Nov. 19, 1957 P. A. SMITH 2,813,401

FILLER VALVE CONSTRUCTION

Filed Dec. 13, 1954

Fig. 1

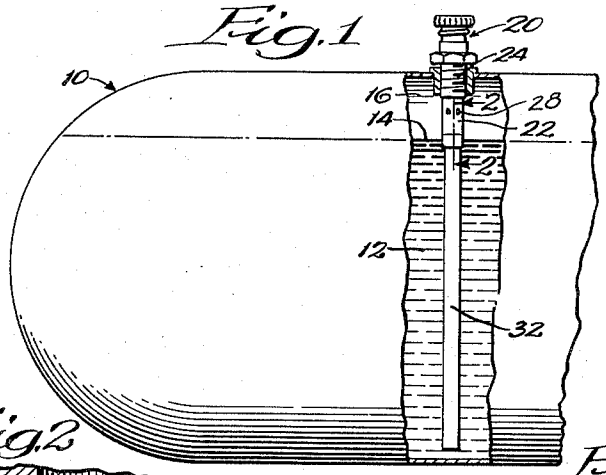


Fig. 3

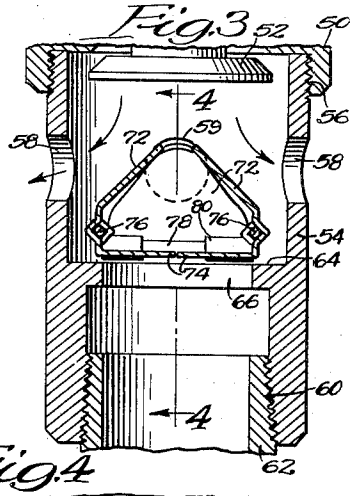


Fig. 2

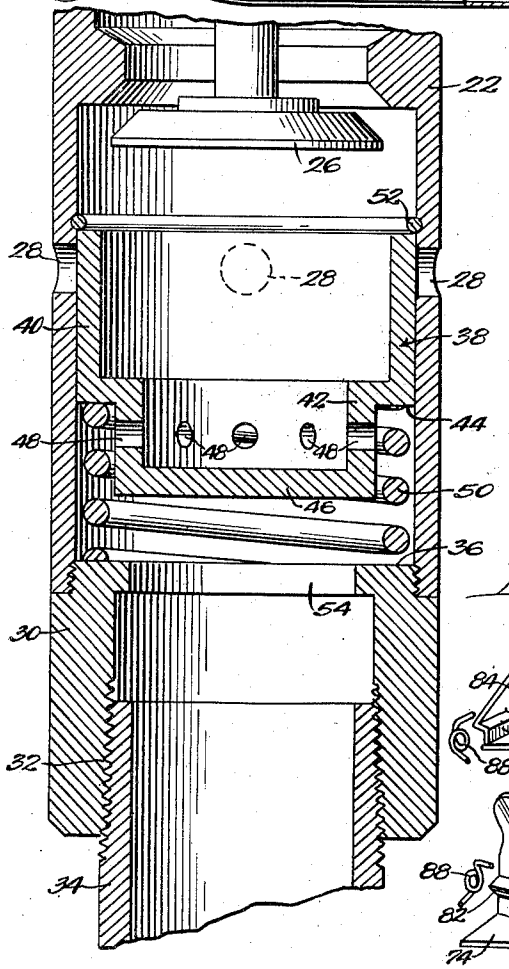


Fig. 4

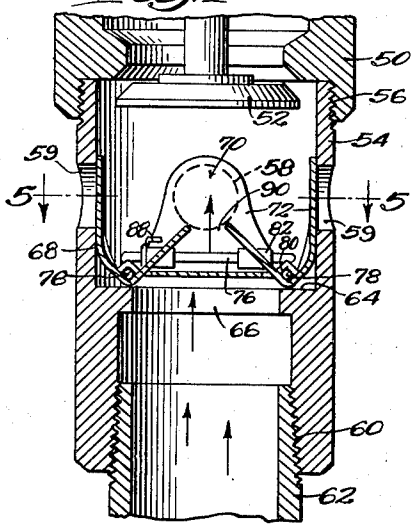


Fig. 6

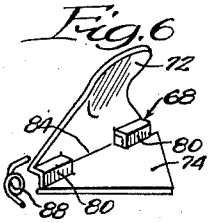


Fig. 5

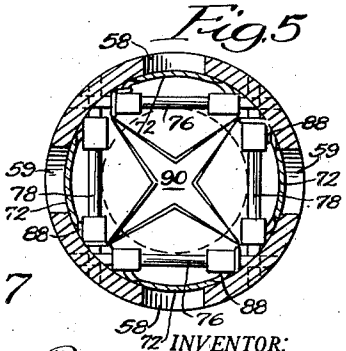
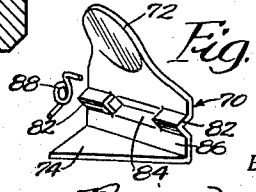


Fig. 7



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FILLER VALVE CONSTRUCTION

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7 Claims. (Cl. 62—1)

This invention relates generally to a filler valve construction, and more particularly to such devices intended for use in liquefied petroleum gas storage and dispensing systems.

Conventional type storage containers commonly known in the liquefied petroleum gas industry generally employ a filler valve in order to replenish the fuel supply within the container and to withdraw the contents of the container under emergency conditions. Such filler valves may comprise individual fittings, or may be valve components of a unitary multiple valved head assembly. During normal filling operations, the risk of excessive vapor pressure build-up within the storage container is conventionally avoided by withdrawing vapor from the container through an outlet means provided with a regulatable vapor return valve. A volume of vapor approximately equal to the volume of replenishing liquid introduced into the container may thereby be withdrawn during the filling operation. Conventionally, the filler valves known to the prior art utilize a dip pipe which extends downwardly from the filler valve to a point closely adjacent the bottom of the tank. In this manner, the replenishing supply of liquid is introduced at the bottom of the tank to permit a smooth and non-turbulent rise in the container liquid level. The increasing pressure of the vapor space above the rising liquid level is relieved by the vapor return means.

The use of a vapor return system in filling operations as described above, has been found to be undesirable in several ways. The handling of liquid petroleum vapor always constitutes a fire and explosion hazard, and the less flow handling necessitated by any fuel system, the less will be the hazards presented. The use of a vapor return system also necessarily requires careful attendance and manual regulation, resulting in an expenditure of time and labor. From the practical standpoint of minimizing waste, the vapor return system is also undesirable because of the difficulty in effecting accurate metering of the vapor withdrawn and conversion into terms of corresponding liquid volume so that the consumer-purchaser may receive an appropriate price allowance for the vapor removed. It will be apparent, therefore, that the provision of filling means which eliminates the necessity for a vapor return system will result in improved efficiency, reduction in cost, and minimization of physical hazards.

I have found that by introducing the highly volatile liquid petroleum into the container directly into the vapor space, rather than through the conventional dip pipe, excessive pressure build-up within the tank can be substantially eliminated. Although methods have been devised in which the outlet of the filler valve is fitted with a device which produces a diffuse or spraylike flow pattern, such arrangements have not also provided effective liquid withdrawal by means of a dip pipe.

The diffusion of incoming liquid into the vapor space in a spray pattern results in a refrigerating effect or temperature drop within the vapor space because of the expansion of the liquid as it discharges from the filler

valve outlet. This cooling effect, together with the consequent lowering of vapor pressure within the container, compensates for the tendency for pressure build-up due to the volume of liquid being introduced into the container. I have found that the compensating effect is sufficient to permit filling operations to be completed entirely without the use of any vapor return system.

It is a primary object of the present invention, therefore, to provide a unitary filler valve construction for introducing a replenishing supply of liquid petroleum gas into the vapor space of a storage container having dip pipe means for emergency liquid removal.

It is another object of this invention to provide a filler valve construction having two-directional flow control means for, alternatively, regulating and directing an incoming supply of liquid into the vapor space of a storage container, while preventing downward flow through an operatively associated dip pipe, and regulating and directing an upward flow of liquid during emergency eduction, while preventing outward flow of such liquid into the vapor space of the container.

It is a further object to provide a filler valve assembly having two-directional flow control means comprising a slidably reciprocable valve plug normally biased in a first position for permitting upward outgoing flow from a dip pipe through the assembly, wherein said valve plug is movable by the force of a downward replenishing flow of liquid to a second position for preventing said outgoing flow and for permitting the incoming flow to be directed into the vapor zone of an operatively associated storage container.

It is still another object to provide a filler valve assembly having two-directional flow control means comprising a plurality of pivotally mounted flapper members each normally biased in a first position for effecting closure of a corresponding plurality of filling ports and permitting upward outgoing flow from a dip pipe through the assembly, wherein said flapper members are pivoted by the force of a downward replenishing flow of liquid to a second position of collective cooperation providing a valve closure for preventing said outgoing flow and for permitting the incoming flow to be directed into the vapor zone of an operatively associated storage container.

Further objects and advantages of this invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

A preferred embodiment of the invention is shown in the accompanying drawing, in which:

Figure 1 of the drawing is a side elevational view, partly broken away and in cross section, showing a liquid petroleum container provided with a filler valve assembly constructed in accordance with the present invention;

Figure 2 is a vertical fragmentary cross sectional view of a first embodiment of a filler valve constructed in accordance with the present invention;

Figure 3 is a vertical cross sectional view, similar to Figure 2, showing a second embodiment of the present invention;

Figure 4 is a vertical cross sectional view of the valve construction shown in Figure 3, illustrating the control valving elements in another position of flow control operation;

Figure 5 is a horizontal cross sectional view taken substantially as indicated by the line 5—5 on Figure 4;

Figure 6 is a perspective view of one of the valve control elements of the construction shown in Figures 3–5; and

Figure 7 is a perspective view of another of the valve control elements of the construction shown in Figures 3–5.

Referring now more particularly to Figure 1 of the drawing, I have indicated generally at **10** a conventional storage and dispensing container of the type commonly used by the liquefied petroleum gas industry. The container **10** serves to enclose a quantity of liquid petroleum gas **12** having a maximum liquid level **14**. The liquid level **14** is spaced below the top of the tank to define a vapor zone **16**. A filler valve employing the features of the present invention and having liquid withdrawal means is indicated generally at **20** in operatively mounted position on the container **10**.

In Figure 2 of the drawing, I have illustrated a first embodiment of the present invention. The spray filling portion of the construction shown is formed as an integral extension of a main filler valve housing **22**. The housing **22** is of hollow form providing a vertically-elongated open-ended body. It will be understood, of course, that the spray filling portion of the construction may be formed as a separate attachment for screw threaded connection to a conventional filler valve. The main housing **22** is adapted to be mounted, as indicated at **24** in Figure 1, through the top wall of the storage container **10**. A conventional back-check or excess-flow check valve **26** is provided in the usual manner of filler valve constructions. The walls of the main housing **22** below the back-check valve **26** are provided with a plurality of circumferentially spaced filling ports **28**, extending laterally therethrough for communication with the vapor zone **16**, as clearly shown in Figure 1.

A suitable adaptor **30** is provided at the lower end of the main housing **22** and screw threaded at **32** for the attachment of a conventional dip pipe **34**. In this manner, the filler valve construction provides, as a unitary portion thereof, suitable dip pipe means for effective liquid withdrawal. The adaptor **30** is formed with an internal shoulder **36** providing an annular abutment surface.

An upwardly open valve plug **38** is mounted within the housing **22** for vertical reciprocating movement. The plug **38** is dimensioned so as to provide a relatively large diameter side wall **40** at its upper end for sliding cooperation with the inner surface of the housing **22**. The plug is constricted at its lower end to provide a relatively small diameter side wall **42** in spaced relation to the inner side wall of the housing **22**. The small diameter lower portion of the plug **38** results in a shoulder **44** providing an annular abutment surface. The lower end of the plug **38** provides a closed bottom wall **46** adapted to cooperate with the shoulder **36** of the adaptor **30** in the manner of a valve and valve seat. The lower side wall **42** of the plug **38** is provided with a plurality of circumferentially spaced flow ports **48** providing communication between the interior of the plug and the space between the side wall **42** and the main housing **22**.

A biasing element in the form of a compression spring **50** seats at its lower end against the shoulder **36** and at its upper end against the shoulder **44** to normally bias the plug **38** in an upward direction. A snap ring **52** carried by the inner surface of the housing **22** cooperates with the upper end of the plug **38** to determine its upper limiting position. Under no-flow conditions, the various parts are disposed relative to each other as shown in Figure 2 of the drawing.

The shoulder **36** serves to define an eduction flow port **54** centrally therethrough. The bottom wall **46** of the plug **38** serves as a valve element adapted to seat on the annular surface provided by the shoulder **36** to effect a closure of the flow port **54**. In its upwardly biased position, as shown in Figure 2, the upper side wall **40** of the valve plug **38** serves to effect closure of the filling ports **28**. It will be apparent that upward flow may occur through the dip pipe **34**, eduction flow port **54**, valve plug ports **48**, valve plug **38**, and housing **22**.

During a filling operation, the force of an incoming flow of liquid downwardly through the housing **22** will serve to effect a downward sliding movement of the valve plug **38** against the bias of the spring **50**. In this manner, the bottom wall **46** will seat against the shoulder **36** to prevent flow communication through the eduction port **54**, while at the same time exposing the filling ports **28** to permit free flow of incoming liquid laterally outwardly therethrough. In this way, the replenishing supply of liquid may be sprayed outwardly through the filling ports **28** into the vapor zone **16**, and flow through the dip pipe **34** will at the same time be precluded.

In Figures 3 through 7 of the drawing, I have shown a modified embodiment of the present invention, utilizing a different form of valving arrangement. I have indicated the hollow main housing of the fillter valve at **50**, and the conventional back-check or excess-flow check valve at **52**. In this embodiment, the spray filling portion of the construction is illustrated as a saparate attachment **54** adapted to be secured to the main housing **50**, as indicated by screw threading at **56**. The spray filling attachment **54** provides a hollow housing in the form of an open-ended body having a plurality of circumferentially spaced filling ports **58** registering with the vapor zone **16** of an operatively associated storage container in the manner of Figure 1.

The lower end of the spray attachment housing **54** is screw threaded at **60** for attachment of a dip pipe **62**. The spray attachment housing **54** is internally formed with a shoulder **64** defining an annular surface defining a flow port **66** extending centrally therethrough.

A two-directional flow control valve, having substantially the same functional utility as the embodiment of Figure 2, is provided in the form of two pairs of flapper elements **68** and **70**. Each of the flappers comprises a filling port valve portion **72** and an eduction valve component portion **74**. Two pairs of pivot shafts **76** and **78** are disposed one pair above the other for pivotal mounting of the pairs of flappers **68** and **70** within the spray attachment housing **54**.

As best seen in Figures 6 and 7, the flappers are formed with an angular bend at the intersection of the respective portions **72** and **74**. The angle bends or intersections are formed with respective pairs of up-bends **80** and **82**. A center down-bend or angle-forming space **84** is provided between the pairs of up-bends **80** and **82**. In this manner the flappers **68** (Fig. 6) and the flappers **70** (Fig. 7) form a guide means at the angular bend or intersection of the portions **72** and **74** which is adapted to receive the respective pivot shafts **76** and **78** therethrough. The flappers are mounted in pairs one above the other in order to effect a compact arrangement with a minimum of space. In order to compensate for the height difference between the respective pairs of flappers, the upper pair **70** is formed with an extension flange portion **86** at the angular bend or intersection between the portions **72** and **74**. This added portion, as compared to flapper **68**, serves to compensate for the difference in horizontal position of the respective pairs of flappers **68** and **70**.

A plurality of springs **88** are provided to normally bias the flapper elements in the positions shown in Figure 4 of the drawing, wherein the filling port valve portions **72** serve to effect closure of the spray filling ports **58**. The upwardly inclined eduction valve portions **74** are substantially spaced from each other, when positioned as shown for filling port closure, so as to provide an up-flow space **90** therebetween. It will be apparent that upward eduction flow of liquid through the dip pipe **62** may be effected through the up-flow space **90** without outward flow through the closed filling ports **58**.

During filling operations, the incoming supply of liquid will exert a force against the bias of the springs **88** serving to pivot the flappers to the positions shown in Figure 3 of the drawing, wherein the component portions **74** cooperate to effect a valve closure of the eduction flow port **66**, while freely permitting laterally-outward flow of the incoming liquid through the filling ports **58** into the vapor zone **16**.

I claim:

1. In a liquid petroleum gas dispensing installation of the type including a tank and a filler valve mounted in the top wall thereof, the combination with said filler valve of flow directing means comprising an open-ended vertically-elongated body of hollow form having its upper end in flow communication with said filler valve and having its lower end adapted to communicate with a dip pipe, means forming a generally horizontal valve seat intermediate the ends of said body and providing an eduction passageway therethrough, said body being formed with a laterally extending filling port above said valve seat, and control valve means mounted within said body and movable between operative positions for alternately closing said eduction passageway and said filling port, said control means comprising a plurality of pivotally mounted flapper members each movable between a first position for effecting closure of a corresponding plurality of filling ports and a second position for collectively cooperating with one another to provide a closure for said eduction passageway.

2. In a liquid petroleum gas dispensing installation of the type including a tank and a filler valve mounted in the top wall thereof, the combination with said filler valve of flow directing means comprising an open-ended vertically-elongated body of hollow form having its upper end in flow communication with said filler valve and having its lower end adapted to communicate with a dip pipe, means forming a generally horizontal valve seat intermediate the ends of said body and providing an eduction passageway therethrough, said body being formed with a laterally extending filling port above said valve seat, control valve means mounted within said body and movable between operative positions for alternately closing said eduction passageway and said filling port, said control means comprising a plurality of pivotally mounted flapper members each movable between a first position for effecting closure of a corresponding plurality of filling ports and a second position for collectively cooperating with one another to provide a closure for said eduction passageway, and spring means serving to normally bias said flapper members in said first positions for closing said filling ports while permitting flow through said eduction passageway, the force of incoming fluid admitted to the top of said body serving to pivot said flapper members downwardly against said spring bias to said second positions for closing said eduction passageway while permitting flow through said filling ports.

3. In combination with a tank for storing liquefied gas under pressure, a filler valve mounted at an opening in the tank and a flow directing device for spray filling and liquid eduction of said tank, said device comprising an open-ended vertically elongated body of hollow form having its upper end in flow communication with said filler valve and defining an eduction passageway, a dip pipe extending to a point adjacent the bottom of said tank and being connected to said body in flow communication with said eduction passageway, said body having a spray filling port extending laterally therethrough above said eduction passageway in communication therewith, said spray port communicating with the interior of the tank near the top thereof, flow control means comprising a slidable member mounted within said body for relative axial movement between positions for alternately closing and opening said spray port, and means for placing said dip pipe in communication with said filler valve through said eduction passageway including a valve element and a valve seat element operative within said body for relative opening movement in the direction of outgoing flow from said dip pipe to said filler valve, said slidable member being movable in response to incoming flow to its port opening position thereby to direct the incoming flow laterally outwardly through said spray port into said tank and being movable in response to outgoing flow from said dip pipe through said eduction passageway to its port closing position thereby to permit eduction flow upwardly through said body and filler valve.

4. In combination with a tank for storing liquefied gas under pressure, a filler valve mounted at an opening in the tank and a flow directing device for spray filling and liquid eduction of said tank, said device comprising an open-ended vertically elongated body of hollow form having its upper end in flow communication with said filler valve and defining an eduction passageway, a dip pipe extending to a point adjacent the bottom of said tank and being connected to said body in flow communication with said eduction passageway, said body having a spray filling port extending laterally therethrough above said eduction passageway in communication therewith, said spray port communicating with the interior of the tank near the top thereof, flow control means comprising a slidable member mounted within said body for relative axial movement between positions for alternately closing and opening said spray port, biasing means serving to normally position said slidable member in its port closing position, and means for placing said dip pipe in communication with said filler valve through said eduction passageway including a valve element and a valve seat element operative within said body for relative opening movement in the direction of outgoing flow from said dip pipe to said filler valve, said slidable member being movable against said biasing means in response to incoming flow to its port opening position thereby to direct the incoming flow laterally outwardly through said spray port into said tank and being movable with said biasing means and in response to outgoing flow from said dip pipe through said eduction passageway to its port closing position thereby to permit eduction flow upwardly through said body and filler valve.

5. In combination with a tank for storing liquefied gas under pressure, a filler valve mounted at an opening in the tank and a flow directing device for spray filling and liquid eduction of said tank, said device comprising an open-ended vertically elongated body of hollow form having its upper end in flow communication with said filler valve and defining an eduction passageway, a dip pipe extending to a point adjacent the bottom of said tank and being connected to said body in flow communication with said eduction passageway, said body having a spray filling port extending laterally therethrough above said eduction passageway in communication therewith, said spray port communicating with the interior of the tank near the top thereof, and flow control means comprising a generally hollow plug member slidably mounted within said body for relative axial movement between positions for alternately closing and opening said spray port, check means for placing said dip pipe in communication with said filler valve through said eduction passageway including an integral wall portion of said plug member serving as a valve element, an internal wall portion of said body serving as a valve seat element, and a flow aperture in said plug member above its valve element portion, said plug member being movable in response to incoming flow to both its filling port opening position and its check means closing position to thereby direct the incoming flow laterally outwardly through said spray port into said tank while preventing downward flow through said check means into said dip pipe, and said plug member being movable in response to outgoing flow from said dip pipe through said eduction passageway to both its filling port closing position and its check means opening position to thereby permit eduction flow upwardly through said body and filler valve.

6. The combination of claim 5, wherein biasing means is provided to normally position said plug member under no-flow conditions in its filling port closing and check means opening positions.

7. In combination with a tank for storing liquefied gas under pressure, a filler valve mounted at an opening in the tank and a flow directing device for spray filling and liquid eduction of said tank, said device comprising

an open-ended vertically elongated body of hollow form having its upper end in flow communication with said filler valve and defining an eduction passageway, a dip pipe extending to a point adjacent the bottom of said tank and being connected to said body in flow communication with said eduction passageway, said body having a spray filling port extending laterally therethrough above said eduction passageway in communication therewith, said spray port communicating with the interior of the tank near the top thereof, flow control means comprising a flapper member pivotally mounted within said body for movement between positions for alternately closing and opening said spray port, and means for placing said dip pipe in communication with said filler valve through said eduction passageway including a valve seat element adapted to cooperate with said flapper member when in its port opening position, said flapper member being

movable in response to incoming flow to its port opening position thereby to direct the incoming flow laterally outwardly through said spray port into said tank and seat against said valve seat element thereby to close said eduction passageway, and being movable in response to outgoing flow from said dip pipe through said eduction passageway to its port closing position thereby to unseat from said valve seat element and permit eduction flow upwardly through said body and filler valve.

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