

Nov. 26, 1940.

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2,223,112

APPARATUS FOR PUMPING AND SEPARATING GAS AND LIQUID BODIES

Filed Oct. 26, 1938

2 Sheets-Sheet 1

FIG. 1

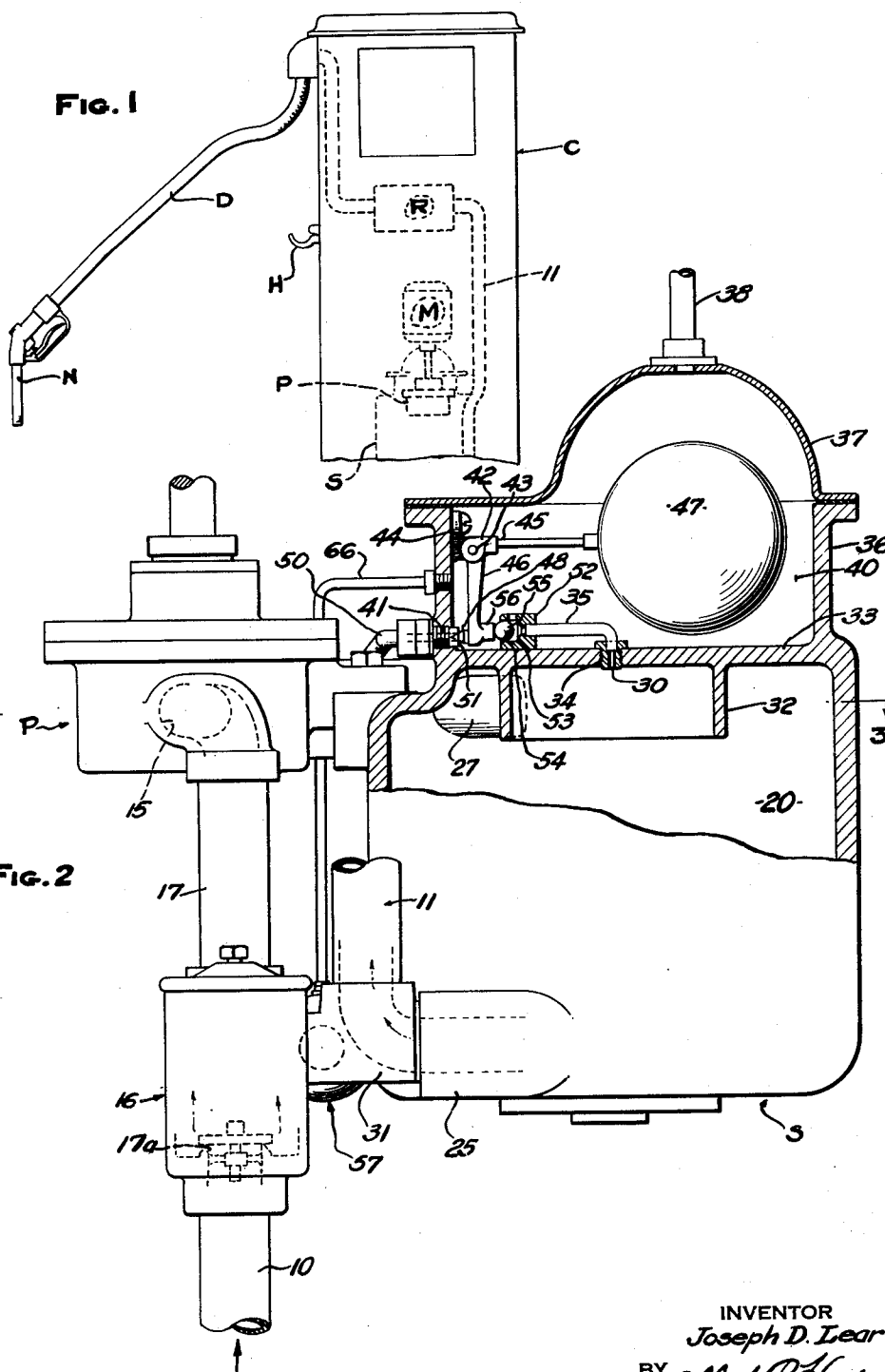


FIG. 2

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2 Sheets-Sheet 2

FIG. 3

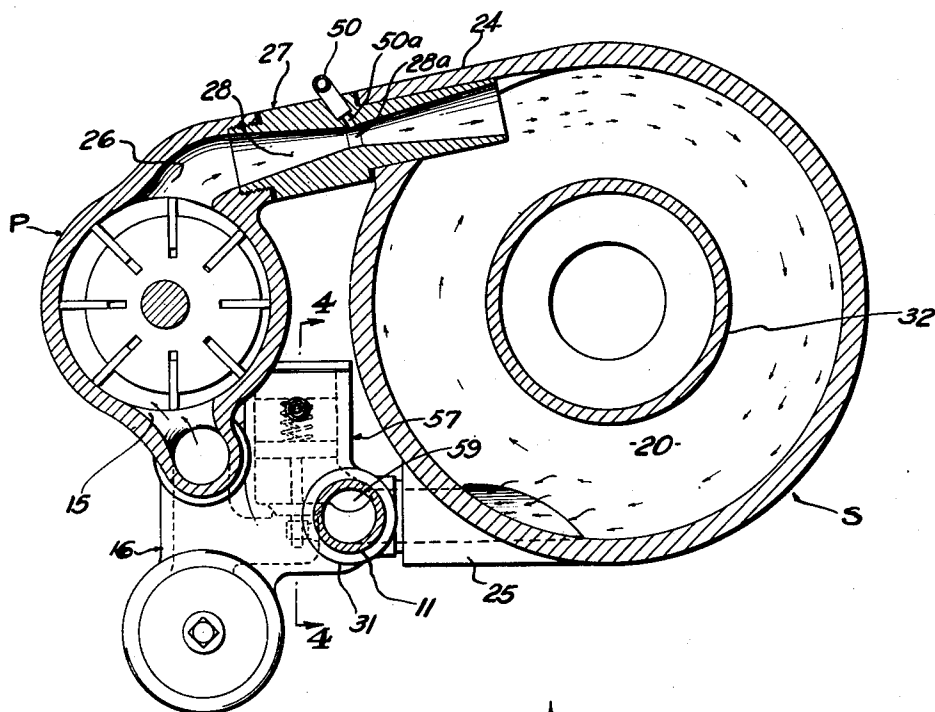
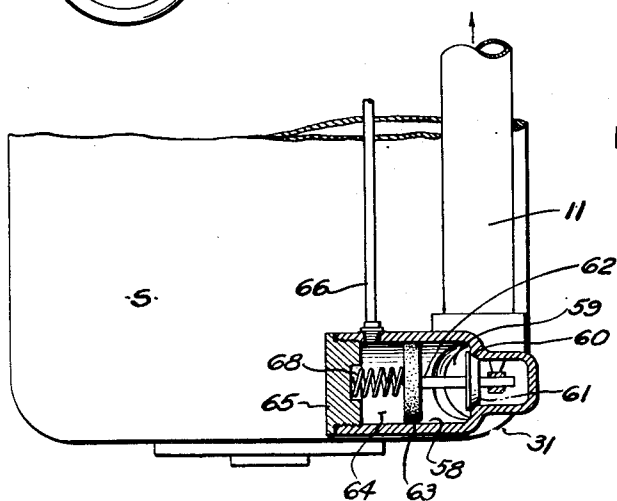


FIG. 4



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APPARATUS FOR PUMPING AND SEPARATING GAS AND LIQUID BODIES

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Application October 26, 1938, Serial No. 237,003

2 Claims. (Cl. 103—203)

This invention relates to the pumping of mixed gas and liquid bodies with the concurrent separation of the gas from the liquid, and it has particular reference to a novel combination of pumping and separating instrumentalities, whereby separation may be effected under all normal running conditions of the pump.

In the retail dispensing of gasoline, it has heretofore been proposed to draw the gasoline, with air entrained therein, from a low level reservoir by means of a displacement pump, whose effluent was delivered to a separating chamber to remove the air, prior to the passage of the liquid to a meter and dispensing hose and nozzle. It has also been proposed, in such apparatus, to drain recovered liquid, separated from the air in a second stage, to the reservoir or directly to the pump inlet.

This proposal, while extensively used for a number of years, has certain serious disadvantages, which are corrected by the present invention. For example, in the prior system just referred to, and because of the difficulties in tightly closing the return line with a valve, there is frequently a direct passage from the atmosphere to the pump inlet, thereby causing a flow of air to the pump, instead of a flow of liquid, which results in decreased pump capacity. Another disadvantage arises in such system during periods of by-passing, which are encountered when the pump is running, but the dispensing nozzle is closed. During such periods, the pump not only may draw in air at the suction side, but it also recirculates whatever amounts of mixed air and liquid may be passing through it. Accordingly, when the suction line is air-bound, as may occur with a faulty foot valve in the suction line, an appreciable time interval may elapse, after the pump is started and the dispensing nozzle is opened, before the pump will deliver its full liquid capacity. While this time interval may be measured in seconds, it is nevertheless significant, because the average motorist becomes very impatient at the least delay at the service station.

According to the present invention, there is effected a complete reorganization of the elements heretofore employed, so that, irrespective of whether the dispensing nozzle is open or closed, the pump, so long as it is driven by its motor, nevertheless is pumping liquid, with only such air as may be entrapped in the suction line, and is not drawing in any atmospheric air through the separator drain line. That is to say, according to the present invention, means are provided

whereby the suction side of the pump is constantly protected from atmospheric air, and also the necessity of recirculating liquid recovered in the second stage of the separator, thereby increasing the liquid capacity of the pump, and permitting it to prime itself in a shorter interval of time.

Such reorganization, as hereinafter more fully explained, is accomplished by causing the effluent of the pump to become, in effect, a secondary pump for returning recovered liquid to the main body of liquid which has already passed the pump, and for diverting any air which may be entrapped in such recovered liquid, or which may flow through the drain lines therefor, from the suction side of the main pump and back into the separator. More specifically, the present invention provides for the discharge of the pump effluent through a Venturi passage, whose throat is connected to the recovery line, and whose discharge orifice is connected to the separator.

My invention further provides, in order to make this principle practically effective, that the main pump shall be provided with a by-pass, so that it may continue to run even though the dispensing nozzle be wholly or partially closed, and in order to make such provision practical, the by-pass must be located at a point in the system beyond the discharge orifice of the venturi. That is to say, the components of my improved system must be so arranged that the secondary pump, or venturi, is constantly functioning so long as the main pump is running, and such constancy must be maintained whether the dispensing nozzle is open or closed. Otherwise, the principle of the invention cannot be satisfactorily applied, as conditions of impossible or impractical operation would be encountered.

The invention therefore prevents the return of air or liquid to the inlet of the main pump, and also provides for the tertiary separation of any small amounts of air re-entering the primary separator, by permitting it to flow directly to the second separating stage. The overall capacity of the pump is therefore increased, and the entire system may be built without expensive parts or fittings, and in a size satisfactory for inclusion in a dispensing unit.

A typical embodiment of the invention, as just described, is illustrated in the accompanying drawings, wherein:

Fig. 1 is a schematic view of a gasoline dispenser including the features of the present invention;

Fig. 2 is a view, partly in elevation and partly in section, showing the pump and separating units;

Fig. 3 is a section on the line 3—3 of Fig. 2, showing particularly the secondary pump or venturi; and

Fig. 4 is a fragmentary view, partly in section, on the line 4—4 of Fig. 3, showing the by-pass arrangement.

Fig. 1 shows schematically a gasoline dispensing unit, to which the present invention may be applied. Such units, as installed at service stations, comprise a casing C, in which is disposed an electric motor M, connected to a liquid pump P. The suction side of the pump is connected, by means of a pipe 10, to a reservoir (not shown) containing the gasoline to be dispensed, and wherein the gasoline becomes admixed with appreciable amounts of air. The discharge side of the pump is connected to a separator S, to effect the removal of the air, and the clarified liquid then flows through a pipe 11 to a flow meter R, and thence to a dispensing hose D terminating in a valved nozzle N. The electric circuit for the motor M is taken through a switch operable by a hook H, on which the nozzle is hung when not in use. When the attendant dispenses gasoline, he removes the nozzle from the hook H, moves the hook to start the motor M and pump P, but of course refrains from opening the nozzle until it is placed in the automobile tank. With this general understanding of a setting for the invention, consideration will now be given to the novel pump and separator adapted to be employed therein, and illustrated in the remaining figures of the drawings.

The pump P is preferably mounted on a vertical axis, and its inlet port 15 communicates with a supply source through the pipe 10, fitting 16, and pipe 17. The fitting 16, which will be more particularly described later, contains a valved inlet 17a which acts to prevent gravity return of the gasoline in the system to its source during idle periods of the dispenser.

The housing of the separator S is formed with a cylindrical separating chamber 20, having tangential inlet and outlet bosses 24, 25 formed in its upper and lower portions respectively. The outlet port 26 of the pump P is connected to the boss 24 by a coupling fitting 27, which, as will be observed in Fig. 3, is internally machined to provide a venturi passage 28. The entire discharge of the pump is thus directed through the Venturi passage 28, whence it enters the cylindrical chamber 20 tangentially, and then swirls vortically downward to the outlet boss 25.

The fitting 16 is formed with a lateral extension 31 in the shape of an angle fitting for connecting the boss 25 to the discharge conduit 11.

A cylindrical baffle 32 is formed in the upper wall 33 of the separator chamber 20, and it serves to shield an air escape fitting 34, located in the center of the wall 33, from the entrant liquid. The fitting 34 contains an orifice 30 through which air separated through centrifugal and gravitational effects in the chamber 20 escapes via an attached pipe 35 to an overlying cylindrical float chamber 40.

The side wall 36 of the chamber 40 is formed integrally with the separator housing, and its open top is closed by a secured cap member 37. A vent pipe 38, secured to the cap member 37, establishes communication between the chamber 40 and the outside atmosphere for the escape of air

and non-condensable gases discharged from the chamber 20 into the chamber 40.

A liquid return vent in the form of an externally connected fitting 41 is located in the lower portion of the chamber 40. A bell crank 42 is mounted for pivotal movement on a stud 43 carried by a fixture 44 secured within the chamber 40, and the arms 45, 46 of the bell crank carry respectively a float 47 and a valve 48. The fitting 41 is formed with a seat portion 51 for the valve 48, and its external portion is connected to a tube 50 which communicates with an orifice 50a in the throat 28a of the venturi passage 28.

The pipe 35 of the previously mentioned air escape fitting 34 is secured in a block 52 which contains a seat 53 and a cage portion 54 for a ball valve 55. The block is secured to the bottom of the chamber 40 in a position adjacent the right side of the bell crank arm 46. The arm 46 is formed with a projection 56 which is engageable with the ball valve 55.

In the operation of the separator unit, the separated gas volumes escape from the chamber 20 through the orifice 30, pipe 35, and seat 53, into the float chamber 40, where, in the absence of liquid, the float 47 is in its lowest position and the valve 48 is accordingly seated on the liquid escape fitting 41. When the gas volumes near depletion in the chamber 20, liquid finally escapes through the orifice 30, and gradually fills the chamber 40, finally raising the float 47 to unseat the valve 48. The liquid in the chamber 40 is immediately withdrawn to the outlet side of the pump by the suction action of the venturi, and the float once more drops to seat the valve 48.

Simultaneously with the opening of the valve 48, the opposed ball valve 55 is moved toward its seat 53 in a progressive throttling action, which automatically decreases the rate of fluid influx during the slow opening movement of the valve 48.

The operation of the apparatus as thus far described is directed to an operative condition of the dispenser where the valve of the nozzle N is wide open, and consequently the full discharge of the deaerated liquid is directed through the meter. As often occurs in gasoline pumping equipment, the nozzle valve is permitted to remain closed for considerable periods while the pump is in operation, thus bringing into action a by-pass device for the pump. In the present instance, a pressure-responsive by-pass valve unit 57 bridges the suction line of the pump and the chamber of the separator.

As shown in Figs. 3 and 4, the unit 57 is conveniently organized with the inlet fitting 16, and it includes a cylindrical piston chamber 58 formed integrally with the fitting and having a port 59 communicating with the extension 31, and thus the discharge side of the separator chamber. A second opening in the chamber 58 in the form of a valve seat 60 communicates with the suction side of the pump, and it is normally closed by a valve 61.

The valve carries a stem 62 to which is attached a large piston 63. The piston 63 is slidably carried within the chamber 58, and it isolates the end portion 64 of such chamber from the liquid stream. The portion or sub-chamber 64 is closed by a head 65, and it is retained under atmospheric pressure by a pipe connection 66 with the float chamber 40. A compression spring 68 in the sub-chamber 64 thrusts the piston 63

inward and constantly urges the valve 61 toward its seat 60.

The piston 63 and valve 61 are so proportioned that pressures above a predetermined normal in the separator chamber exert sufficient force on the piston face to offset the opposing forces of the spring 68 and pressure on valve 61. The valve 61 is thus forced open and it is held in such open position until pressures drop below normal, due to opening of the nozzle valve or stopping of the pump motor.

It will be observed that, during the periods of by-passing operation, the pump P nevertheless continues to deliver a full volume of liquid to the separator, and hence, if there be any excess quantities of air in the pump or suction line, such air may be eliminated during non-dispensing periods of operation. It will also be observed that no air is returned to the pump inlet, nor is any recovered liquid returned to the inlet, but, on the contrary, is sent directly to the separator.

It may be noted that, with the pump, separator, and discharge line 11 located at the relative levels indicated in the drawings, there need be no fear of a reverse flow through the drain tube 50 of high pressure liquid passing the venturi. A very high vacuum may be obtained, even though the pipe 11 extends above the chamber 40. It will, of course, be understood that while the invention has been illustrated in one particular form, and has been described with reference to its applicability to a gasoline dispenser, it is not to be limited thereto, but may be modified in form, or applied to general uses, without departure from the scope of the invention, as set forth in the following claims.

I claim:

1. Liquid pumping and separating apparatus for pumping liquid from a reservoir through a delivery conduit provided with a closable outlet, a primary separating chamber, a secondary separating chamber, a fluid passage between said chambers for admitting gas and liquid from the primary chamber to the secondary chamber, an open air vent connected to the secondary chamber, a liquid drain line from the secondary chamber, a valve for closing said drain, liquid

responsive means in said secondary chamber for controlling said valve, a liquid outlet from the primary chamber adapted to be connected to said delivery conduit, a liquid pump having an inlet connected to a source of fluid supply and a discharge connection terminating in said primary separator, a Venturi passage formed in said discharge connection, said liquid drain line being connected to the throat of said venturi, whereby discharge of fluid from said pump induces a flow of liquid from said secondary chamber into said primary chamber, and a by-pass connection between said primary chamber and the inlet of said pump, said by-pass being open upon the occurrence of predetermined pressure conditions in said discharge conduit to return liquid passing through said venturi and primary chamber.

2. Liquid and gas pumping and separating apparatus comprising a pump having a liquid inlet and outlet, a primary separating chamber, a Venturi passage connecting said outlet and chamber, said Venturi passage terminating within said chamber at a high point therein and being tangential with respect to the wall thereof, a second separating chamber disposed above said primary chamber and divided therefrom by a wall, a baffle depending from said wall, a fluid passage between said chambers formed in said wall and within the confines of the baffle, a drain line connecting said second chamber with the throat of the venturi, a float controlled valve in said second chamber for said drain line, a second valve in said second chamber for closing said fluid passage, means operative upon the opening of the float controlled valve for closing said second valve, an air vent connected to said second chamber, a liquid discharge line connected to said primary chamber at a low point therein, a by-pass line connecting said liquid discharge line with the inlet of the pump, a normally closed valve disposed in said by-pass line, means for holding said last named valve in closed position, said means being movable to open said valve when liquid pressure in said discharge line reaches a predetermined value.

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