TWO-PORT VALVE FOR VOLATILE LIQUID CONTAINERS

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1 Claim. (Cl. 62—1)

1. This invention relates to a special valve construction adapted for use with volatile liquid containers. The valve comprises two ports, one adapted for the filling of the liquid container with a liquid, and the other adapted for the venting of vapors of the liquid during filling.

Volatilé liquid containers are used for the storage, or transportation of a wide variety of liquefied gases in the chemical industry. In general it is necessary that the container be sufficiently strong to withstand the pressure of the volatile liquid contained and to provide suitable safety in the handling of the container. The pressure the container must sustain is of course dependent upon the type of volatile liquid concerned. In general the pressure is sufficiently high, particularly in the storage of such liquids as liquid oxygen, liquid nitrogen, or liquid hydrocarbons, that extremely strong construction of the container is necessary and furthermore strong piping connections are required during filling operations. In filling containers of this type it is necessary to vent vapors of the liquid, which form as the container is filled, and to maintain a proper filling height. This may be accomplished by any suitable piping connections. It has been conventionally done by building a “Christmas Tree” of pipe nipples and valves to permit the simultaneous venting of the containers during filling. Such an expedient is disadvantageous for various reasons. First, the necessary piping connections are complicated enough so that a rather bulky, difficult to install, assembly of piping results. Secondly, use of ordinary piping and valves to vent and fill a high pressure container is disadvantageous from a safety view point. Even though extremely heavy pipe is used, the process of cutting threads on the pipe weakens the pipe sufficiently so that due to the length of the assembly of piping a nipple may be easily broken.

It is the object of the present invention to overcome the above-mentioned disadvantages in the provision of a special type of valve for the filling and venting of volatile liquid containers. In accordance with the present invention an integral two port valve is employed, having one valve positioned in a line flowing direct from the liquid container to an external pipe connection for filling purposes and having the other valve positioned in a venting line connected to the vapor space of the container. The container is being equipped with a capillary tube, the length of which governs the filling height.

The special valve of our invention is so constructed that it may be exceedingly compact, being as small as 3 x 3 inches.

A further advantage of the valve of this invention is that extremely strong construction can be employed so that use of the valve in no way constitutes a safety hazard.

A special feature of this valve eliminates the possibility of overfilling a volatile liquid container.

A further advantage of this valve is that the connection to the source is in line with the cylinder being filled.

Other objects and advantages of this invention will be appreciated from the following detailed description in connection with the accompanying drawings in which:

Figure 1 indicates a section of the two port valve, taken vertically, through the liquid container and through the valve controlling liquid flow during filling, and in which:

Figure 2 represents a section through line 2—2 indicated in Figure 1, comprising a section through the valve employed in venting volatile vapors during filling.

Referring now to Figure 1, the top portion of a heavy liquid container is indicated by the numeral 3. The special valve of our invention is fixed to the top of the container 3 by means of the standard pipe threads 4. Extending upward from the liquid container is a line 5 within the main body of the valve 6. Line 7 extending through the pipe connection 8 is an offset continuation of line 5. Needle valve 9 is arranged to open or close a passage between lines 5 and 7 permitting flow of liquid through these lines in the open position, and preventing flow in the closed position. The construction of the needle valve 9 is conventional, opening and closing of the valve being achieved by the rotation of the handle with the consequent movement of the valve due to the interaction of the threads 10 on the stem 9, and the threads 11 in the bonnet of the valve.

Suitable packing 12 in conjunction with packing gland 13 is employed to seal the valve stem against leakage of liquid. The standard pipe thread 4 employed to connect the valve to the container may be % inch or % inch threading, or may be any other type of thread employed on liquid containers. The pipe thread 6, to which is connected the external fitting connections required, may be of any desired diameter.

Also extending upwardly from the container is a line 14 positioned within the body of the valve and running midway up the body. Positioned at right angles to the main body of the valve and
adapted to close the line 14 is a valve 15 shown in Figure 2. Valve 16 is a needle valve similar to valve 9 in all respects. Opening of valve 16 permits flow of vapor from the container 3, through the line 14 and through the vent line 18 which may terminate in a standard pipe thread 17 adapted for the connection of pipe fittings to recover the vented vapors. In line 14 immediately above the vapor space of the container 3 is an enlarged recess 18. This is adapted to receive a capillary tubing 19 extending downwardly into the container. Capillary tubing 19 may be 1/4 inch tubing for example; it may conveniently be sweated into the recess 18. The capillary extends downward into the container to the point at which it is desired to fill the container with liquid. Consequently, when valve 9 and valve 15 are open for filling, when sufficient liquid has entered the container through lines 17 and 5 to reach the level 20, the capillary tubing 19 will be sealed preventing overfilling of the container.

As described the valve of this invention comprises an integral construction of a double port, double valve system. One valve is adapted to control the venting of vapor from the vapor space of a liquid container during filling, while the other valve is adapted to permit the flow of liquid into the container. It is important that, as shown, the liquid control valve be positioned in line with the container.

Having now fully described this invention, what is claimed is:

In combination with a receiver vessel adapted to contain liquefied volatile materials, and having a threaded orifice at one end, a closure for said orifice, comprising a solid body member, a threaded orifice closure element integral and concentric with the member, adapted for fluid and pressure tight engagement with said vessel orifice, a threaded longitudinal nipple integral and concentric with the other end of said member, adapted for fluid and pressure tight engagement with filling or evacuating means for said vessel, a threaded lateral nipple integral with the body member at an intermediate point on a side wall portion thereof, in angular relationship thereto, adapted for fluid and pressure tight connection to venting means for the vessel, a pair of passageways extending longitudinally of said body member, one opening inwardly through said orifice closure element, and the other inwardly through said longitudinal nipple, each passageway terminating within the body member in spaced, parallel, overlapping relationship one to another, a second pair of passageways in said body member, of which one opens inwardly through said lateral nipple, and the other inwardly through said orifice closure element, each of said passageways terminating within the body member in spaced, parallel, overlapping, angular relationship one to another, a capillary dip-tube element rigidly secured in the end of the latter passageway opening through the said orifice element, extending from said element into the interior of said vessel, a valve port connecting the terminal ends of each pair of passageways within said closure member and needle valve elements carried by said body member for each of the valve ports.

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