May 31, 1960 C. E. KLAMM ET AL 2,938,550

AUTOMATIC TANK FILLING DEVICE

Filed Aug. 17, 1956 4 Sheets-Sheet 1

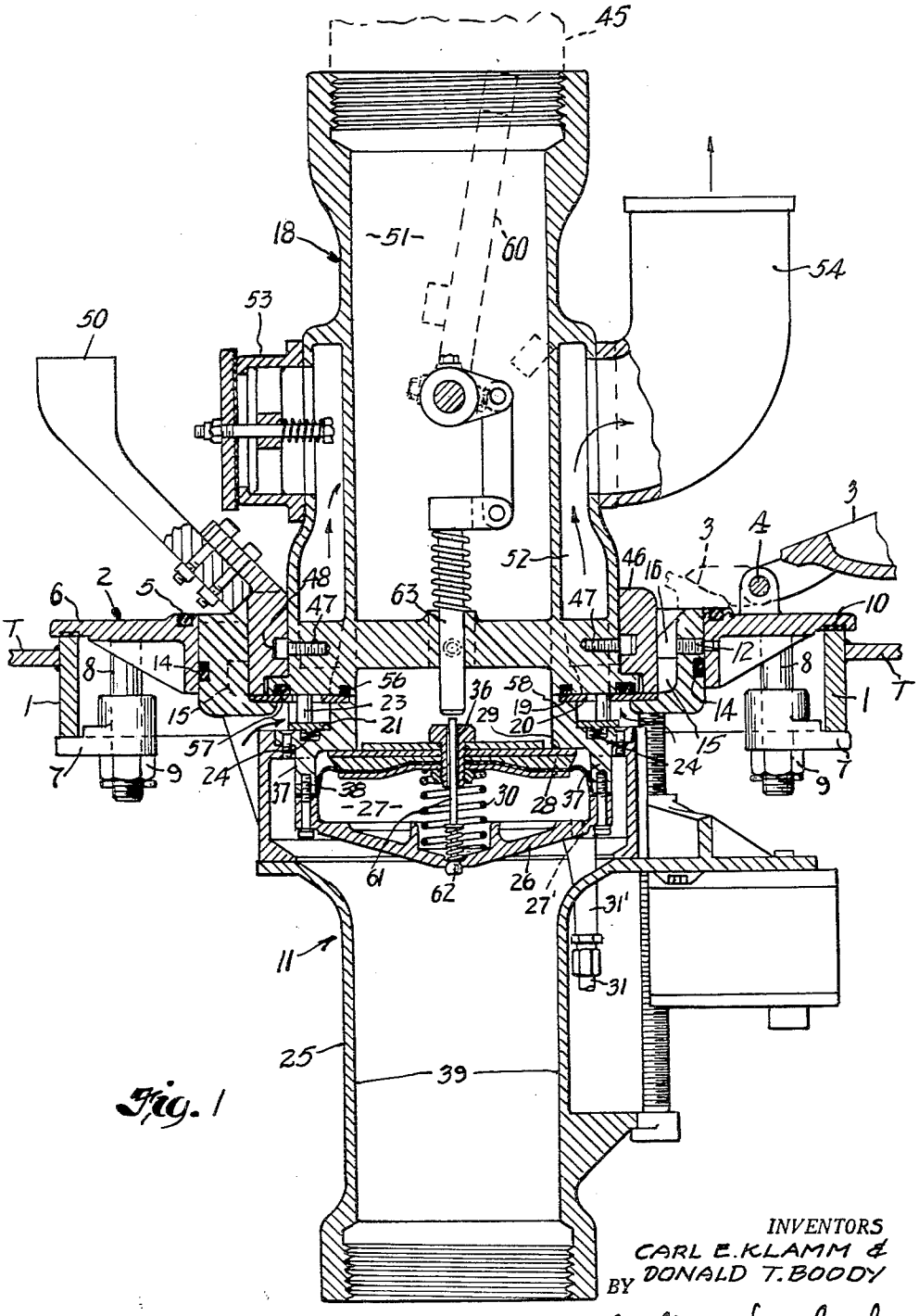


Fig. 1

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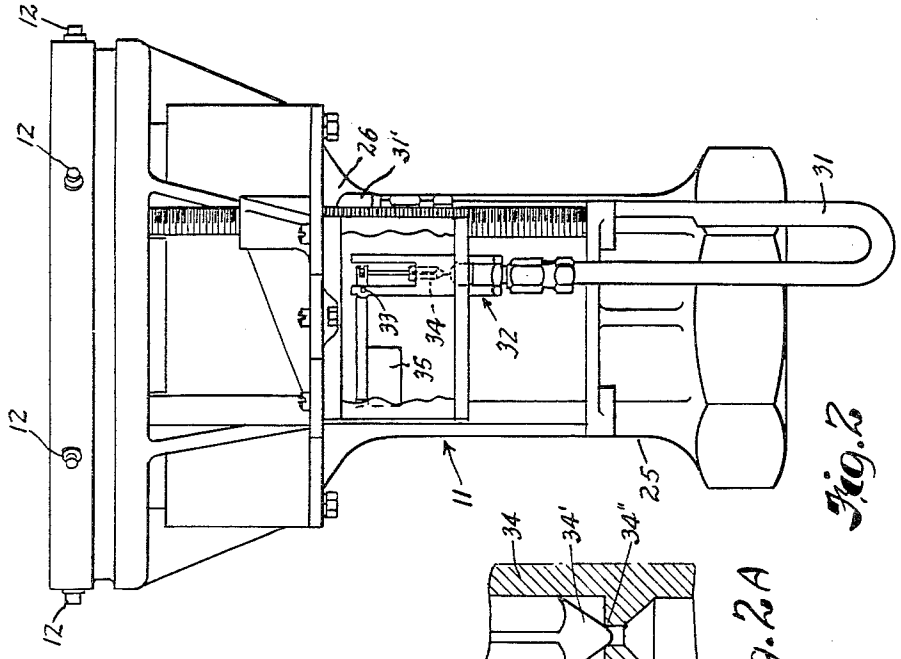


Fig. 2

Fig. 2A

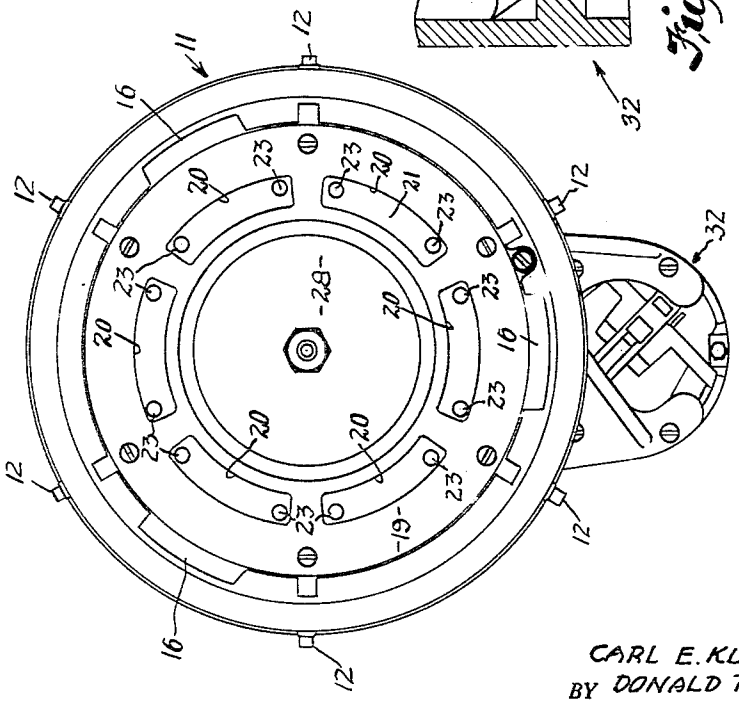


Fig. 3

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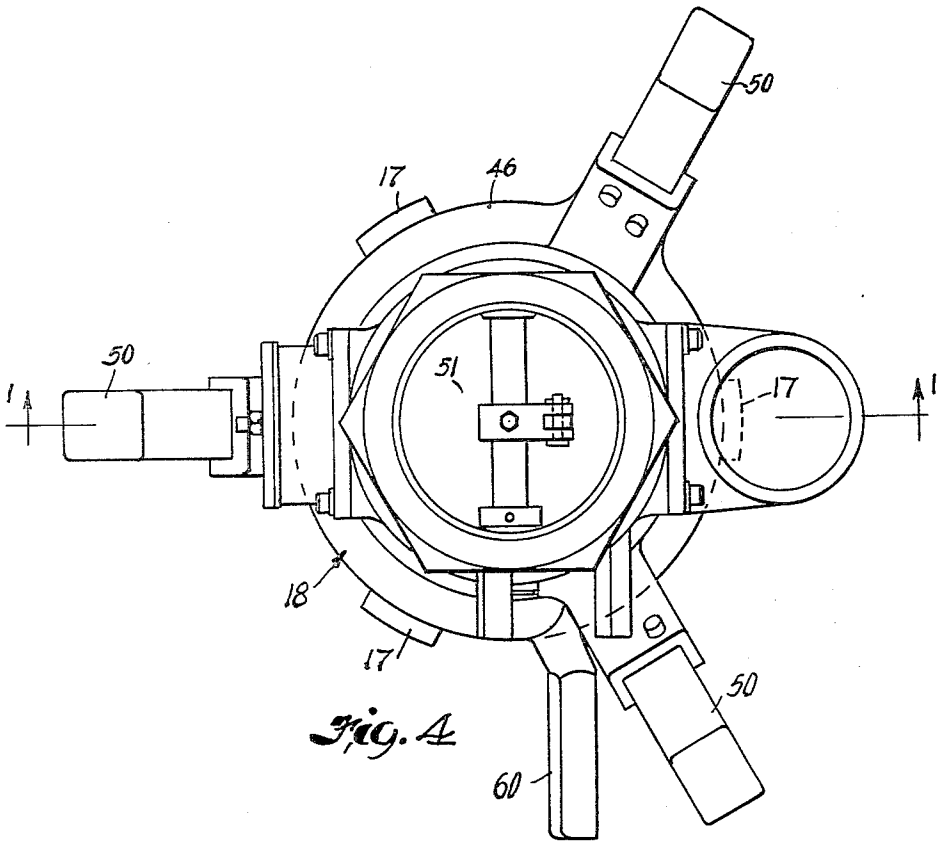


Fig. 4

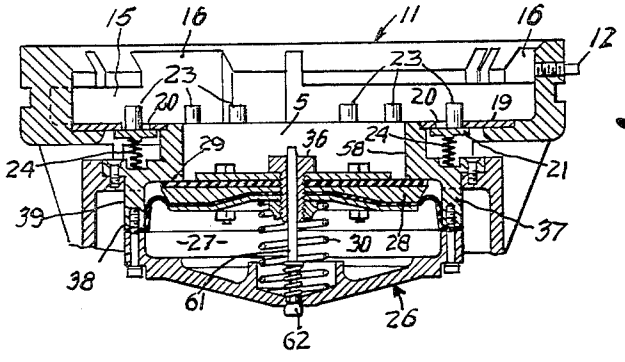


Fig. 5

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Fig. 7

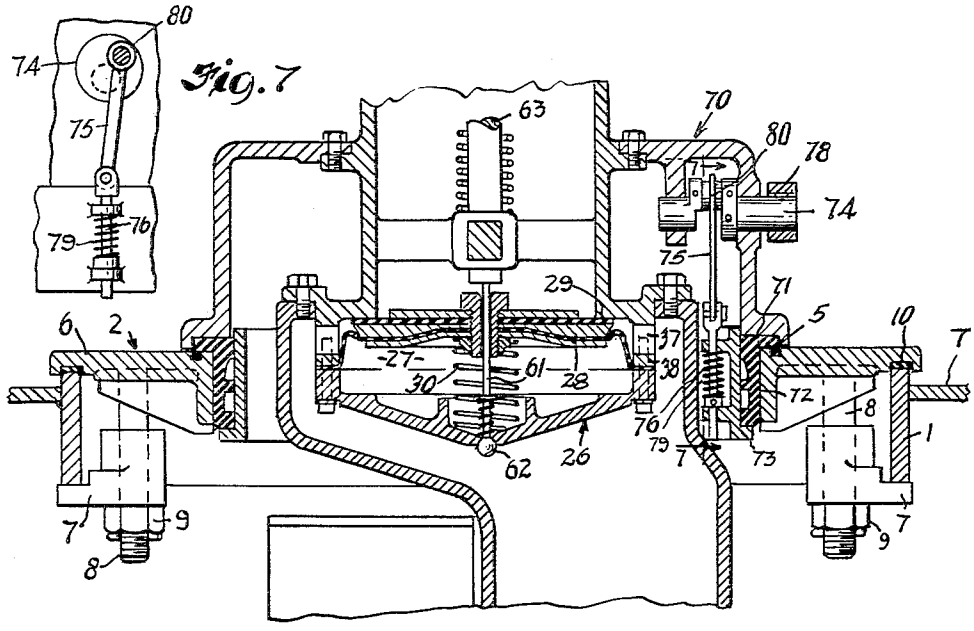


Fig. 6

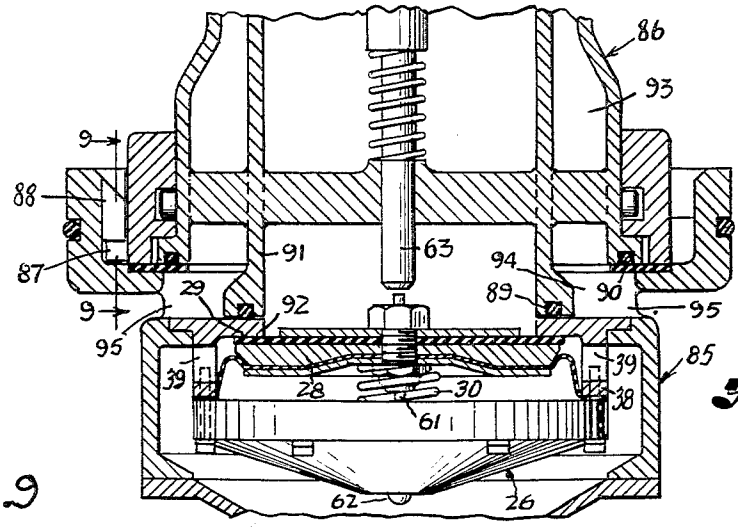
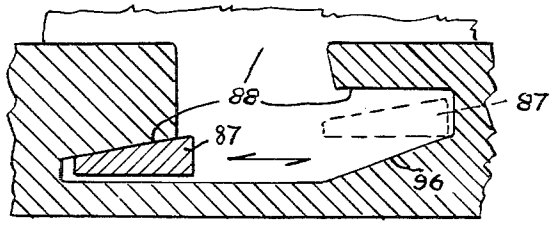


Fig. 8

Fig. 9



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AUTOMATIC TANK FILLING DEVICE

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Filed Aug. 17, 1956, Ser. No. 604,661

9 Claims. (Cl. 141—215)

The present invention relates generally to an automatic tank filling device, and more especially to such a device adapted for use in conjunction with the filling of gasoline truck tanks at bulk service stations.

This invention has for its principal objects the provision of a valve of the character indicated which either eliminates, or at least reduces to insignificant amount, the escape of gasoline fumes into the atmosphere and which ensures proper filling of fuel tanks without splashing or overflow and its attendant hazards.

In some industrial communities, smog has become a serious problem, endangering the health of large numbers of persons and has even necessitated affirmative action on the part of local officials either to eliminate the sources thereof or to reduce air pollution to a safe level. A contributing factor to the pollution or contamination of the atmosphere results from the present mode of operation of many bulk service stations in which hundreds of gasoline trucks are filled daily.

For instance, a truck which is equipped with a tank of 3,000 gallons capacity is filled in a matter of a few minutes time by pumping fuel thereinto at the rate of 500–1200 gallons per minute and in doing so the vapor or fume loss may amount to about 8 gallons per tank.

Accordingly, when a large number of truck tanks are filled every day, the amount of smog may be considerable. The usual practice in filling gasoline truck tanks is merely to insert a fuel supply nozzle into the filler opening of the tank and to pump the gasoline into the tank while allowing the fumes to escape into the atmosphere. Even when the lid on the empty or nearly empty tank is opened, there may be considerable escape of fumes, especially in warm weather when fume pressure builds up within the tank.

Recently there has been a move afoot to install fume recovery systems in bulk service stations, said systems being operative to withdraw fumes during filling of the tanks and to re-liquefy said fumes rather than to release such fumes into the atmosphere, and it is in connection with such fume recovery that the present invention is particularly concerned. Thus, the valve herein is provided not only with a fuel delivery passage, but a separate vent passage adapted for connection to a fuel recovery system.

It is also the present practice to employ flow meters in the fuel supply lines or dip sticks in the tanks to indicate the volume of gasoline pumped into the tanks, but these meters and other methods are not foolproof in that the capacities of the tanks are different. Moreover, the tanks may not be completely empty at the time that the trucks stop in at the bulk station for refilling.

Therefore, the gasoline will sometimes overflow the tank, thus creating not only a fire hazard but also contributing to contamination of the atmosphere. Of course, with the dip stick method, the operator periodically peeks into the tank to attempt to see how the filling operation is progressing, and this results in splashing of the fuel and

also entails the possibility of inadvertent overfilling and overflow.

Accordingly, as aforesaid, the object of this invention is to provide an automatic and foolproof level control device which automatically shuts off the fuel delivery when the fuel in the tank reaches a predetermined level.

The filling nozzles at the bulk service stations are usually equipped with so-called "dead man" valves which automatically shut off the delivery of fuel should the operator release his grip on the valve opening lever. It is to be understood though not illustrated herein, that such "dead man" valves will be used in conjunction with the valves constituting the present invention.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention then comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative however, of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawings:

Fig. 1 is a central vertical cross-section view of one embodiment of the present invention which is in the form of a valve disconnect coupling assembly, one coupling member of which is mounted within the filling opening of the truck tank and the other coupling member of which is mounted at the end of a fuel delivery nozzle;

Fig. 2 is a side elevation view of the tank coupling member which is adapted to be mounted in the tank filling opening;

Fig. 2A is a fragmentary sectional view illustrating the details of the pilot valve assembly shown in Fig. 2;

Fig. 3 is a top plan view of said tank coupling member;

Fig. 4 is a top plan view of the supply line coupling member as viewed from the top of Fig. 1;

Fig. 5 is a fragmentary vertical cross-section view of the tank coupling member showing the normal position of the parts therein prior to and after the filling operation;

Fig. 6 is a partial vertical cross-section view of another embodiment of this invention, the automatic tank filling valve being self-contained for mounting at the end of the fuel supply line without entailing any consequential alteration of the conventional tank filling opening structure;

Fig. 7 is a detail cross-section on line 7—7, Fig. 6;

Fig. 8 is a partial central vertical cross-section view of yet another embodiment of this invention wherein complementary coupling members are parts of the truck tank and bulk service station equipment; and

Fig. 9 is a cross-section view taken substantially along the line 9—9, Fig. 8.

Referring now in detail to the drawings, and first to the form of the invention illustrated in Figs. 1–5 inclusive, the letter T designates the truck tank, only the top wall of which is shown herein. Said tank T is formed with an opening in the top wall thereof having a ring 1 welded or otherwise secured therein, said ring 1 having secured thereto the dome assembly 2 which hingedly carries a closure lid 3 on hinge pin 4. As is the well known practice, a suitable latch mechanism (not shown) will be provided on said lid 3 and on said tank T for locking the lid in closed position. A packing ring 5 disposed in a groove of the dome assembly ring 6 prevents leakage of gasoline and fumes from within the tank T when lid 3 is in closed position. Said lid 3 may be equipped with what may be termed a sniffle valve which, in effect comprises a pair of oppositely disposed check valves, one of

which permits air to enter the tank in the event of contraction of the contents, and the other of which permits escape of fumes due to expansion of the contents of the tank. Such sniffle valve and other details of the structure of the lid 3 are so well known in the art as not to require illustration herein.

In the present case, said dome assembly 2 is mounted in place by clamps 7 which are slidable on the downwardly extending studs 8 of the dome assembly ring 6, said clamps 7 being drawn upward as by the means of the nuts 9 on the studs 8 to thus draw said ring 6 tightly against the gasket 10 which is interposed between the top edge of ring 1 and said ring 6.

In the Figs. 1–5 embodiment of the present automatic tank filling device, the same is in the form of a valved disconnect coupling, the tank coupling member 11 of which is mounted in the tank filling opening as by means of radially projecting screws 12, the outer ends of which extend into holes formed in the ring 6 of the dome assembly 2.

The joint between said tank coupling member 11, and the dome assembly ring 6 is sealed as by means of the O-ring 14, or equivalent packing ring.

The upper portion of said tank coupling member 11, is formed with a recess, the peripheral wall of which is undercut and axially slotted at 15 and 16 (see Figs. 3 and 5) to provide a bayonet-type connection with radially projecting lugs 17 of the fuel supply coupling member 18. At the bottom of the recess there is a seat plate 19 formed with a series of arcuate slots 20 therethrough which communicate with the interior of the tank T when the annular vent valve 21 is moved downwardly from the position shown in Fig. 5 to the position shown in Fig. 1. Said vent valve 21 has with a plurality of pins 23 which project upwardly through solts 20 and by which said valve 21 is moved downwardly as explained hereinafter. Said valve 21 is normally held in closed position as by means of the springs 24 which are compressed between said tank coupling member 11 and said valve 21.

Said tank coupling member 11 has a downwardly depending tubular body portion 25 to the lower end of which a pipe is adapted to be connected so that incoming fuel will be discharged near the bottom of the tank T.

Mounted in said body portion 25 is a diaphragm-type, pilot-operated valve assembly 26 which has a pressure chamber 27 therein, the pressure in such chamber reacting against the rubber-faced diaphragm valve member 28 to urge the latter upwardly against the annular valve seat 29. Spring 30 also urges valve member 28 upwardly.

Leading into the chamber 27 through port 27′ is one end of a tube 31 connected to boss 31′ (see Figs. 1 and 2), the other end of said tube leading to the inlet side of a pilot valve assembly 32. Said pilot valve assembly 32 in turn has its outlet side leading into the tank T and the pilot valve member 34, having a conoidal nose 34′ seating on port 34″ in communication with tube 31, is lifted to open position by swinging downwardly of the float 35 about pivot 33 and is moved downwardly to closed position by upward swinging of said float 35.

When the tank T is empty, the pilot valve 32 will, of course, be open whereby, upon application of fuel pressure on the top side of the main valve member 28, said valve member will be moved downwardly to open position by reason of the pressure drop in the chamber 27 caused by escape of fluid through the open pilot valve 32 more rapidly than it can be replenished through the annular main valve orifice 36. When said main valve member 28 is thus opened, fluid flows between it and the seat 29 and between the posts 37 of the diaphragm clamping ring 38 and thence downwardly around the valve assembly 26 and through the passage 39 into the tank T.

Now, when the level of fluid in the tank T rises sufficiently to swing the float 35 upwardly so as to move pilot valve member 34 down to close the pilot valve 32, the pressure of the fluid acting on opposite sides of the main valve member 28 equalizes, whereby the area differential and the force of spring 30 effects upward closing movement of said main valve member 28 to cut off the supply of further fluid into the tank T at this time.

In the structure thus far described the escape of fumes from within the tank T is prevented (even when the dome lid 3 is open) by reason of the closing of the main valve member 28, and vent valve member 21. However, should the pressure of the fumes build up in the tank T due to thermal expansion of the contents, for example, the main valve member 28 will be unseated by pressure acting downwardly on the area of member 28 surrounding seat 29 and, conversely, if there is a negative pressure in the tank T due, for example, to thermal contraction of the contents, the vent valve 21 will be drawn downwardly to open position. As aforesaid, when the dome lid 3 is closed, it additionally prevents the free escape of fumes except as due to excess pressure in the tank T, and it also relieves negative pressure in the tank T with respect to normal atmospheric pressure.

Now, having described in detail the tank coupling member 11 which is adapted to be mounted in the tank T, reference is now made to the top or supply line coupling member 18 which has its upper end connected at the end of a fuel supply line 45, and adjacent the usual dead man valve (not shown) mounted in said supply line. As previously mentioned the so-called dead man valve usually comprises a lever-actuated valve which automatically shuts off should the operator release his grip on the actuating lever thereof.

The lower end of the supply line coupling member 18 has a ring 46 rotatably mounted thereon as by means of the screws 47 in the body of member 18 having their heads disposed in an annular groove 48 inside said ring 46. As evident, the screws 47 may be installed one by one through an opening (not shown) which leads radially from the exterior of said ring 46 to the groove 48.

Said ring 46 is provided with a plurality of radially projecting lugs 17, herein three lugs being provided, said lugs 17 being complementary with the axially extending slots 16 in the tank coupling member 11 so that said supply line coupling member may be lowered into the upper end of said tank coupling member 11. Said ring 46 is locked in place by rotating the same, as by kicking one of the several levers 50 connected to said ring to engage said lugs 17 in undercut 15. The top surfaces of said lugs 17 and the surfaces of the circumferentially extending undercut 15 with which the lugs are engaged are so formed as to produce a wedging action for tightly locking the coupling members 11 and 18 together.

Said supply line coupling member 18 has a central fuel supply passage 51 and a surrounding annular passage 52 the latter including a safety relief valve 53 for release of puffs or surges of fumes which cannot be handled by the fume recovery device adapted to be connected to the elbow outlet 54 of the annular passage.

The bottom end of said supply line coupling 18 carries a pair of concentric sealing rings 56 and 57 whereby, when the coupling members 11 and 18 are joined together as shown in Fig. 1, with the filling and vent passages 51 and 52 in register with bore 58 and arcuate slots 20 respectively, these passages are isolated from each other and external leakage is prevented. The lower end of the supply line coupling 18 is arranged to engage the upwardly projecting pins 23 of the vent valve 21 so as to open the latter as the supply line coupling member 18 is lowered into place. Accordingly, any fumes in the tank T will flow out through the vent passages 20 and 52 and elbow 54 as represented by the arrows in Fig. 1.

When the tank T is empty or the level of fuel therein is below the desired full level, the pilot valve 34 is open and, therefore, when the operator opens the dead man valve, the pressure of the fuel in the inlet passage 51—58 acts

on the top exposed side of the main valve member 28 to open the latter. Such opening of the main valve 26 is made possible by the fact that the pressure seating chamber 27 thereof is vented through the pilot valve 34 more rapidly than fluid pressure can build up in the chamber 27 by way of the orifice 36. Accordingly, the filling of the tank T progresses until the float 35 rises to close the pilot valve 34, and at this time, the escape of fluid from the pressure seating chamber 27 of the main valve 26 is prevented, whereby the pressure equalizes in the filling passage 51—58 and in the pressure seating chamber 27 through the orifice 36. Thus, pressure of spring 30 and the fluid pressure in the chamber 27 acting on the larger area of the underside of the main valve member 28 urges the latter to closed position irrespective of whether or not the fuel is under pressure in the filling passage 51—58. When this closing of the main valve 26 occurs, the operator closes the dead man valve. He then swings the lever 60 by hand or by foot so as to move the rod 61 down, and this permits draining of the pressure seating chamber 27 by the resulting unseating of the valve 62 and then the rod 63 engages the main valve member 28 to force the same downwardly to open position whereby the one-half gallon or so of fuel trapped above the main valve member 28 is allowed to drain into the tank T. The release of the lever 60 then permits the main valve member 28 and valve 62 to close.

Finally, the operator kicks or moves by hand the levers 50 to rotatably unlock the coupling members 11 and 18 so that the supply line coupling member 18 may be lifted and thus disconnected from the tank coupling member 11. The springs 24 of the vent valve 21 urge the latter upwardly to closed position to prevent escape of fumes from within the tank T. The dome lid 3 may then be closed and latched in the customary manner.

In the Fig. 6 embodiment of the invention, the automatic tank filling valve is made up as a unitary assembly 70 adapted to be attached to the fuel supply line 45 at the bulk service station without requiring any special equipment in the filling opening of the truck tank T.

The Figure 6 assembly is substantially the same as that illustrated in Figs. 1–5 insofar as the construction and operation of the main valve 26, the float controlled pilot valve 32, and the manual operation of the main valve 26 for draining is concerned. When the Fig. 6 structure is used, fumes escape from the tank T only in the interval between the opening of the dome lid 3 and the insertion of the filling valve assembly 70 and between the removal of the filling valve assembly 70 and the closing of said lid 3. This fume loss, of course, is considerably less than presently encountered when the fumes are allowed to vent into the atmosphere during the entire filling operation.

The Fig. 6 unit 70 is locked and sealed in the dome lid assembly 2 by means of a sealing ring 71 which is carried by unit 70 and which fits within the filling opening 72 of the dome lid assembly plate 6. Said sealing ring 71 is adapted to be axially deformed so as to expand radially into fluid-tight and frictional engagement with the wall of the opening 72. Axial compression or deformation of the sealing ring 71 is effected as by means of a ring 73 which is moved upwardly through cranks 74, links or cables 75, and links 76 which are actuated as by means of levers or, preferably, a tilt bale 78 on one side of which the operator may step to turn the cranks 74 and through links 75 and 76 and springs 79 raise the ring 73 and on the other side of which he may step when it is desired to move the ring 73 down under the expansive influence of the sealing ring 71 to release the frictional grip between said sealing ring 73 and the surrounding wall of opening 72 in the dome lid assembly 2. See Fig. 7 for additional details of crank 74, link 75, and link 76. It is preferred to arrange the links 75 and 76 so that when cranks 74 are turned the pivots 80 move past dead center whereby springs 79 are effective to yieldably hold the ring 73 in its upper position.

In asmuch as the operation of the Fig. 6 embodiment is generally the same as that of Figs. 1–5, repetition is not necessary.

The structure illustrated in Figs. 8 and 9 is like that of Figs. 1–5 in that the Figs. 8 and 9 assembly is a disconnect coupling assembly including a tank mounted coupling member 85 and a supply line mounted coupling member 86 which are locked together separably as by means of a bayonet-type lug 87 and slot 88 connection. The Figs. 8 and 9 construction omits the separate vent valve 21 and in this case the sealing rings 89 and 90 for joining together the registering filling and vent passages 91–92 and 93–94 in fluid tight relation are axially offset with respect to each other so that, after the filling operation has been completed and the main valve 26 has closed a slight raising of the supply line coupling member 86 allows the trapped fuel in the portion of the filling passage 91 above the main valve 26 to drain into the tank T by way of openings 95. Of course, if desired, manual operation of the main valve 26 for draining may be effected by rod 61 and 63 as previously described in connection with Figs. 1–5.

As best shown in Fig. 9 the lugs 87 and slots 88 are formed so that when the coupling member 86 is turned (after the filling operation has been completed) it is first raised by cam surfaces 96 to permit draining of passage 91 between sealing ring 89 and coupling member 85 and into tank T through openings 95. Thereafter, the lugs 87 register with the axial portions of slots 88 whereupon the coupling member 86 may be disconnected from coupling member 85.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

We, therefore, particularly point out and distinctly claim as our invention:

1. A tank filling and venting device comprising a body provided with sealing means adapted to be engaged in fluid-tight relation within a tank-filling opening, said body being formed with separate filling and vent passages through which the tank is filled and vented respectively, such vent passage terminating at one end in means adapting such passage for connection with a fuel recovery system, a normally closed fluid pressure operated valve in said filling passage, means responsive to the pressure of the fluid with which it is desired to fill the tank operative to open said normally closed fluid pressure operating valve, and a fluid level responsive means carried by said body and effective to build up a counter fluid pressure acting on said valve for closing said valve upon predetermined filling of the tank.

2. A tank filling and venting device comprising a body provided with a sealing means adapted to be engaged in fluid-tight relation within a tank filling opening, said body being formed with separate filling and vent passages through which the tank is filled and vented respectively, a normally closed fluid pressure operated valve in said filling passage, means responsive to the pressure of the fluid with which it is desired to fill the tank operative to open said normally closed fluid pressure operating valve, and a fluid level responsive means carried by said body and effective to build up a counter fluid pressure acting on said valve for closing said valve upon predetermined filling of the tank, and means for selectively opening and closing communication between the tank and the portion of the filling passage which is closed off as a result of operation of said valve by said fluid level responsive means.

3. A tank filling and venting device comprising a body provided with sealing means adapted to be engaged in fluid-tight relation within a tank-filling opening, said

body being formed with separate filling and vent passages through which the tank is filled and vented respectively, a normally closed fluid pressure operated valve in said filling passage adapted to be opened under the influence of the pressure of the fluid with which it is desired to fill the tank, and a fluid level responsive means carried by said body and effective to close said valve upon predetermined filling of the tank, said valve being of the pilot-operated type including a pressure seating chamber therebehind and a pilot valve which first vents said pressure seating chamber whereby fluid pressure opens said fluid pressure operated valve and then closes said seating chamber whereby fluid pressure builds up therein to assist in closing said fluid pressure operated valve, said fluid level responsive means including a float which is operatively connected with said pilot valve to close the latter upon predetermined filling of the tank.

4. In a disconnect coupling assembly, the combination of first and second coupling members respectively provided with means for connecting the same to a tank opening and to a fluid pressure supply source, means for separably joining together said members, said members being provided with filling and vent passages which are in registry when said members are thus joined together and through which the tank is filled and vented respectively, such vent passage terminating at one end in means adapting such pasage for connection with a fuel recovery system, a normally closed fluid pressure operated valve in the filling passage of said first coupling member, means responsive to the fluid pressure in the filling passage of said second coupling member operative to open said valve, and fluid level responsive means carried by said first coupling member effective to close said valve upon predetermined filling of the tank.

5. In a disconnect coupling assembly, the combination of first and second coupling members respectively provided with means for connecting the same to a tank opening and to a fluid pressure supply source, means for separably joining together said members, said members being provided with filling and vent passages which are in registry when said members are thus joined together and through which the tank is filled and vented respectively, such vent passage terminating at one end in means adapting such passage for connection with a fuel recovery system, a normally closed fluid pressure operated valve in the filling passage of said first coupling member, means responsive to the fluid pressure in the filling passage of said second coupling member operative to open said valve, fluid level responsive means carried by said first coupling member effective to close said valve upon predetermined filling of the tank, and a valve-operating member carried by said second coupling member for opening said valve when it is desired to drain fluid from said second coupling member into the tank prior to disjoining of said coupling members.

6. In a disconnect coupling assembly, the combination of first and second coupling members respectively adapted to be connected to a tank opening and to a fluid pressure supply source, means for separably joining together said members, said member being provided with filling and vent passages which are in registry when said members are thus joined together and through which the tank is filled and vented respectively, a fluid pressure operated valve in the filling passage of said first coupling member adapted to be opened by fluid pressure in the filling passage of said second coupling member, fluid level responsive means carried by said first coupling member effective to close said valve upon predetermined filling of the tank, a normally closed vent valve in the vent passage of said first coupling member, and means on said second coupling member operative to open said vent valve upon joining together of said coupling members.

7. In a disconnect coupling assembly of which one coupling member is adapted for installation in the filling opening of a tank and another coupling member is adapted to be installed at the end of a fluid pressure supply line, said one coupling member comprising a body formed with first and second passages respectively leading into the tank for flow of fluid into the tank and for venting the tank during filling thereof, a movable pressure-actuated valve in said first passage designed to be opened by fluid under pressure during filling of the tank and to be closed responsive to predetermined filling of the tank, and means for closing said second passage, except during filling of the tank.

8. In a disconnect coupling assembly of which one coupling member is adapted for installation in the filling opening of a tank and another coupling member is adapted to be installed at the end of a fluid pressure supply line, said one coupling member comprising a body formed with first and second passages respectively leading into the tank for flow of fluid into the tank for venting the tank during filling thereof, a movable pressure-actuated valve in said first passage designed to be opened by fluid under pressure during filling of the tank and to be closed responsive to predetermined filling of the tank, a vent valve in said body normally closing said second passage, except during filling of the tank, and vent valve-actuating means carried by said another coupling member effective to move said vent valve to open position when said coupling members are joined together, said another coupling member having separate passages respectively registering with said first and second passages and which are adapted to be communicated respectively with a fluid supply source and with a gas handling device.

9. The assembly of claim 8 wherein there are means for joining together said coupling members in fluid-tight relation to prevent leakage of fluid and gases adapted to flow in the respective registering passages of said coupling members.

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