Oct. 28, 1958 J. E. AYRES 2,857,937

APPARATUS FOR LOADING PRESSURIZED CONTAINERS

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Fig. 1.

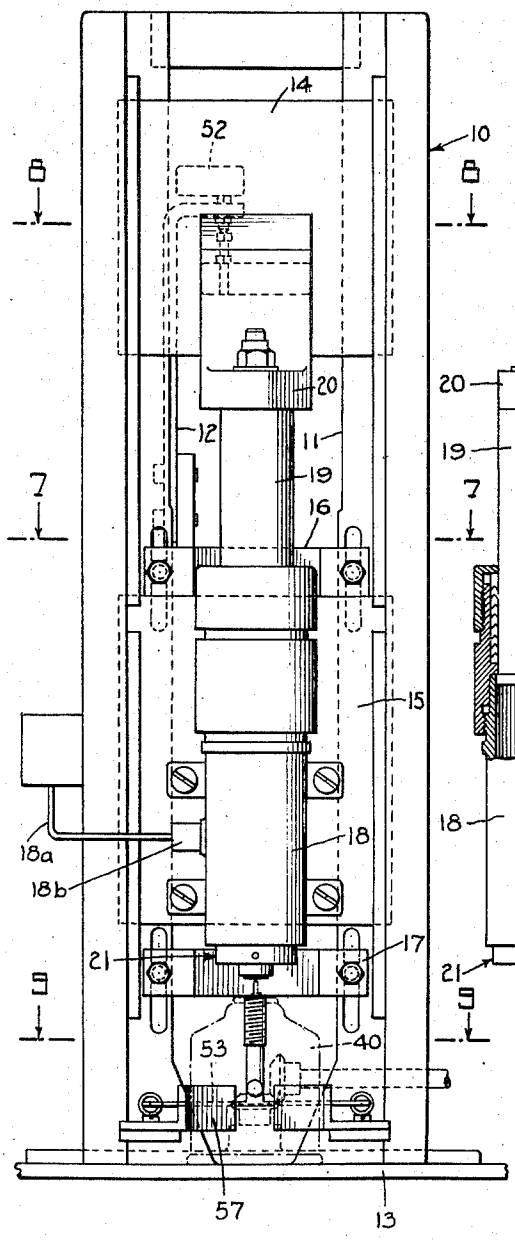
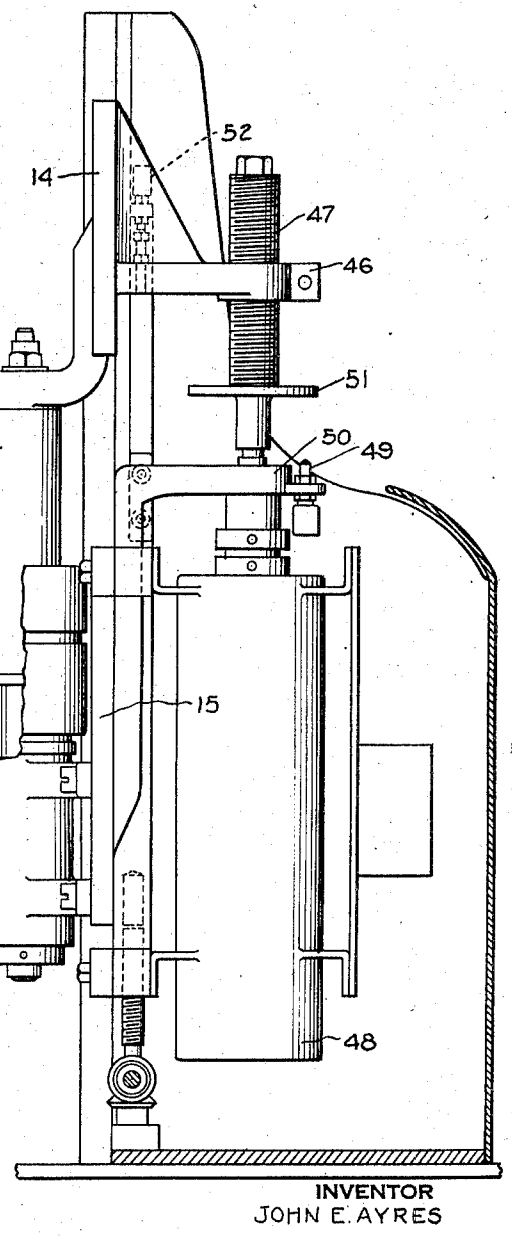


Fig. 2.



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Fig. 3.

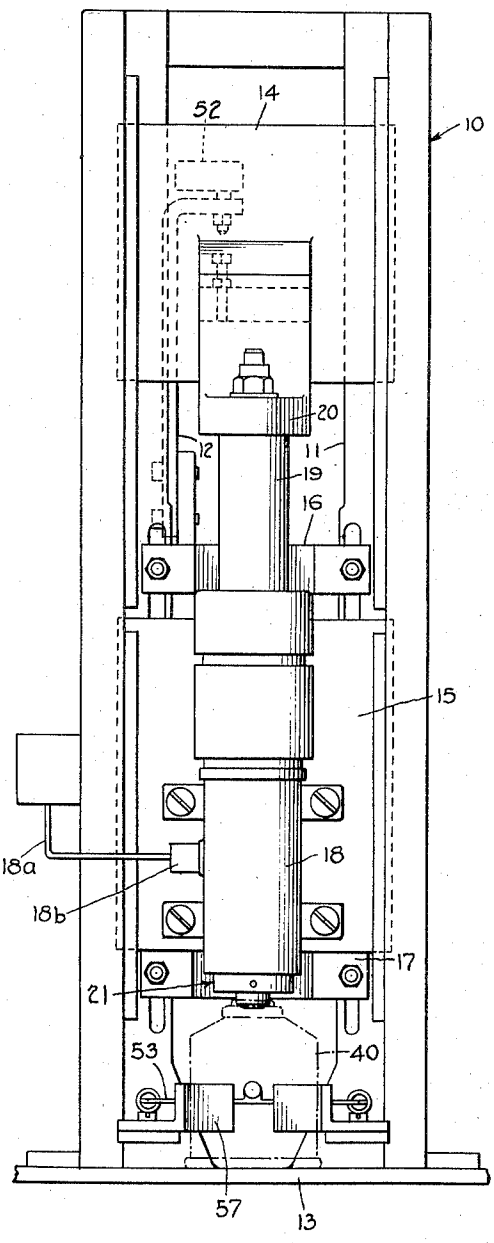
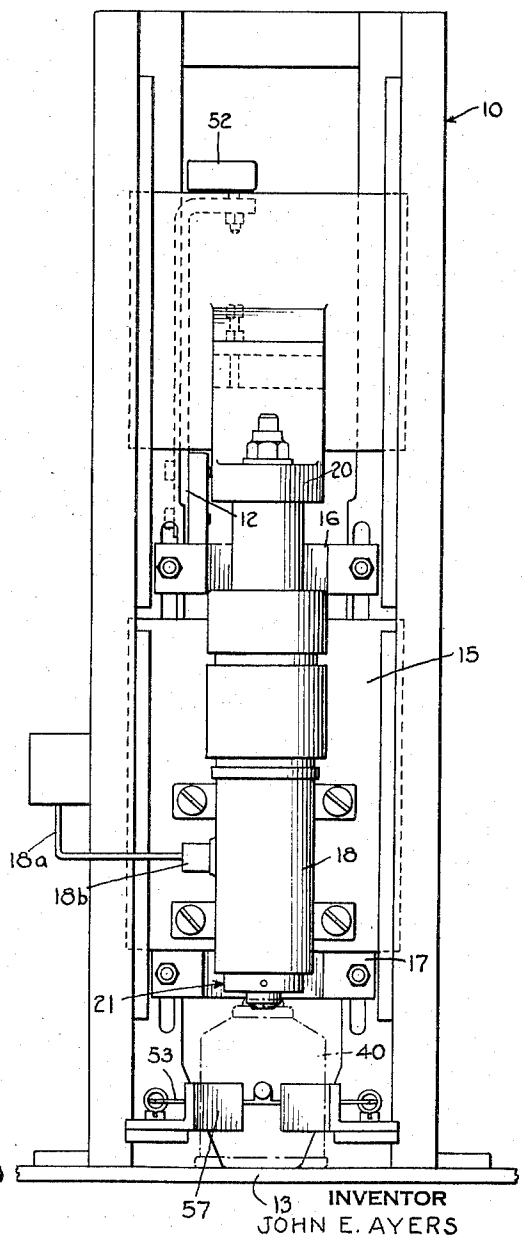


Fig. 4.



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Fig. 5.

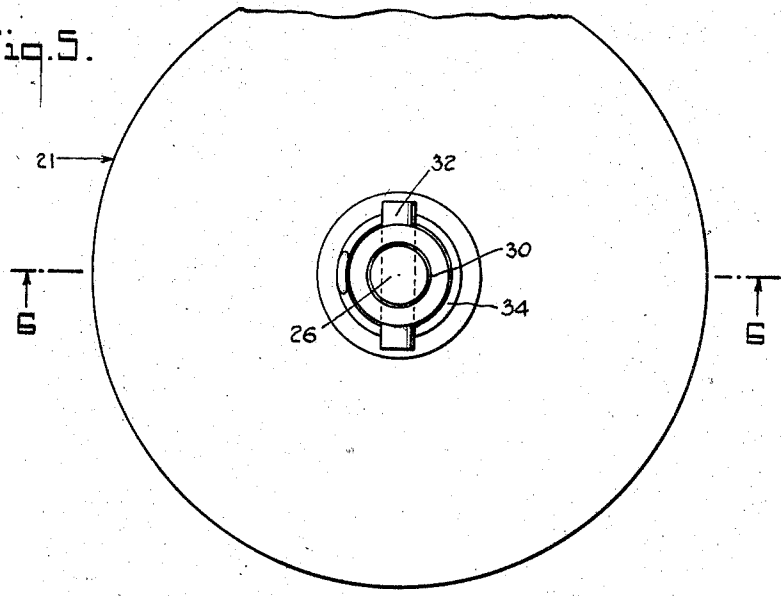
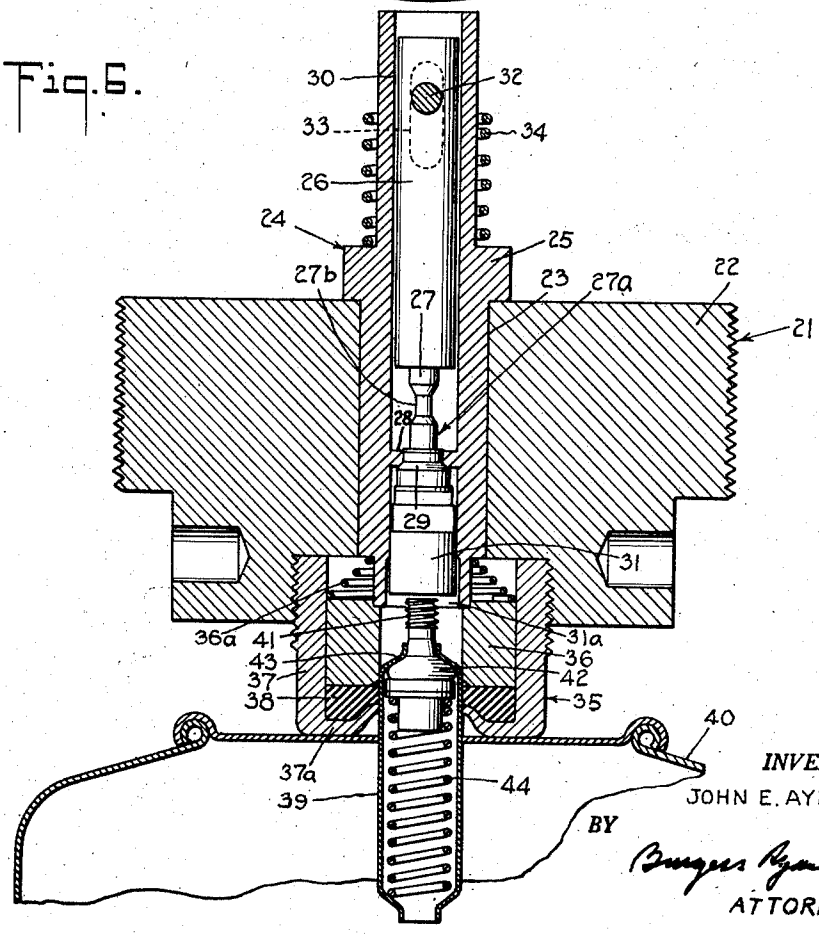


Fig. 6.



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Fig. 7.

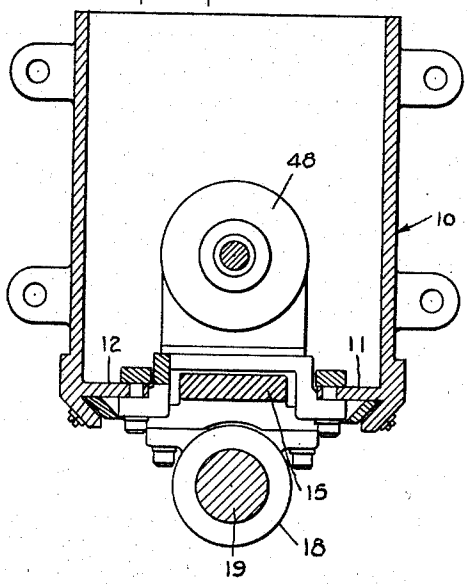


Fig. 8.

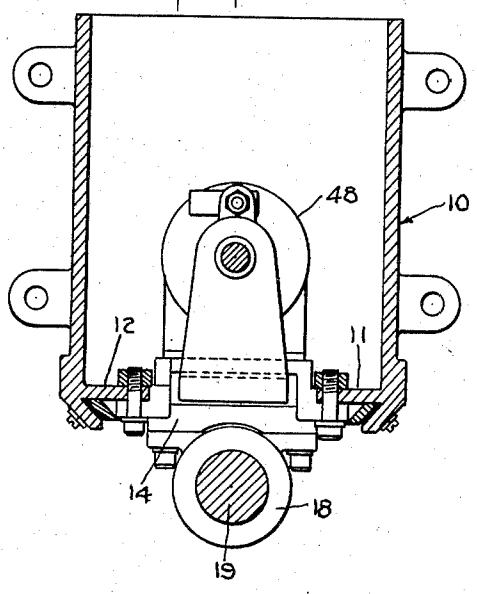
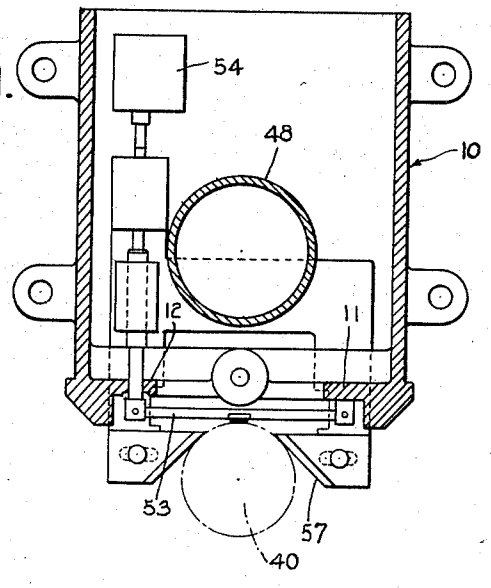


Fig. 9.



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APPARATUS FOR LOADING PRESSURIZED CONTAINERS

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Application May 10, 1954, Serial No. 428,449

11 Claims. (Cl. 141—20)

The present invention relates to apparatus for hydraulically loading pressurized containers with propellants or with the commodities to be dispensed.

An object of the present invention is to provide a machine for hydraulically loading containers for dispensing commodities such as insecticides, cosmetics, shaving soap or the like with a propellant in liquid form. Another object of the invention is to provide a machine for loading such containers with a propellant without the necessity of carrying out the loading operation at low temperatures.

A further object of the invention is to provide a machine for hydraulically loading containers for such commodities with accurately measured amounts of a propellant in liquid form to eliminate wastage and loss of the propellant, which is expensive. This also insures proper functioning of the container in the dispensing of the commodity.

Other objects and advantages of the present invention will be apparent and best understood from the following description and the accompanying drawings in which:

Fig. 1 is a front view of a loading machine embodying the present invention;

Fig. 2 is a side view of the machine shown in Fig. 1;

Figs. 3 and 4 are front views of the machine shown in Fig. 1, with parts of the machine in different operating positions;

Fig. 5 is a plan view of a displacement head for the machine shown in Fig. 1;

Fig. 6 is a section view taken along the line 6—6 of Fig. 5;

Fig 7 is a section view taken along the line 7—7 of Fig. 1;

Fig. 8 is a section view taken along the line 8—8 of Fig. 1; and

Fig. 9 is a section view taken along the line 9—9 of Fig. 1.

The embodiment of the invention illustrated and described herein is a machine for hydraulically loading a container of the pressurized dispensing type with a propellant such as fluorochloromethane or ethane (commercially known as "Freon"). However, it will be understood that such a machine may also be utilized for loading the container with the commodity that is to be dispensed. In the operation of the machine, the propellant is maintained in liquid form by keeping the pressure on the propellant sufficiently high to prevent vaporization. As will be pointed out hereinafter, the hydraulic pressures required to carry out the filling operation are obtained through the medium of the liquid propellant.

The maintenance of the propellant in liquid form also has other important advantages such as the elimination of refrigeration equipment. This makes it economical for a producer of a commodity to fill and load pressurized containers in his own plant.

Referring now to the drawings and, in particular to Figs. 1 through 4, there is a frame **10**. The frame **10** includes two spaced rails **11** and **12** which extend in a vertical direction from a bedplate **13**.

Two members, an upper slide **14** and a lower slide **15**, are slidably mounted one above the other on the rails. The slides **14** and **15** are vertically reciprocable on the rails and the movement of the lower slide is limited by two adjustable stops **16** and **17** which are respectively positioned above and below the lower slide.

The stops **16** and **17** may be in the form of bars extending between the rails and they may be connected together so that they can be adjusted on the rails as a unit for controlling the position of the lower slide during the operation of the machine. As will be seen hereinafter, such adjustment of the stops permits the machine to be set without difficulty for the loading of containers of different heights.

A displacement cylinder **18** is mounted on the lower slide and is movable therewith. The displacement cylinder contains a displacement rod or ram **19** which extends beyond the upper end of the displacement cylinder and is connected to a bracket **20** on the upper slide **14**. Movement of the upper slide is transmitted to the lower slide through the displacement rod in moving the lower slide between the upper and lower stops.

The displacement cylinder normally contains a supply of a propellant or other material against which the displacement rod exerts pressure when it is moved downwardly relative to the displacement cylinder. To maintain the supply of the propellant in the displacement cylinder, the displacement cylinder **18** is connected to a source of the propellant in liquid form (under pressure) through a conduit **13***a* and a check valve **18***b* (see Fig. 1). The check valve **13***b* is arranged so that it will automatically open and permit the propellant to flow into the displacement cylinder under the pressure exerted on it when the pressure within the displacement cylinder is less than the pressure acting on the propellant. However, when the pressure in the displacement cylinder exceeds the pressure of the propellant, the check valve automatically closes and prevents increased pressure from within the displacement cylinder being transmitted to the source of the propellant. In normal operation, the check valve closes when the displacement rod is moved downward in the displacement cylinder on its work stroke and opens when pressure is released from the displacement rod at the end of its work stroke.

A displacement head, indicated generally at **21**, is threaded into and closes the lower end of the displacement cylinder **18**. As shown in Figs. 5 and 6, the displacement head **21** includes an externally threaded body portion **22** having a bore **23** extending therethrough. A valve mechanism, indicated generally at **24** (hereinafter called the machine valve) is located in the bore and normally remains closed against the pressure of the liquid propellant in the displacement cylinder. As will be described hereinafter, the machine valve is opened hydraulically when the pressure on the liquid propellant in the displacement cylinder is increased by downward movement of the displacement rod in the cylinder.

The machine valve includes a valve body in the form of a sleeve **25** which is fitted into the bore **23** of the displacement head. If desired, the valve body may be formed integrally with the body portion **22** of the displacement head. The sleeve **25** contains a plunger **26** which is movable therein. The lower end of the plunger **26** is connected to a valve stem **27** which extends through a centrally apertured valve seat **28** on the interior of the sleeve **25**. The valve seat **28** is formed by an inwardly extending annular flange or shoulder on the sleeve **25** and has an inclined lower surface which engages with a washer **29** of resilient material on the valve stem when the machine valve is closed.

When the machine valve is closed, an annular shoulder **27***a*, which may be termed the primary area, on the

valve stem fits into the opening in the valve seat and is exposed to the pressure of the liquid propellant within the displacement cylinder. Clearance, as indicated at **30**, is provided between the plunger **26** and the interior of the sleeve and permits the liquid propellant to pass through the sleeve to the valve seat.

Beneath the washer **29**, there is an enlarged or headed portion **31** of cylindrical shape of the valve stem which makes a sliding fit for a short distance with the opening in the sleeve at this point. An enlarged opening **31***a* is formed in the sleeve at its lower end and the enlarged portion **31** of the valve stem is located within the enlarged opening in the sleeve when the machine valve is fully open. The enlarged opening in the sleeve thus provides a passageway along the sides of the enlarged portion of the valve stem through which the liquid propellant can flow when the machine valve is open.

It will be seen from the foregoing that the force initially required to keep the machine valve closed need only be sufficient to counteract the hydraulic pressure of the liquid propellant in the displacement cylinder acting on the primary area **27***a* of the valve stem. However, once the force tending to hold the machine valve closed has been overcome and the washer on the valve stem has been moved away from the valve seat, the effective force acting to move the valve stem downward to open the valve is increased materially by the increase in the area on which the fluid pressure acts. As will be described hereinafter, the increased force is utilized by other forces which oppose movement of the machine valve stem after its initial movement.

A pin **32**, extending crosswise of the plunger, projects through slotted openings **33** in the sides of the sleeve and engagement of the pin **32** with the ends of the slotted openings limits movement of the plunger and machine valve stem relative to the sleeve. A coil spring **34** surrounding the sleeve is interposed between a shoulder on the valve body and the ends of the pin which project beyond the sides of the valve body. The spring **34** normally urges the plunger upwardly and holds the machine valve closed against the pressure acting on the primary area of the valve stem.

A sealing device **35** is threadably attached to the lower face of the body **22** of the displacement head and has an opening extending therethrough which communicates with the enlarged opening at the lower end of the sleeve **25**. The sealing device includes an inner ring or collar **36** located inside of an outer ring or collar **37**. The outer collar **37** has an inturned flange **37***a* which holds a washer **38** of resilient material in place between the inner and outer collars.

The sealing device fits over and engages with the exterior of a valve **39** in a container **40** when the displacement cylinder has been moved to its lower position.

The washer **38** and the inner collar **36** are movable relative to the outer collar **37** and a spring **36***a* acting on the inner collar **36** urges the washer and the inner collar into engagement with the retaining flange **37***a* on the outer collar. This arrangement permits the washer and the inner collar to move relative to the outer collar when the sealing device is brought into engagement with the container valve and prevents damage to the sealing washer. It also compensates for variations due to manufacturing tolerances in the height of the particular container being filled.

The container valve **39** may be of any suitable type and communicates with the interior of the container. The container valve illustrated has a body portion which projects beyond the top of the container and extends into the sealing device on the displacement head to engage with the sealing washer. The upper end of an operating member or valve stem **41** projects beyond the top of the valve body and carries a washer **42** of resilient material at its lower end. The washer **42** is normally held in sealing engagement with a centrally apertured valve seat **43** by a spring **44**.

When the sealing device **35** in the displacement head is in sealing engagement with the container valve, the top of the valve stem **41** is positioned beneath but in spaced relation to the lower end of the headed portion **31** of the machine valve. Thus, increase of the fluid pressure in the cylinder upon downward movement of the displacement rod in the displacement head will first move the washer of the machine valve away from its seat prior to bringing the end of the machine valve into engagement with the top of the valve stem **41** in the container valve. This permits the pressure in the displacement cylinder to act on an increased area of the machine valve and continued downward movement of the machine valve stem will then cause the machine valve to depress the valve stem of the container valve against the force of its closure spring **44** to open the container valve at the same time the machine valve is opened.

When the container valve is fully open, the machine valve is also opened with the headed portion **31** of the machine valve stem being positioned in the enlarged opening at the end of the sleeve of the machine valve. Under such conditions, the interior of the container **40** communicates with the interior of the displacement cylinder through the machine valve and the container valve and the propellant can flow freely from the displacement cylinder into the container.

As shown best in Fig. 2, there is a bracket **46** extending rearwardly from the upper slide **14**. The bracket **46** is connected by a threaded member **47** to a piston in a double acting, electrically controlled air cylinder **48**. The air cylinder **48** is mounted on the adjustable stops **16** and **17** and is located at the rear of the frame **10**. A switch **49** for reversing the operation of the air cylinder is mounted on a bracket **50** carried on the rear of the lower slide **15**. A plate **51** is adjustably carried on the threaded member **47** to engage with and operate the switch **49** when the upper slide and the displacement rod have been moved to the downward limit of their stroke. The operation of the switch **49** automatically reverses the action of the air cylinder and causes the piston in the air cylinder to be moved upwardly. This first moves the upper slide and the displacement rod upwardly and then moves the lower slide and displacement cylinder upwardly. A limit-off switch **52** carried by the stops **16** and **17** is positioned above the upper slide **14** and is actuated by the upper slide when the slide and displacement rod reach the upper limit of their stroke. Upon actuation of the limit-off switch a complete cycle of operation of the machine has been completed and the machine will stop in rest position where the loaded container can be removed and a new container put in place for loading.

As shown best in Fig. 9, a linkage **53** is located beneath the displacement cylinder in position to be engaged by a container placed beneath the displacement cylinder for loading. Insertion of the container beneath the cylinder moves the linkage **53** rearwardly and actuates a starting switch **54** which causes the piston in the air cylinder to be moved downwardly. The downward movement of the air cylinder piston carries the upper slide **14** and the displacement rod downward. The lower slide **15** and the displacement cylinder mounted thereon are carried downward with the displacement rod until the lower slide strikes the lower adjustable stop **17**.

When the lower slide strikes the lower stop **17**, its downward movement is stopped and the displacement head is then in engagement with the container and the sealing member is in engagement with the container valve. Continued downward movement of the upper slide and displacement rod increases the pressure on the liquid propellant within the displacement cylinder. The increased pressure opens the machine valve and

the container valve is opened by the downward movement of the machine valve stem so that the liquid propellant can then flow through the machine valve and the container valve into the container.

It will be understood that other suitable mechanisms may be utilized for moving the displacement cylinder into engagement with the container and the container valve and thereafter moving the displacement rod downward in the displacement cylinder. For example, the actuating mechanism may be located above and in line with the displacement cylinder and rod if desired and in such event the upper slide may be eliminated.

To insure that there will not be a drop in pressure that would tend to cause the liquid propellant to vaporize in passing through the machine valve and the container valve, the flow area of these two valves is made as nearly the same as possible. As previously indicated, the spring **34** which normally holds the machine valve closed must be of sufficient strength to resist the hydraulic pressure acting on the primary of the valve stem as a result of the pressure in the displacement cylinder required to maintain the propellant in liquid form.

The adjustment of the switch contacting plate **51** on the threaded member **47** controls the downward or work stroke of the displacement rod in the displacement cylinder and provides a means for accurately controlling the amount of the propellant that is forced into the container. It will be understood that the amount of the propellant that is forced into the container for a given movement of the displacement rod may also be varied by using rods of different diameters for containers having different volumes. However, it is preferable to use a displacement rod that will have a relatively long stroke in order to obtain the most accurate filling in any given case.

In this connection, it should be noted that in order to obtain the desired accuracy in the amount of propellant that is forced into the container, it is important to keep the propellant in liquid form as it flows from the displacement cylinder into the container. By maintaining the propellant in liquid form, the amount of propellant placed in the container has a direct relationship to the stroke of the displacement rod whereas this would not necessarily be true if the propellant is partially vapor and partially liquid.

When the air cylinder piston reaches the end of its downward stroke, pressure is released from the displacement rod in the displacement cylinder and the displacement rod then moves upwardly. The spring **34** acting on the machine valve may then close the machine valve and thus, move the machine valve stem **27** out of engagement with the container valve stem permitting the valve spring **44** of the container valve to close the container valve. The closing of the machine valve and the container valve by their respective springs takes place before the displacement rod has reached the end of its upward stroke in the displacement cylinder and before the displacement head is disengaged from the container valve. Thus, when the displacement head is disengaged from the container, both the machine valve and the container valve are closed and the propellant cannot escape from the container or displacement cylinder. This prevents loss or wastage of the propellant, which is a fairly expensive material.

To summarize, the operation of the machine is as follows: After propellant under a pressure sufficient to keep it in liquid form has been admitted to the displacement cylinder and the displacement cylinder is in its rest position (fully raised), as shown in Fig. 1, the container **40** having a valve **39** is inserted between a pair of guides **57** which position the container with the valve therein beneath the displacement head. The placing of the container in this position actuates the starting switch through the linkage **53** and the air cylinder operates to move the upper and lower slides downwardly relative to the frame of the machine.

The downward movement of the lower slide and the displacement cylinder is limited by the lower stop to a position where the displacement head will be brought into engagement with the top of the container without damage to the container and a seal will be made between the displacement head and the container valve, as is shown in Fig. 3. In this position, the machine valve and the container valve are both closed. The air cylinder continues to move the upper slide and the displacement rod carried thereon downward, and the downward movement of the displacement rod in the displacement cylinder increases the pressure on the liquid propellant in the displacement cylinder.

The increase in the pressure on the fluid propellant is exerted against the primary area of the machine valve stem and when the force of the machine valve spring is overcome the machine valve stem moves away from its valve seat. The area on which the pressure acts is then increased and the machine valve stem is moved downward and into engagement with the container valve stem until both the machine valve and the container valve are fully open. When these valves are thus opened, the liquid propellant is forced into the container under pressure of the displacement rod.

When the displacement rod reaches the downward limit of its stroke (as shown in Fig. 4) and the container has been loaded with the desired amount of the propellant, the plate carried by the upper slide strikes the reversing switch. The reversing switch causes the air cylinder to move the slides in the opposite direction and thus, releases the force acting on the displacement rod. The slides are then returned to the rest position. When the pressure is released from the displacement rod, the machine valve and the container valve close under the influence of their respective springs before the seal between the displacement head and the container is disturbed.

When the slides reach their upper position, the upper slide strikes the limit-off switch which conditions the machine for its next cycle of operation and in this position the displacement head has been raised from engagement with the loaded container so that the loaded container may be withdrawn and a new container may be inserted in position for loading.

A mixture of one part trichloromonofluoromethane (Freon-11) and one part dichlorodifluoromethane (Freon-12) is commonly used as a propellant for containers of this type. Such a mixture has a vapor pressure at room temperature (70° F.) of about 40 to 50 pounds gauge. To prevent such propellant from vaporizing due to a drop in pressure as the propellant flows into the displacement cylinder during the charging of the displacement cylinder with propellant or due to any suction effect on the upstroke of the displacement rod, it has been found desirable to maintain a pressure on the propellant at its source of about 100 pounds per square inch, or, in other words, a pressure of about twice the normal pressure required to keep the propellant in liquid form. The machine valve should thus be designed to remain closed under at least 100 pounds per square inch pressure at all times.

The pressure in the displacement cylinder is then increased to approximately 800 or 1,000 pounds per square inch by the downward movement of the displacement rod to open the machine valve and to force the propellant into the container.

It will be understood that various modifications and changes may be made in the embodiment of the invention illustrated and described herein without departing from the scope of the invention as defined by the following claims.

I claim:

1. In a machine for loading a pressurized container having an opening therein and a valve normally closing said opening, the combination of a displacement cylinder, said cylinder being movable into and out of engagement with a container and having a discharge outlet therein, said discharge outlet communicating with a valve in the container when the cylinder is in engagement therewith, a displacement member mounted in the cylinder and being movable relative thereto, a valve normally closing the discharge outlet in the cylinder, said discharge valve being operable to open said outlet under hydraulic pressure from within the cylinder, means for forming a seal between the discharge outlet and the container valve when the cylinder is in engagement with the container, and power means connected to the displacement member for moving the cylinder into engagement with the container valve and moving the displacement member relative to the cylinder.

2. In a machine for loading a container having an opening therein with a valve normally closing said opening, the combination as defined in claim 1 wherein the power means connected to the displacement member includes a pneumatically operated piston and cylinder.

3. In a machine for loading a pressurized container having an opening therein and a valve normally closing said opening, the combination of a displacement cylinder movably mounted on a frame, said cylinder being movable into and out of engagement with a valve controlled opening in a container and having a discharge outlet and an inlet therein, a displacement member mounted in the cylinder, said displacement member being movable relative to the cylinder, a check valve in the inlet to the cylinder, said check valve being arranged to admit material under pressure into the cylinder and to close said inlet upon an increase of the pressure on the material in the cylinder, a valve in the discharge outlet of the cylinder, said discharge valve normally closing the discharge outlet and being operable to open said outlet under the influence of hydraulic pressure resulting from movement of the displacement member relative to the cylinder, and means for sealing the discharge outlet to the valve controlled opening in the container when the cylinder is in engagement with said opening.

4. In a machine for loading a pressurized container having a valved opening therein and a valve normally closing said opening, the combination as defined in claim 3 which includes power means connected to the displacement member for moving the cylinder into engagement with the valve controlled opening in the container and moving the displacement member relative to the cylinder.

5. In a machine for loading a pressurized container having an opening with a valve therein, the combination of a displacement cylinder, said cylinder being movable relative to a frame and having a discharge outlet therein, a displacement member mounted in the cylinder, said displacement member being movable relative to the cylinder, a valve normally closing the discharge outlet in the cylinder, said valve being operable to open said outlet under hydraulic pressure resulting from movement of the displacement member relative to the cylinder and having a flow area corresponding to a flow area of a valve in a container, and sealing means surrounding said discharge outlet for connecting the discharge outlet in the cylinder to the valve in the container.

6. In a machine for loading a pressurized container having an opening therein and a valve normally closing said opening, the combination of a displacement cylinder, said cylinder being movable into and out of engagement with a container and having a discharge outlet therein, said outlet communicating with a valve in the container when the cylinder is in engagement therewith, a displacement member mounted in the cylinder and being movable relative thereto, a valve normally closing the discharge outlet in the cylinder, said discharge valve being operable to open the outlet in the cylinder under hydraulic pressure resulting from movement of the displacement member relative to the cylinder, means for forming a seal between the discharge outlet and the valve in the container when the displacement cylinder is in engagement with the container, and means on the discharge valve for engaging with and opening the container valve in movement of the discharge valve to open the discharge outlet in the cylinder.

7. In a machine for loading a pressurized container, the combination as defined in claim 6 which includes power means connected to the displacement member for moving the displacement cylinder into and out of engagement with the container and for moving the displacement member relative to the displacement cylinder upon engagement of the cylinder with the container.

8. In a machine for loading a container through a valve-controlled opening with a measured amount of material in liquid form, the combination of a movable cylinder containing a supply of material in liquid form and having a discharge outlet therein, said cylinder being movable into and out of engagement with a container whereby the discharge outlet in the cylinder is moved into and out of communication with a valve-controlled opening in the container, valve means in the cylinder normally closing the discharge outlet therein, said valve means being operable upon an increase of pressure on the liquid material in the cylinder to open said discharge outlet, a displacement member mounted in said cylinder and being movable therewith, said displacement member being movable with the cylinder in movement of the cylinder into and out of engagement with the container and being movable relative to the cylinder for exerting pressure on the liquid material therein to open the valve means in the discharge outlet and to displace a measured amount of said material from the cylinder when the valve means in the discharge outlet in the cylinder is open, a stop engaging with and limiting movement of the cylinder in engagement of the cylinder with the container, and means for regulating the movement of the displacement member relative to the cylinder when the cylinder is in engagement with said stop.

9. In a machine for loading a container, the combination as defined in claim 8 which includes power means connected to the displacement member for moving the cylinder into engagement with the container and for moving the displacement member relative to the cylinder when the cylinder is in engagement with the stop.

10. In a machine for loading a container, the combination as defined in claim 8 which includes means for forming a seal between the discharge outlet of the container and the valve-controlled opening of the container.

11. In a machine for loading a container, the combination as defined in claim 8 wherein the stop engaging with and limiting movement of the cylinder is adjustable.

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