A valve device mounted in an opening provided in the wall of a pressurized container comprises an outer cup-shaped member made of a resilient plastic and an inner cup-shaped member made of a rigid material and mounted as a force fit in the outer cup-shaped member. The outer cup-shaped member has a perforated bottom which carries an upwardly extending axial portion adapted to form the closure member of the device. Under the action of the resiliency of the outer cup-shaped member this closure member is engaged in gas-tight contact into a tubular seat portion carried by the bottom of the inner cup-shaped member. This seat portion has a perforatable upper wall adapted to be perforated by the needle of a gas-intake head. The needle depresses the closure member and thus opens the valve device. If the gas-intake head is accidentally removed, the closure member returns to the closed position and prevents any gas exhaust from the container.

2 Claims, 14 Drawing Figures
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VALVE DEVICES FOR PRESSURIZED CONTAINERS

DISCLOSURE OF INVENTION

This invention relates to a valve device for pressurized containers.

Such containers, and more particularly those filled with liquefied butane or propane, are frequently considered as non-returnable packings. Their manufacturing cost should therefore be as low as possible. They are often realized for this purpose in the form of so-called "cartridges" comprising a wall portion adapted to be perforated by the needle of a gas-intake head applied in gas-tight contact around the perforated zone.

This quite simple and inexpensive arrangement has the disadvantage that if the gas-intake head is disengaged from the cartridge before the latter is exhausted, the gas from the cartridge flows freely into the ambient atmosphere, which of course entails a risk of fire or explosion. This may be prevented by providing the cartridge with a valve adapted to be pushed to the open position by the gas-intake head against resilient means which return the valve to the closed position if the gas-intake head is removed. But such combined devices of a perforatable wall and of a spring-pressed valve are somewhat intricate and relatively expensive.

Similar problems arise for other kinds of containers, as for instance those for aerosols.

It is an object of the present invention to provide a valve device for pressurized containers which will be quite simple in construction and of quite reduced manufacturing cost, while ensuring a perfectly gas-tight closure.

Another object of the invention is to provide for such containers a valve device combined with a perforatable diaphragm in which the presence of the perforatable diaphragm does no increase the manufacturing price of the device.

Still a further object of the invention is to provide a valve device, with or without a perforatable diaphragm, for liquefied gas containers, which may be mounted on the empty container by means of a head adapted at the same time to fill the container at a normal filling rate in spite of the small section of the passage provided in the said valve device for the passage of the gas during normal use of the container.

In accordance with the present invention a valve device adapted to be mounted in an opening of a wall of a pressurized container, comprises an outer cup-shaped member made of a resilient plastic material the said outer cup having a lateral wall adapted to be mounted in the said opening and a perforated bottom in one with an upwardly extending axial portion, and an inner cup-shaped member made of a substantially rigid material, the said inner cup-shaped member being engaged into the outer cup-shaped member in such manner as to expand the latter in gas-tight contact against the edge of the opening of the container, and including itself an axial seat portion into which the extending axial portion of the outer cup-shaped member is engaged in gas-tight contact under the action of the resiliency of the said outer cup-shaped member so as to form the movable closure member of the valve device.

In the accompanying drawings:

FIG. 1 is an axial section of a first embodiment of a valve device according to the invention mounted on a pressurized container.

FIG. 2 is a side view of the outer cup-shaped member of the device.

FIG. 3 is an axial section thereof.

FIG. 4 is a plan view thereof with parts in section along line IV—IV of FIG. 3. In this FIG. 4 line III—III corresponds to the section shown in FIG. 3.

FIG. 5 is an axial section to a smaller scale showing the valve device of FIG. 1 after its perforatable diaphragm has received the action of the needle of a gas-intake head applied against the container.

FIG. 6 is an axial section showing the parts of the valve device of FIG. 1 at the beginning of the mounting operation of the device on the container.

FIGS. 7, 8 and 9 illustrate three successive steps of the mounting operation.

FIG. 10 is a side view with parts in section showing in superposition the upper wall of a pressurized container and the parts of the valve device adapted to be mounted thereon in accordance with another embodiment of the invention.

FIGS. 11 and 12 illustrate two successive steps of the mounting of this valve device on the container while filling the latter.

FIG. 13 is a diagrammatical section illustrating how the outer cup-shaped member of the device is ruptured when it is attempted to refill the exhausted container with a liquid under pressure.

FIG. 14 illustrates a modification wherein no upper perforatable wall is provided.

In the embodiment of FIGS. 1 to 9 the valve device is mounted on the upper wall 1 of a pressurized container, as for instance on a cartridge for butane or propane under liquefied form, adapted to be considered as a non-returnable packing. This upper wall 1 has a depression including a first inwardly directed cylindrical portion 1a, then a flat portion 1b, and a second inwardly directed cylindrical portion 1c with an open lower end. The flanged edge 2a of a cup-shaped member 2 made of a resilient plastic material rests on the flat portion 1b. This cup-shaped member, which will be thereafter called the outer cup, comprises a lateral wall 2b and a bottom which supports an upwardly directed frusto-conical axial extension 2c adapted to form the closure member of the device as more fully explained below. The flanged edge 2a of the outer cup 2 is covered by the flanged edge 3a of another cup-shaped member or inner cup 3 made of a substantially rigid material such as metal, the lateral wall 3b of this inner cup being engaged as a force fit into the lateral wall 2b of the outer cup. The bottom of the inner cup 3 has a tubular upwardly directed frusto-conical axial boss 3c adapted to form a seat for the above-described closure member 2c. The periphery of the lateral wall 2b of the outer cup 2 has an outer circular rib 2d with a cross-section in the shape of a ratchet tooth, the straight edge of which is intended to snap under the lower edge of the cylindrical portion 1c. In other words, the circular rib 2d and the flanged edge 2a define a circular groove 2e (see FIGS. 2 and 3) in which the cylindrical portion 1c is retained. The wall 2b of the outer cup 2 is formed with perforations 3f (FIGS. 2 to 4) disposed below the circular rib 2d. The bottom of the said outer cup is further provided with four legs 2g the downwardly diverging outer edge of which has a downwardly directed notch 2h. The lower portion of the closure member 2c is hollow and a central depression 2i is provided in its solid upper end.
The cylindrical wall 3b of the inner cup 3 has a rib 3d which protrudes outwardly by the cylindrical portion 1c of the upper wall of the container, in order to expand the lateral wall 2b of the outer cup 2 and thus to retain positively the said portion 1c in the groove 2e. This rib 3d is formed after the inner cup is mounted into the outer cup. The upper end of the tubular boss 3c is closed by a wall portion 3e adapted to form a perforable diaphragm, as explained below. The flanged edge 3a of the inner cup 3 has a downwardly directed peripheral portion 3f intended to form an abutment limiting the compression of the flanged edge 2a of the outer cup during the mounting operation. It will further be noted that before being mounted the inner cup comprises an inner rib or contracted portion 3g (FIG. 6) where the outwardly protruding rib 3d is subsequently to be formed.

The device described thus constitutes a combined unit including a valve and a perforable diaphragm. When the container is filled with a liquefied gas under pressure, this combined unit 2-3 is perfectly gas-tight, the plastic material of the outer cup 2 being compressed by the lateral wall 3b of the inner cup 3 and the cylindrical portion 1c of the upper wall of the container. The closure member 2e is applied against its seat 3c under the action of the resiliency of the outer cup 2. FIG. 3 clearly shows that in the free state this closure member is situated at a substantially higher level than in the unit as mounted on the container.

In use a gas-intake head 4 (FIG. 5) of known type is applied against the upper wall 1 of the container, the said head comprising a thick annular seal 5 mounted in a downwardly urged support 6 by means of which it is applied in gas-tight contact against the flanged edge 3a of the inner cup 3. This head 4 further comprises a flat perforating needle 7 which may be lowered against the diaphragm 3c while being rotated. This needle thus perforates the diaphragm and its lower end acts on the upper end of the closure member 2e which is thus lowered. The gas under pressure of the container may then flow towards the gas-intake head through the perforations 2f and on each side of the flat needle 7.

FIGS. 6 to 9 illustrate a method for mounting the valve and perforable diaphragm unit of FIGS. 1 to 4 on a container and for filling the latter with a liquefied gas such as butane, for instance. An inner cup 3 with the inwardly protruding rib or contraction 3g (FIG. 6) is first partly engaged into an outer cup 2. The lower ends of the legs 2g of the outer cup 2 are then introduced into the opening of the container in such manner that the substantially horizontal upper edge of each notch 2h and against the flat portion 1b in order to retain the unit 2-3 at an axial position above the opening of the container, as shown in FIG. 6.

A filling head is then lowered on the container, this head comprising an outer cylindrical sleeve 8 (FIG. 7) having at its lower end a seal 9 which is applied in gas-tight contact against the upper wall 1 of the container around the depression formed in the said wall. This sleeve is formed with conduits 8a which may be connected either with a vacuum line in order to evacuate the container, or with a reservoir of liquefied gas in order to fill the container, the liquid flowing between the legs 2g.

When the filling operation is completed a tubular pusher 10 (FIGS. 7 and 8) is lowered within the sleeve 8 in order to push downwardly the inner cup 3. The latter is therefore fully engaged into the outer cup 2 and the resilient legs 2g are contracted and are fully introduced into the container as illustrated in FIG. 8. When the pusher 10 has effected its downward stroke, an expanding mandrel 11 (FIGS. 7 to 9) is introduced into the inner cup 3 and it is actuated in order to realize the outer rib 3b as indicated in FIG. 9.

The mounting and filling operation is now terminated and the container may be removed from the machine.

The embodiment illustrated in FIG. 10 dispenses with the legs 2g, which results in a somewhat lower manufacturing cost and in a simplified mounting operation. In this embodiment the inner cup 3 is substantially as in FIGS. 1 to 4. The outer cup 2 has a single perforation 2f for the passage of the gas, this perforation being disposed in the lowermost portion of the lateral wall of the cup. Its cross-sectional area is relatively small in order to limit the gas flow if, for instance, the valve of the gas intake head were opened in the absence of any burner. The lateral wall 2b further comprises a circular row of horizontally elongated openings 2i situated immediately below the outer rib 2d and which are separated from each other by relatively narrow intermediate portions 2k.

The depression of the upper wall 1 of the container remains as in FIGS. 1 to 4 but its central perforation has a sharp lower edge when the container is to be filled, the outer cup 2 is first mounted in position as indicated in FIG. 11. The lower end of the inner sleeve 20 of a filling head 21 is then applied against the flanged edge 2a of the cup. A movable tubular plunger 22 is vertically movable within this sleeve 20. In this tubular plunger is disposed an expanding mandrel formed of a number of fingers actuated by an axial cone 24, each finger having an outer rib 25. An inner cup 3 is pushed upwardly on the mandrel where it is frictionally retained well above the outer cup 2. The head 21 further comprises an outer sleeve 26 slidably mounted on the inner sleeve 22, this outer sleeve being formed with a vacuum conduit 26a and with a filling conduit 26b which open on the inner periphery of the sleeve, their ends cooperating with ports 20a and 20b provided in the inner sleeve. Appropriate seals are inserted between the outer and the inner sleeve.

The outer sleeve 26 is first brought to such a position that the conduit 26a registers with the port 20a (which corresponds to a somewhat higher position than illustrated in FIG. 11). Conduit 26a is then connected with a vacuum line. The outer sleeve is thereafter lowered to the position of FIG. 11 and liquefied gas is introduced into the previously evacuated container through the conduit 26b. The liquid flows down into the outer cup 2 and it passes easily through the openings 2f of large cross-sectional area, without slowing down the filling operation.

When the container is filled up to the required level, the plunger 22 is lowered in order to engage the inner cup 3 as a force fit into the outer cup 2. The mandrel 23 is expanded by the axial cone 24 so as to form the outer rib 3d. This rib in turn expands the lateral wall 2b of the outer cup 2 just below the lower end of the cylindrical portion 1c. The sharp edge 1d which forms this lower end penetrates into the plastic material of the cup and thus realizes a perfectly gas-tight seal in spite of manufacturing tolerances. It will be noted that the filling openings 2f of the outer cup are wholly covered.
and sealed by the portion of the lateral wall of the inner cup 3 situated immediately below the rib 3d.

If after exhaustion of the container some one attempted to refill it with liquefied gas, as for instance by means of a filling tube such as 27 (FIG. 13) applied against the flanged edge 2a of the outer cup 2, the liquid would admittedly flow through the perforated diaphragm 3e and it would lower the closure member 2c against the resiliency of the outer cup 2. The liquid would therefore flow into the latter wherefrom it could flow into the container through the perforation 2f. But the cross-sectional area of the latter is so small that the flow rate would be quite insignificant. If the pressure of the liquid were increased in order to increase the flow rate, this would result in the application to the outer cup of a downwardly directed force of such value that the intermediate portions 2k, of quite small cross-section, would break, the cup being divided into two separate pieces. The valve device would thus become wholly inoperative. The container is therefore practically non-refillable.

FIG. 14 illustrates an embodiment in which the axial boss or seat portion 3c does not comprise the upper perforatable wall or diaphragm 3e. With such a construction gas-tightness is exclusively realized by the closure member 2c. But experience demonstrates that if the parts have been correctly manufactured, the arrangement is perfectly gas-tight. The embodiment of FIG. 14 is therefore quite suitable for containers which are not to be used with a perforating gas-intake head, as for instance for aerosol cans.

In such a case an appropriate spraying head may be mounted in the outer cup 3 in any appropriate manner.

I claim:

1. In a unit comprising a container for a pressurized fluid and a valve device mounted thereon, with said container having a wall formed with an opening to receive said valve device, said valve device comprising: a first substantially cup-shaped member made of a resilient elastomeric material and having a bottom, a central closure portion projecting from said bottom, a substantially cylindrical skirt portion extending from said bottom to surround said central closure portion, with said skirt portion having an end opposed to said bottom, and means on said end of said skirt portion to secure same to the wall of the container, with said bottom having at least one perforation and with said skirt portion having apertures, the total cross-sectional area of said apertures being greater than the cross-sectional area of said perforation;

and a second substantially cup-shaped member made of a substantially rigid material and having an annular bottom, a central seat portion extending form said last-named annular bottom to sealingly receive said central closure portion of said first member, a substantially cylindrical skirt portion extending from said bottom of said second member to surround said seat portion thereof, said skirt portion of said second member fitting into said skirt portion of said first member so as to close the apertures thereof, said skirt portion of said second member also having a free end, and means on said free end of said skirt portion of said second member to secure same to said first member.

2. In a unit as claimed in claim 1, said apertures of said cylindrical skirt portion of said first member being separated from each other by intermediate bridges of such cross-sectional area that they break under the action of an overpressure within said first member, particularly if an attempt is made to refill said container through said valve device.