

[54] RETURN OF VAPOR CONDENSATE
FORMED IN DISPENSING VAPOROUS
LIQUID

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55/171-175, 277, 40, 41, 55, 164, 165, 189,
55/190; 62/268; 220/85 VS, 85 VR

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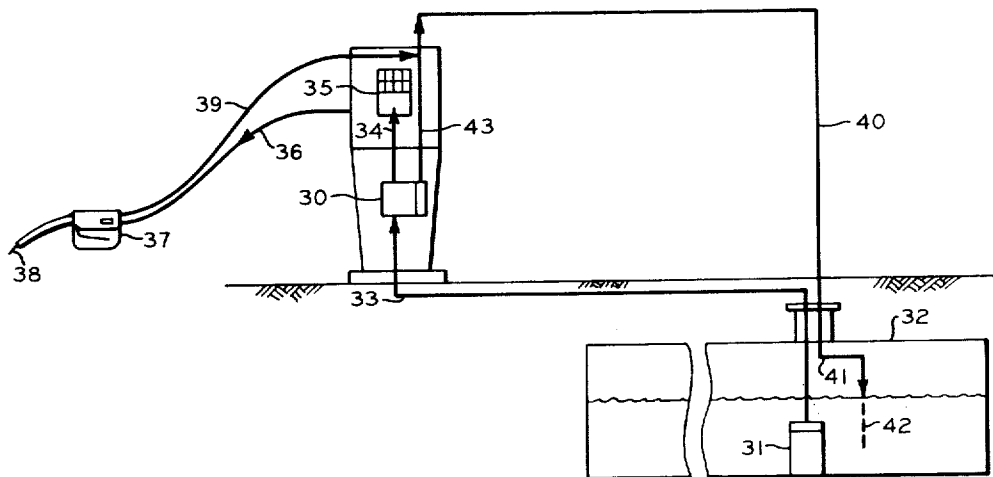
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[57] ABSTRACT

The pressure of a fuel being dispensed is applied to create a suction as by a Venturi to suck from a reservoir in which it has accumulated vapor condensate back into the fuel delivery system or the pressure of the fuel being dispensed is employed to inflate a flexible member or bladder whereby to express the accumulated liquid or condensate from the reservoir back into the fuel dispensing system.

5 Claims, 5 Drawing Figures



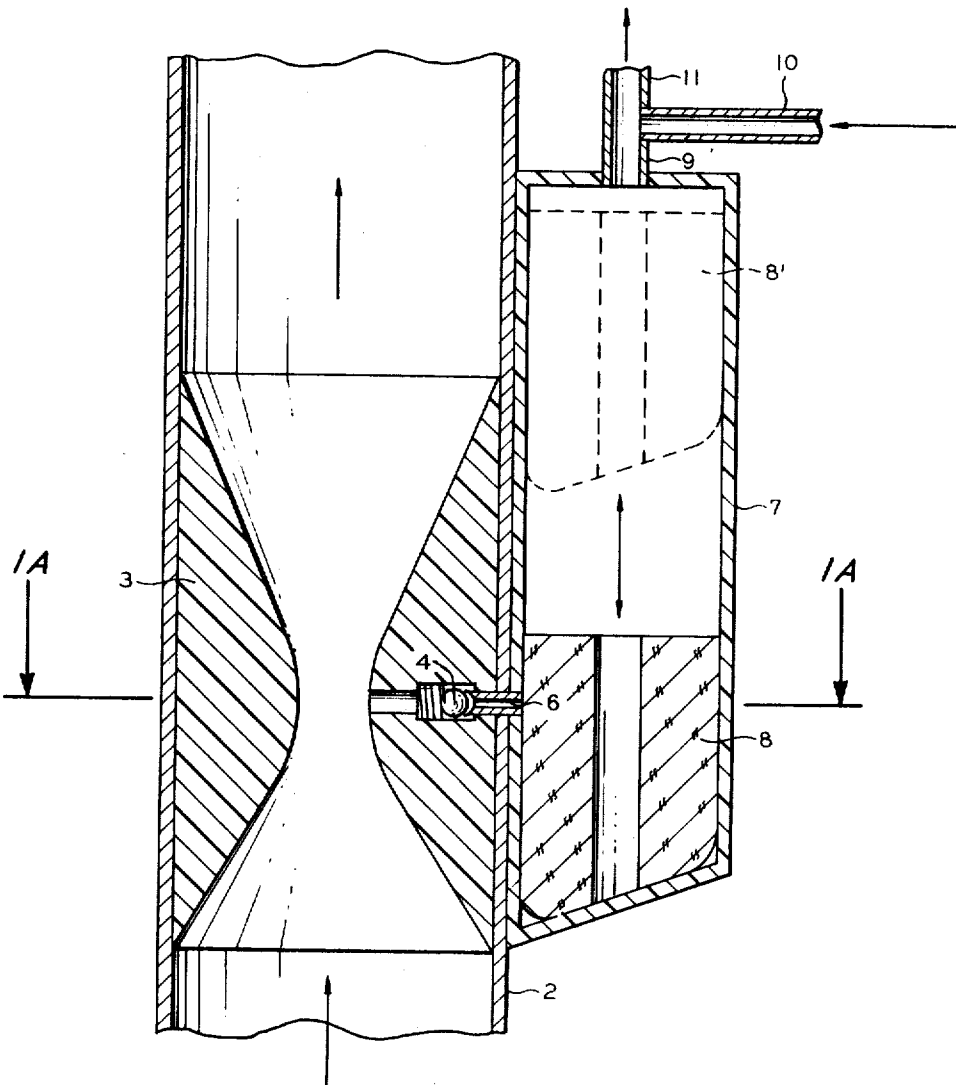


FIG. 1

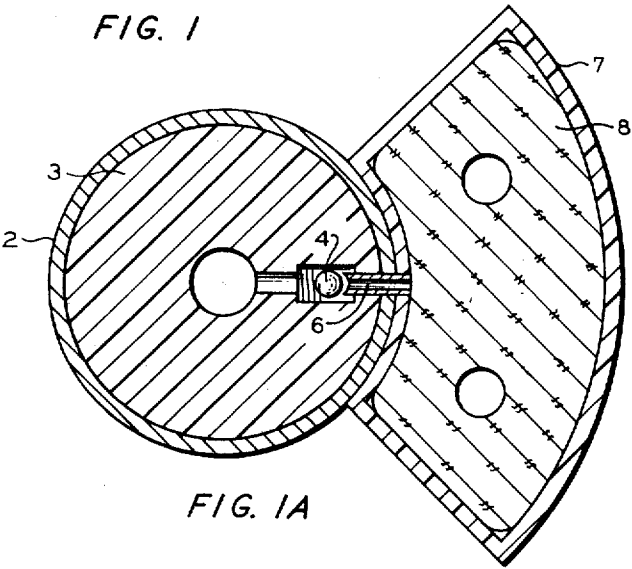


FIG. 1A

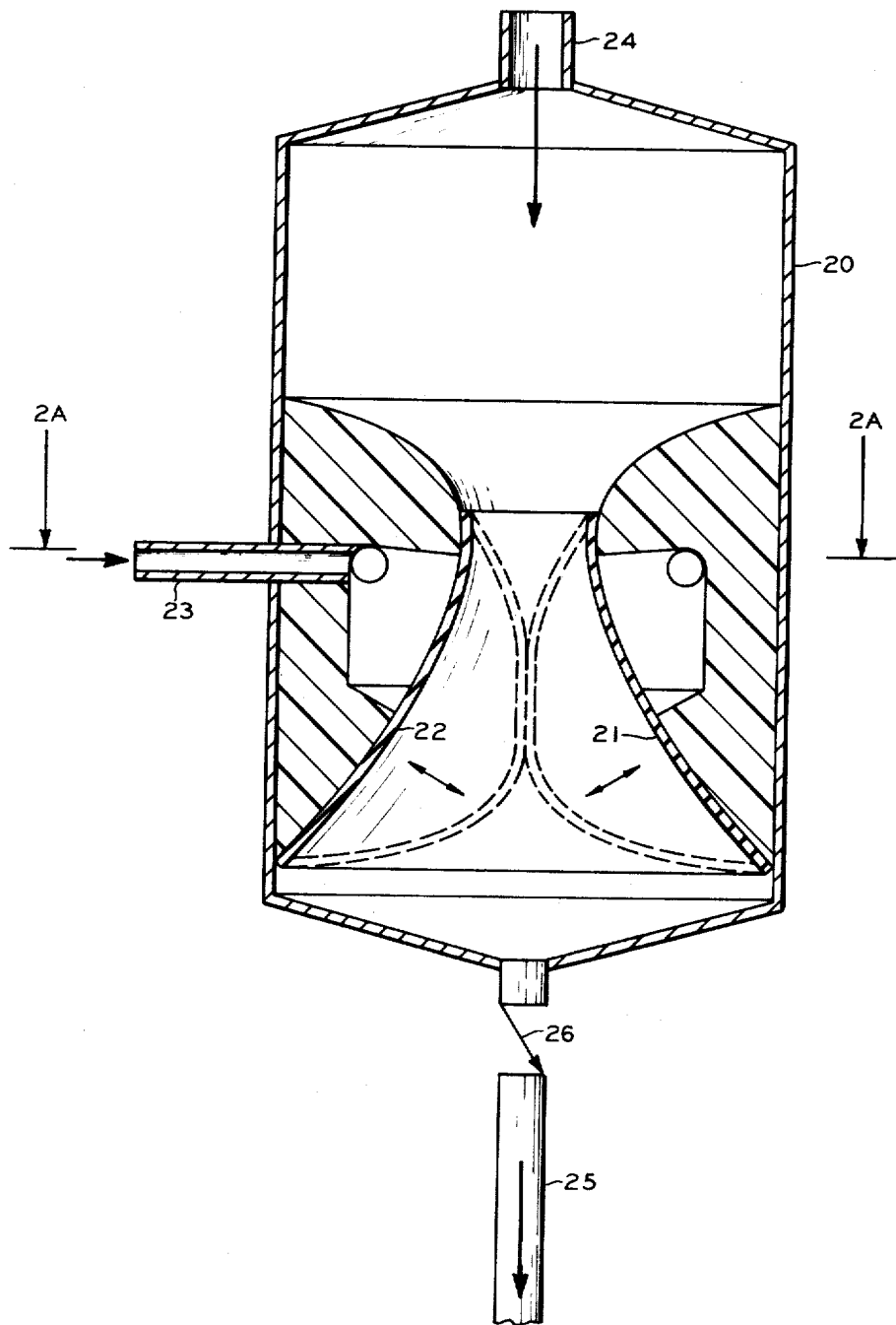


FIG. 2

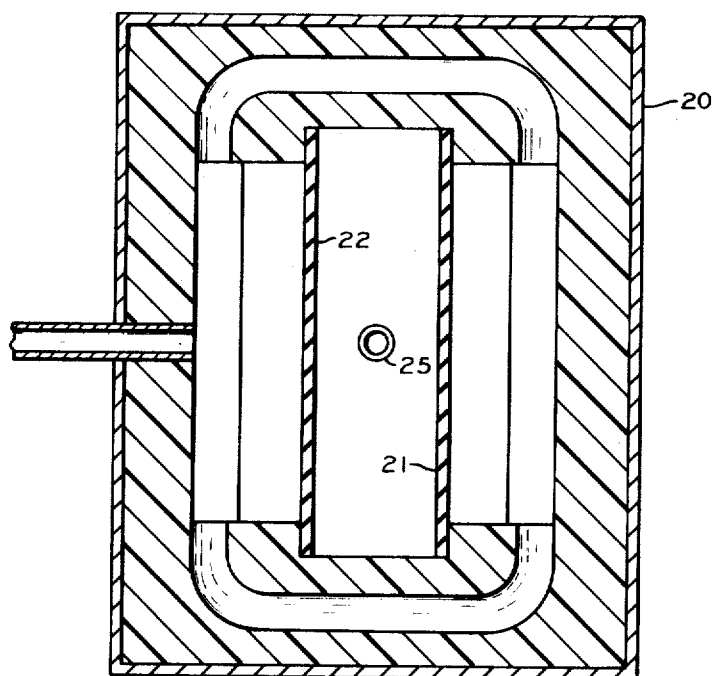


FIG. 2A

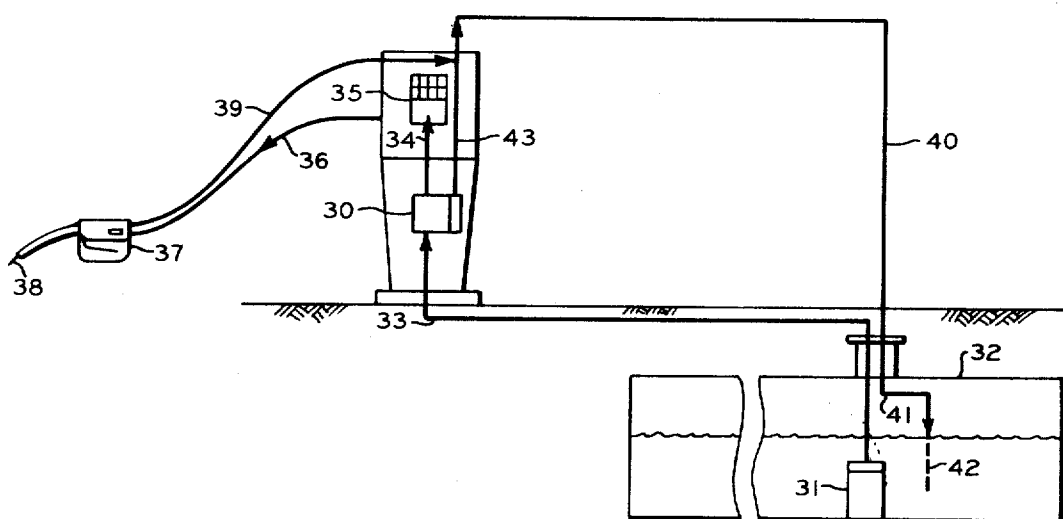


FIG. 3

RETURN OF VAPOR CONDENSATE FORMED IN DISPENSING VAPOROUS LIQUID

This invention relates to the return into a fuel dispensing system of vapor condensate formed or recovered during the dispensing of a fuel. In one of its aspects the invention relates to the recovery of condensate from vapor generated and/or recovered during the dispensing of a fuel back into the fuel dispensing system.

In one of its concepts the invention provides a combination of steps and means for recovering condensate or liquid from a vapor line, accumulating the condensate in a condensate accumulator or reservoir and then drawing or forcing from said reservoir the accumulator liquid employing the pressure of the liquid being dispensed to cause removal of condensate from said reservoir as by passing the liquid being dispensed to a suction zone motivated by passage of the liquid to be disposed therethrough or as by applying the pressure of the liquid being dispensed to cause contraction of the space in the reservoir in which said liquid has accumulated, thus to express the same therefrom.

Losses due to evaporation of vaporous fuel, such as gasoline, take place when the fuel is pumped into a tank in which the rising level of the liquid fuel displaces vapors which are in the tank. These vapors can be generated within the tank before or during the filling thereof. They can be generated by disturbing the liquid already in the tank and, of course, by the disturbance caused to the liquid being delivered to the tank. Such evaporative losses occur during filling of various grades of gasoline stored in service stations underground storage tanks into automobile or truck fuel tanks. Also, vapors are formed during the loading and unloading operations at bulk stations for various grades of gasoline.

Almost any tank holding a level of gasoline with a vapor space above it will normally have some gasoline vapor in the vapor space. The vapor is not all gasoline. The vapor can contain ordinarily 30-70 percent air. The gasoline content will depend mainly upon the vapor pressure and temperature of the gasoline with the vapor being richer as vapor pressure and temperature are higher. The amount of losses, termed evaporative losses, can be as high as from about 0.1 percent to about 0.2 percent of the amount of gasoline being transferred.

Evaporative losses as described can also occur at a bulk plant when the plant storage is filled and also when delivery trucks are filled from storage. Also, at terminals, losses occur when transport vehicles are filled. These vehicles may be tank trucks, railway tank cars, buses or tank ships.

It has occurred to me that when a fuel tank is being filled, the displaced vapors can be transferred to the storage tanks, for example, underground storage tanks from which the fuel is pumped. Volume of gasoline taken from the underground storage and vapors put in will be substantially equal, so little or no venting to the air will occur. Similarly, when the underground storage tank is filled as from a tank truck delivering gasoline to the station, vapors displaced from the storage tank will be taken to the tank truck again with an equal volume exchange.

Whenever vapor thus recovered or transferred is being transferred a portion of it will condense and this condensate must be disposed of.

It has now occurred to me that a combination of a float equipped reservoir acting in combination with a Venturi disposed in the fuel delivery pipe, there being preferably a flow control or check valve between the reservoir and the Venturi can be employed to return vapor condensate to the fuel dispensing system. Also, it has occurred to me that in lieu of the float equipped vessel there can be mounted within the vessel a bladder or bladders or expandable member or members to which the delivery pressure of the fuel can be supplied to cause the expandable member in effect to press downwardly upon the liquid or condensate, thus to express it from the reservoir in which it has been accumulated, thus returning it to the fuel dispensing system.

It is an object of this invention to recover and to return to a fuel dispensing system a liquid condensate formed when recovering evaporatively generated vapors or vapors otherwise generated. It is another object of this invention to provide a method for the recovering of such liquid condensate in a manner in which no pressure other than the pressure of fuel being dispensed when said liquid is to be recovered is needed. It is a further object of the invention to provide apparatus means in combination to recover such condensed vapors or condensate as herein described.

Other aspects, concepts, objects and the several advantages of the invention are apparent from a study of this disclosure, the drawings and the appended claims.

According to the present invention, there are provided method and means for removing a liquid from a reservoir in which it accumulates which comprises a reservoir for the accumulation of said liquid, means for pumping a liquid to be dispensed from a place of storage or supply to a place at which it is to be dispensed, said liquid yielding vapors during its dispensing and condensation of at least some of said vapor yielding said liquid which accumulates in said reservoir, a conduit means for conveying said liquid to be dispensed to a place for its dispensing to which said means for pumping pumps said liquid thus creating a fluid pressure therein, fluid pressure actuated means cooperatively functioning with said reservoir adapted to move from said reservoir liquid accumulated therein and means operatively connected between said conduit means and said fluid pressure actuated means to transmit the pressure of said fluid to said fluid pressure actuated means.

The invention is possessed of wide applicability as evident from this disclosure and from a study of the same.

Various attempts are being made to minimize evaporative losses of valuable fuels.

The present invention provides method and means for recovering vapors and vapor condensate or liquid when transferring fuels or dispensing the same.

It is within the scope of the invention to apply a nozzle to a fuel tank as on a truck or automobile such that the tank is sealed to the nozzle which on the one hand delivers fuel to the tank and on the other makes use of the rising liquid created pressure in the tank to force vapors back to a recovery zone. Further, the invention provides for recovery of condensate formed in, say, exposed vapor lines as in the winter months when the fuel coming from an underground storage tank can be considerably warmer than the atmosphere and therefore condensation will occur as in exposed vapor lines. The invention effectuates return of such condensate to a fuel dispensing system utilizing only the pressure of the liquid or gasoline being dispensed.

In one embodiment of the invention later described, a Venturi disposed in the liquid or gasoline delivery pipe coacts by means of a one-way flow disposed between it and a float equipped reservoir to cause return of liquid or condensate from said reservoir into the Venturi and thus into the main stream of liquid or gasoline being pumped.

In another embodiment, the pressure of the liquid or gasoline being pumped is supplied to an expandable member or bladder within a condensate accumulating reservoir, thus to expand the bladder which then presses upon the liquid in the reservoir causing it to be returned into the main stream of gasoline or liquid being pumped.

Referring now to the drawings,

FIG. 1 shows an embodiment of the invention in vertical cross section, in which there is provided a float-containing condensed liquid accumulating reservoir from which accumulated liquid is removed with the aid of a Venturi in the fuel delivery pipe.

FIG. 1A is a cross sectional plan view taken along line 1A—1A of FIG. 1.

FIG. 2 is a modification of the invention in which the liquid accumulating reservoir is equipped with expandable bladders which can expand across the reservoir and downwardly therein responsive to pressure of fuel being dispensed so as to express accumulated liquid from said reservoir.

FIG. 2A is a horizontal cross sectional plan view of FIG. 2 taken along line 2A—2A.

FIG. 3 is an overall system in which an embodiment of the invention can be incorporated. Such embodiment can be according to FIG. 1 or FIG. 2.

Referring now to the drawings, and more particularly to FIG. 1, 2 is a conduit through which varporous fuels such as a gasoline is being delivered to a fuel tank as on an automobile or on a truck. 3 is a Venturi. Fuel passing through the Venturi causes a pressure drop which in turn tends to cause spring biased ball check valve 4 in conduit 6 to open, thus providing open communication between the throat of the Venturi and reservoir 7 in which there is a float 8 so shaped and coacting with the bottom of the reservoir which is also so shaped that when there is little or no liquid in the reservoir the float 8 is pressed against the inlet end of conduit 6. The float is shown in the top of reservoir 7 at 8 prime to depict its position when the reservoir is liquid full. Liquid enters reservoir 7 by conduit 9 which is in open communication with conduit 10 into which vapor from the dispensing nozzle is forced by the rising liquid in the tank which is being filled and/or by pressure otherwise engendered in said tank. Vapors leave by conduit 11 for return at least to the vapor space above the liquid being stored prior to its being dispensed if indeed not into the body of the liquid being stored, as later described.

Referring now to FIG. 2, there is shown a reservoir 20 equipped with flexible bladders 21 and 22. The bladders are shown in contracted or unexpanded condition. They are also shown by use of broken lines in expanded condition. The fluid pressure as from the dispensing pump is connected into the bladders by conduit 23. Liquid and some vapor enter into reservoir 20 at 24 and liquid is expressed at 25 through check valve 26.

One skilled in the art understands that the drawings of the several figures are schematic only. Details of structure and construction can be supplied by one

skilled in the art in possession of this disclosure having studied the same.

Variation in the embodiments of FIGS. 1 and 2 is possible. In its broad concept the invention deals with a combination of structural elements operating as described. Thus, the precise shape or coaction of the float in FIG. 1 with the reservoir can be varied. Also, referring to FIG. 2, the bladders can be readily shaped and depending upon material of construction and shape can be combined into a single unit or bladder.

Referring again to FIG. 2, the essential action of the bladders is such that as they expand they will tend to come together thus preventing liquid from rising and upon coming together will press downwardly on the liquid to push it through the check valve 26. Although it is possible, given sufficient static head and an elongated design, which is required to do so, to simply cause liquid level within vessel 20 to rise sufficiently to create a static head such that check valve 26 will operate. Such operation though within the scope of the invention and the claims appended hereto is not now preferred.

Referring now to FIG. 3, an embodiment according to the invention, such as described in FIGS. 1 and 2, is disposed in a gasoline pump or other pump as shown at 30. A pump 31 pumps gasoline from storage tank 32 by 33 through a unit according to the invention 30, meter 35 and delivery hose 36 to dispenser nozzle 37. At the nozzle there is a vapor return inlet 38 which returns vapor by 39 and overhead vapor return 40 to storage tank 32. The vapor can be returned into the vapor space in storage tank 32 at 41 or depending upon the pressure into the liquid in storage tank 32 at 42. Condensate in overhead vapor return pipe 40 flows downwardly through pipe 43 into the reservoir of the unit according to the invention. This reservoir can be like that of FIG. 1, namely reservoir 7, or like that of FIG. 2, namely reservoir or vessel 20.

Reasonable variation and modifications are possible within the scope of the foregoing disclosure, the drawings and the appended claims to the invention, the essence of which is that there has been provided a fluid pressure actuated vapor condensate return system, as described, in one embodiment the condensed vapor or liquid being returned from a place of its accumulation with the aid of a suction sucking condensate, as allowed, into the very liquid from which the vapors have been generated and in another form of the invention using the pressure of liquid being delivered to express from its place of accumulation the condensed vapor or liquid and thus essentially back to the liquid from which it has come as a vapor.

I claim:

1. A means for removing a liquid from a reservoir in which it accumulates which comprises:
 - a. a reservoir for the accumulation of said liquid;
 - b. means for pumping a liquid to be dispensed from a place of storage to a place at which it is to be dispensed, said liquid yielding vapors during this dispensing and said vapors condensing, thus yielding said liquid which accumulates in said reservoir;
 - c. a conduit means for conveying said liquid to be dispensed to a place for its dispensing through which said means for pumping a liquid pumps said liquid, thus creating a fluid pressure; and
 - d. fluid pressure actuated means cooperatively functioning with said reservoir adapted to remove from

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said reservoir liquid accumulated therein and means operatively connected between said conduit means and said fluid pressure actuated means to transmit the pressure of said fluid in said conduit means to said fluid pressure actuated means.

2. A means according to claim 1 where there is provided:

1. a Venturi means with an open communication conduit between said reservoir and the throat of said Venturi,
 2. a flow control means in said communication conduit adapted to allow flow only from said reservoir into said conduit, and
 3. means within said reservoir to close said open communication conduit when there is no liquid in said reservoir at the level of said open communication conduit.
3. A means according to claim 1 wherein in said reservoir above the bottom thereof there is provided
1. a fluid pressure expandable means, said expandable means
 - a. in a partly expanded condition forming a complete cover above the liquid in said reservoir and
 - b. in completely expanded condition occupying a substantial portion of said reservoir which can be occupied by liquid when the expandable means is not expanded, in said expanded condition filling and occupying said portion of said reservoir and thereby pressing onto liquid therein, and

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2. one-way flow means for permitting the liquid thus placed under pressure in said reservoir to be expressed therefrom.

4. In a system for pumping a liquid through a conduit from a place of storage to a place of dispensing said liquid yielding vapors:

- a. a reservoir for the accumulation of said liquid;
- b. means for pumping a liquid to be dispensed from a place of storage to a place at which it is to be dispensed, said liquid yielding vapors during this dispensing and said vapors condensing, thus yielding said liquid which accumulates in said reservoir;
- c. a conduit means for conveying said liquid to be dispensed to a place for its dispensing through which said means for pumping a liquid pumps said liquid, thus creating a fluid pressure; and
- d. fluid pressure actuated means cooperatively functioning with said reservoir adapted to remove from said reservoir liquid accumulated therein and means operatively connected between said conduit means and said fluid pressure actuated means to transmit the pressure of said fluid in said conduit means to said fluid pressure actuated means.

5. A system according to claim 4 wherein there is means for mixing said condensed vapor removed from the reservoir with the liquid being pumped for dispensing.

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