an extraneous fluid to said second chamber to cause the diaphragm to displace fluid from the first chamber through said nozzle, and valve means responsive to predetermined increase of fluid weight in the container for discontinuing both the flow of fluid from said first chamber to the container and the delivery of said extraneous fluid to the second chamber.

6. Container filling equipment of the character described, comprising a movable weight-responsive container support, a container filling nozzle carried by said movable support, an accumulator containing a diaphragm separating first and second chambers within the accumulator, means connecting said first chamber with said nozzle, means for delivering fluid to said first chamber, means for delivering an extraneous fluid to said second chamber to cause the diaphragm to displace fluid from the first chamber through said nozzle, a first control valve at said nozzle, a second valve for controlling the delivery of said extraneous fluid to said second chamber, and means responsive to predetermined increase of fluid weight in the container for closing said valves to discontinue the flow of fluid from said first chamber to the container and the delivery of fluid to said second chamber.

7. Container filling equipment of the character described, comprising a movable weight-responsive container support, a container filling nozzle carried by said movable support, a discharge control first valve at said nozzle, an accumulator containing a diaphragm separating first and second chambers within the accumulator, means connecting said first chamber with the nozzle, means for delivering a liquefied normally gaseous fluid to said first chamber, means for delivering a higher pressure motivating fluid to said second chamber to cause the diaphragm to displace fluid from the first chamber through said nozzle, a second valve for controlling the delivery of said motivating fluid to the second chamber, and control means operable in response to predetermined movement of said support under a predetermined weight to close both of said valves to discontinue the flow of fluid from said chamber to the container and delivery of the motivating fluid to said second chamber.

8. Container filling equipment of the character described, comprising a movable weight-responsive container support, a container filling nozzle carried by said movable support, a discharge control first valve at said nozzle, an accumulator containing a diaphragm separating first and second chambers within the accumulator, means connecting said first chamber with the nozzle, means for delivering a liquefied normally gaseous fluid to said first chamber, means for delivering a higher pressure motivating fluid to said second chamber to cause the diaphragm to displace fluid from the first chamber through said nozzle, a second valve for controlling the delivery of said motivating fluid to the second chamber, a third valve for controlling the discharge of fluid from said second chamber, and control means operable in response to predetermined movement of said support under a predetermined weight to close both of said first and second valves and to open said third valve.

9. Container filling equipment of the character described, comprising a movable weight-responsive container support, a container filling nozzle carried by said movable support, a normally closed discharge control first valve at said nozzle, manually controlled means for opening said valve, an accumulator containing a diaphragm separating first and second chambers within the accumulator, means connecting said first chamber with the nozzle, means for delivering a liquefied normally gaseous fluid to said first chamber, means for delivering a higher pressure motivating fluid to said second chamber to cause the diaphragm to displace fluid from the first chamber through said nozzle, a second valve for controlling the delivery of said motivating fluid to the second chamber, and control means operable in response to predetermined movement of said support under a predetermined weight to close both of said valves to discontinue the flow of fluid from said first chamber to the container and delivery of the motivating fluid to said second chamber.

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