

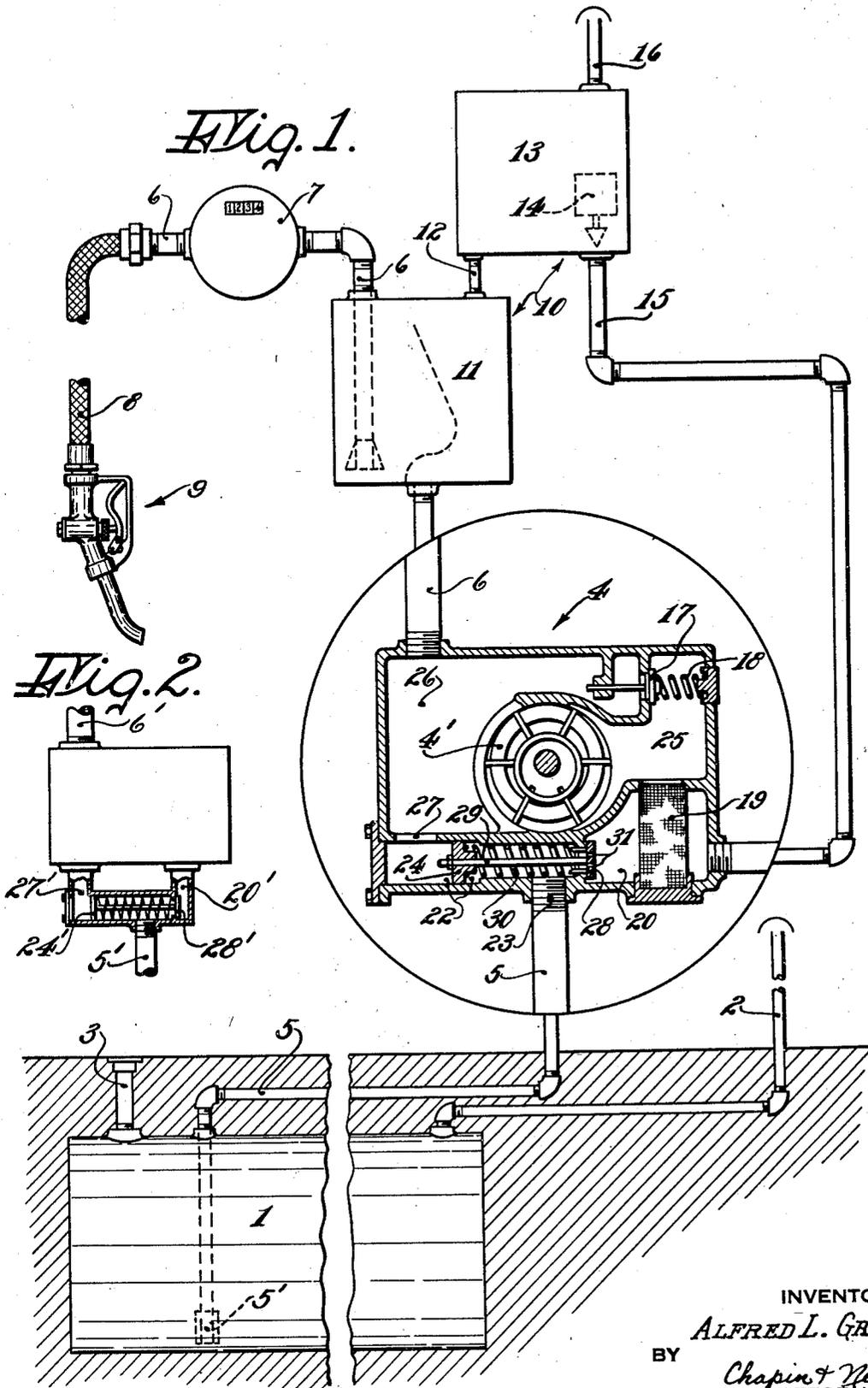
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AIR SEPARATOR CONTROL FOR LIQUID DISPENSING APPARATUS

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AIR SEPARATOR CONTROL FOR LIQUID DISPENSING APPARATUS

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This invention relates to liquid dispensing apparatus of the kind used and known as gasoline "pumps." The same kind of apparatus is generally used also for dispensing fuel oil for Diesel engines, furnace oil, and other similar liquids.

Specifically, this invention is designed to accomplish the same broad result as two previous devices which are disclosed in my copending applications Serial No. 346,338, filed July 19, 1940, and Serial No. 356,281, filed September 11, 1940. In said applications means were disclosed to control the delivery of liquid to the meter upon an overloading of the air separator by restricting the flow in the pressure side of the apparatus. According to the present invention I propose to restrict liquid delivery whenever the air separator is overloaded, but to do this in the suction line leading to the pump. There are various advantages in placing the restriction at this point in the apparatus. These will be pointed out in the description of the device.

The improved mechanism disclosed in this application also differs from my prior devices in the means by which the reaction to an overloading of the air separator is attained and used. Specifically, the present mechanism reacts to changes in the liquid pressure of the system in contradistinction to a reaction to changes in the pressure of a body of air collected and used by the mechanism of my prior disclosures.

These and other differences will be apparent from a description of my present conception and the advantages gained thereby will be discussed while explaining the operation of the apparatus in connection with the appended drawing, in which—

Fig. 1 is a diagrammatic view of the apparatus with the unit embodying my invention shown in enlarged section; and

Fig. 2 is a diagrammatic view of a modification of my new device.

The prior art functions of the apparatus are the same as outlined in my previous applications. These are all well known to those skilled in this art, and I shall briefly point them out without extended discussion except where it is necessary to do so for a complete understanding of my invention.

Liquid is stored in underground tank 1 which is vented through pipe 2 and filled through pipe 3. A pump 4' contained in unit 4 (in which the mechanism of my invention is contained and which will be later described in detail) is driven by a suitable motor (not shown). Pump 4' draws liquid from tank 1 through suction pipe 5. A

screen 19 in chamber 20 on the suction side of the pump eliminates foreign matter which might be drawn up with the liquid from tank 1. A check valve 5' in the inlet to pipe 5 prevents a drainage of liquid back into the tank and thus keeps a column of liquid in the system when pump 4' is idle between dispensing operations.

Liquid is discharged by the pump into pipe line 6 and into air separator 10. The air separator is one of many well known types of devices in which air will go out from the top of a primary chamber 11 and pass with some liquid through a restricted opening 12 into a recovery chamber 13. In chamber 13 a float valve 14 controls a passage 15 leading back to the suction side of the pump into chamber 20. Liquid accumulating in chamber 13 lifts valve 14 and returns down passage 15. Air cannot return as the valve closes with liquid above it and the air goes to the top. It is vented freely to the atmosphere through vent 16.

From the primary chamber 11 of separator 10 "solid," air-freed liquid is discharged to the meter 7, to flexible hose 8 and hand-operated nozzle valve 9.

When the motor for pump 4' is started for dispensing it will immediately operate the pump and create a discharge pressure in pipe line 6. Until nozzle valve 9 is opened manually for delivery, this pressure upon reaching a predetermined value operates to open a valve 17 and by-pass the liquid around the pump. The result is that the pressure on the high side of the pump tends to be maintained at a predetermined value. Valve 17 is spring loaded and when valve 9 is opened enough, spring 18 will force valve 17 back on its seat as the pressure on the high side of the pump will be lowered enough when the dispensing line is opened.

The apparatus thus far described is of the prior art. In my improved mechanism I provide a piston chamber 22 at the inlet port 23 of the unit 4. A piston 24 divides the chamber 22 into two compartments, one of which leads to chamber 20 and the suction side 25 of pump 4', the other of which is in communication with the pressure side 26 of pump 4' through opening 27. The entrance to chamber 20 is provided with a valve 28 which is connected to piston 24 by a rod 29. A spring 30 seated around the outlet to chamber 20 normally urges piston 24 to the left as shown in the drawing, thus tending to keep valve 28 closed against the passage of liquid into chamber 20. In the face of valve 28, however, there are two small bore holes 31 by which

pump 4' will always be in communication with the source of supply in tank 1.

The mechanism operates as follows: The motor is turned on and the pump begins to operate. Should the pump need priming the liquid will be drawn up at a slow rate through the small bore holes 31 until a sufficient amount of liquid is delivered to the discharge side of the pump to create a pressure in chamber 26. Any air ahead of this liquid will be vented without substantial pressure because the air will travel fast enough along the air separator vent line to the atmosphere. When a sufficient liquid delivery pressure is built up it is exerted in the pressure side of piston chamber 22 to force piston 24 against spring 30 and cause valve 28 to open. Under ordinary operating conditions valve 28 will remain open to allow the passage of liquid, unrestricted by valve 28, from suction pipe 5 until the pump has ceased operating. Since check valve 5' and nozzle valve 9 are closed between dispensing operations, a column of liquid will generally be present in the system at all times. Therefore, valve 28 will open practically the same instant the motor is started and no priming operation will be necessary before the valve 28 is moved from its seat. The desired rate of liquid delivery at the nozzle outlet commences immediately when valve 9 is opened.

In the event that serious air leaks develop in the suction line to pump 4' the piston mechanism will operate to cut down the rate of liquid delivery. Comparatively minor leaks, or what might be termed a "normal" amount of air entrained in the liquid, will be eliminated by the air separating chambers in the well known manner before described, and the rate of flow will not be affected. However, when an extraordinary amount of air has entered the system, the separating chamber 11 which I wish to use and which is made possible by my invention as herein described is not large enough if the full rate of flow is maintained, to prevent some air passing on to the meter. That is to say, the air separator would be overloaded at the full rate of flow. Under such circumstances of an excessive leak, the piston valve mechanism in the combination will function to relieve the burden on chamber 11 and allow it to pass only "solid" liquid through the meter. The restriction imposed by valve 28 will allow only a restricted amount of liquid to flow to the pump. Thus, the discharge from the pump is less in volume and less turbulent. Chamber 11 has an opportunity to clear itself of the excessive air.

The large accumulation of air in chamber 11, happening upon excessive air leaks, causes a drop in the liquid pressure deliverable by the pump. Spring 30 is gauged so that it will overcome the lowered pressure and cause piston 24 to seat valve 28. When the suction inlet is thus restricted, liquid delivery is cut down to the amount passable through holes 31. Only so long as the pressure remains decreased will the restriction be maintained. Spring 30 will again be compressed by liquid pressure as chamber 11 becomes cleared of air. This will take but a short space of time and delivery at the prior and full rate may continue.

The chief factor causing a drop in pressure affecting the piston 24 is the action of the restricted passage 12 in chamber 11. It is well known that if the suction lines are substantially air-tight, liquid being pumped into the chamber will be in the main pushed through to the

meter and out the delivery nozzle. Passage 12, however, forms a bleed hole for a minute quantity of liquid to pass into chamber 13 where it is returned as described to the suction side of the pump. As air enters the system it passes out passage 12 also, but at a faster rate than the liquid is able to escape. When an excessive amount of air collects in the separator it results in a greater dissipation of pump energy out this passage 12 and a consequent drop in the pressure exerted in the pump discharge lines. Spring 30 is adjusted to overcome the reduced pressure on the piston before the air is accumulated in amounts substantial enough to pass any part of it on to the meter. The restricted flow through valve 28 immediately cuts down the capacity of pump delivery and forestalls that possibility as the air in the liquid then has sufficient time to rise very rapidly to the top of chamber 11 and out passage 12. Since the pump is still operating through the holes 31 to draw liquid into the system, it will quickly displace the excess air being vented to the atmosphere. A delivery pressure will build up anew and valve 28 will open.

The effect of the mechanism at the delivery end of the dispensing system will be reflected by a correctly metered discharge at the highest rate of delivery for which the system is designed, then a short period of correctly metered discharge at an appreciably slower rate when and if excessive air leaks occur. When the overload on the air separator is vented off, the high rate of delivery will be resumed. The station attendant will notice the intermittently reduced delivery and can make the necessary repairs at an opportune time and at his convenience. Dispensing service need not be suspended immediately because of the extraordinary leakage indicated by the action of the "pump." A correctly metered amount of liquid may be dispensed at all times under conditions of excessive air leakage unless the leakage is so aggravated that the pump can no longer draw liquid enough to force the meter to register.

It is to be noted that the mechanism of this disclosure shows the control valve in advance or on the low pressure side of the pump. An advantage in efficiency is thus gained over my prior devices. Air in any amount causes in a gasoline "pump" a certain turbulence. Any means for maintaining a minimum amount of turbulence provides conditions for better air elimination. By placing the restriction in the suction line in this device I give the pump no chance to work up a highly objectionable emulsion in the pump chambers during the reduced delivery. In my prior devices the separating chamber was allowed to clear itself while the pump was straining to push fluid through the restriction in the pressure side. This meant that the pump was more or less churning air and liquid in the chambers and through the by-pass line until the valve again opened. Thus, the initial fluid pushed to the separator after the valve opened was apt to be agitated to a large extent. The separator had a greater burden to clear this liquid of air and consequently was likely to operate the control valve more frequently. The present device, by controlling flow to the pump, insures a more quiescent delivery to the separator on removal of the restriction, and the periods of reduced flow will come at greater intervals.

Still another advantage in the position of the restriction may be noted during the reduced de-

livery. The previous device in churning the fluid through the pump passages was sending an emulsion through the restriction. In this device the pump takes in less air during reduced delivery and in sending a quieter flow to the separator it can send a greater volume of liquid. Consequently, for a small separator of a given size the flow in my present device need not be reduced to the same extent as in my prior structure. The rate of pump delivery which a separator of the same size can handle is higher than when the valve was between the pump and air separator.

If desired, the advantage of a quieter flow can be used in another way. A smaller separator may be built and the mechanism will perform equally as well as my prior apparatus did. Since the present chamber 11 during the reduced delivery has less work to do because a quieter flow is maintained, a smaller separator will clear itself in the same time it took for the larger separator to do the same work.

As in my previous inventions, I may use a smaller size air separator in the gasoline "pump" and yet meet conditions imposed by the officials of weights and measures. The high standards set by these officials are met by this apparatus which will compensate for excessive air leaks and will under no conditions allow a false measurement of liquid dispensed. Also, the smaller size separator may in apparatus not designed for an especially high rate of delivery be made from simple piping instead of special castings.

The apparatus as shown in the drawing of Fig. 1 gives my preferred form of the invention. To those skilled in the art various modifications can be made without departing from the structure and its mode of operation considered from their broadest aspect. For example, it may not be desirable in every case to build the new automatic valve in the same casing with the pump. It can, of course, be built as a separate unit and appropriately connected by pipes to the high and low pressure sides of the pump casing and to the suction pipe. Built as a separate unit and thus piped into the system, one can see how easily a dispensing system of the older type can be converted to get the advantage of this invention. In the diagram of Fig. 2, I have shown how in an ordinary dispensing system the piston unit may be piped in. Its advantage will be obvious.

There are two especially important aspects of my invention from the "pump" manufacturer's point of view as distinguished from the user's. If the manufacturer wants to make an apparatus for a high delivery rate, he can use most all of the same size parts and same size pump casing as he customarily uses for a lower rate of delivery. The rate for example might differ as between 12 and 24 gallons per minute. To get the higher delivery rate he needs only to put in a larger capacity pump—an easy change to make. He can keep his old size air separator for the higher rate of delivery, without the chance of overloading it, provided he uses my automatic control valve in the combination. The other aspect is that he can by the use of my invention substantially cut down the size and manufacturing cost of his air separators for the lower rate of delivery and use the old sizes for the higher rate delivery.

In this connection it should be noted that the operation of the air separators must meet the official tests. They are ordinarily met by a large enough separator to take care of the emergency

of the largest "officially expected" leak of dispensing operations. The official test is with such excessively large air leak condition. By my invention I meet the test of correct measurement by automatically cutting down the rate of flow. This leaves me free to size the working capacity of the air separator so as to take care of air leaks considered inconsequential and give adequate warning of excessive highly objectionable leaks. They are not frequent in practice. All the official inspector wants is automatic insurance against measuring air as if it were liquid. My apparatus gives this insurance under a different mode of operation.

Having disclosed my invention, I claim:

1. A pumping unit for liquid dispensing apparatus having in combination a pump with a suction chamber and a pressure chamber, a by-pass valve between the chambers to relieve the pump of excess liquid pressures, and a piston operated means responsive to a decrease in the normal delivery pressure of the pump to restrict thereby liquid flow through the unit, said means comprising a piston chamber having one end thereof in communication with the pressure chamber, a piston located in the piston chamber and dividing it into a pressure and a suction side, a spring tending to resist the pressure of liquid against said piston, the other end of said piston chamber having an inlet supply port for the unit and an outlet in communication with said suction chamber, and a valve in said outlet connected to the piston and movable by it, said valve being provided with holes in the disk thereof to permit a restricted communication between the pump and said inlet port whenever the valve is seated on said piston chamber outlet.

2. The combination in a metering and dispensing apparatus of means to automatically cut down the normal rate of dispensing when an abnormal amount of air leaks into the apparatus and to automatically restore the normal rate when such air is vented from the apparatus, said metering and dispensing apparatus including an air separator with a vent, a pump for delivering liquid under pressure through the air separator for the air to be vented, the air separator, by means of its vent, being arranged to automatically lower its normal pressure and consequently its normal back pressure to the delivery side of the pump whenever the pump starts to deliver an abnormal mixture of air and liquid, said means to automatically cut down and restore the normal delivery rate comprising pressure-operated mechanism arranged to be responsive to the presence or absence of said normal back pressure from the air separator and a choke valve device actuated by said mechanism, said device being located in the intake passage of said pump, all constructed and arranged so that said device cuts down but does not stop the dispensing rate when an abnormal amount of air gets in the air separator and restores said rate after time enough elapses for the air separator to vent its excess air.

3. In a liquid measuring and dispensing apparatus the combination of a power-operated pump with suction and discharge conduits, a choke valve in the suction conduit of a kind adapted to avoid stopping but to cut down the flow rate in the suction conduit, yielding means tending to hold said valve in choke position, pressure actuated means operable upon a predetermined pressure in the discharge conduit to move and hold said choke valve out of choking operation, a constantly vented air separator of the pressure type

in the discharge conduit, said pressure actuated means being connected at all times to substantially the same pressure from the pump discharge as is in said air separator, all constructed and arranged for the purpose described.

4. In a liquid measuring and dispensing apparatus the combination of a power-operated pump with suction and discharge conduits, a cylinder and piston valve actuating mechanism adjacent the pump, said cylinder on one side of its piston being connected to the discharge conduit to receive its pressure and the other side of its piston being arranged as a section of said suction conduit, a valve disk adapted to seat on the end of said section to control the suction flow through the cylinder, said valve having a stem connected to said piston, yielding means positioned to hold said valve disk seated, an air separator of the pressure type in the pump discharge conduit, and the said discharge conduit including a constantly open pressure communicating passage between said air separator and the high pressure side of said piston, said valve disk having a constantly open passage of restricted character to permit restricted flow therethrough when on its seat, said piston being movable to take the valve off its seat when the pressure in the air separator is above

a predetermined amount, said yielding means being operable to otherwise return or hold the valve on its seat, all for the purpose described.

5. In combination a power-operated pump having on its discharge side a dispensing pipe line with an air separator of the pressure type and a liquid meter with accuracy assured by the separator for the dispensing line, said separator having a predetermined separating capacity and adapted to start rapidly losing pressure whenever an excess amount of air enters with liquid during constant operation of the pump, a valve arranged in the inlet passage of the pump for two operable positions, one permitting a full flow and the other permitting a substantially restricted but constant flow in such passage during constant operation of the pump, opposed pressure operating means, one tending to put said valve means in position for full flow and the other to put said valve means in position for restricted flow, the former means being operated by the pressure in the air separator and arranged to dominate when the air separator is not overloaded with air and the latter operating means arranged to dominate so long as the air separator is so overloaded, all for the purpose described.

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