June 8, 1965 J. C. DAWSON 3,187,956

LIQUID DISPENSING APPARATUS

Filed March 9, 1962

3 Sheets-Sheet 1

FIG. 1.

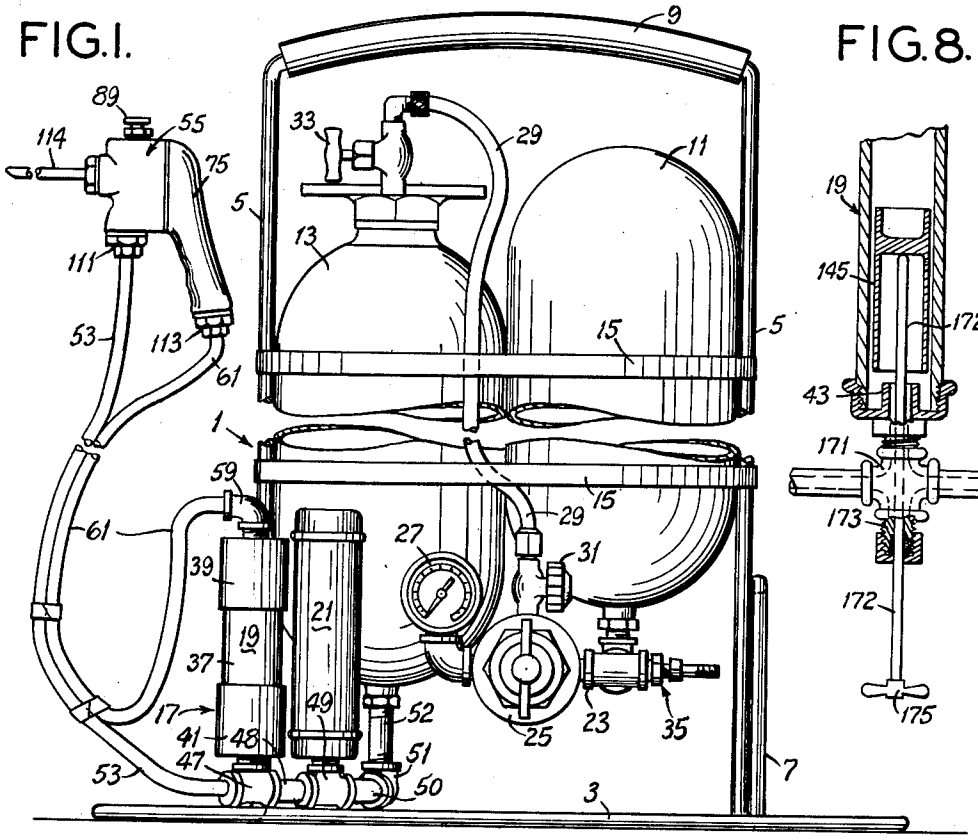
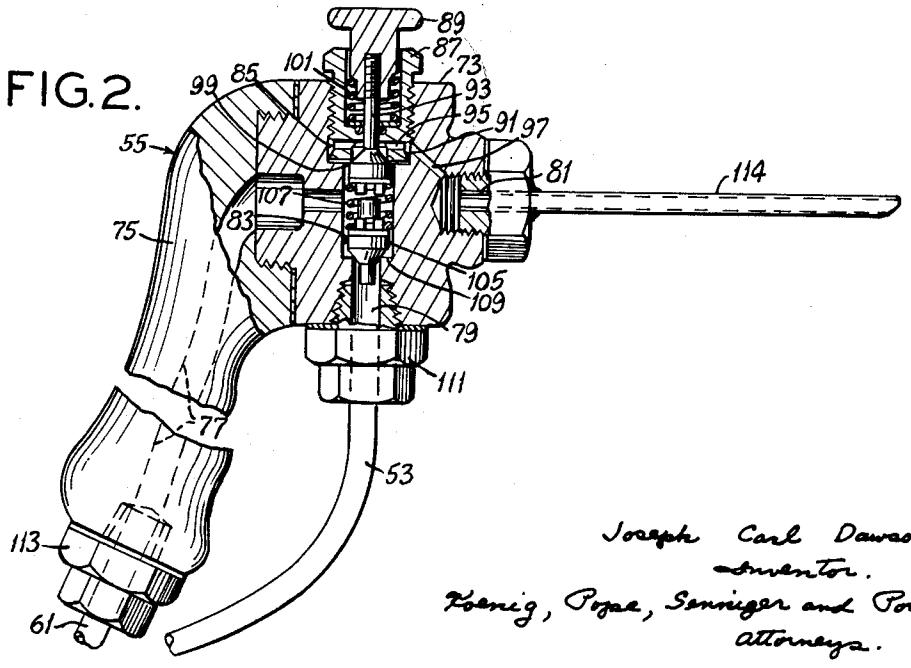


FIG. 8.

FIG. 2.



Joseph Carl Dawson,
inventor.
Koenig, Pope, Senniger and Powers,
attorneys.

June 8, 1965 J. C. DAWSON 3,187,956

LIQUID DISPENSING APPARATUS

Filed March 9, 1962 3 Sheets-Sheet 2

FIG.3.

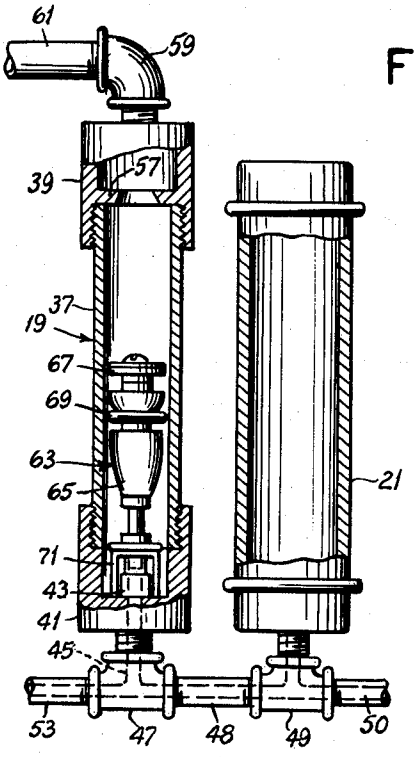


FIG.4.

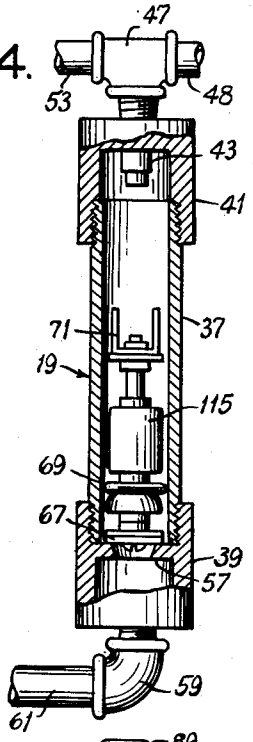
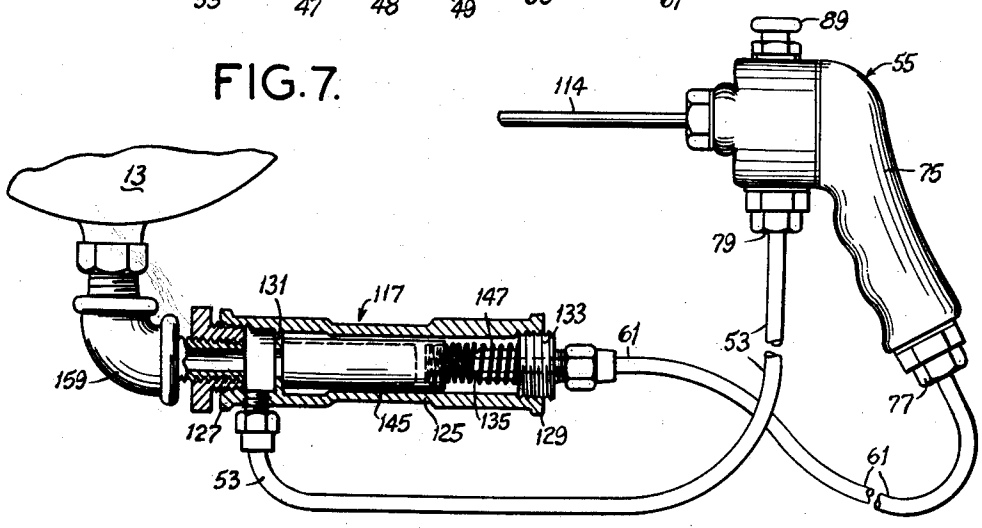


FIG.7.



June 8, 1965 J. C. DAWSON 3,187,956

LIQUID DISPENSING APPARATUS

Filed March 9, 1962 3 Sheets-Sheet 3

FIG.5.

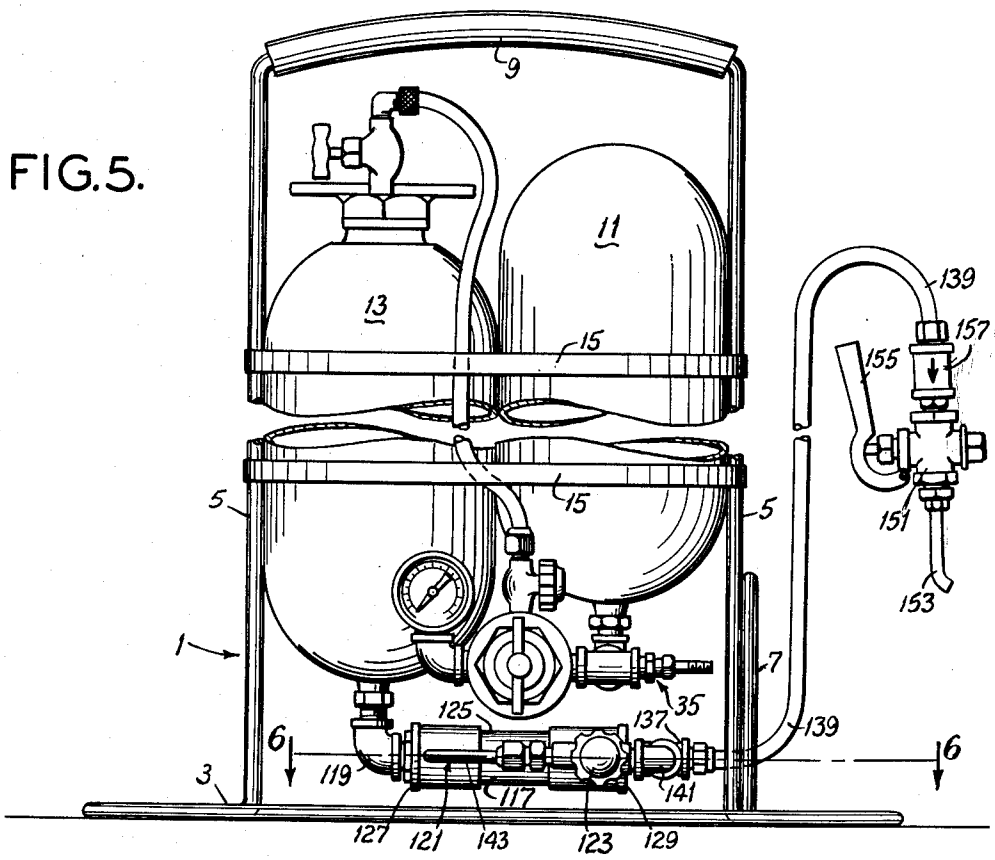
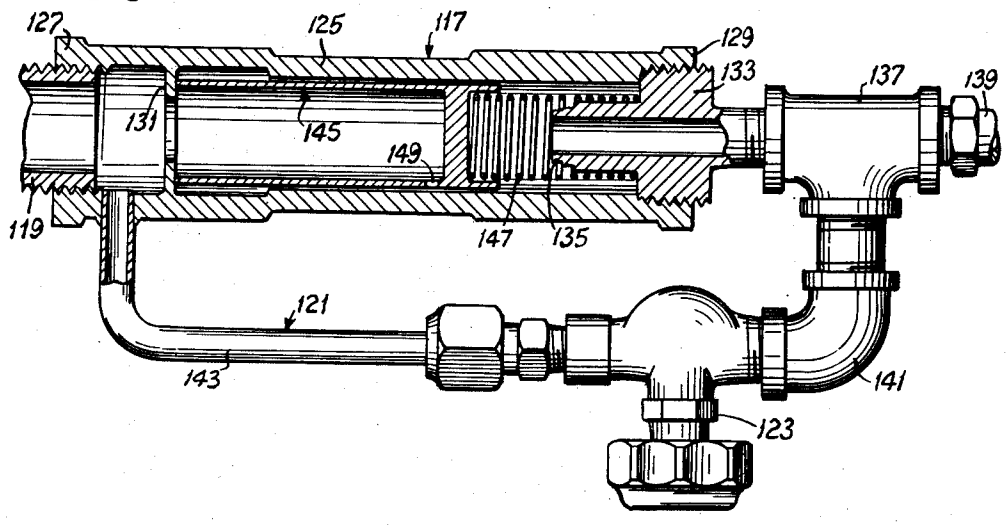


FIG.6.



United States Patent Office 3,187,956 Patented June 8, 1965

3,187,956

LIQUID DISPENSING APPARATUS

Joseph Carl Dawson, P.O. Box 5868, Ferguson 35, Mo.

Filed Mar. 9, 1962, Ser. No. 178,731
3 Claims. (Cl. 222—185)

This invention relates to liquid dispensing apparatus, and more particularly to apparatus for dispensing measured dosages of a liquid fumigant or the like.

The invention involves improvements upon the apparatus shown in my U.S. Patent Re. 25,172, reissued May 15, 1962. In the apparatus shown in said patent, there is provided a vertical measuring cylinder having an inlet at its lower end and an outlet at its upper end. Liquid under pressure is supplied to the inlet. The cylinder has a valve seat at its upper end, and contains a valve member adapted to sink to the lower end of the cylinder. A delivery hose extends from the outlet and has a manually operable delivery valve at its end. A by-pass having a restriction therein is provided around the cylinder. When the delivery valve is opened, pressure causes the valve member to rise and force liquid out through the delivery hose, the valve member ultimately engaging the valve seat to cut off delivery from the cylinder. On closing the delivery valve, pressure is equalized above and below the valve member via the by-pass, and the valve member sinks back to the lower end of the cylinder. If the delivery valve should not be closed immediately upon seating of the valve member against the valve seat, some liquid may leak on by through the by-pass, and increase the dosage of liquid delivered. In some instances, this may be undesirable, and accordingly, one of the objects of this invention is the provision of an apparatus of the class described which provides for pressure equalization in such manner as to avoid the possibility of delivery of an overdose. Also, in the apparatus shown in said patent, in which return of the valve member is by gravity, an upright arrangement of the measuring cylinder is in order, and return of the valve member may be slower than desired. Accordingly, a further object of the invention is the provision of apparatus of the class described in which the valve member is positively returned, rather than returned by gravity, which tends to speed up the return and enables the measuring cylinder to be mounted in any desired position, such as in horizontal position. Such a positive return type of device may be used in apparatus with a by-pass such as shown in said patent, if the possibility of a slight overdose is not critical, or may be used in the improved system of this invention which provides for pressure equalization in such manner as to avoid the possibility of an overdose. Still another object of the invention is the provision of means for adjusting the apparatus to deliver different dosages. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the constructions hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings, in which several of various possible embodiments of the invention are illustrated,

FIG. 1 is a view in elevation of a liquid dispensing apparatus of this invention;

FIG. 2 is an enlarged fragment of FIG. 1, with parts broken away and shown in section, showing details of a delivery valve;

FIG. 3 is an enlarged fragment of FIG. 1, with parts broken away and shown in section, showing details of a measuring cylinder;

FIG. 4 is a view showing modification;

FIG. 5 is a view in elevation of an alternative embodiment of this invention;

FIG. 6 is an enlarged section taken on line 6—6 of FIG. 5 showing the measuring cylinder arrangement of FIG. 5;

FIG. 7 is an enlarged partial section showing the measuring cylinder of FIG. 6 used in the FIG. 1 apparatus; and

FIG. 8 is a view showing a modification providing for adjustment to deliver different dosages.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Referring to FIG. 1 of the drawings, a liquid dispensing apparatus of this invention is shown to comprise a portable support generally designated **1** comprising a base **3**, upstanding legs **5**, a brace **7**, and a carrying handle **9** extending between the upper ends of the legs **5**. Mounted between legs **5** are a pressurized gas (air) supply tank **11** and a tank **13** which may be filled with liquid fumigant. The tanks **11** and **13** are adapted to be held between legs **5** by metal straps **15**. Mounted on the base **3** of the support is an assembly designated in its entirety by the reference character **17** and including a vertical measuring cylinder **19**, and an air chamber **21** having its lower end in communication with the lower end of the cylinder **19**.

Pressure tank **11** is connected to the fumigant tank **13** by piping **23** in which is located a pressure regulator **25** and pressure gauge **27**, and a hose **29** extending from the regulator to the upper end of the fumigant tank. Cut-offs are provided as indicated at **31** and **33**. The pressure tank is adapted to be pressurized by closing the valve **31** and connecting a supply hose (not shown) which is connected to a suitable pressurizing source (also not shown) to an inlet nipple **35**. Nipple **35** includes a check valve adapted to open under pressure in the supply hose.

The measuring cylinder **19** comprises a tube **37** having an upper end head **39** and a lower end head **41**. The lower end head **41** has an upwardly extending nipple **43** (FIG. 3) projecting upwardly into the tube, and has a passage **45** for flow of liquid upward through the nipple into the tube. Attached to the lower end head **41** is the stem of a T **47**. A short length of pipe **48** extends from one side of the T **47** and has a T **49** secured to one end thereof. The stem of T **49** is threaded in the lower end of the air chamber **21**. The other end of T **49** is connected to the lower end of fumigant tank **13** by a pipe **50**, an elbow **51** and a pipe **52**. A by-pass hose **53** (which may be a plastic hose such as a polyethylene hose) is secured at one end thereof to the other side of the T **47**. The other end of by-pass hose **53** is secured to a manually operable delivery valve **55** which will be hereinafter described.

The upper end head **39** of tube **37** is formed with an annular shoulder **57** which constitutes a valve seat. An elbow **59** is connected to the upper end head **39**. A delivery hose **61** (which may be a plastic hose such as a polyethylene hose) extends from the elbow **59** to the manually operable delivery valve **55**.

A valve member generally designated **63** is vertically movable in tube **37** of cylinder **19**. This valve member **63** may be similar to that shown in U.S. Patent Re. 25,172, comprising a weight **65** (a body of lead, for example), having at its upper end two vertically spaced horizontal discs **67** and **69** which may be made of plastic such as polyethylene. The upper disc **67** is a valve disc engageable with shoulder or seat **57** to cut off flow from the upper end of the cylinder **19** to the delivery hose **61**. The lower disc **69** serves as a piston whereby the valve member **63** is adapted to rise in the cylinder from an initial position in the lower end of the cylinder (FIG. 3) in response to a pressure drop in the cylinder above the valve member **63**. Both discs have a relatively loose fit in the cylinder so that the valve member **63**, without undue impedance, is adapted to sink to the lower end of the cylinder under the gravity bias of its weight upon equaliza-

tion of pressure above and below the valve member 63. This is because in this embodiment the weight of the volume of the liquid in the cylinder displaced by the valve member (which is made of lead, for example) is less than the weight of the valve member. Accordingly, the weight of the volume of the liquid in the cylinder displaced by the valve member is such in relation to the weight of the valve member that the valve member tends to move toward the inlet end of the cylinder. At the lower end of the weight 65 is an inverted cup 71 which covers nipple 43 when the valve member 63 is at the lower end of the cylinder 19.

The manually operable delivery valve 55 (FIG. 2) comprises a valve body 73 threaded into a handle 75. Valve 55 is provided with a transfer port 77, a by-pass port 79 and a delivery outlet 81. A passage 83 is provided in valve body 73 and is counterbored at 85. Threaded into the counterbore 85 is a cup-shaped fitting 87 in which a manually operable button 89 is slidably mounted. A valve member 91 has a stem 93 threaded into the lower end of button 89. The fitting 87 is provided with ports 95 which communicate with a port 97 in the valve body 73. Port 97 is connected to the delivery outlet 81. The valve member 91 is biased toward a seat 99 on the bottom of the fitting 87 by a spring 101 extending between the button 89 and the upper surface of the bottom of the cup-shaped fitting 87. A second valve member 105 is mounted in passage 83. Valve member 105 is biased by a spring 107 towards a seat 109 surrounding the by-pass port 79. The valve member 105 is adapted to be held against seat 109 by the valve member 91 when the button 89 is pushed downwardly as viewed in FIG. 2.

A delivery nozzle 114 is threaded into a delivery outlet 81. The by-pass hose 53 is connected to the by-pass port 79 by a fitting 111. The delivery hose 61 is connected to the transfer port 77 by a fitting 113.

Assuming the pressure tank to be pressurized and the valves 31 and 33 open, operation is as follows:

Liquid under pressure is supplied to by-pass hose 53. This pressurized liquid forces the valve member 105 in the delivery valve 55 upwardly as viewed in FIG. 2 against the bias of spring 107. The liquid in by-pass hose 53 passes through passage 83 and back through port 77 and delivery hose 61 to prime the apparatus. After the pressure on both sides of the valve member 105 is equalized spring 107 will force it toward engagement with seat 109.

When the button 89 is manually pushed downwardly as viewed in FIG. 2, communication is established between the transfer port 77 and the delivery outlet 81 and the valve member 91 is moved down toward valve member 105 to hold the latter against seat 109 whereby communication is blocked between ports 77 and 79. With transfer port 77 and outlet 81 in communication, the pressure in the delivery hose 61 is released, and there is a pressure drop in the cylinder 19 above the valve member 63, which at this time is at the lower end of the cylinder 19 with cup 71 covering nipple 43. Accordingly, the valve member 63 is driven upwardly by the pressure below it and rises to the upper end of the cylinder 19. As it rises, it forces liquid out the upper end of the cylinder 19, through the delivery hose 61 and delivery valve 55 to deliver a measured dose of liquid through the nozzle 114 of the delivery valve 55. Upon rising to the upper end of the cylinder 19, the valve disc 67 engages the seat 57 to cut off delivery of any liquid through the delivery hose 61. As long as button 89 is held down, port 79 is blocked so that no liquid can pass from by-pass hose 53 to the nozzle. Consequently, there is no particular urgency for the operator immediately to release the button upon cut-off of delivery through hose 61.

Upon release of the button 89, valve member 91 closes on seat 99 and valve member 105 is released. Pressure from the by-pass hose 53 forces the valve member 105 upwardly as viewed in FIG. 2 to establish communication between the ports 79 and 77. The liquid flows from the by-pass hose 53 through the valve 55 and delivery line 61

to the upward end of the cylinder 19, and the pressure above and below the valve member 63 equalizes, whereupon the valve member 63 sinks to the lower end of the cylinder 19. When it reaches the lower end of the cylinder, the apparatus is ready for the next operation.

With liquid under pressure in the pipe 50, a supply of compressed air is maintained in the air chamber 21 above the liquid in the chamber. This chamber being close to the cylinder 19, the compressed air therein is effective on opening the delivery valve 55 for application of pressure to the liquid at the lower end of the cylinder 19 to offset the inertia of liquid and the loss of head, if any, in the pipe 50, elbow 51 and pipe 52 from the liquid fumigant tank 13. The air chamber may not be essential when the fumigant tank 13 is located close to the cylinder 19 as in the embodiment shown in FIG. 1, but would be particularly useful in a case where the piping or a connecting hose between the fumigant tank and the cylinder 19 is of such length or is of such character as to cause substantial loss of head.

FIG. 4 shows a measuring cylinder arrangement which may replace the measuring cylinder 19 shown in FIG. 3. The measuring cylinder 19 in FIG. 4 is inverted or reversed so that the nipple 43 extends downwardly into the tube from the end head 41 and the seat 57 is at the lower end of the cylinder. The T 47 is connected to the end head 41 and is connected on one side to the pipe 48 and on the other side to the by-pass hose 53. The elbow 59, which is at the lower end of the cylinder in the embodiment shown in FIG. 4, is connected to the delivery hose 61. Instead of a weighted valve member 63, a floating valve member 115 is employed. That is, the weight of the liquid displaced by the valve member 115 is greater than the weight of the valve member so that the valve member 115 will rise upon equalization of pressure on both sides thereof. Accordingly, the weight of the volume of the liquid in the cylinder displaced by the valve member 115 is such in relation to the weight of the valve member that the valve member 115 tends to move (rise) toward the inlet end of the cylinder.

The construction shown in FIG. 5 includes the same support 1, pressure tank 11, fumigant tank 13 and the connections between pressure tank 11 and fumigant tank 13. The lower end of the fumigant tank 13 is connected to a horizontal measuring cylinder 117 by an elbow 119. As shown, a by-pass 121 is provided for the cylinder 117. In the by-pass 121 there is an adjustable valve 123. This may be a conventional needle valve, for example.

The cylinder 117 comprises a tube 125 having an inlet end 127 and an outlet end 129. A peripheral flange 131 is provided internally of tube 125 adjacent to but spaced inward from the inlet end 127. A nipple 133 is threaded into the outlet end 129 of the tube 125 and extends toward the inlet end 127 of the tube. The inner end of this nipple constitutes a valve seat 135. The outer end of the nipple 133 is connected to one side of a T 137. The other side of the T 137 is connected to a delivery hose 139. By-pass valve 123 has one end secured to an elbow 141 and its other end connected to the inlet end 127 of the cylinder 117 by a conduit 143. The other end of elbow 141 is connected to the stem of T 137 to complete the by-pass 121.

A cup-shaped valve member generally designated 145 is movable in the tube 125 of cylinder 117. Valve member 145 is biased toward the inlet end of the cylinder 117 by a spring 147 extending between the bottom of the cup-shaped valve member 145 and the outlet end of the cylinder 117. Spring 147 surrounds the nipple 133. The location of the annular flange 131 prevents the valve member 145 from cutting off the by-pass 121. The open end of the valve member 145 is adapted to be seated on flange 131 by spring 147 upon equalization of pressure on both sides of the valve member. Valve member 145 is adapted to be moved toward the outlet end 129 of the

cylinder from an initial position at the inlet end of the cylinder (illustrated in FIG. 6) in response to a pressure drop on the outlet side of the valve member **145**. A hole **149** is provided in the valve member wall so that the valve member **145**, without undue impedance, is adapted to move to the inlet end **127** of the cylinder under the bias of the spring **147** upon equalization of pressure on both sides of the valve member **145**.

At the outer end of the delivery hose **139** is a manually operable delivery valve **151** (which may be the same as shown in U.S. Patent Re. 25,172) having a delivery nozzle **153** and a manually operable lever **155** for opening it. The delivery valve includes a check valve **157** adapted to open in the direction indicated by the arrow in FIG. 5 under the pressure in the delivery hose when the delivery valve is opened.

Operation of the embodiment shown in FIGS. 5 and 6 is as follows:

The pressure at the inlet end of the cylinder **117** is preferably regulated to be, for example, about fifty to seventy-five pounds per square inch. When such pressure is employed, the check valve **157** is one that is adapted to open under about 10 lb. per sq. inch pressure in the delivery hose line **139**. The by-pass valve **123** is opened wide to allow liquid to flow freely through the by-pass **121** to the delivery hose **139** to prime the apparatus. Then the by-pass valve **123** is turned down to provide a restriction in the by-pass **121** such as to effect a pressure drop in cylinder **117** on the outlet side thereof whenever the manually operable delivery valve **151** is operated.

Thus, when the delivery valve **151** is operated, the pressure in the delivery hose **139** is released, and there is a pressure drop in the cylinder **117** on the outlet side of the valve member **145**, which at this time is at the inlet end of the cylinder with the open end of the valve member **145** engaging the flange **131**. The restriction provided in the by-pass **121** by valve **123** is sufficiently small to preclude such flow of liquid through the by-pass as would materially reduce this pressure drop. Accordingly, the valve member **145** is driven toward the outlet end of the cylinder **117** by the pressure on the inlet side of the valve member and moves to the outlet end of the cylinder **117**. As it moves, it forces liquid out of the outlet end of the cylinder **117** and through the delivery hose **139** to deliver a measured dose of liquid through the nozzle **153** of the delivery valve **151**. Upon moving to the outlet end of the cylinder **117**, the bottom of the cup-shaped valve member **145** engages the seat **135** to cut off delivery (except for the small amount that may leak through the restriction in the by-pass provided by the valve **123**). Upon such cut-off, the pressure in delivery hose **139** drops below that required to maintain check valve **157** open, and this check valve closes to keep the delivery hose primed, even though the operator should not at once release the lever **155** of the delivery valve **151** to allow it to close. However, the cut-off is readily sensed by feel so that an alert operator may immediately release the lever **155** to close the delivery valve **151**.

With the delivery valve **151** closed, pressure from the elbow **119** bleeds through the restriction in by-pass **121** provided by valve **123**, and the pressure on the inlet and outlet sides of the valve member **145** equalizes, whereupon the valve member **145** is moved to the inlet end of the cylinder **117** by the spring **147**. When the open end of the valve member **145** reaches the flange **131**, the apparatus is ready for the next operation.

If positive cut-off is desired, the cylinder **117** and spring-returned valve member **145** such as shown in FIG. **6** may be incorporated in the FIG. 1 embodiment in place of the cylinder **19** and gravity-returned valve member **63** shown in FIGS. 1 and 3. FIG. 7 illustrates the cylinder **117** and valve member **145** as they would appear when so substituted in the FIG. 1 embodiment. An elbow **159** connects the fumigant tank **13** to the inlet end of the cylinder **117**. By-pass hose **53** is connected between the inlet end of the cylinder **117** and the inlet port **79** of the manually operable delivery valve **55**. The delivery hose **61** is connected between the outlet end of cylinder **117** and the inlet port **77** of the delivery valve **55**. In operation, the FIG. 7 embodiment functions in substantially the same manner as the embodiments shown in FIGS. 1–4. Upon pushing button **89** downwardly the inlet port **77** is placed in communication with the delivery port **81** so as to effect a pressure drop on the outlet side of the valve member **145**. Accordingly, the pressure on the inlet side of the valve member **145** forces the valve member toward the outlet end of the cylinder **117** against the return bias of spring **147**. When valve member **145** engages seat **135**, delivery through the delivery hose **61** is cut off. When the button **89** is released, the inlet ports **77** and **79** are placed in communication to equalize the pressure on both sides of the valve member **145**, whereupon the valve member is returned by spring **147** toward and into engagement with the flange **131**.

It will be seen that in each of the embodiments shown in FIGS. 3, 4 and 7 the valve member is biased toward the inlet end of the cylinder when the pressure on both sides of the valve member is substantially equalized and the valve member moves towards the outlet end of the cylinder in response to a pressure drop on the outlet side of the valve member.

FIG. 8 shows another possible modification providing for adjustment to vary the amount of liquid delivered. Here a measuring cylinder **19** such as shown in FIGS. 1 and 3 is provided. A valve member **145** such as shown in FIG. 6 may be used, with or without a spring such as shown at **147** in FIGS. 6 and 7. Instead of using a T at the inlet end of the cylinder, there is used a cross fitting **171**. One arm of this fitting is coupled to the inlet end of the cylinder. A packing gland **173** is threaded in the end of the opposite arm of the fitting, and a stop rod **172** extends slidably through the gland. This rod has a handle **175** at its outer end, and reaches axially through nipple **43** into the cylinder **19** (with space around the rod for flow of liquid). The valve member **145** is engageable with the inner end of the rod to determine the retracted position of the valve member, and by loosening the gland, sliding the rod in or out and tightening the gland, the stroke of the valve member **145** may be varied to vary the dosage delivered on a pressure stroke of the valve member **145**.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. Apparatus for dispensing measured dosages of a liquid, such as liquid fumigant, comprising a pressure tank for containing pressurized gas, a liquid tank for containing the liquid to be dispensed, a support, said tanks being mounted on said support, a delivery line connecting said pressure tank to said liquid tank, a cylinder mounted on said support, said cylinder having an inlet at one end and an outlet at the other end, a line connected between said liquid tank and said cylinder inlet for supplying liquid under pressure to the latter, said cylinder having a valve seat at its outlet end, a movable valve member in the cylinder, resilient means in the cylinder biasing said movable valve member toward the inlet end of the cylinder, said movable valve member being adapted to move toward the outlet end of the cylinder in response to a pressure drop in the cylinder on the outlet side of the movable valve member and force liquid through the cylinder outlet, said movable valve member,

upon moving to the outlet end of the cylinder, being engageable with said valve seat to cut off flow from the outlet end of the cylinder, an inwardly projecting nipple at the outlet end of said cylinder through which liquid flows, said valve seat being on the inner end of said nipple, said resilient means comprising a spring surrounding said nipple and extending between the movable valve member and the outlet end of the cylinder, a delivery hose having a connection to the cylinder outlet, a manually operable delivery valve at the outer end of the delivery hose, a by-pass for the movable valve member providing for communication from the supply hose to the cylinder outlet on the outlet side of the movable valve member, said by-pass being adapted to effect a pressure drop on the outlet side of said movable valve member upon operation of said manually operable valve whereupon the movable valve member moves toward the outlet end of the cylinder to force a measured dosage of liquid out through the cylinder outlet and delivery hose, and adapted to provide for equalization of pressure on both sides of the movable valve member after the latter has moved into engagement with said valve seat and said manually operable valve is released, whereupon said resilient means moves the movable valve member to the inlet end of the cylinder.

2. Apparatus as set forth in claim 1 wherein said cylinder includes a peripheral flange internally thereof adjacent to but spaced from the inlet end of the cylinder, said movable valve member, when the pressure on both of its sides is equalized, being forced into engagement with said flange by said spring.

3. Apparatus as set forth in claim 2 wherein said movable valve member has an opening therein to permit said spring to force the movable valve member toward said inlet end of said cylinder without undue impedance upon equalization of pressure on both sides of the movable valve member.

References Cited by the Examiner

UNITED STATES PATENTS

1,376,558	5/21	Lien	222—341
1,454,765	5/23	Patterson et al.	222—335
1,646,567	10/27	Weber	222—250
2,188,676	1/40	Crandall	222—250
2,741,404	4/56	Burton	222—235
2,783,920	3/57	Negoro	222—250
2,817,462	12/57	Lipinski	222—335
2,895,649	7/59	Dawson	222—318

RAPHAEL M. LUPO, *Primary Examiner.*

LOUIS J. DEMBO, *Examiner.*