Jan. 5, 1943. J. B. MOORE ET AL 2,307,060

LIQUID DISPENSING APPARATUS

Filed Dec. 30, 1938 2 Sheets-Sheet 1

FIG. 1.

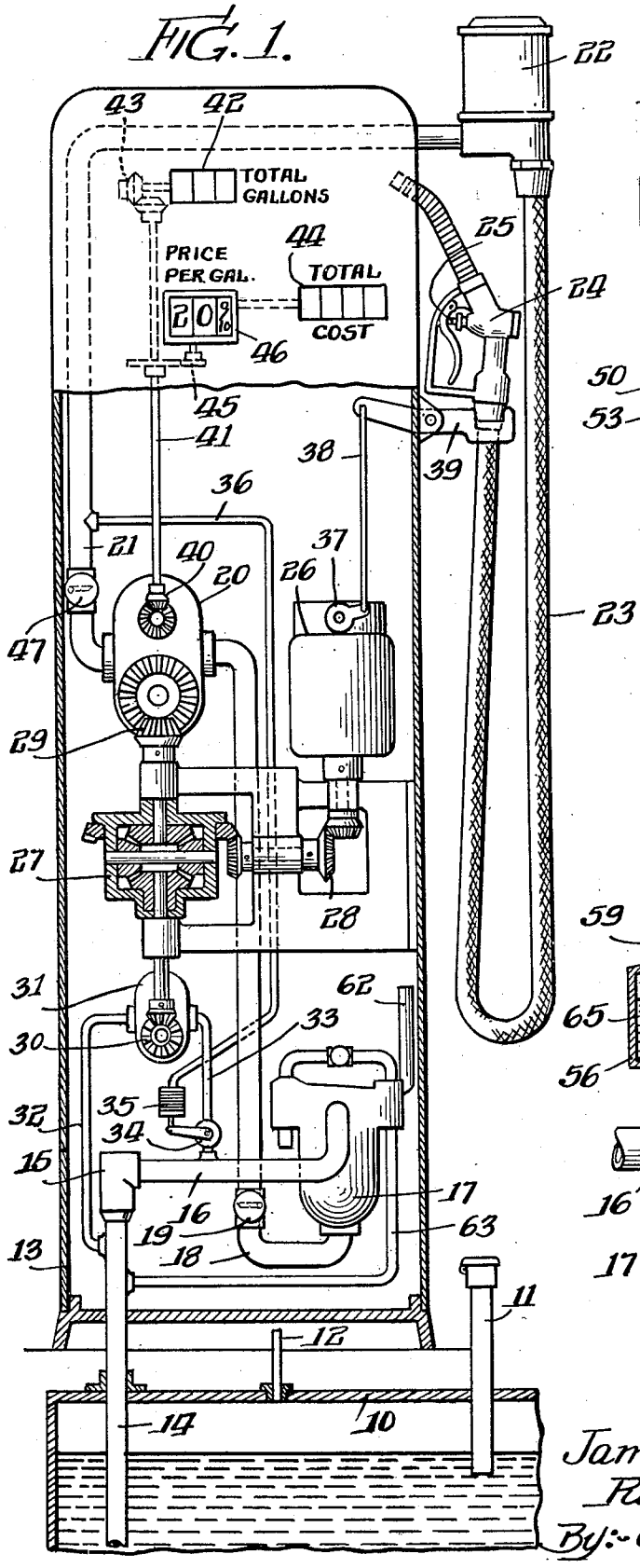


FIG. 2.

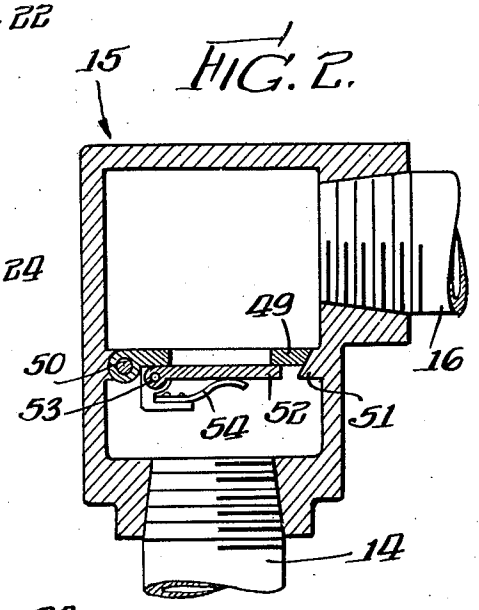
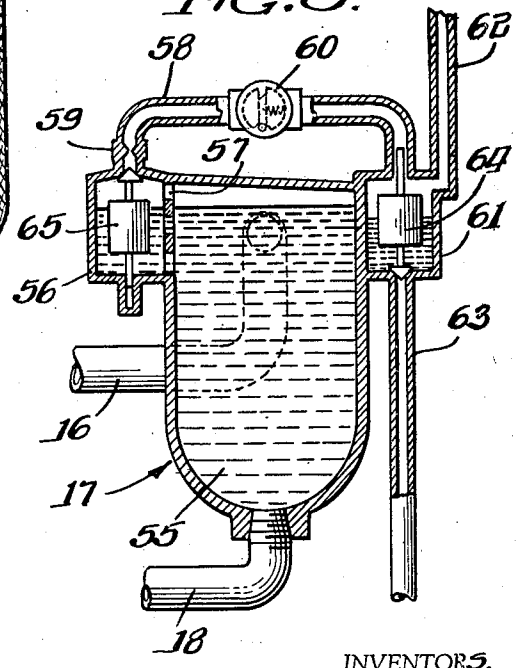


FIG. 3.



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Filed Dec. 30, 1938 2 Sheets-Sheet 2

FIG. 4.

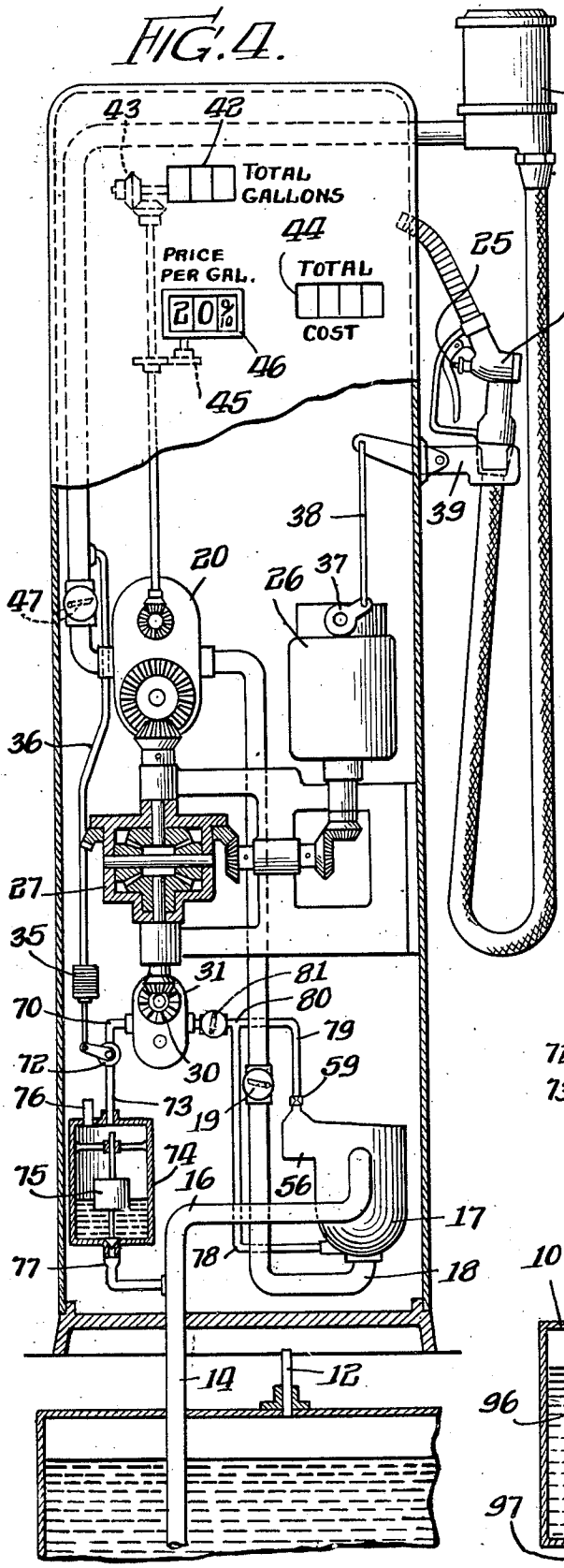


FIG. 5.

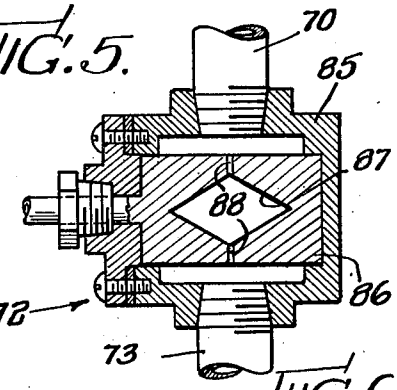


FIG. 6.

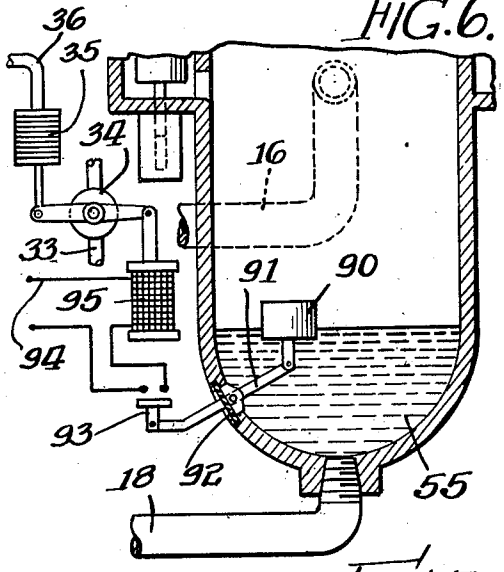
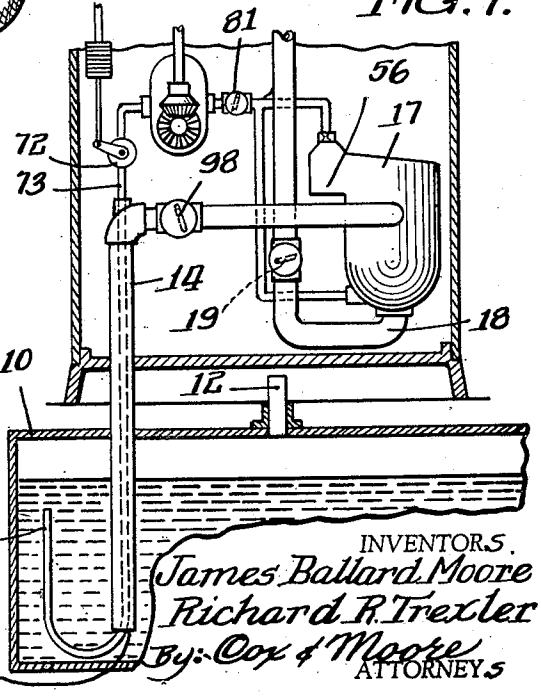


FIG. 7.



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LIQUID DISPENSING APPARATUS

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Application December 30, 1938, Serial No. 248,378

10 Claims. (Cl. 221—95)

This invention relates to liquid dispensing apparatus, and more particularly to air and vapor release mechanisms therefor.

It is an object of the invention to provide an air and vapor release mechanism particularly adapted for use with liquid dispensing apparatus wherein no metering mechanism is provided, the pumping means itself being used as a measuring unit.

More specifically it is an object of the invention to provide an air and vapor release mechanism which may be applied to the dispensing line of liquid dispensing apparatus on the inlet or suction side of the pumping means.

In accordance with one form of the invention means is provided for applying pressure to the inlet or suction side of the main dispensing pump at predetermined times during the dispensing cycle whereby to provide for the release of air and liquid vapor from the dispensing line.

In accordance with another form of the invention auxiliary pumping means, which may be intermittently or continuously operable, is provided for withdrawing the air and liquid vapor from the dispensing line on the suction side of the main dispensing pump.

Further and more specific objects of the invention are to provide safety control means for interrupting the dispensing operation in the event that the amount of air or vapor to be removed exceeds the capacity of the removal apparatus; and to provide means whereby the supply tank or reservoir for the apparatus may itself be used as an air, liquid, and liquid vapor separation unit.

Still other objects, advantages and features of the invention will be apparent from the following specification when taken in connection with the accompanying drawings wherein certain preferred embodiments are illustrated.

In the drawings, wherein like reference numerals refer to like parts throughout:

Fig. 1 is a general assembly view, partly in section, of a liquid dispensing apparatus embodying the features of the invention in accordance with one embodiment thereof.

Fig. 2 is a detail view of the pressure producing valve mechanism used as a part of the apparatus shown in Fig. 1.

Fig. 3 is a detail view of the air and vapor release mechanism of the apparatus shown in Fig. 1.

Fig. 4 illustrates a liquid dispensing apparatus embodying a modified arrangement for releasing air and liquid vapor.

Fig. 5 is a detail view of a control valve which may be used with the apparatus illustrated in Fig. 4.

Fig. 6 illustrates a safety control mechanism such as may be used to interrupt the dispensing operation when the capacity of the release mechanism is exceeded, and

Fig. 7 is a partial view illustrating an arrangement similar to that shown in Fig. 4, but wherein the supply reservoir of the apparatus is used as a part of the separation means.

This invention relates particularly to gasoline dispensing apparatus of the type embodied in the copending application of Richard R. Trexler, Serial No. 237,593, filed October 29, 1938, which has matured into Patent No. 2,239,207, and provides air and liquid vapor release mechanism particularly adapted for use therewith. It is to be understood, however, that various features of the invention are adapted for use in other connections, and that they may be used with various types of mechanisms, including liquid dispensing apparatus, in the removal of air and liquid vapor from the liquid to be dispensed.

Referring to the embodiment of the invention illustrated in Figs. 1, 2 and 3, and first particularly to Fig. 1, the gasoline dispensing apparatus shown comprises an underground tank or reservoir 10 adapted to form a source of gasoline or liquid supply for the apparatus. The tank is supplied with a filling pipe 11 by means of which the gasoline may be introduced to the tank, and with an air release pipe 12 exhausting to the atmosphere beneath the casing 13 of the dispensing apparatus. A pipe 14, which may be provided with the usual foot valve (not shown), leads from the underground tank 10 from a position adjacent the bottom thereof, to a valve mechanism 15 shown specifically in Fig. 2 and later to be described. A pipe 16 leads from the valve 15 to the air and vapor release chamber 17, shown in detail in Fig. 3. A pipe 18 leads from the bottom of chamber 17 through a foot valve 19 to the inlet side of the main dispensing pump 20. The outlet of the pump is connected to a pipe 21 leading to a sight glass 22, a flexible hose 23, and a dispensing nozzle 24 controlled by a valve 25.

The dispensing pump 20 is adapted to be driven by means of an electric motor 26 through a mechanism more particularly described in said aforementioned copending application of Richard R. Trexler. In brief this mechanism comprises a differential 27 adapted to be driven from the electric motor by means of gearing 28. One branch of the differential leads to gearing 29 which is adapted to drive the main dispensing

pump 20. The other branch of the differential leads to gearing 30 which is adapted to drive an auxiliary pump 31. This auxiliary pump is adapted to circulate the liquid or gasoline within a closed circuit consisting of a pipe 32 leading to the inlet side of the pump, an outlet pipe 33 controlled by a valve 34, and parts of the main dispensing pipes 14 and 16, these several pipes forming a closed circuit through which liquid is adapted to be circulated by the auxiliary pump. The control valve 34 is adapted to be operated by a pressure bellows 35 connected to a pressure line 36 leading to the outlet side of the main dispensing pump. The current to the electric motor is controlled by means of a switch 37 mechanically connected by means of linkage 38 to the pivoted hook 39 forming a support for the dispensing nozzle. The main dispensing pump is arranged to drive the registering mechanism of the apparatus by means of gearing 40 and shaft 41. The upper end of the shaft drives a volume register 42 by means of gearing 43. The shaft is also arranged to drive a total cost register 44 by means of gearing 45 which drives through a variator or change speed gearing 46, enabling the cost of the gasoline to be computed at different unit prices.

In the operation of the parts described, the dispensing cycle is initiated by removing the hose nozzle from its supporting hook 39 and raising or pivoting the hook upwardly after removal of the nozzle. This causes the actuation of the motor switch 37 causing the operation of the driving motor 26. At this time, and prior to the opening of the nozzle valve 25, there is pressure in the pipe 21, this pressure having been maintained in the pipe following the previous dispensing operation, by a foot valve 47. This pressure is transmitted through pipe 36 to the pressure bellows 35, and the arrangement is such that when the bellows is under pressure control valve 34 will be moved to open position. Accordingly gasoline may be circulated through the closed control circuit by the auxiliary pump 31. The auxiliary pump being free to operate, the electric motor merely drives the auxiliary pump through the differential 27, no substantial driving force being transmitted to the main dispensing pump 20.

As the operator opens nozzle valve 25, after arranging the nozzle in dispensing position, the pressure within pipe 21 and within the bellows 35 is released. This causes the closing of control valve 34 stopping the circulation of liquid within the control circuit for the auxiliary pump. Inasmuch as the auxiliary pump is now locked from operation, the driving force of the electric motor is transmitted through the differential 27 to the main dispensing pump and the dispensing of gasoline takes place.

If it is desired to dispense at partial rate of flow, the operator merely partially closes the nozzle valve 25. This causes a partial building up of pressure within dispensing pipe 21 causing a partial opening of control valve 34, and under such conditions both the auxiliary pump 31 and the main dispensing pump 20 will be operated by the differential mechanism, but at reduced speed in proportion to the rate of flow permitted by the nozzle opening. At the end of the dispensing operation the operator closes nozzle valve 25. This causes a building up of pressure within pipe 21 opening control valve 34 to permit the free operation of the auxiliary pump 31. The electric motor continues to operate the auxiliary pump, the dispensing pump 20 remaining stationary, until the hoze nozzle is restored to the support hook 39 and the current to the electric motor is cut off.

It will be seen that the movements of the dispensing pump 20 are proportional to the volume of liquid dispensed. Accordingly the dispensing pump may be used to drive the total gallon register 42 and the cost register 44 through the change speed gearing 46, in the manner previously indicated. It will also be seen that there are times during the dispensing cycle, both before and after the actual delivery of gasoline from the dispensing nozzle, when the auxiliary pump 31 is operating while the dispensing pump remains stationary. More particularly these periods occur at the beginning of the dispensing cycle from the time the operator removes the nozzle from the support hook 39 and starts the electric motor until the nozzle is arranged in dispensing position and the control valve 25 actually opened, and at the end of the dispensing cycle after nozzle valve 25 has been closed and until the nozzle is restored to its support hook 39. These periods are utilized to effect the removal of air and liquid vapor from the dispensing line, as will now be described.

As shown in Fig. 2, the valve device 15 which connects the pipes 14 and 16 contains a foot valve 49 pivoted as indicated at 50, and cooperating with the valve seat 51. The valve is freely movable upwardly at all times to allow the free flow of gasoline from the pipe 14 to the pipe 16. This is the direction of gasoline flow when the main dispensing pump 20 is operating and gasoline is being dispensed. The valve device is also provided with a second valve member 52 pivoted to the valve 49 as indicated at 53, and normally urged into closed position by a spring 54. When the auxiliary pump 31 is operating with the main dispensing pump 20 inoperative, or if the volume of liquid pumped by the auxiliary pump is greater than that which is being passed through the main dispensing pump, the flow of gasoline through the valve device 15 will be reversed so that flow occurs from the pipe 16 to the pipe 14. The valve 52 opens to permit such flow, but due to the spring 54 a slight pressure is maintained in the pipe 16, which pressure is utilized to effect the ejection of the air and gasoline vapor which may have accumulated in the release chamber 17.

As shown in Fig. 3, the air and vapor release device 17 comprises a main chamber 55 into which gasoline is introduced by the supply pipe 16 and removed by the outlet pipe 18. During the dispensing operation, as gasoline is passed through the chamber 55, any air and vapor contained therein will separate out and accumulate at the upper part of the chamber 55, and also in the auxiliary chamber 56 communicating with chamber 55 through a perforated baffle plate 57. The baffle plate reduces turbulence within the auxiliary chamber 56. A pipe 58 provided with a restricted orifice 59 leads through a check valve 60 to a separation or recovery chamber 61. This latter chamber is provided with a pipe 62 leading to atmosphere and a pipe 63 leading back to the main inlet pipe 14. Float valves 64 and 65 are provided in the chambers 61 and 56 as shown.

In operation, during the delivery of gasoline, entrained air and the gasoline vapor will be separated from the liquid as it passes through chamber 55, as previously stated, liquid free of air and vapor being drawn from the bottom of the

chamber through the pipe 18. The separated air and vapor accumulate at the upper end of the main chamber 55 and also within the auxiliary chamber 56. When sufficient air and vapor have accumulated, the float valve 65 will be lowered opening the passage to pipe 58. During dispensing, while the dispensing pump 20 is operating, no ejection of the air and vapor through the pipe 58 takes place, the air and vapor merely being accumulated within chambers 55 and 56. However, at the beginning and end of each dispensing cycle, when the auxiliary pump 31 is operating with the main dispensing pump inoperative, the pressure produced within chamber 55 forces the accumulated air and gasoline vapor through the restricted orifice 59, past the check valve 60 and into the recovery chamber 61. In the recovery chamber the air separates from the liquid vapor and passes out to atmosphere through the exhaust pipe 62. The recovered or condensed liquid accumulates within the recovery chamber until the float 64 is raised, whereupon the liquid returns to the suction pipe 14 by means of conduit 63. The check valve 60 prevents any reverse passage of material through pipe 58 due to suction within the chamber 55 during dispensing operations. The float valve 64 maintains a liquid seal within the recovery chamber between pipes 62 and 63, preventing the passage or suction of air into the pipe 63.

The float valve 65 may be eliminated, if desired. This valve merely insures that there will be no passage of material into the pipe 58 unless and until sufficient air and vapor have accumulated in the chambers 55 and 56 to lower the valve and open the passage 58. However, the restricted orifice 59 cuts down the permissible rate of flow through the passage to such an extent that even though liquid is forced through the passage, the capacity of pipe 63 will not be exceeded so that the liquid will merely continue on from pipe 58 through chamber 61 and pipe 63 back to the suction pipe 14.

In Fig. 4 an embodiment of the invention is illustrated in which the general dispensing mechanism is the same as that described, but the air and vapor is sucked from the separation devices rather than forced therefrom by pressure, and the arrangement is such that elimination may be effected continuously even while gasoline is being delivered from the dispensing nozzle. In this instance the control circuit for the auxiliary pump 31 consists of an outlet pipe 70 leading through a control valve 72 and then by means of a pipe 73 to a recovery chamber 74. The recovery chamber is provided with a float valve 75, an air exhaust 76 and a pipe 77 leading to the main suction pipe 14. The inlet to the auxiliary pump consists of a pipe 78 leading from the bottom of the separator 17 and a pipe 79 leading from the top of the auxiliary chamber 56 of the separator through the restricted orifice 59. The pipes 78 and 79 join as indicated at 80, and then connect with the inlet side of the pump through the check valve 81. The auxiliary pump operates in the reverse direction from that shown in Fig. 1, and for this purpose the gearing 30 by which the pump is operated is transposed as indicated. The auxiliary pump 31 and the main dispensing pump 20 may be rotary gear pumps of conventional design.

In operation, when the auxiliary pump 31 is operating, accumulated air and liquid vapor will be drawn from the upper portions of the separator device 17 through pipe 79 and restricted orifice 59. Liquid will also be simultaneously drawn through the pipe 78. The pipe 70 furnishes a constant source of liquid supply and prevents any unpriming of the auxiliary pump. Also, the restricted orifice 59 prevents an unduly rapid flow of air or vapor to the auxiliary pump which might tend to unprime it. A float valve (such as valve 65 as shown in Fig. 3) would be superfluous for if there is no accumulated air or liquid vapor in the upper end of chamber 56, liquid will merely be drawn through the pipe 79. The mixture of liquid, vapor, and air is exhausted from the auxiliary pump through control valve 72 to the recovery chamber 74 wherein the air separates out and passes to atmosphere through the pipe 76, and the liquid is returned through pipe 77 to the suction pipe 14, passing back to the separator device 17 through pipe 16 to complete the closed circuit. The check valve 81 prevents any reverse flow through the circuit due to suction within the device 17 when the main dispensing pump 20 is operating if the auxiliary pump should be stationary. The float valve 75 provides a liquid seal within the recovery chamber preventing the drawing of air from pipe 76 through the pipe 77 into the conduit 14.

The control valve 72 may be so constructed as to completely stop flow within the auxiliary pump control circuit when the main dispensing pump is operating at full capacity rate, as in the embodiment shown in Fig. 1, in which event there will be no air or vapor elimination during full dispensing flow, the air and vapor merely accumulating at the upper portion of chamber 17 as described. Alternatively the valve may be constructed so that there will be a slight flow through it even when it is turned to closed position causing the auxiliary pump 31 to be operated, at least slowly, during all the time that the electric motor 26 is operating. Such a valve is illustrated in Fig. 5. The valve comprises a casing 85 and a rotary barrel member 86 having a primary bore 87 which forms a communication between pipes 70 and 73 when the valve is turned to open position, and a small bore 88 arranged in quadrature with respect to the primary bore and adapted to form communication at a reduced rate between pipes 70 and 73 when the valve is turned to closed position. With such an arrangement the auxiliary pump will operate to withdraw air and vapor from the separator device at all times during the dispensing cycle. However, when the control valve 72 is turned to closed position, such resistance will be applied to the auxiliary pump 31 so that the main dispensing pump 20 will be driven by the electric motor through the differential at a dispensing rate.

In an arrangement such as just described, air and vapor will be withdrawn from the separator device 17 constantly during the dispensing cycle; and in an arrangement such as shown in Fig. 1 wherein there is no withdrawal during actual liquid dispensing, the capacity of the reservoir chamber 55 will be such as to handle the full accumulation of air and vapor during normal dispensing conditions. That is, the capacity of reservoir 55 will be such as to accommodate the normal entrained air and vapor in a quantity of gasoline, perhaps twenty gallons, which is the maximum that is ordinarily dispensed in one continuous operation.

However, if desired a safety device such as illustrated in Fig. 6 may be used with either form of the invention. As here shown the chamber 55 is provided with a float 90 which will be low-

ered when the accumulated gas and vapor reaches any predetermined amount and approaches the bottom of the chamber. The float is mounted on an arm 91 carried by a flexible diaphragm 92 arranged in the wall of the chamber 55. A switch 93 is carried by the other end of the arm. This switch controls an electric circuit 94 provided for a solenoid 95 adapted to control the valve 34 as applied to the embodiment illustrated in Fig. 1. In operation when the float is lowered by the lowering of the liquid level within chamber 55, switch 93 is closed energizing solenoid 95. The energization of the solenoid opens valve 34 causing the operation of the auxiliary pump 31 and the resultant stopping of the dispensing pump 20. This mechanism thus constitutes an over-control for the valve 34 causing the stopping of dispensing when the capacity of chamber 55 is exceeded. As soon as dispensing is stopped, the withdrawal of the accumulated gas and vapor will begin. As applied to the embodiment of Fig. 4, the solenoid 95 would control the valve 72 in a manner similar to that described in reference to valve 34.

In Fig. 7 an arrangement is illustrated substantially similar to that shown in Fig. 4 except that the pipe 73, instead of leading to a separate recovery chamber, such as shown at 74 in Fig. 4, leads through the main inlet pipe 14 into the underground tank 10. Pipe 73 is bent upwardly and terminates at a point 96 sufficiently removed from the inlet 97 to the pipe 14 that any air and vapor exhausted at 96 will not be drawn into the inlet. With such an arrangement the underground tank itself constitutes the recovery chamber, the air being exhausted through the pipe 12. The pipe 73 may be introduced into the underground tank by forcing it downwardly through pipe 14 until the end of the smaller pipe is bent upwardly and away from the inlet to the larger pipe, as shown. In such construction the foot valve normally provided at the bottom of the inlet pipe 14 may be arranged at an upward position such as indicated at 98.

It is obvious that changes may be made in the specific embodiments shown and described without departing from the spirit of the invention. Accordingly the invention is not to be limited to the specific embodiments illustrated and set forth, but only as indicated in the following claims.

The invention is hereby claimed as follows:

1. A liquid dispensing apparatus comprising, a dispensing line adapted to be connected to a source of liquid supply, dispensing pumping means arranged in said line for propelling liquid therethrough, air release means arranged in the dispensing line on the inlet side of said pumping means, said air release means comprising an air separator and means for withdrawing air therefrom and ejecting it to atmosphere, and means controlled by the pressure conditions within the dispensing line for controlling said last named means.

2. A liquid dispensing apparatus comprising, a dispensing line adapted to be connected to a source of liquid supply, dispensing pumping means arranged in said line for propelling liquid therethrough, air release means arranged in the dispensing line on the inlet side of said pumping means, said air release means comprising an air separator having outlets adjacent the top and bottom thereof, and auxiliary pumping means connected to both of said outlets for withdrawing air from the upper outlet and liquid from the lower outlet.

3. A liquid dispensing apparatus comprising a dispensing line adapted to be connected to a source of liquid supply, a dispensing pump for propelling liquid through the dispensing line, a prime mover, and air release means arranged in the dispensing line for separating air from the liquid to be dispensed, said air release means comprising a separator chamber within which air is separated from the liquid, a fluid forcing device for removing air from the separator chamber, transmission mechanism for connecting the prime mover in driving relation with both the dispensing pump and the fluid forcing device, and means controlled by the accumulation of air within said separator chamber beyond a predetermined amount for disabling the operative functioning of the dispensing pump while causing the prime mover to operatively drive the fluid forcing device.

4. A liquid dispensing apparatus comprising a dispensing line adapted to be connected to a source of liquid supply, a dispensing pump arranged in said line for propelling liquid therethrough, air release means comprising an air separator arranged in the dispensing line on the inlet side of the dispensing pump, an auxiliary pump for withdrawing separated air from the air separator, a prime mover, a differential gearing, the prime mover, dispensing pump and auxiliary pump being respectively connected to the three branches of the differential gearing whereby said prime mover serves to drive either the dispensing pump and the auxiliary pump or both, and means controlled by the pressure conditions within the dispensing line for varying the relative speeds of the dispensing pump and the auxiliary pump.

5. A liquid dispensing apparatus comprising a dispensing line adapted to be connected to a source of liquid supply, dispensing pumping means arranged in said line for propelling liquid therethrough, air release means arranged in the dispensing line on the inlet side of said pumping means, said air release means comprising an air separator and fluid forcing means for removing air from the separator, a common prime mover for driving said pumping means and said fluid forcing means at predetermined relative speeds, and control means for varying the predetermined relative speed relation of the pumping means and the fluid forcing means.

6. A liquid dispensing apparatus comprising a dispensing line adapted to be connected to a source of liquid supply, dispensing pumping means arranged in said line for propelling liquid therethrough, air release means arranged in the dispensing line on the inlet side of said pumping means, said air release means comprising an air separator and fluid forcing means for removing air from the separator, a common prime mover for driving said pumping means and said fluid forcing means at predetermined relative speeds, and means controlled by the pressure conditions within the dispensing line for varying the predetermined relative speed relation of the pumping means and the fluid forcing means.

7. A liquid dispensing apparatus comprising a dispensing line adapted to be connected to a source of liquid supply, dispensing pumping means arranged in said line for propelling liquid therethrough, a prime mover, air release means arranged in the dispensing line on the inlet side of said pumping means, said air release means

comprising an air separator, auxiliary pumping means for removing air from the air separator, a common transmission mechanism connecting the prime mover with both the dispensing pumping means and the auxiliary pumping means for driving them in complementary relation, whereby as the speed of one of the said pumping means is increased the speed of the other is correspondingly decreased, and means for controlling the transmission mechanism to vary the driving speeds of the dispensing pumping means and auxiliary pumping means.

8. A liquid dispensing apparatus comprising a dispensing line adapted to be connected to a source of liquid supply, dispensing pumping means arranged in said line for propelling liquid therethrough, a prime mover, air release means arranged in the dispensing line on the inlet side of said pumping means, said air release means comprising an air separator, auxiliary pumping means for removing air from the air separator, a common transmission mechanism connecting the prime mover with both the dispensing pumping means and the auxiliary pumping means for driving them in complementary relation, whereby as the speed of one of the said pumping means is increased the speed of the other is correspondingly decreased, and means controlled by the pressure conditions within the dispensing line for controlling the transmission mechanism to vary the driving speeds of the dispensing pumping means and auxiliary pumping means.

9. A liquid dispensing apparatus comprising a dispensing line adapted to be connected to a source of liquid supply, dispensing pumping means arranged in said line for propelling liquid therethrough, air release means arranged in the dispensing line on the inlet side of said pumping means, said air release means comprising an air separator and fluid forcing means for removing air from the separator, a common prime mover for driving said pumping means and said fluid forcing means in predetermined operating relationship, and means controlled by the accumulation of air within the air separator beyond a predetermined amount for varying the operating relationship between the dispensing pumping means and the fluid forcing means.

10. A liquid dispensing apparatus comprising a dispensing line adapted to be connected to a source of liquid supply, dispensing pumping means arranged in said line for propelling liquid therethrough, air release means arranged in the dispensing line on the inlet side of said pumping means, said air release means comprising an air separator and fluid forcing means for removing air from the separator, driving means for driving said pumping means and said fluid forcing means in predetermined operating relationship, and means controlled by the accumulation of air within the air separator beyond a predetermined amount for rendering the dispensing pumping means functionally inoperative to propel liquid through the dispensing line while the fluid forcing means remains operative to remove air from the separator.

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