Nov. 14, 1944. R. J. JAUCH ET AL 2,362,559

AIRPORT FUELING MECHANISM

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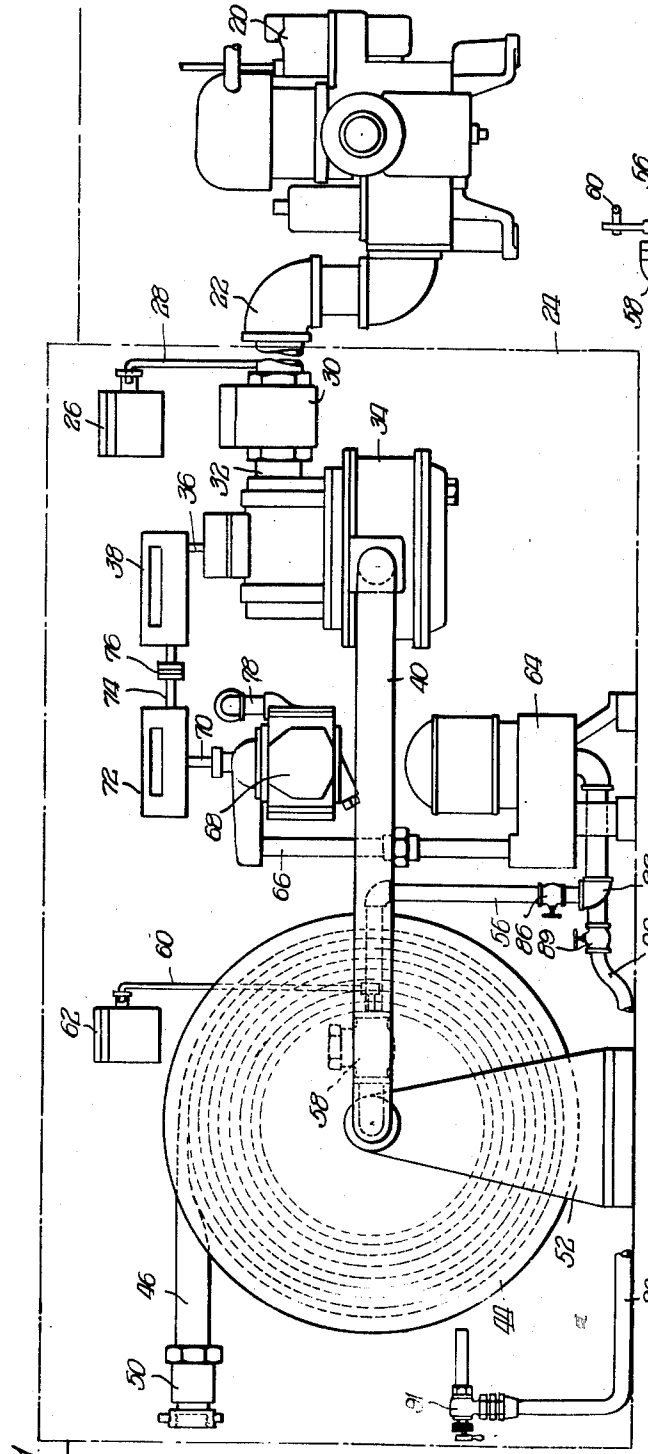


Fig. 1

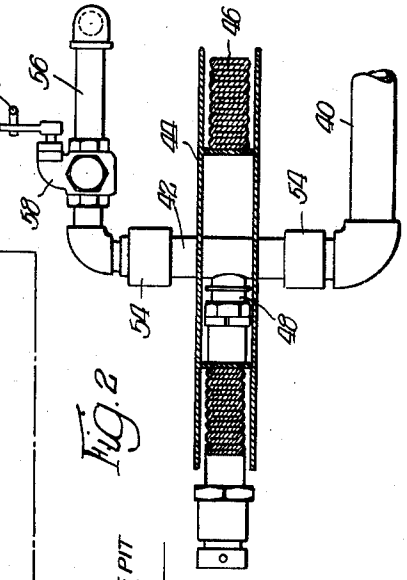


Fig. 2

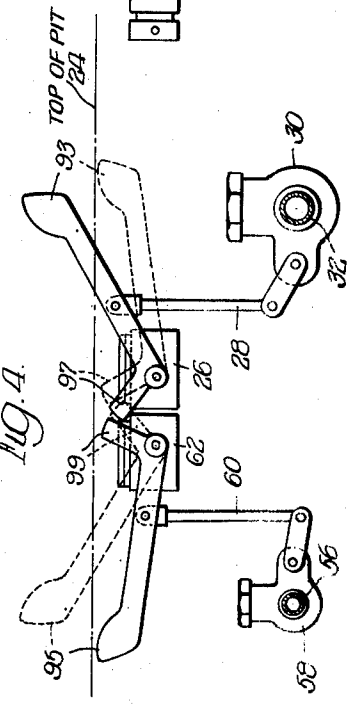


Fig. 4

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Fig. 6.

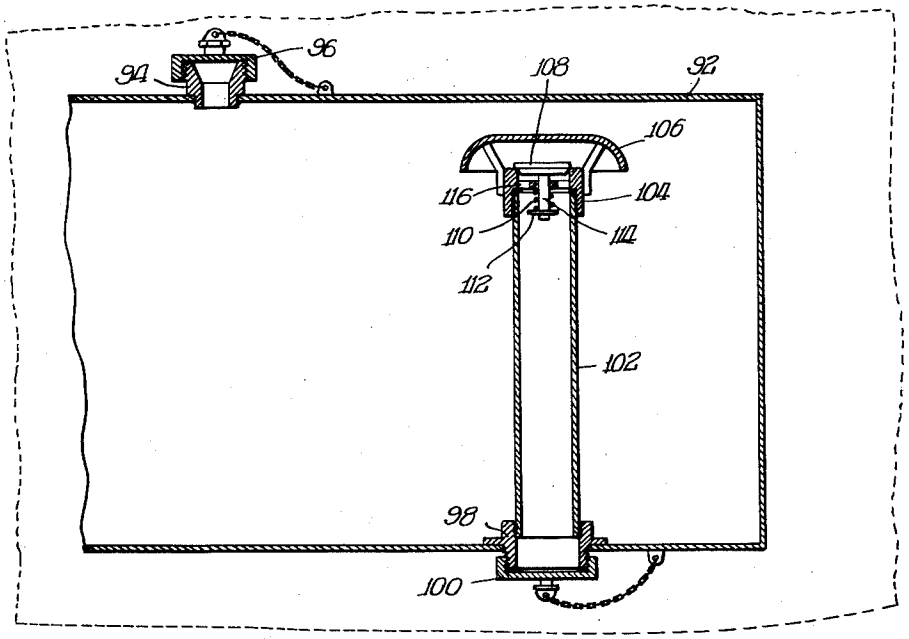


Fig. 3.

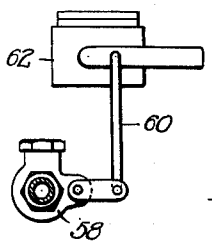
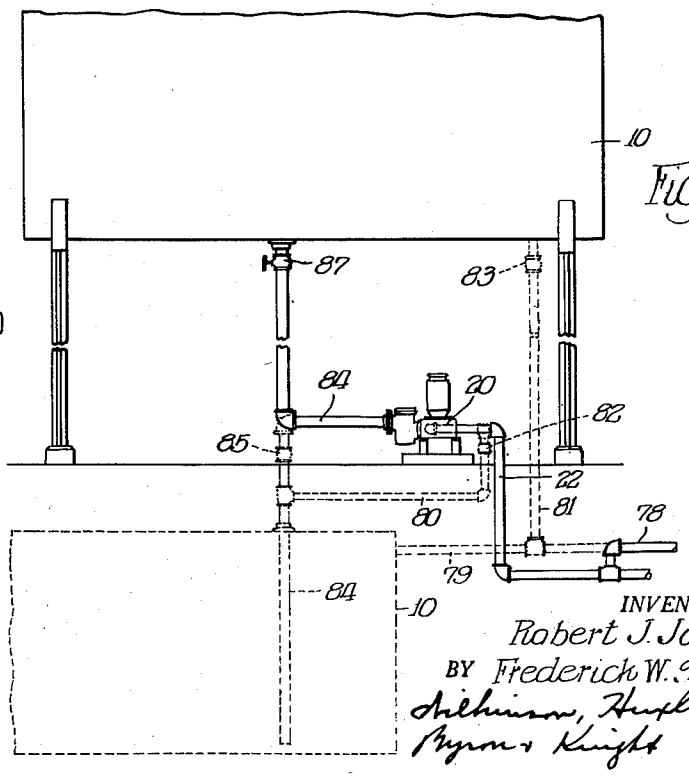


Fig. 5.



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AIRPORT FUELING MECHANISM

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Application April 7, 1944, Serial No. 530,000

11 Claims. (Cl. 222—23)

This invention pertains to liquid dispensing apparatus and more particularly to mechanism and apparatus for fueling wherein high delivery can be effected and a long hose readily used and handled, making it readily adaptable for use as an airport fueling apparatus.

For a number of years the so called fueling pit has been used extensively in airports. This pit system has a source of liquid supply in the form of an underground or overhead storage tank and, by means of a pump, usually located near the source of supply, gasoline under pressure is forced to the fueling pit which houses a meter, control valves, switches, and a reel on which fifty or more feet of hose is coiled. To the end of the hose is attached a nozzle for controlling the flow of liquid to the plane. The usual practice is for the plane to taxi to a location at or near the fueling pit. The attendant then withdraws a sufficient length of hose to reach to the fill opening, usually on the top of the wing, and filling is then effected.

A hose containing gasoline under pressure is difficult to handle, not only by reason of the weight involved, but because it is difficult to control the shut-off nozzle when closing against the high pressure necessary to force gasoline through the dispensing system. A hose larger than 1½ inches in diameter becomes so unwieldy that it is almost impossible to handle, and since the hose size must be confined to 1½ inch diameters or less, flow rates are greatly restricted and the objective of the air lines to obtain delivery speeds of 100 G. P. M. upwards are not obtainable.

This pit system has a rather wide spread use in airports where planes, smaller than the transport type, are serviced. The commercial air lines have not taken kindly to fueling pits and prefer, instead, to fuel planes from a gasoline truck equipped with power take-off. This system has several advantages over the pit system. The plane can come to rest at any position on the field and the fueling truck is driven to the plane. The pump, which is driven by power take-off mechanism installed as a part of the equipment of the truck, forces gasoline through the meter, hose, and nozzle, and by reason that the tank truck can be positioned rather closely to the plane, it is usually necessary to only withdraw about twenty-five feet of the hose from the reel, and since the pump is so closely associated with the source of supply, faster deliveries are obtained.

The commercial air lines, visualizing the future, are endeavoring to improve the present fueling system. They visualize capacities of 150 G. P. M. as being necessary to quickly complete the fueling of large transport planes. It is obvious that extremely high pressures would result if attempts were made to force 150 G. P. M. through a hose of 1½ inch diameter and, as stated before, it has been found impractical to handle a hose in excess of that diameter. They object, also, to the hose being dragged over the wing of the plane and have considered the possibility of fueling from underneath the wing, making the system a bottom fueling rather than a top fueling arrangement. Efforts to accomplish bottom fueling have, to date, met with failure, because the valve mechanism developed for insuring against any loss of fuel, after the connection has been broken, has resulted in so much intricate mechanisms as to be considered impractical. The system described herein is designed to expedite the delivery of fuel to a plane, making it possible to deliver gasoline at a rate of 150 G. P. M. with less effort than it now takes to deliver gasoline at 40 G. P. M. It further contemplates the abandonment of the present fueling pit apparatus entirely and dispenses with the costly fueling truck. This is accomplished through the use of a flexible, collapsible hose which is expanded to its true diameter only while gasoline is being delivered to the plane, and which is collapsed to a flattened position with all gasoline withdrawn from the hose before the connection to the fill pipe of the plane is broken.

In the herein disclosed system, a storage tank located remotely from the airport may be used, and this storage tank can be either above ground or can be buried underground. In either case, a pump of suitable capacity is positioned near the source of supply and lines are run to the landing field and branched out in several directions. To the ends of the various branches are affixed the control and dispensing apparatus for the particular branch, which apparatus is readily positioned and readily and easily operated.

It is an object of this invention to provide fueling apparatus which is readily adapted to bottom fueling.

Another object of the invention is to provide fueling apparatus adapted for high delivery but one which is easily and readily handled and operated.

Another object of the invention is to provide fueling apparatus which may be used to supply fuel to airplanes or other vehicles, and may also be provided with means for withdrawing fuel

from the tanks of the airplanes or other vehicles when this is found to be necessary.

Another object of the invention is to provide fueling apparatus wherein the delivery hose is exhausted of fuel after delivery and is stored dry.

Another object of the invention is to provide fueling apparatus wherein the fueling and defueling, where necessary, is controlled at a point remote from the source of fuel supply.

Another object of the invention is to provide fueling apparatus wherein the delivery hose which is used may be of large diameter, but is moved and stored only in dry condition.

With these and various other objects in view, the invention may consist of certain novel features of construction and operation as will be more fully described and particularly pointed out in the specification, drawings and claims appended hereto.

In the drawings which illustrate an embodiment of the device and wherein like reference characters are used to designate like parts—

Figure 1 is an elevation showing an airport dispensing device embodying the invention, the parts of the device being shown more or less diagrammatically arranged;

Figure 2 is a sectional plan view showing the hose reel used in the dispensing device illustrated in Figure 1, the same illustrating the hose in coiled and collapsed position;

Figure 3 is an end view of the throttle valve and switch box for the pump disposed in the pit illustrated in Figure 1;

Figure 4 is an end elevation of certain valves and switches in the pit showing interlocking means therebetween, disposed so that there must be a predetermined sequence of operation thereof;

Figure 5 is an elevation showing the source of supply and main pump for the device illustrated in Figure 1; and

Figure 6 is a fragmentary sectional elevation showing the gasoline tank of an airplane, or other vehicle to be fueled, the same showing means provided for fueling through the base of the tank.

Referring first of all more particularly to the form of dispensing apparatus illustrated in Figures 1 to 5, inclusive, the pump 20 is adapted to be located preferably adjacent a storage tank 10 which may either be of the buried or of the raised type. The pump supplies liquid under pressure to the supply line 22 which may lead to various pits, such as shown at 24, and such pit is provided with the usual cover, not shown, which, when in closed position, is substantially flush with the ground. Within the pit there is provided the switch 26 adapted to control the pump 20 and this switch also is connected through rod 28 to a throttle valve 30 which controls the flow from the pipe 22 into the dispensing apparatus provided in the pit 24. When switch 26 is open, valve 30 is closed and switch 26 cannot be opened or remain open when the cover of the pit 24 is closed.

The valve 30 is connected through pipe 32 to the inlet side of the meter 34, liquid passing through the meter rotating meter shaft 36 which in turn causes registration of the register 38. The outlet side of the meter is connected through the pipe 40 to the manifold 42 of the hose reel 44. One end of the collapsible hose 46 is connected to the manifold as at 48 and it will be noted that inasmuch as the hose is coiled in dry condition, as will be later described, that it is coiled flat.

The opposite end of the hose is provided with the coupling 50 for attachment to the bottom filling mechanism illustrated in Figure 6, to be later described. The hose reel is supported on a suitable pedestal 52 and the manifold 42 is provided with the usual swivel joints 54 for permitting rotation of the reel. The manifold 42 is also connected to the pipe 56 provided with the throttle valve 58 connected through the link or rod 60 to the switch 62 whereby operation of the switch will also operate the throttle valve. The switch 62 is adapted to control operation of the pump 64 and the pipe 56 is connected to the inlet side of said pump. The outlet side of the pump is connected through the pipe 66 to the inlet side of the meter 68. The liquid passing through the meter causes rotation of the meter shaft 70 for operating the register 72 which records the amount of liquid passing through the meter 68.

The register 72 in addition is connected through the shaft 74 to the register 38 whereby rotation of the shaft 74 deducts from the registration of the meter 38 the amount which is recorded on the register 72. A suitable clutch 76 may be provided whereby the registers 72 and 38 may be selectively disconnected.

The outlet side of the meter is connected through the pipe 78, either to the source of supply through a separate line, as shown at 79 or 81 (a check valve being used at 83), or the pipe 78 may be connected to the line 22 (as shown in full lines in Figure 5) and the line 22 may be provided with the by-pass line 80 provided with the check valve 82 opening toward the suction line 84 of the pump 20 whereby the liquid from pipe 78 may be returned to the source of supply. Where the underground tank is used, the suction line is provided with the check valve 85 opening toward the pump and where the overhead tank is used a valve 87 is provided.

Frequently it is desirable to withdraw gasoline from the vehicle tank and for this purpose the pipe 56 is provided with the manually operable valve 86 and at the joint 88 of the pipe 56 there is coupled a hose 90 which may be suitably supported in the pit 24 and is provided with a suitable hand valved nozzle 91 for insertion into the tank of the vehicle from which liquid is to be withdrawn. This hose, being of small diameter, may be coiled or provided on a separate reel and stored wet, in which case valve 89 is connected to the manifold of a reel suitably supported, the inner end of the hose being connected to the manifold and the manifold supported in a suitable pedestal provided with swivels permitting rotation of the reel. In order to register the withdrawn liquid, register 72 is provided driven by the meter shaft 70 and this register may either be continually driven and reset as shown, or suitable shifting means (not shown) may be provided whereby shaft 70 drives shaft 74 but does not drive the register 72.

Frequently it is desired that the valve 58 be arranged so that it cannot be opened when valve 30 is open, and switch 62 cannot be closed when switch 26 is closed, and vice versa. To this end an arrangement as shown in Figure 4 may be used.

Switches 26 and 62 are disposed adjacent each other and are provided with the operating levers 93 and 95 movable upwardly to switch closed position, the rods 28 and 60 being piv-

oted to said levers. As the rods are connected to the control levers of valves 30 and 58 when the levers are raised the valves are opened. Levers 93 and 95 are provided with the interlocking lugs 97 and 99, respectively, so arranged that when one lever, (say lever 93) is raised, the other lever (95) cannot be raised. It is thus apparent that valve 58 cannot be opened when valve 30 is open, and switch 62 cannot be closed when switch 26 is closed, and vice versa.

The tank 92 (Figure 6) may be used in any suitable vehicle such as an airplane, automobile, or the like, and is provided with the top fill or withdrawal fitting 94 having a closure cap 96. A bottom fill fitting 98 is provided with a suitable closure cap 100 and the fitting 98 is adapted to receive the coupling 50 for filling purposes. The fitting 98 is provided with the upwardly extending fill tube 102, extending upwardly adjacent a high point in the tank and the upper end of the tube is provided with the fitting 104 having deflecting means 106 thereon. A spring-pressed valve 108 is urged toward closed position by means of the spring 110 interposed between the head 112 of the valve stem 114 and the spider 116.

Assuming that a vehicle containing the tank 92 is disposed adjacent the pit 24 and it is desired to fill the tank 92, the cap 100 is removed from the fitting 98, the cover of the pit 24 is opened and the hose 46 is withdrawn from the reel and the coupling 50 is attached to the fitting 98. At this time switch 62 is open, and valve 58 is closed. Closing switch 26 operates the pump 20 to supply liquid through the pipe 22 and valve 30, opened when switch 26 is closed, to the meter 34 causing rotation of the meter shaft 36 and registry on the register 38.

Liquid then passes through pipe 40, manifold 42, through the hose 46 into tank 92 past the valve 108. At this time switch 62 is open and valve 58 is closed. When sufficient liquid has been supplied to the tank 92, switch 26 is opened and valve 30 is closed, stopping supply of liquid from the source to the particular pit. Of course other pits may still be in operation, pump 20 being operated from the switches 26 of those pits. Switch 62 is then closed and the valve 58 is opened. Closing switch 62 causes operation of the pump 64 to withdraw all of the liquid in hose 46 and tube 102 from the hose 46 and tube 102, but no liquid will be withdrawn from tank 92 as valve 108 will be closed. The withdrawn liquid passes through pipe 56, past open valve 86 and through the meter 68 where it is registered on the register 72 and causing a deducting computation of the register 38 to an amount equal to the volume of the tube 102 and hose 46.

The hose being of the collapsible type, when liquid is withdrawn from the hose, it will totally collapse by the high vacuum of pump 64, so that it will be readily reeled as shown in Figure 2, and inasmuch as it is entirely void of liquid, it is readily handled as, of course, it is much lighter as well as more pliable. By the use of this hose, one of more than twice the diameter of the ordinary wet hose can be used, and handled more easily and, of course, deliver more volume at lesser pressure. Liquid passing through the meter 68 will be delivered through pipe 78 to the source of supply as has already been described.

In some instances, it is desirable to withdraw liquid from tank 92 as in the case of an airplane where additional weight is added to the plane after fueling, so that the plane must be lightened by withdrawing some fuel. In this case, the nozzle 91 of hose 90 is opened and inserted in the fitting 94, valve 86 is closed, and valve 89 is opened. Pump 64 is actuated to withdraw liquid through hose 90, supplying the liquid to the meter 68, through which the liquid passes returning it to the source of supply through pipe 78. The amount of liquid so withdrawn is registered at 72.

Thus in applicant's device mechanism is provided to supply liquid at a high rate of flow in discharging liquid from the hose at its tank or discharge end to a receptacle, and also to return the hose to dry hose condition where it is substantially free from liquid which otherwise would be retained therein, thereby facilitating storage and handling thereof.

It is to be understood that we do not wish to be limited by the exact embodiments of the device shown, which are merely by way of illustration and not limitation, as various and other forms of the device will, of course, be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

We claim:

1. In liquid dispensing apparatus, the combination of a flow line, liquid forcing means for forcing liquid through said line, a meter in said line for measuring flow through said line, delivery means for dispensing liquid supplied through said flow line, said delivery means comprising a flexible, collapsible hose adapted to be in dry hose condition and collapsed when the apparatus is in inoperative condition, means for closing the delivery end of the hose, and means for removing the liquid from said hose after a dispensing operation and after closing the delivery end of the hose, by subjecting the inside of the hose to vacuum conditions after the delivery end of the hose is closed, thereby removing liquid from the hose and returning said hose to its inoperative condition wherein it is collapsed and in dry hose condition.

2. In liquid dispensing apparatus, the combination of a flow line, liquid forcing means for forcing liquid through said line, a meter in said line for measuring liquid passing through said line, a register controlled by said meter for registering the liquid measured by said meter, delivery means for dispensing liquid supplied through said flow line, said delivery means comprising a flexible, collapsible hose adapted to be in dry hose condition and collapsed when the apparatus is in inoperative condition, means for closing the delivery end of the hose, and means for removing the liquid from said hose after a dispensing operation and after closing the delivery end of the hose, by subjecting the inside of the hose to vacuum conditions after the delivery end of the hose is closed, thereby removing liquid from the hose and returning said hose to its inoperative condition wherein it is collapsed and in dry hose condition, said last named means including a pump having its suction connected to said hose, a meter for measuring the liquid removed from said hose, a register operated by said last named meter for registering the liquid measured by said last named meter, and connecting means between said registers whereby the same amount is deducted from the first register that is registered by the second register.

3. In liquid dispensing apparatus, the combination of a flow line, liquid forcing means for forcing liquid through said line, a meter in said

line for measuring liquid passing through said line, a register controlled by said meter for registering the liquid measured by said meter, delivery means for dispensing liquid supplied through said flow line, said delivery means comprising a flexible collapsible hose adapted to be in dry hose condition and collapsed when the apparatus is in inoperative condition, means for closing the delivery end of the hose, and means for removing liquid from said hose after a dispensing operation and after closing the delivery end of the hose, by subjecting the inside of the hose to vacuum conditions after the delivery end of the hose is closed, thereby removing liquid from the hose and returning said hose to its inoperative condition wherein it is collapsed and in dry hose condition, said last named means including a pump having its suction connected to said hose, a meter for measuring the liquid removed from said hose, and a register operated by said last named meter for registering the liquid measured by said last named meter.

4. In liquid dispensing apparatus, the combination of a liquid flow line, delivery means for dispensing liquid supplied through said flow line, said delivery means comprising a flexible collapsible hose adapted to be in collapsed condition when empty as when the apparatus is in inoperative condition, means for closing the delivery end of the hose, and means for subjecting the inside of the hose to vacuum conditions for removing liquid from the hose after the delivery end is closed thereby reducing the internal pressure in the hose below the outside atmospheric pressure to thereby cause said hose to be in collapsed condition.

5. In liquid dispensing apparatus, the combination of a liquid flow line, a pump the outlet side of which is connected to said line, the inlet side of said pump being adapted to be connected to a source of liquid supply, a meter in said line for measuring liquid passing through said line, a register controlled by said meter for registering the liquid measured by said meter, delivery means for dispensing liquid supplied through said flow line, said delivery means comprising a flexible, collapsible hose adapted to be in dry hose condition and collapsed when the apparatus is in inoperative condition, means for closing the delivery end of the hose, and means for removing the liquid from said hose after a dispensing operation and after closing the delivery end of the hose, by subjecting the inside of the hose to vacuum conditions after the delivery end of the hose is closed, thereby removing liquid from the hose and returning said hose to its inoperative condition wherein it is collapsed and in dry hose condition, said last named means including a pump having its suction connected to said hose, a meter for measuring the liquid removed from said hose, the outlet side of said meter being connected to return means for returning the liquid to the inlet side of the first named meter, and a register operated by said last named meter for registering the liquid measured by said last named meter.

6. In liquid dispensing apparatus, the combination of a liquid flow line, a pump the outlet side of which is connected to said line, the inlet side of said pump being adapted to be connected to a source of liquid supply, a meter in said line for measuring liquid passing through said line, a register controlled by said meter for registering the liquid measured by said meter, delivery means for dispensing liquid supplied through said flow line, said delivery means comprising a flexible, collapsible hose adapted to be in dry hose condition and collapsed when the apparatus is in inoperative condition, means for closing the delivery end of the hose, and means for removing the liquid from said hose after a dispensing operation and after closing the delivery end of the hose, by subjecting the inside of the hose to vacuum conditions after the delivery end of the hose is closed, thereby removing liquid from the hose and returning said hose to its inoperative condition wherein it is collapsed and in dry hose condition, said last named means including a pump having its suction connected to said hose, a meter for measuring the liquid removed from said hose, the outlet side of said meter being connected to return means for returning the liquid to the inlet side of the first named meter, a register operated by said last named meter for registering the liquid measured by said last named meter, and connecting means between said registers whereby the same amount is deducted from the first register that is registered by the second register.

7. In liquid dispensing apparatus, the combination of a flow line, liquid forcing means for forcing liquid through said line, a meter in said line for measuring liquid passing through said line, a register controlled by said meter for registering the liquid measured by said meter, delivery means for dispensing liquid supplied through said flow line said delivery means comprising a flexible, collapsible hose adapted to be in dry hose condition and collapsed when the apparatus is in inoperative condition, means for closing the delivery end of the hose, and means for removing liquid from said hose after a dispensing operation and after closing the delivery end of the hose, by subjecting the inside of the hose to vacuum conditions after the delivery end of the hose is closed, thereby removing liquid from the hose and returning said hose to its inoperative condition wherein it is collapsed and in dry hose condition, said last named means including a pump having its suction connected to said hose, a meter for measuring the liquid removed from said hose, connecting means between said registers whereby the same amount is deducted from the first register that is registered by the second register, and means for preventing supply of liquid to said first meter when liquid is being supplied to said second meter.

8. In liquid dispensing apparatus, the combination of a liquid flow line, delivery means for dispensing liquid supplied through said flow line, said delivery means comprising a flexible, collapsible hose adapted to be in dry hose condition and collapsed when the apparatus is in inoperative condition, means for closing the delivery end of the hose, and means for removing liquid from the hose after a dispensing operation and after closing the delivery end of the hose by subjecting the inside of the hose to vacuum conditions after the delivery end of the hose is closed, thereby removing liquid from the hose and returning said hose to its inoperative condition wherein it is collapsed and in dry hose condition, and means for preventing flow through said liquid flow line when said last named means is removing liquid from said hose.

9. The method of filling a tank and handling a hose comprising bringing a hose in dry hose condition into communication with a tank inlet, pumping liquid through the hose into the tank causing the hose to be distended by the liquid

pumped therethrough, measuring the total amount of liquid pumped, closing the hose at the tank or discharge end of the hose and extracting the liquid in the hose therefrom by subjecting the inside of the hose, after closure at the tank end, to vacuum conditions while allowing atmospheric pressure to collapse the hose thereby returning said hose to dry hose condition and permitting storage thereof, measuring the amount of liquid so extracted and deducting the second amount from the first amount to determine the net amount put into the tank.

10. The method of filling a tank and handling a hose comprising bringing a hose in dry hose condition into communication with a tank inlet, pumping liquid through the hose into the tank causing the hose to be distended by the liquid pumped therethrough, closing the hose at the tank or discharge end and extracting the liquid in the hose therefrom by subjecting the inside of the hose, after closure at the tank end, to vacuum conditions while allowing atmospheric pressure to collapse the hose thereby returning said hose to dry hose condition, and permitting storage thereof.

11. The method of handling a liquid dispensing hose after dispensing operation therethrough to supply liquid to a receptacle, which comprises closing the hose at the receptacle or discharge end and extracting the liquid from the hose by subjecting the inside of the hose to vacuum conditions after closing the receptacle end thereof, thereafter allowing atmospheric pressure to collapse the hose thereby disposing said hose in dry hose condition whereby it may be stored in this condition.

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