SINGLE POINT FUELING AND DEFUELING SYSTEM

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Application December 28, 1950, Serial No. 203,047

7 Claims. (Cl. 158—36.5)

The invention relates to a novel fueling and defueling system for two or more tanks.

An object of the invention is to provide a fueling system for two or more tanks wherein the tanks may be simultaneously filled from a single point and the fuel of one tank stopped when filled to a predetermined level without disturbing the filling of the others.

A further object of the invention is to provide a system of fueling one or more tanks which can be readily used for transferring fuel from one tank to another or in defueling all of the tanks through the main conduit.

Still further object of the invention is to provide a fueling and defueling system of the above type wherein the conduits for fueling and defueling are entirely separate from the fuel lines leading to the place of use.

Another object of the invention is to provide a system of the above type for fueling and defueling wherein the main conduit is disposed above all the tanks with a branch conduit extending into each tank so that fuel may either be drawn from the bottom thereof and with a branch conduit disposed outside of the tanks and extending downwardly to a point below the three tanks. Attached to the lower end of this branch pipe 14 is a valve housing 15 connected to a suitable supply of fuel which is supported by the spider for longitudinal reciprocation thereof. Mounted on this valve stem is a valve 18 which is adapted to engage a valve seat 20 surrounding an opening in the valve housing. The purpose of this valve 19 is to close the opening through which fuel may pass into the housing or out of the housing and in particular to prevent fuel from passing out of the valve housing when the nozzle is disconnected from the system. A spring 21 normally seats the valve.

The housing has a depending sleeve 22 to which a nozzle 23 may be attached. The attachment of the nozzle to the sleeve is accomplished by an outer rotatable sleeve 24. The sleeve 24 is manipulated by means of handles 25. Within this nozzle 23 is a spider 26 and a valve 27 which is supported by the spider for longitudinal reciprocation thereof. The valve stem 27 has an extension 29 and a sleeve 30 carrying a rack bar 31 mounted on the extension which is a spring 32 mounted on this extension which spring bears at its lower end on a nut 33 fixed to the extension and at its upper end against a pinion 34 on the shaft 35 meshes with the rack member 31. A crank handle 36 on the outer end of the shaft 35 is adapted to be manually turned for moving the valve 27 away from its valve seat, thus opening the nozzle for the flow of fluid therethrough. This movement of the valve 27 causes the valve 19 to be raised and provides an opening for fuel flow into the housing 41. The housing 41 is provided with a float valve 42. There is a check valve 43 pivoted at 44 in the coupling which is adapted to close the port 39 and prevent the flow of fluid downwardly through the port 39 to the lower section 11b of the conduit 11. The lower end of this section 11b is a float control valve 45 which is pivoted at 46 to lugs 47—47 carried at the lower end of the conduit extension 11a. Connected to this valve 45 is a rod 48 carrying a float ball 49. When the tank A contains fuel to a point above the swing of the float ball 49 the valve 45 will be retained in open position. This permits fuel to be drawn from the tank to A through the bottom until the float ball 49 drops and closes the valve 45. By this arrangement a small portion of the fuel in the tank will be retained when defueling and will prevent the drawing of fuel from the pipe leading to the places of use.

In Figure 1 there is a pipe 50 which leads to the place of use which, of course, has the power equipment when the tanks are employed in an aircraft. That portion of the pipe that is, when drawing the fuel from the tank through the extension 11a, the valve 43 moves to open position 46 and the valve 51 moves to closed position. On the other hand, when supplying the tank with fuel the valve 43 will close and the valve 45 will open to allow the fuel to flow into the float valve housing 42. This float valve housing 42 is shown more in detail in Figures 6 and 7 of the drawings. The housing has an opening 52 surrounded by a valve seat 53. A
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Valve 54 is adapted to engage the valve seat 53. This valve is carried by the diaphragm 55 carried by the valve housing. A spring 56 normally presses the valve against this seat. There is a restricted opening 57 through the valve stem and there are openings 58 beneath the diaphragm so that when the valve is open fuel will flow into the housing beneath the diaphragm and out through the openings 56 into the tank. The fuel will also flow through the restricted opening 57 into the chamber 59 above the diaphragm.

The valve housing 42 is divided into two chambers by means of a partition wall 60. Extending through this passage is a valve stem 61 and a valve seat 62 extending through this passage and carrying a valve 63. When the valve is in raised position the passage will be closed and when the valve drops into the passage the valve will be opened and will connect the chamber 59 with the valve housing above the partition. There are openings 64 in the wall of the valve housing above the partition. These openings lead to the tank. There is a float 65 pivoted at 66 which is connected to the upper end of the valve stem 62. When the tank is filled with fuel it enters these openings 64 into the valve housing and will lift the float to the position shown in Figures 1, 6 and 7. Figure 1 closes this passage and when the passage is closed then the chamber 59 is a closed chamber and the pressure of the fluid passing through the restricted opening will cause these passages to close and prevent further flow of fuel passing into the tank.

The float control valve in tank B for cutting off the supply when the predetermined level in tank B is exactly the same as the float control valve shown in connection with tank A and which has been described in detail above, and like numerals in general have been applied to this float control valve and housing.

The float control housing in tank C is likewise similar in connection to the float control housing and valve arrangement in tank A and like numerals have been generally applied thereto. All three of the tanks shown in Figure 1 may be fueled at the same time and the supply of fuel to each tank will be cut off when the tank reaches a predetermined level. This will be accomplished for any one of the tanks without disturbing the fuel supplied to the others.

Associated with the tank A is a vent pipe 67. This vent pipe 67 is connected to a branch 68 which is open to the atmosphere.

Tank B has a similar vent pipe 76 which is connected to the same branch pipe 68. The conduit 13 leading to the tank B has a coupling 37 therein containing check valves which are exactly the same as those shown and described in connection with Figures 1 and 2.

Conduit 13 has an extension 13 which is a float control valve similar in construction to the float control valve shown in connection with the tank A and shown in detail in Figure 4 and like numerals have been applied to this float valve. There is a fuel pipe 50 leading from the tank B to the pipe 52 so that fuel may be drawn from this tank B through the pipe 50 for use by the power equipment.

The branch conduit 12 leading to the storage tank C includes a coupling 37 similar in construction to that shown in Figure 5. This branch conduit 12 also has an extension 12 leading to the bottom of the tank and a float control valve 45 also similar in construction to the tank A and B and the float control valve thereon and like numerals have in general been applied thereto.

In this storage tank C there is a housing 42 and in this housing is a float control valve which is similar to the construction to the housing and float control valve shown in Figures 1, 6 and 7 and like numerals have been applied thereto. There is a pipe 77 connected to the tank C through which air or gases may be drawn into the tank under pressure which is provided to transfer the fuel in this tank to the tank A. When these gases under pressure are admitted to the storage tank the fuel will pass through the extension 12, the conduit 11, and the tank A and is closed when desired to transfer the fuel from the storage tank C to the tank A.

From the above description it will be noted that all fueling and defueling conduits are through the top of the fuel tank and are drawn through a pressure regulating valve and is through piping which is completely separated from the regular fuel system piping. By this arrangement there are no connections or openings added to the sides of the tank, the bottom is never under pressure except when fueling and can be drained after fueling by connecting a draining nozzle to the branch conduit 14. Draining of the conduits and the tanks may be accomplished by siphoning or by suction of a defueling pump connected to the nozzle 23.
It is obvious that many changes in details of construction and the arrangements illustrated may be made without departing from the spirit of the invention as set forth in the appended claims.

1. In a fueling system, two or more tanks, a main conduit having a valve controlled opening through which the tanks may be filled or drained, a branch conduit extending into each tank and connecting each tank to the main conduit, a filling extension connected within each tank to each branch conduit and extending to a point adjacent the top of the tank, a float operated valve within each tank and associated with the filling extension for closing the same when fuel in the respective tank reaches a predetermined level, a defueling extension connected within each tank to each branch conduit and leading from said branch conduit to a point adjacent the bottom of the respective tank, and a check valve in said defueling extension for closing the same while the tanks are being filled.

2. In a fueling system, two or more tanks, a main conduit having a valve controlled opening through which the tanks may be filled or drained, a branch conduit extending into each tank and connecting each tank to the main conduit, a filling extension connected within each tank to each branch conduit and extending to a point adjacent the top of the tank, a float operated valve within each tank and associated with the filling extension for closing the same when fuel in the respective tank reaches a predetermined level, a defueling extension connected within each tank to each branch conduit and leading from said branch conduit to a point adjacent the bottom of the respective tank, a check valve in said defueling extension for closing the same while the tanks are being filled, and another check valve in said filling extension for closing the same when the tank is being drained.

3. In a fueling system, two or more tanks, a main conduit having a valve controlled opening through which the tanks may be filled or drained, a branch conduit extending into each tank and connecting each tank to the main conduit, a filling extension connected within each tank to said branch conduit and extending to a point adjacent the top of the tank, a float operated valve within each tank and associated with the filling extension for closing the same when fuel in the respective tank reaches a predetermined level, a defueling extension connected within each tank to each branch conduit and leading from each branch conduit to a point adjacent the bottom of the respective tank, a check valve in said defueling extension for closing the same while the tank is being filled, and another check valve in said filling extension at the end of said defueling extension for closing the same when the tank has been drained to a predetermined level.

4. In a fueling system, two or more tanks, a main conduit having a valve controlled opening through which the tanks may be filled or drained, a branch conduit extending into each tank and connecting each tank to the main conduit, a filling extension connected within each tank to each branch conduit and extending to a point adjacent the top of the tank, a float operated valve within each tank and associated with the filling extension for closing the same when fuel in the respective tank reaches a predetermined level, a defueling extension connected within each tank to each branch conduit and leading from said branch conduit to a point adjacent the bottom of the tank, a float operated valve in said defueling extension for closing the same while the tank is being drained, and a check valve in said filling extension for closing the same during defueling.

5. In a fueling system, a main tank and a storage tank, a main conduit having a valve controlled opening through which the tanks may be filled or drained, a branch conduit extending into each tank and connecting each tank to the main conduit, a filling extension connected within each tank to each branch conduit and leading from said branch conduit to the main conduit, a float operated valve within each tank and associated with the respective branch conduit for closing the same when fuel in the respective tank reaches a predetermined level, a defueling extension connected within said storage tank and leading from adjacent the bottom of the storage tank to the branch conduit therein, a third branch conduit connecting the main tank with the main conduit, a second float operated valve in the main tank and associated with the third branch conduit for closing the same when fuel in the tank reaches a predetermined level, and means for admitting air under pressure to the storage tank whereby fuel therein will be forced through the defueling extension, the associated branch conduit, the portion of the main conduit between said storage tank branch conduit and said third conduit, and through the third branch conduit to the main tank.

6. In a fueling system, a main tank and a storage tank, a main conduit having a valve controlled opening through which the tanks may be filled or drained, a branch conduit extending into each tank and connecting said tank to the main conduit, a float operated valve within each tank and associated with the respective branch conduit for closing the same when fuel in the respective tank reaches a predetermined level, a defueling extension within said storage tank and leading from adjacent the bottom of the storage tank to the respective branch conduit, a filling extension connecting the main tank with the main conduit, a second float operated valve in the main tank and associated with the third branch conduit for closing the same when liquid in the tank reaches a predetermined level, and means for admitting air under pressure to the storage tank whereby fuel therein will be forced through the defueling extension, the associated branch conduit, the portion of the main conduit between said storage tank branch conduit and the third conduit, and through the third branch conduit to the main tank, a check valve in the main conduit between the third branch conduit and the fueling conduit in the main tank, a bypass conduit connecting the main conduit on opposite sides of the check valve, and a valve in said bypass conduit for opening and closing the same whereby said storage tank can be defueled through the bypass conduit and the valve controlled opening.

7. In a fueling system, a main tank and a storage tank, a main conduit having a valve controlled opening through which the tanks may be filled or drained, a branch conduit extending into each tank and connecting said tank to the main conduit, a float operated valve within each tank and associated with the respective branch conduit for closing the same when fuel in the respective tank reaches a predetermined level, a defueling extension within the storage tank leading from adjacent the bottom of the storage tank to the respective branch conduit, a check valve in said defueling extension for closing the same while the tanks are being filled, conduit means including said defueling extension and the branch conduit associated therewith connecting the storage tank to the main tank, means for admitting air under pressure to the storage tank for forcing fuel therein through said conduit means to the main tank, and a float operated valve within said main tank and associated with said conduit means for closing the same when fuel in the main tank has reached a predetermined level.

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