TRANSFER EQUIPMENT FOR VOLATILE LIQUIDS

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This invention relates to improvements in equipment for transferring volatile liquids from one enclosure to another. The particular improvements lie in providing for a completely sealed system during transfer with means for normally starting and controlling flow and automatically shutting off the flow of liquid when the vessel being filled is filled to a proper level. In the system of the invention the portion of the liquid which may evaporate during transfer does not escape into the atmosphere but is pumped off and reclaimed.

The invention may be adapted for use with a large number of different volatile liquids and in any of various situations where the liquid is transferred from one tank for example to another. The invention herein is exemplified by way of transfer of gasoline from bulk storage to tank trucks before delivery to filling stations, by way of transferring gasoline from tank trucks to filling station reserves or from filling station reservoirs to vehicle fuel tanks.

In the ordinary free transfer of gasoline, for example, from a tank, that is, from storage to another tank, it is known that there may be a loss of approximately 3 percent of the liquid by evaporation. In the process of several transfers, for example three, there may be a loss of as high as 10 percent of the liquid before it is finally consumed. In addition to this relatively large economic loss the portion that evaporates escapes into the atmosphere and appears therein as a contaminant. In certain areas, for instance, in Southern California, evaporation of volatile liquids in this manner and their escape may constitute a large percentage of the contaminants in the atmosphere giving rise to conditions familiarly known as "smog conditions."

The purpose of the present invention is to alleviate and overcome the economic losses described above and the contribution made thereby to a smog condition, while providing for efficient and advantageous manual and automatic control of the liquid transfer operations. In transferring gasoline from bulk storage to a tank truck the equipment heretofore known and used has comprised a delivery tube or hose having an adapter unit or fitting at its end constructed to engage with and form a closure for the filler pipe or opening in the tank truck. In the past it has been known to provide a constant source of liquid at the end of the delivery hose which incorporates and has built into it a control valve in the form of a float actuated valve for automatically shutting off the delivery of liquid when the tank truck (for example) is filled up to the desired level. The control valve is preferably pilot-actuated and a pilot control valve is provided and so arranged that the main control valve cannot be opened for delivery until the adapter unit has made sealing engagement with the opening or filler pipe of the tank truck. Thus, there can be no inadvertent escape of evaporated liquid to the atmosphere. The system is always sealed during delivery of liquid. A control pilot valve is also provided so that the main control valve can only be opened by manual actuation of the operator, the arrangement requiring the constant presence and attention of the operator to keep the main control valve open, it always being subject to automatic closure upon the level rising to the proper point in the tank truck. In an alternative form of the invention, flow begins automatically when sealing engagement is made with the tank truck and continues without the presence of an operator.

In accordance with the foregoing it is a primary object of the invention to provide improved equipment for transferring volatile liquids, without escape of evaporated liquid.

Another object is to provide volatile liquid delivery equipment comprising an adapter unit or fitting for use with a liquid delivery conduit having built into it an automatic shut-off valve including a float actuator as a part of the adapter unit, the fitting having means providing for sealing engagement with a filler opening and for delivery of liquid only when the system is sealed.

A further object of the invention is to provide an additional improvement in the structure of the foregoing object wherein manually controlled means are provided in the adapter unit in conjunction with the float actuator whereby delivery of liquid can be initiated by opening of the shut-off valve. The manual means may be of a type requiring constant attention of an operator.

Further objects and numerous advantages of the invention will become apparent from the following detailed drawings and annexed description wherein:

Fig. 1 is a cross sectional view of the adapter unit of the invention;
Fig. 2 is a detail view of the evacuating side arm of the adapter unit;
Fig. 3 is a detail cross sectional view of the manually operated pilot valve;
Fig. 4 is another view of the manually operated pilot valve;
Fig. 5 is a detail view of the operating lever for sealing the adapter unit to the filler opening; and
Fig. 6 is a sectional view of another form of my invention.

Referring now more particularly to the drawings in Fig. 1, there is shown an adapter unit which may be coupled to the end of a delivery tube or hose 11 supported from an overhead crane or trolley 13. Gasoline may be delivered through the hose to the main opening 14 of the tank truck. The adapter unit or fitting comprises a cylindrical housing or sleeve 21 surrounding a cylindrical member 22. The sleeve 21 has an internal annular rib at the upper part as shown and their escape may constitute a large percentage of the contaminants in the atmosphere giving rise to conditions familiarly known as "smog conditions."

The purpose of the present invention is to alleviate and overcome the economic losses described above and the contribution made thereby to a smog condition, while providing for efficient and advantageous manual and automatic control of the liquid transfer operations. In transferring gasoline from bulk storage to a tank truck the equipment heretofore known and used has comprised a delivery tube or hose having an adapter unit or fitting at its end constructed to engage with and form a closure for the filler pipe or opening in the tank truck. In the past it has been known to provide a constant source of liquid at the end of the delivery hose which incorporates and has built into it a control valve in the form of a float actuated valve for automatically shutting off the delivery of liquid when the tank truck (for example) is filled up to the desired level. The control valve is preferably pilot-actuated and a pilot control valve is
of a circular flexible sealing ring 34. Just below the sleeve 25 is a ring member 35 attached by suitable means such as screws to the cylinder 22. This ring has an annular grooved 36 having in it three axles or trunnions for a U-shaped manual operating lever as designated at 42 which is pivoted on these trunnions. The lever 42 is shown in detail in Fig. 5. The legs of the lever 42 each have an extending bell crank arm 43, the end of which is bifurcated to form a clevis and pivoted on a pin 44 extending between the arms of the clevis is a roller 45. The rollers 45 are adapted to engage the upper surface of the flange 27. The trunnion members 41 extend through openings shown at 47 in the side walls of the housing 21. When the handle 42 is rotated as may be seen the rollers 45 engage the flange 27 tending to bodily lift the operating handle and the trunnions, thus lifting or sliding the sleeve 25 upwardly within the housing 21. The effect of this is to compress the sealing ring 34 causing it to bow outwardly to produce sealing engagement between itself and the interior of the filler pipe or opening 14 in the tank truck. At the same time the seal is broken between the lower edge of the sleeve 25 and the sealing ring 37 permitting ingress of the evaporated liquid to the space on the inside of the sleeve 25 and housing 21. The housing 21 has an integral side connection or elbow 50 as shown in Fig. 2 through which the evaporated liquid may escape and be pumped off. The connection 50 is connected to a compressor not shown whereby the evaporated liquid may be recompressed and liquefied.

Mounted on the upper end of the housing 21 is a section 53 having a flange shown at 54 which is attached by screws as shown at 55 there being a gasket 56 between the flange 54 and the upper end of the cylinder 21 as shown. Attached to the upper side of section 53 is a mating section 57 having a flange as shown at 58 attached to the section 53 by screws as shown at 59 there being a similar sealing gasket as shown at 69 between these parts. Section 57 is screw threaded as shown adapting it for coupling or connection to the liquid delivery hose.

Disposed within the sections 53 and 57 is the main control valve 64 which is a piston type valve. This valve has a piston type valve member 65 adapted to seat on a seat 66 formed within the section 53 controlling flow of liquid to the interior of cylinder 22. The section 53 includes an integral downwardly extending spider formed by legs 67 which connect to a cylindrical fitting 68 having a cylindrical bore as shown. The fitting 68 will be described more in detail presently.

The valve member 65 is equipped with an appropriate sealing ring as shown. The control valve 64 includes a body 70 which is attached to a cylindrical portion 71 by screws as shown at 72, the portion 71 having a cylindrical bore adapted to have the valve member 65 operate therein. The valve member 65 has a ring 73 attached to its upper end by screws as shown which clamps a sealing ring providing a seal with the bore of member 71. Within the valve body is a divider member 74 having the cross sectional shape shown which has a circular flange disposed between the section 70 and the cylindrical member 71 of the valve, the sections being attached by screws as shown. The divider member or portion 74 has an integral cylindrical stem 75 extending through the section 70. The stem 75 is enlarged at the lower portion forming a cylindrical bore within which is a coiled biasing spring 76 which acts against the valve member 65 normally biasing it downwardly toward its seat. Valve member 65 has a central integral boss or stem 77 and extending upwardly therefrom is a cylindrical stem 78 which extends through an opening at the upper end of the cylindrical portion 75 and forms a bleed port permitting a relatively slow bleed of liquid under pressure into the interior of cylindrical member 75 and to the space or chamber between the valve member 65 and the divider member 74.

The opening and closing of the valve 64 is controlled by pressure acting on the piston valve member 65 and this pressure is controlled by pilot valves as will be described.

Automatic control of the main valve 64 is provided by a float actuated pilot valve. However, the pilot valves which are built into the section 53 of the adapter will be described first and the float actuated pilot valve then be described.

In one side of the section 53 there is a cylindrical bore 85 within which there is a piston type valve member 86 normally biased downwardly by a biasing spring 87. This valve controls a port or channel 90 communicating with the space above the valve member 65. Valve 86 is operated by a stem 91 connected to a plunger 92 operable in a bore as shown in section 53. The plunger 92 extends outwardly beyond the section 53. The plunger 92 is adapted to engage in a bore 94 formed in the housing 21. As can be seen when the sleeve 25 is moved upwardly when the adapter unit is brought into sealing engagement with the lower edge of the plunger 92 moving it upwardly causing opening of the pilot valve 86. As long as this pilot valve is not open the main control valve 64 cannot be opened. Thus it can be seen that the main control valve cannot be opened until the adapter unit is brought into full sealing engagement with the opening or filler pipe of the tank truck.

Numerals 95 and 96 designate ports formed in the section 53 and in the spider leg 67 providing communication with the interior of the fitting 68.

Built into the section 53 is another pilot valve which is shown in more detail in Fig. 3. Formed within the section 53 is a cylindrical bore 100, the upper end of which communicates with the port or channel 96. Numerals 101 designates a side port communicating with the bore 100 and with port 95 connecting with valve 86. This port 101 at its end has a plug 102 as shown. Within the bore 100 is a valve member 104 having a stem 105, the lower end of which is flat as shown and which is pivoted by way of a pivot pin 106 to an operating handle 107 which has a slot or opening 108 through which the end of the stem 105 extends. The valve member 104 has an annular groove 111 in which is mounted an O-sealing ring 112. Between the valve 104 and the stem 105 there is a shoulder which is engaged by a disc 104 having a downwardly extending sleeve 116 forming a stop as it engages the fitting 117 closing the lower end of the bore 118 which is a counterbore relative to bore 108. The fitting 117 is attached by screws 120 as shown. Numerals 122 designates a coiled biasing spring surrounding the stem 105 which normally urges the valve 114 upwardly to seat against the extremity of the channel 56, the valve 104 having a valve member 123 at its end.

The operating lever 107 is pivoted on a pin 126 extending between lugs 127 and 128. The pressure in the chamber above the piston valve member 65 can only be released when the pilot valve 104 is opened. Thus, the main control valve 64 can only open when this pilot valve is manually opened. Therefore, in order for liquid to be delivered from the hose the operator must manipulate the handle 107 to open the extending upwardly by the section normally biased towards closed position, it must be held open by the operator in the manner of a throttle all during the time that liquid is being delivered. This demands the constant attention and surveillance of the operator and any inadvertent malfunctioning of the system is thereby
Prevented. Pilot valve 104 could be omitted, however, and other means provided for initiating flow of liquid.

As described, automatic control of valve 64 is provided by a float mechanism. The float is within a housing 130 having laterally extending slanting legs 131 as shown. These legs communicate with openings 132 in the side walls of the cylinder 22 by way of couplings 133 which are held in place by cotter pins as shown. The housing 130 has a cap 136 at the top attached by screws 137 as shown. The cap 136 has an inwardly extending boss 139, and connected to and extending upwardly from the boss 139 is a pipe or tube 140 having a fitting 141 in the form of a piston at its end fitting within the bore in the adapter unit. (See Fig. 2.)

Communication is provided through the port 96, the fitting 68, and the tube 140 to the interior of the float housing 130.

Formed within the housing 130 is a pilot valve housing 144, the interior of which communicates with the boss 139 by a spring chamber 145. The lower end of the pilot valve housing 144 is closed by a disc member 146 sealed by a sealing ring in an annular groove to the bore of the housing 144. The disc 146 has a central port 147 controlled by a valve member 148 carried by a pivoted lever 151. The lever 151 is pivoted to the lower end of a float actuated stem 152. Mounted on the stem 152 is a float 154 made of cork or a similar material. The float 154 is mounted on a central cylindrical sleeve 155 which engages the stem 153 there being washers at the end of this sleeve as shown whereby the sleeve may be adjustably positioned on the stem by way of cotter pins extending through holes in the stem 153 as shown. The lower end of the stem 153 fits in a guiding arrangement in a bore 159 in a boss 160 formed in the lower end of the housing 130.

When liquid is admitted by the control valve 64 to the interior of cylinder 22, it passes down around the outside of the float housing 130. When the liquid level rises in the tank or other vessel being filled, it rises up to the level of the openings 132 and is admitted through these openings to the interior of the float housing 130. It causes the float to rise to then operate the pilot valve 148 to control the main valve 64.

Before describing the overall operation of the equipment, the mechanical device for mechanically actuating the control valve 64 will be described.

When the adapter unit is not in engagement with the tank truck, it may be desired to mechanically open the main valve 64 if not being possible to open it then by means of the pilot valve. For example, if after a filling operation when the adapter unit is disengaged from the tank truck, there may be a few gallons of liquid left in the end of the delivery hose which it is desired to discharge. Or, there may not be enough pressure head in the delivery hose to open the main valve 64 since a certain head of pressure is required to open this valve against the force of the spring 168. In either of these circumstances, it may be desired to mechanically open the main valve. This can be done by way of the operating handle as shown at 165 in Fig. 1. This handle is connected to a stem 166 journalled in the section 53. At the end of this stem it carries a cam member 167 directly below the lower part of the valve member 65. The inner end of the stem 166 is supported in U-shaped grooves in the sides of the legs of the U-shaped member 169 which is attached to the spider 67 by a bolt as shown at 170. The stem 166 is normally biased in one direction by a coiled torsion spring 171. When the stem 166 is rotated by the handle 165 the cam 167 mechanically engages the valve member 65 to mechanically lift it off its seat. Thus, the valve 64 can be opened manually. When the handle 165 is released, the valve 64 automatically recloses.

To summarize the overall operation, to conduct a filling operation of a tank truck, the adapter unit is engaged
a cylindrical bore 213 adapted to have disposed therein a sliding valve member 214 which is arranged to seat against a seat formed by the bore of the fitting 206. The valve member 214 is normally disposed in closing direction or flow for the valve by a coil spring 215 disposed between it and the interior of member 212. Numeral 220 designates a central stem carried by a screw threaded fitting 221, this stem extending to an orifice in the valve member 214. The stem 220 has an indentation on one side providing for a bleed opening in it adapted to sealingly engage the inturned flanged portion at the end of the valve member 214. The stem 220 also has a central bore 223 which communicates by way of side openings 224 with the space behind the valve member 214 for bleeding pressure out of this space. The bore 223 communicates with a central bore 226 in the stem 211.

The body portion 202 also has a bore 230 disposed at an angle as shown and disposed in this bore is a manually actuated pilot valve having a stem 231 with a valve member 232 at its end communicating with and controlling flow through a bore of 233 which communicates with another bore 234 disposed substantially at a right angle as shown in Fig. 6. The outer end of the bore 234 is closed by a sealing plug 235 as shown. The bore 226 communicates with the bore 230. The outer end of the bore 230 is closed by a plug member 237 which when the valve is in the closed position by way of a sealing ring 238 in an annular groove as shown. The valve stem 231 extends through the end member 237 and this stem is attached to a portion of a manual bell crank lever 238 pivoted on a pin 239 as shown. When the lever 238 is pushed inwardly, the stem 231 is drawn outwardly so that the valve member 232 is disengaged from its seat permitting bleed of pressure from behind the valve member 214 to the interior of the bore 234. The stem 231 is biased in closing direction of the valve 232 by a coil spring 240 bearing against a flange 241 near the end of the stem 231. The end member 237 is flanged as shown at 244 and it is attached to the body 202 by a screw as shown.

The end of the lever 238 is bifurcated to engage the end of stem 231 and it has an opening in it as designated at 246 and extending through this opening is a latch or trigger member 247 so that the handle 238 can be latched in open position of the valve 231. The latch 247 is pivoted on a pivot 259 and it is normally biased in latching direction by a coil spring 250, the ends of which are engaged in respective openings or depressions in the latch member and in the body 202. The latch has a square shoulder at 251 and the latch can move in counterclockwise direction so that this shoulder engages the lever or handle 238 to hold the lever in open position of the valve 231.

Forming a part of the dispensing spout 263 is a closure member 255 which is a circular member which, as shown, surrounds the spout 263 and is sealed to it by way of a sealing ring 256 in an annular groove as shown. The stem or filler spout of the tank 204 has an inwardly extending rib or flange 258 as conventional and this flange or rim has openings in it as conventional so that a bayonet joint or lock can be formed between it and the closure member 255. The latter member has inwardly extending flanged projections 259 which can fit between the openings in the rim or flange 258 and then when the spout or nozzle 263 and the closure member 255 are rotated, a bayonet lock is formed between the parts 258 and 259. Adjacent the end of the filler opening or spout 264, the closure member 255 has a circular groove with a sealing ring 261 in it adapted to sealingly engage the inturned flanged portion at the end of the filler opening spout 264.

As shown, there is an annular space between the nozzle or spout 263 and part of the interior bore of the closure member 255 and in communication with this space is a bore or channel 263 in the closure member 255 and connecting with it is a tube 264 which is attached to and communicates with a vapor line or conduit 265 through which vapor can be withdrawn or pumped out of the spout 264 and from the interior of the vehicle fuel tank above the level of liquid gas. From the foregoing it can be seen that the system is entirely sealed when liquid is being dispensed through the nozzle and any evaporated portion is withdrawn or pumped out through the conduit 265.

Within the nozzle 263 is a housing 270 which houses a rectangular shaped float member 271 which sits fairly closely within the housing. The float 271 is attached by a stem 272 to a pivoted lever 273, the other end of which is attached by stem 274 to another pilot valve member 275. The stem 274 extends through an opening leading into the bore 234 and the valve 275 is adapted to seat on a valve seat formed by the inner end of this opening.

With reference to the operation of the dispensing nozzle, the valves 233 and 275 act as pilot valves controlling the main valve 214. The main valve may be closed as the result of closure of either of the pilot valves. When the pilot valves are opened, pressure from behind the valve 214 can bleed out through the orifices 224, the bores 223 and 226 through the valves 233 and 275 into the spout 263. With the pilot valves open, the pressure against the valve member 214 is sufficient to open it against the force of spring 215. Normally, the valve 214 will be closed when the fuel tank is filled up to a level sufficient to actuate the float 271. When the float moves upwardly, it will withdraw the stem 274 to close the pilot valve 275. This cuts off bleed from behind the valve member 214 and this pressure builds up causing the valve to be closed. When the level is low in the fuel tank, the valve 275 will be opened and the valve 214 can now be opened by opening the pilot valve 232 by the handle or lever 238. When valve 232 is thus opened, pressure is released from behind the valve 214 and it opens. The lever 238 may be latched in opened position of valve 232 by the latch or trigger 247.

In operations, the operator will effect sealing engagement between the closure member 255 and the filler spout 264 by way of the bayonet joint as described. Having done this and the operator being assured of this seal having been completed, he will then manipulate the handle or lever 238 for opening the valve. Having been done, the tank will fill up and the valve will automatically close in response to the movement of the float. During this operation any vaporized liquid is withdrawn through the conduit 265 so that during the entire operation there is assurance that there will be no escape of vapor or other contaminants to the atmosphere.

The foregoing disclosure is representative of preferred forms of my invention. It is intended that it be interpreted in an illustrative rather than a limiting sense, the scope of the invention to be limited only in accordance with the claims appended hereto.

I claim:
1. Apparatus of the character described adapted to dispense liquid into a receptacle having a filler opening, comprising an adapter unit adapted to extend downwardly into and to make sealing engagement with said filler opening, said unit having means for withdrawing vapor from said filler opening; a control valve forming a part of said adapter unit; a float control for said adapter unit embodied in said adapter unit whereby, when the adapter unit is brought into engagement with the filler opening, the float is in position to shut off the flow of liquid when the liquid reaches a predetermined level in the receptacle; and means actuated upon said adapter unit being brought into sealing engagement with the said filler opening for controlling said control valve to initiate flow of liquid.
2. The structure of claim 1 wherein said adapter unit embodies a closure member adapted to form a sealing closure for the said filler opening in the receptacle.
9. In a dispensing unit in combination: means comprising a cylindrical fitting adapted to be inserted into the filler opening of a receptacle to be filled, said fitting having embodied therein a pressure responsive control valve for controlling the flow of liquid through the fitting; a float embodied in the fitting at the lower part thereof and adapted to be actuated by liquid in the receptacle when the fitting is in position; a pilot valve actuable by the float and arranged adjacent thereto in the lower part of the fitting; and means including a conduit arranged coaxially of said fitting whereby said pilot valve controls the actuation of said pressure responsive control valve.

10. Apparatus of the character described adapted to dispense liquid into a receptacle, having a filler opening, comprising an adapter unit adapted to extend downwardly into and to make sealing engagement with said filler opening, said unit having means for withdrawing vapor from said filler opening; a control valve forming a part of said adapter unit; a float control for said valve embodied in said adapter unit whereby, when the adapter unit is brought into engagement with the filler opening, the float is in position to shut off the flow of liquid when the liquid reaches a predetermined level in the receptacle; means associated with the adapter unit for opening said control valve to initiate flow of liquid, said last means including a pilot valve mechanism having means in control of the main valve, and means whereby said pilot valve is actuated upon the adapter unit being brought into sealing engagement with the said filler opening in a manner to actuate said pilot valve whereby to permit control of the main valve by the said float.

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