# United States Patent

**Devol**

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[54] **VALVE SYSTEMS FOR NON-REFILLABLE CONTAINERS**


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[52] **U.S. Cl.** .....**222/147,** 137/315, 141/18, 215/18

[51] **Int. Cl.** .....**B65d 47/02**

[58] **Field of Search**.....222/147, 402.16, 153, 394, 222/395, 399, 400.7; 137/315, 329.1–329.4; 141/18; 215/14, 17, 18, 19, 21, 22, 25



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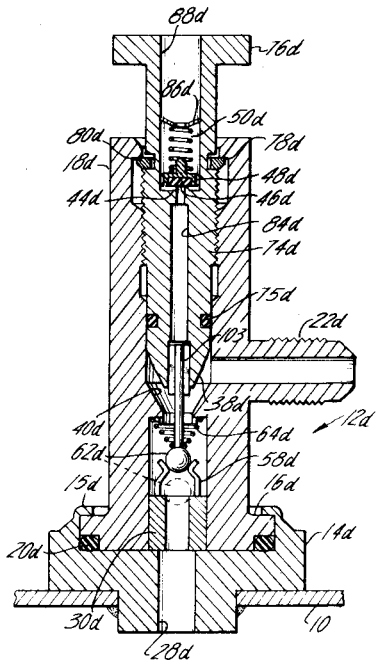
[57] **ABSTRACT**

Several forms of valve assembly, to be secured permanently to a container, enable one-time-only filling of the container, for avoiding dangerously refilled containers. The valve assembly has a shut-off valve for controlling fluid dispensing. In some forms, the shut-off valve converts the assembly to its non-fillable condition as a consequence of the first closing operation of the shut-off valve. There may be an initially inactive check valve that allows the container to be filled and becomes a discharge-only check valve, or a check valve in a dispensing passage may have a parallel filling passage that is blocked after one use.


**10 Claims, 12 Drawing Figures**



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SHEET 1 OF 3

FIG. 2

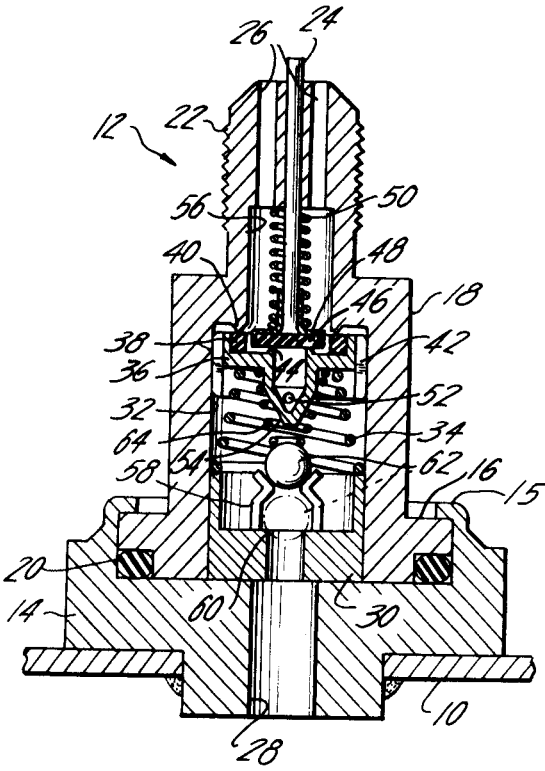
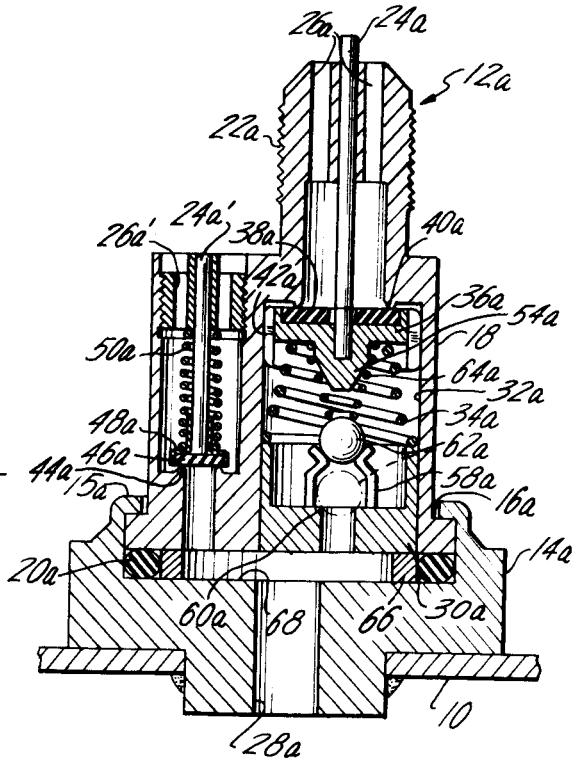



FIG. 3



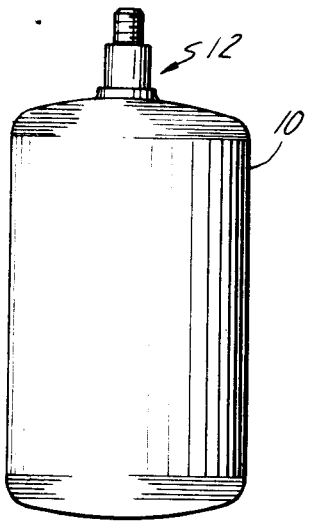




FIG. 1

FIG. 4

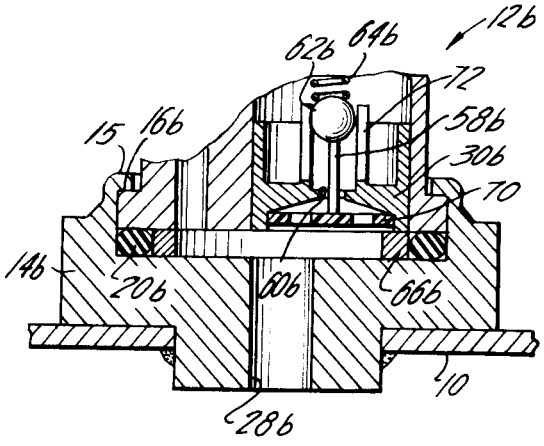



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FIG. 5

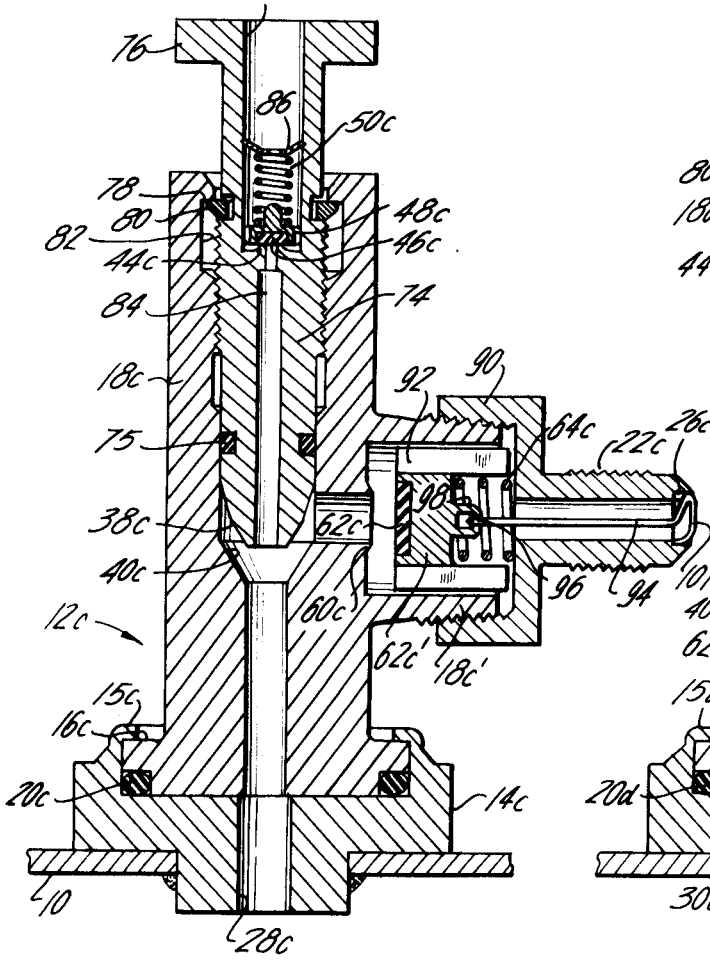
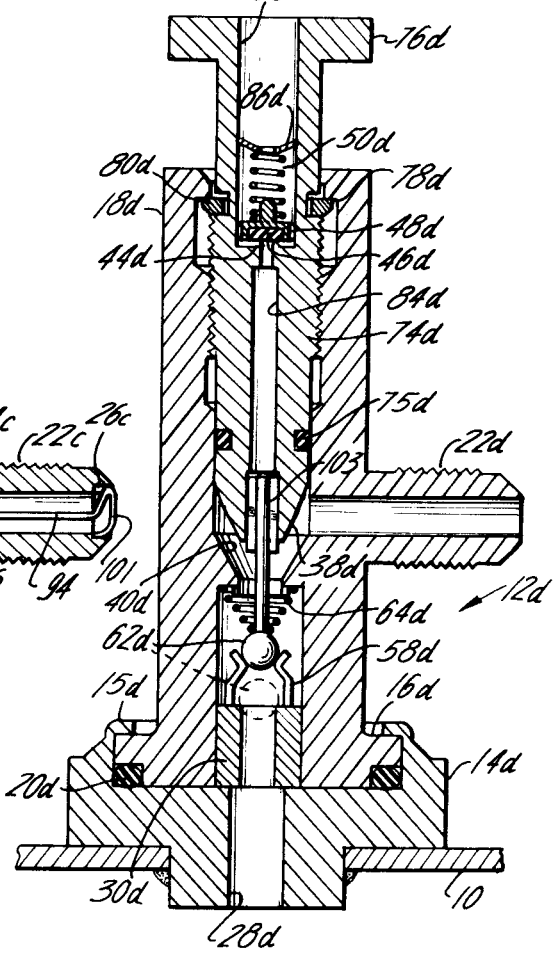



FIG. 6



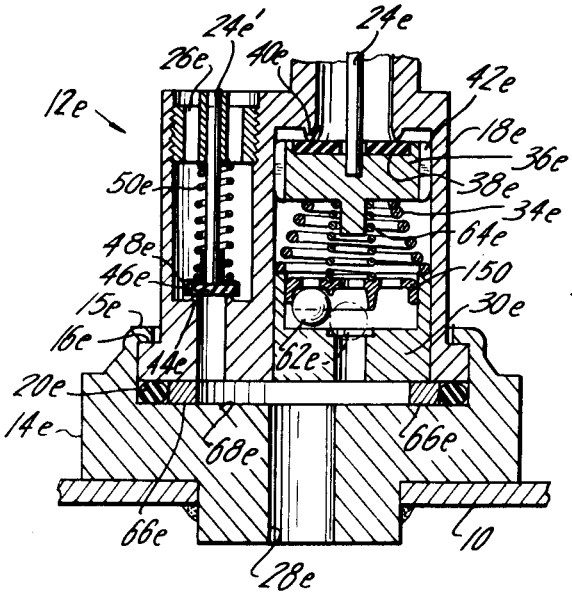




FIG. 7

FIG. 8

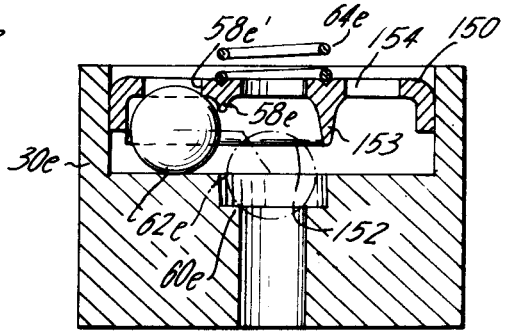



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FIG. 9

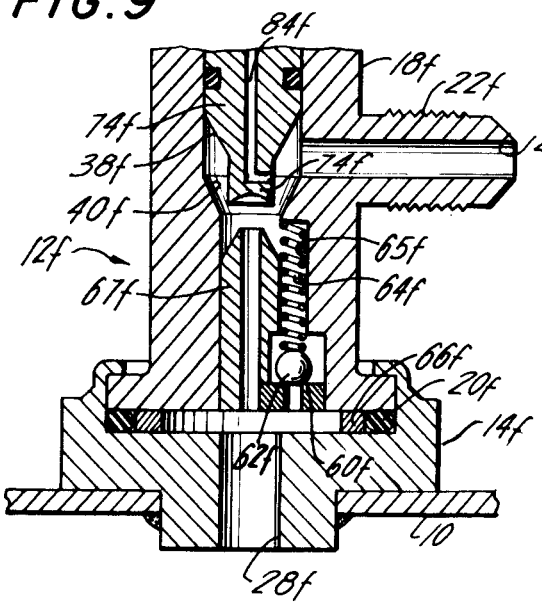



FIG. 10

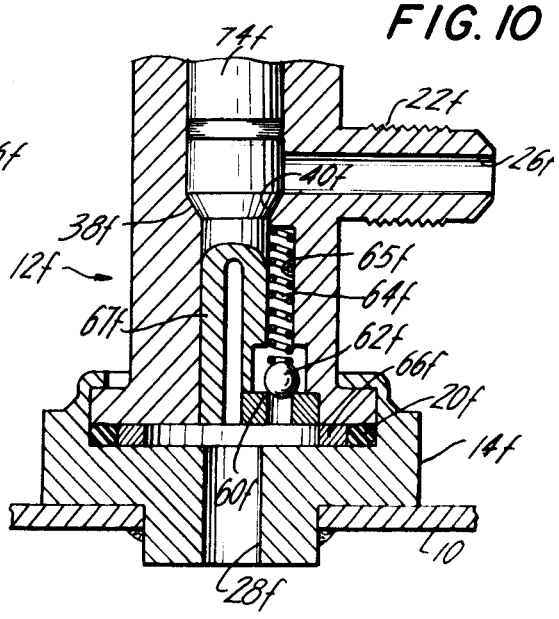



FIG. 11

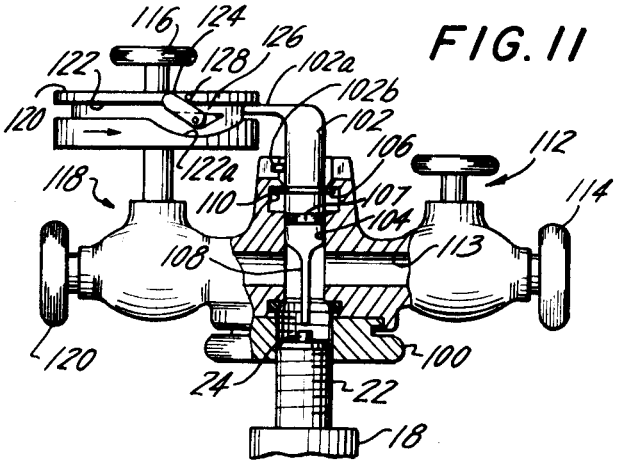
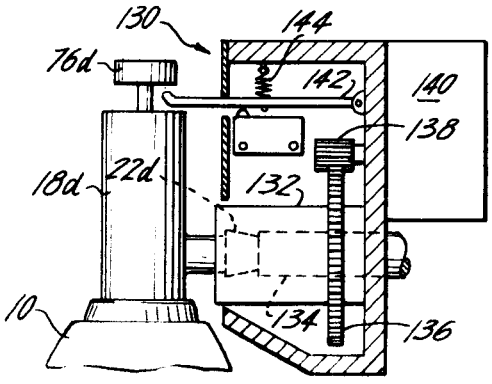



FIG. 12

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# VALVE SYSTEMS FOR NON-REFILLABLE CONTAINERS

The present invention relates to non-refillable containers and in particular to a valve system for such containers having provision for a first-time filling operation.

Many forms of liquefiable fluids are sold in disposable containers. Small metal tanks containing liquefied propane, liquified butane, and refrigerants such as freon are common examples of this practice. When containers of this type are filled by a manufacturer who has full control of the starting condition of the container and of the filling procedures and the specifications, a remarkably safe product can be distributed to the public. However, sometimes empty or partly empty containers are collected and these are refilled by poorly skilled and poorly equipped persons. The result is often a hazardous product. For example, an overfilled container can be a real danger to life and property.

An object of the present invention resides in providing a valve system for containers of liquefied gas under pressure for allowing the container to be filled initially and in which the valve system can then be modified expeditiously and in a virtually permanent manner by the persons responsible for the first filling, for preventing subsequent filling operations.

Another object of the invention resides in providing a valve system for dispensing liquefied fluid from a container in which there is provision for a first-time filling operation, readily modified after the first fill so that any attempts to refill the container would necessitate tampering and would leave tell-tale marks. This feature is aimed at providing a defense for the manufacturer who originally filled the container in case the container should later be refilled by another and then be involved in a harmful mishap.

A related object resides in providing novel methods of filling fluid containers through a valve system that is subsequently used for dispensing the fluid, involving relatively secure modification of the valve system to virtually prevent subsequent refilling of the container.

A still further object resides in the provision of methods and apparatus for filling containers of the aforementioned type in a way to provide assurance that the valve system has been converted to its fill-preventing condition once the original filling operation has been completed.

The foregoing and other objects of the invention and its various features of novelty and their advantages will be more fully appreciated from the description below of several illustrative embodiments of the invention which are shown in the accompanying drawings. In each of these embodiments there is a valve system for controlling the flow of fluid between an external port where fluid is supplied or discharged and an internal port that opens into the container. The valve system is contained in a short conduit secured permanently to the container. It includes a shut-off valve that has an externally accessible operating part for opening the discharge passage when required, and a check valve for preventing the flow of fluid in the filling direction after the container has once been filled. The check valve is virtually inaccessible so that it remains effective to prevent a refilling operation. In each embodiment, the valve system includes provision for an initial filling operation that can be readily and securely modified for preventing refilling.



In the initial condition of several embodiments, the check valve is prevented from seating by a detent. This condition allows the check-valve passage to be used in a filling operation. After the container has been filled, this detent is disabled. The check valve assumes its operative configuration for preventing flow of fluid in the container-filling direction. The check valve and its detent are virtually inaccessible for restoring the detent to its condition needed for holding the check valve open, such as would become necessary for refilling the container.

In one form, the check valve includes a ball that is spring biased toward a seat and arranged to allow flow of fluid in the discharging direction. However, before the container has been filled, a cluster of spring-fingers acts as a detent holding the ball away from the valve seat and thereby provides a passage for the flow of fluid in the filling direction. The shut-off valve of the valve system is open, and the container is filled under controlled conditions. Thereafter, the ball is forced past the detent fingers to cooperate with its valve seat. The movable member of the shut-off valve is used to force the ball of the check valve past its detent fingers. From this point on, there is no practical way of gaining access to the check valve for opening it in an attempt to refill the container.

In another embodiment involving a convertible check valve, the check valve is held open by a wire that extends from the external port of the valve system to a rupturable connection to the movable member of the check valve. After the filling operation has been completed, the wire is torn away, and the movable valve member of the check valve thereupon becomes effective for preventing flow of fluid in the filling direction while freely accommodating flow of fluid in the dispensing or discharging direction.

In another form involving a convertible check valve, there is a temporary support or detent that initially holds the movable valve member at some distance from its seat. The support or detent is made of material that is attacked by the filling fluid. It may be dissolved, or it may be severely softened. After the container has been filled, the detent loses all capacity to hold the valve open to the flow of fluid in the filling direction. In a still further construction, the check valve has parts that are initially out of effective check-valve cooperation, but after the initial filling operation, a properly directed impact shifts the parts of the check valve permanently into check-valve configuration.

In each example mentioned above, the valve system has a single passage that serves both for the initial filling operation and subsequently for check-valve controlled discharge of fluid. The check valve is in that passage, and it is convertible from an initially disabled freely open condition utilized during the initial filling operation into active check-valve configuration to block subsequent flow in that passage in the filling direction. In a further modification, there are two parallel passages between an inner port and an outer port of the valve system, one passage being controlled by a check valve and the other passage being initially open to provide a filling passage but which is blocked after the initial filling operation. A shut-off valve is included, for controlling the delivery of fluid from the container.

In both the one-passage system and the two-passage valve system described above briefly, certain embodiments in common follow the concept of utilizing the shut-off valve (which is notably accessible externally) as a tool or probe that reaches deep into the valve system to convert the system from its filling condition to its non-refillable condition.

In the routine operation of a plant where containers are filled with liquefied fluid, the containers equipped with the novel valve system are successively evacuated and filled. A procedure that is then carried out as part of the routine is to convert the inactive check valves to their active state. It is of course possible for an occasional unit to be overlooked so that there could be isolated instances of inactive check valves. However, so long as most of the check valves are made active, there would be little incentive for anyone to set himself up as a refilling facility.

It is nevertheless desirable for the foregoing valve systems to be rendered non-refillable automatically after the first filling of the container. Two forms of apparatus that insure conversion of the convertible valve systems of the present invention to their non-refillable condition after filling is completed are described. In one example of the filling apparatus, the filling valve in the container filling apparatus is coordinated with the device that converts the valve system to its non-refillable condition. The check valve remains in its initial condition both while the filling valve is open and while it is closed and also when it is being opened for a filling operation; but when the filling valve is being closed, thus signalling completion of the filling operation, the filling valve automatically causes the valve system conversion to its non-refillable state. In a second example of the filling apparatus, the removal of the valve system from the evacuating and initial filling apparatus is made dependent on the activation of the valve-system converting device. Thus, there is an automatic safeguard against operator error, providing assurance that initially fillable containers cannot remain in their fillable condition after having been filled once.

The foregoing embodiments which have been thus briefly described are shown in the accompanying drawings, wherein:

FIG. **1** is a lateral view, drawn to reduced-scale, of a liquefied gas container and a valve system for filling the container and for discharging fluid as required;

FIG. **2** is a longitudinal cross-section of a valve system on a fragmentary portion of the container of FIG. **1**, FIG. **2** being drawn to enlarged scale and representing an embodiment of several features of the invention;

FIG. **3** is a longitudinal cross-section of a modification of the valve system of FIG. **2**;

FIG. **4** is a fragmentary longitudinal cross-section of a modification of the valve system in FIG. **3**;

FIGS. **5** and **6** are two further valve systems for one-time filling and for controlled discharge or dispensing of fluid from the container of FIG. **1**;

FIG. **7** is a fragmentary vertical cross-section of another embodiment of certain features of the invention;

FIG. **8** is an enlarged fragmentary vertical cross-section of the valve system in FIG. **7**;

FIG. **9** is a fragmentary vertical cross-section of a further embodiment of certain features of the invention;

FIG. **10** is a fragmentary vertical cross-section of the embodiment of FIG. **9** following operation thereof for conversion to the non-refillable state;

FIG. **11** is a lateral view of one form of apparatus for use in filling containers having valve systems of a form such as that in FIGS. **2**, **3** and **4**; and

FIG. **12** is a lateral view, partly in cross-section, of another form of apparatus for use in filling containers having valve systems as shown in FIGS. **6**, **9** and **11**.

Referring now to the drawings, container **10** has a valve system **12** secured to one end thereof. Valve system **12** is shown enlarged in longitudinal cross-section in FIG. **2**. Collar **14** is welded or otherwise hermetically joined to the wall of container **10**. A flanged part **16** of the valve system in FIG. **2** is held firmly in place in its complementary cavity in collar **14** by a turned-in or spun-over edge portion **15** of the collar. An "O-ring" **20** that is in compression between flange **16** and collar **14** provides assurance of a hermetic seal between the collar and body **18**. Portion **15** of the valve system mounting is to be permanent in the sense that it can be reworked only with such great difficulty as to be readily detected. The metal of which flange **15** is made is hard or otherwise of such character that if it were raised to release flange **16** and turned down again, it would fracture. Other secure fastening techniques may be used.

Threaded portion **22** of body **18** provides a coupling for a companion threaded coupling or fitting of a supply line or a receiving line. Stem **24** of pressure relief valve is slideable along a bore in body **18** at the axis of coupling **22**. A number of lengthwise passages around stem **24** provide a composite external port **26** for the valve system. Body **18** provides a through conduit to an internal port **28** that opens into the container **10**.

Member **30** has a force fit or is otherwise fixed in the bore surface **32** of body **18**. A firm compression spring **34** bears against the end of member **30** and presses upward against cup **36** of a shut-off valve. This cup and resilient ring **38** form the movable member of a shut-off valve. Resilient ring **38** bears against annular rib **40** that forms the shut-off valve seat. Cup **36** has a number of ribs **42** that are spaced apart and provide a slide bearing for the cup against bore surface **32**. When the shut-off valve is open, the spaces between ribs **42** provide a passage past cup **36** for the flow of fluid through body **18**.

An annular rib **44** surrounding a cavity in the center of cup **36** forms the seat for a pressure relief valve. Disc **46** of resilient non-porous material such as rubber and a cup portion **48** that has a tubular extrusion joined to valve stem **24** form the movable member of the pressure relief valve. A compression spring **50** biases valve member **46**, **48** against its seat **44**. One or more holes **52** in the hollow conical tip **54** of valve cup **36** provides a passage for escape of excess-pressure fluid via internal port **28**, bore **32**, hole **52**, and the space **56** surrounding spring **50** to the passages forming exit port **26**. The compression of spring **50** is selected in relation to the area within valve seat **44** so that an excess pressure in container **10** will lift valve member **46** to provide

pressure relief. Spring **34** which biases valve cup **36** upward is much more powerful than spring **50** so that there is no tendency for the pressure relief valve to open the shut-off valve **38, 40**.

Member **30** has a cluster of spring fingers **58** around a seat **60**. Ball **62** is initially supported by fingers **58** in the position illustrated. Compression coil spring **64** has its upper end centered about the generally conical center projection **54** of valve cup **36**. Spring **64** bears against ball **62** and biases that ball against spring fingers **54**. This is a relatively light biasing force, sufficient to maintain ball **62** in the position illustrated, against spring fingers **58**.

The operation of the valve system of FIG. **2** is as follows. The parts in the positions illustrated in FIG. **2** represent the valve system in condition for a filling operation. The valve system is first coupled to a vacuum line, using a fitting that depresses shaft **24** flush with the end of the coupling **22**. This opens the shut-off valve **38, 40**. When the container has been evacuated, the vacuum line can be disconnected, the shut-off valve closing automatically. The valve system is then coupled to a fluid-filling line, again depressing stem **24** and opening shut-off valve **38, 40**. When the container **10** has been filled according to specifications, the valve system is released from the filling station. As a matter of routine, an attendant uses a suitable rod to depress stem **24** far enough to drive ball **62** to its dotted-line position. This activates the check valve. Subsequent refilling of the container is prevented, short of drastic steps that would leave tell-tale marks.

Conversion of the check valve **60, 62** from its inactive to its active state is carried out automatically by the apparatus of FIG. **12**. Threaded coupling **22** is screwed into internally threaded part **100** of a filling unit. For convenience, part **100** is made rotatable relative to the filling unit so that coupling **22** on container **10** is drawn into part **100**. A shaft **102** is held captive in bore **104** by a snap-ring **106**, and O-ring **107** provides a seal between shaft **102** and bore **104**. A part **108** of shaft **102** depresses the upper end of stem **24** so as to be flush with the upper end of coupling **22** when ring **106** bears against the top of cavity **110** and when fitting **22** is seated in part **100**. This depression of stem **24** lifts the movable member **36, 38** of the shut-off valve away from its seat **40** (FIG. **2**) and opens a passage from the external port **26** through the conduit formed by body **18** from coupling **22** to the internal port **28**.

Valve **112** controls the connection of passage **113** to a vacuum pump connected to rotatable internally threaded fitting **114**. Valve **112** is opened for evacuating container **10**, and then valve **112** is closed. At the same location or at another location in the plant, rotatable internally threaded fitting **120** is connected to a supply of pressurized fluid. Valve **118** is opened by rotating valve handle **116** for filling container **10**.

Valve **118** has a disc **120** on the valve stem. When the filling valve is to be opened, disc **120** rotates counterclockwise as observed looking downward, i.e., in the direction of the arrow. In the position shown, the valve **118** is closed. As the valve starts to open, arm **102*a*** on shaft **102** moves in a circular groove **122**. Pin **102*b*** prevents arm **120*a*** from swinging away from groove **122**. Bar **124** is pivoted to an area **126** at the outer surface of disc **120**, and is normally biased against pin **128** by a spring (not shown) so as to extend slantwise across groove **122**. During opening of the valve, disc **120** rotates and bar **124** swings out of the way of arm **102*a***. Depending on the design of valve **118**, it may be sufficient to rotate handle **116** one revolution to open the valve, and in that case bar **124** snaps out of the way of arm **102*a*** only once.

When container **10** has been filled according to specifications, valve **110** is closed. Disc **120** rotates opposite to the arrow and bar **124** forces arm **102*a*** to follow groove **122*a***. This depresses the upper end of rod or stem **24**, pressing members **46** and **36** downward until the tip of conical member **54** drives ball **62** past the detent represented by spring fingers **58** and into the dotted-line position illustrated. Spring **64** continues to bear lightly against ball **62**, biasing the ball against its seat **60**. Thus, ball or movable valve member **60** which is biased toward its seat **60** by spring **64** acts as a check valve preventing flow of fluid in the filling direction from external port **26** to internal port **28**. At the same time this check valve allows reverse flow of fluid in the discharging direction from internal port **28** to the external port **26**. The flow of fluid in the discharging direction occurs only when the coupling of a fluid receiver is attached to threaded coupling **22** and stem **24** is depressed to open the shut-off valve **36, 38, 40**. Additionally, it is evident that ball **62** would lift from its seat in the event of an excess pressure developing in container **10**, providing a passage from internal port **28** via (open) check valve **60, 62**, through hole or holes **52**, through (open) pressure relief valve **44, 46** and to the exterior via space **56** and external port **26**.

Shifting of ball **62** to the dotted-line position of FIG. **2** activates the check valve of the valve system on container **10**, the valve system of container **10** thus assuming its non-refillable condition. The operation of closing the fluid supply valve **118** must be done before fitting **22** of the valve system on container **10** can be released from part **100**. This provides the definite assurance of the check valve being activated to prevent subsequent filling, as an incident of the initial filling operation.

Repeated operation of shut-off valve **36, 38, 40** for opening the passage through the valve assembly has no effect on check valve **60, 62** after the spring-finger detent **58** has been forcibly deflected out of the path of ball **62**. The check valve remains effective thereafter and is virtually inaccessible for being restored to the position represented by the solid-line showing of ball **62**, to return the valve to the condition necessary for a refilling operation.

In some situations it is considered desirable for the valve system to incorporate a safety valve having an exit port that does not extend into either the fluid supply or the fluid receiver. A modified construction like FIG. **2** is shown in FIG. **3**, wherein like parts have the same numerals as in FIG. **2**, distinguished by a suffix *a*. The like parts and their operation will be understood from the description of the valve system of FIG. **2**, and the filling operation follows that of the embodiment in FIG. **2**.

In FIG. **3**, pressure relief valve **44*a***, **46*a***, **48*a*** has a stem **24*a'*** that is separate from the stem **24*a*** which carries cup **36*a*** of the shut-off valve. The pressure relief valve opens to an exit port **26*a'*** that is external of

coupling 22*a* and separate from external port 26*a* of the valve assembly. In the lateral position of the pressure relief valve in FIG. 3, that valve can respond to an over-pressure and vent to the outside atmosphere even when the fluid supply (FIG. 12) or a fluid receiver is connected to coupling 22*a*. A spacer ring 66 lifts the lower end of body 18 off the face 68 in collar 14*a* so that there will be a fluid passage from internal port 28*a* into the bore 32*a* and into the passage of the pressure-relief valve. Holes 52 of FIG. 2 are unnecessary in the shut-off valve cup 36*a* of FIG. 3.

A modification of the valve assembly of FIG. 3 is shown in FIG. 4, wherein only enough of the valve assembly is illustrated to show the modification. The parts in FIG. 4 that correspond to those in FIG. 3 bear the same reference numerals with a suffix *b*.

Fingers 58*a* which are shaped as detents in FIG. 3 for supporting ball 62*a* are replaced by a rod 58*b* in FIG. 4, carried by a perforated disc 70 that fits tightly in a cavity in member 30*b*. Ball 62*b* is supported by rod 58*b*, and is guided laterally by upstanding straight fingers 72. As in FIGS. 2 and 3, there is a light spring 64*b* that bears downward against ball or movable check-valve member 62*b*. Member 70 and its post 58*b* are formed of a material that softens or is dissolved by the fluid with which the container is filled. The solubility should be limited so that the filling operation can proceed to completion. In the case of a refrigerant such as freon, an acrylic plastic can be used. Once the filling operation is complete and the post 58*b* has softened or dissolved and has thus been removed from its position supporting check-valve member 62*b*, that valve member moves against its seat 60*b*. The parts of the check valve are remote and inaccessible from the exterior of the valve assembly. Due to the valve location, tampering with the check valve for refilling the container is virtually impossible. The valve assembly will provide for the discharge of fluid whenever the shut-off valve is opened, but refilling of the container is prevented by check valve 60*b*, 62*b*, 64*b* after it is activated. This form of valve assembly makes the container fillable once, and it inherently prevents refilling even without a specialized filling apparatus such as that of FIG. 12.

A further form of valve system having the same broad characteristics of the assemblies in FIGS. 2, 3 and 4 appears in FIG. 5 where the same numerals are used with a suffix *c* to indicate corresponding parts. Collar 14*c* and body 18*c* are united to each other and to can body 10 in a secure, hermetically sealed manner. There is a right-angled passage through the body 18*c*, forming a conduit between internal port 28*c* and and external port 26*c*. This passage can be closed off by a manually operable shut-off valve having a movable member 38*c* adapted to cooperate with valve seat 40*c*. The shut-off valve has a laterally threaded stem 74 that mates with internal threads in body 18*c* so that, when knob 76 is rotated, movable valve member 38*c* of the shut-off valve will close against its seat 40*c* and thereby close off the passage from internal port 28*c* to the exterior. Body 18*c* has a shoulder 78 that overlies snap ring 80 contained in a groove around the valve stem. Snap ring 80 abuts against shoulder 78 in the position illustrated, and prevents removal of the manual valve stem. As valve stem 74 is turned for driving movable valve member 38*c* in the valve-closing direction, snap ring 80 moves along the internal passage 82 in body 18*c*.

There is a bore 84 in valve stem 74 that communicates with the internal port 28*c*. Bore 84 provides a passage to valve seat 44*c*. Movable valve member 46*c* cooperates with valve seat 44*c* to close this passage. Member 46*c* is made of resilient non-porous material and is contained in a cup 48*c*. A spring 50*c* biases valve member 40*c* against its seat, constituting a pressure relief valve. A castellated sharp-edged washer 86 fits in bore 88 and acts as stop for the upper end of compression spring 50*c*. Seat 44*c*, member 46*c* and spring 50*c* form a pressure relief valve which, as in FIGS. 3 and 4, communicates to the atmosphere.

At right-angles to body 18*c* there is a threaded lateral extension 18*c'*, and internally threaded cap 90 is mounted on lateral extension 18*c'*. Mounting of the cap may be rendered permanent by welding instead of or in addition to the threads. Also, cap 90 and body 18*c* may be made of a plastic such as nylon, and they may be welded by a solvent or bonded by a cement when screwed together.

An initially inactive check valve is enclosed in lateral extension 18*c'*. Annular rib 60*c* forms a valve seat. Resilient member 62*c* of resilient non-porous material is supported in a body 62*c'* forming a movable member of a check valve. The sides of member 62*c'* have grooves 92 forming fluid passages when the movable valve member is spaced from its seat. A wire 94 has a headed end 96 that is captive in a cavity formed by small cup 98 whose edges are turned-over behind head 96. At its opposite end, wire 94 has a looped portion 101 that bears against a shoulder in the external port 26*c* and in this condition wire 94 holds movable valve member 62*c*, 62*c'* away from its seat 60*c*. In this condition, external port 26*c* can be used for admitting a fluid filling when valve 38*c*, 40*c* is open. Valve 38*c*, 40*c* is closed when the filling operation is complete. Then wire 94 is forcibly removed, spreading the turned-in edges of cup 98. Alternatively, the wire could be weakened adjacent to its head 96 for fracturing easily. In any case, once wire 94 has been removed, valve elements 60*c*, 62*c*, 62*c'* and spring 64*c* constitute a check valve that prevents flow of fluid in the filling direction while accommodating discharge of fluid from internal port 28*c* to external port 26*c* when shut-off valve 38*c*, 40*c* is open.

Filling of a container 10 having a valve system of FIG. 5 can be carried out by connecting coupling 22*c* to a vacuum line and then to a liquefied fluid supply line, closing valve 38*c*, 40*c* each time coupling 22*c* is to be disconnected. Wire 94 is next extracted at an established place in the routine of the filling plant. The routine can also be carried out using the apparatus of FIG. 12 modified, however, to form part 108 as an extracting hook for wire 94. Curved track 122*a* of FIG. 12 would then curve away from the valve system of the container so as to extract the wire 94 when the filling valve is closed at the end of the controlled filling procedure.

The additional modification illustrated in FIG. 6 shows a similar valve system. The shut-off valve of FIG. 6 is identical to that in FIG. 5 except that there is a fluted extension 103 on the valve stem 74*d* that is

adapted to drive ball **62***d* past spring-finger detent **58***d* so that the ball can occupy the dotted-line position illustrated. This is the operative position of the check valve for accommodating flow of fluid in the discharge direction but preventing flow of fluid in the container-filling direction. In the construction of FIG. **6**, check valve **62***d*, **60***d*, **64***d* operates the same as that in FIGS. **2** and **3**. The notable distinction of the construction in FIG. **6** is that the shut-off valve stem **74***d* must remain in its full-open position until the container has been filled. Once valve stem **74***d* has been operated to drive movable drive member **38***d* against its seat **40***d*, the check valve is thereafter in its refill-preventing condition. Of course, fluted rod **103** does not drive ball **62***d* against seat **60***d*. The embodiment of FIG. **6**, like that of FIG. **5**, involves a right-angled discharge-port construction.

The routine of evacuating and then filling a container **10** equipped with a valve system of FIG. **6** requires an external shut-off valve arrangement, to be used after the container has been evacuated. This is because shut-off valve **38***d*, **40***d* cannot be used until the time when rod **103** is to drive ball **62***d* past detent fingers **58***d*, to activate the check valve. Alternatively, the filling routine can be carried out effectively using the apparatus of FIG. **13**.

The valve assembly of FIG. **6** is shown coupled to a filling apparatus **130**, including a rotary coupling **132** that is internally threaded to receive coupling **22***d* and to seal that coupling to an evacuating and filling line **134**. Coupling **132** has a gear **136** that is operated by pinion **138** on reversible slow-speed drive unit **140**.

After the specified evacuating and filling sequence has been completed, knob **76** of the shut-off valve is operated for the first time. It is necessary to operate the valve before removing the container **10** and its valve system from the filling apparatus, since otherwise there would be nothing to prevent discharge of the liquefied fluid from the container. Drive unit **140** contains an electric motor and a suitable speed reducer. When knob **76** is operated to close the shut-off valve of container **10**, lever **142** is pressed down against the bias of tension spring **144** to operate reversing switch **146**. Then, when drive unit **140** is energized by a starting switch, coupling **132** will operate in the direction to release coupling **22***d*.

The filled container **10** cannot be removed from the filling apparatus without a controlling reminder to the attendant to operate knob **76** of the shut-off valve, thus causing part **103** to activate the check valve in body **18***d* and render the valve system non-refillable.

FIGS. **7** and **8** illustrate still another principle for activating an initially inactive check valve in a once-fillable non-refillable valve system for liquefied gas containers. By way of illustration, this modification utilizes the otherwise-similar valve assembly of FIG. **3**. Corresponding parts bearing like numerals with the *e* suffix are alike in form and function.

Spring **34***e* biases shut-off valve member **38***e* toward its annular seat **40***e*. Weaker spring **64***e* biases a part **150** in the opposite direction. Part **150** has a cylindrical periphery that is guided in a cylindrical cavity in member **30***e*. Ball **62***e* is initially held captive by detent means in the position represented in solid lines in FIGS. **7** and **8**. There is a hole **58***e'* in part **150**, and a projection **58***e* both of which serve as the detent means. A channel formed by a pair of walls (including wall **152**) guides ball **62***e* toward valve seat **60***e*.

After a container has been evacuated and filled following prescribed procedures, a sharp blow against body **18***e* is used to activate the check valve. A sharp blow at point X causes ball **62***e* to shift past its detent means, dropping into a cavity to its dotted-line position at valve seat **60***e*. Stop **153** prevents excess travel of the ball.

Point X can be recognized as being opposite the pressure relief valve. However, the required path of the ball to activate the check valve may be changed from one valve to the next. In that case, point X can be identified by a mark on the body **18***e* that is of a form readily removed after the filling operation. In any case, once the ball has shifted to its valve seat, an enormously larger impact would be needed to restore the check-valve ball to its initial position. Thus, this valve system makes the container non-refillable after the check valve has been activated.

Part **150** has a hole **154** for flow of fluid out of the container when the shut-off valve is opened, and hole **58***e'* serves as such an opening. Spring **64***e* acting on part **150** biases ball **62***e* against its seat.

Check valve **62***e*–**60***e*–**64***e* is to be activated only on completion of an evacuating and filling sequence, and it should be activated at that time. An impact-applying station can be located in the container-filling plant adjacent to the filling station, so as to be used as a matter of routine. If a marker is applied to valve system **12***e* to indicate point X, the marker should be removed after impact is applied.

Alternatively, an impact tool can be coordinated with the filling apparatus. The impact tool can assume the form of an electromagnet having a hammer-like armature, and the control switch for the electromagnet can be activated in coordination with filling apparatus like that of FIG. **11** or FIG. **12**. Thus, the electromagnet control switch can be activated by a suitably modified part **102** (FIG. **12**) during the closing operation of the filling valve. Similarly the electromagnet control switch can be activated by manually depressing lever **142** (FIG. **12**), this control switch being adjacent to, or part of, reversing switch **146**. In this way the impact for activating the check valve would necessarily occur before the valve system **12***e* of container **10** can be disconnected from the filling apparatus. It will be appreciated that the valve system **12***e* and container **10** must be movable at the time of the impact so that the inertia of ball **62***e* will cause the ball to become seated as the whole valve system and the container shift due to the impact. To accommodate this shift, a length of flexible hose should be used in the connection of containers **10** to the filling apparatus of the modified FIGS. **11** or **12**.

In each of the various embodiments that have been described above, there is a deactivated check valve whose parts are maintained separated by a detent and the valve is accordingly maintained open during the filling operation; the detent which maintains the separation of the valve members is overcome or permanently removed from the detent or obstructing position; and the valve is thereafter effective as a check valve for preventing flow of filling liquid while accommodating the flow of liquid in the discharge or

dispensing direction. In each case, the check valve is so located remote from the exterior in an inaccessible position so that restoration of the valve to its initial condition for accommodating a refill operation is virtually impossible.

FIGS. **9** and **10** show a still further approach to realization of a one-time fillable non-refillable valve system. This modification includes a valve body **18***f* and a shut-off valve stem **74***f* like that of FIG. **5** and incorporates a pressure-relief valve in the shut-off valve stem, movable valve surface **38***f* bearing against seat **40***f* when the valve is closed. Body **18***f* forms a conduit between outer and inner ports **26***f* and **28***f*.

A check valve comprising seat **60***f*, ball **62***f* and spring **64***f* is disposed in a fluid discharge passage **65***f* between ports **26***f* and **28***f* allowing discharge of fluid from container **10** when the shut-off valve is open. A parallel passage is formed by a tube **67***f* fixed in body **18***f*. The upper end of tube **67***f* is initially open (FIG. **9**) for a first filling operation. Tube **67***f* is of readily deformable material such as lead. Valve stem **74***f* has a cupped extension **74***f'* proportioned to close off the upper end of tube **65***f* (FIG. **10**) when the shut-off valve is closed for the first time. Pressure-relief valve **84***f* opens laterally through extension **74***f'*, to communicate with passage **65***f* both when the shut-off valve is open and when it is closed.

Filling of a container having valve system **12***f* follows the procedure described in connection with FIG. **5**. The check valve is initially effective in FIG. **9**, but tube **67***f*, a passage in body **18***f* between the outer port and the inner port, is open initially for a first filling operation and is closed thereafter so as to prevent refilling. The check valve and the convertible structure that provides a passage for the once-only filling operation is located deep inside the unit so that tampering for refilling efforts would inevitably leave tell-tale marks.

The foregoing detailed description of several illustrative embodiments of various aspects of the invention will inevitably suggest modifications and still further embodiments to those skilled in the art, and therefore the invention should be construed broadly in accordance with its full spirit and scope.

What is claimed is:

**1**. A fluid dispensing valve assembly having a body one end of which is formed for securement to a container, said body forming a conduit for filling and discharge flow of fluid, a shut-off valve operable for controlling the flow of fluid through said conduit, said shut-off valve having an externally accessible control, and convertible means in said body in condition initially to accommodate the flow of fluid through said conduit in both filling and discharge directions, a portion of said conduit including two passages in parallel, a check valve in one of said two passages arranged to pass fluid only in the discharge direction and said convertible means including means for sealing permanently the other of said two passages when the valve assembly is to be rendered non-refillable, said sealing means being operable by the shut-off valve from the exterior of the valve assembly into its sealing condition, and means including said body and said shut-off valve for securely enclosing and guarding said sealing means against access from the exterior of the valve assembly for reopening the conduit to the flow of fluid in the filling direction, whereby a container equipped with the valve assembly may be evacuated and then filled with fluid in the initial condition of the valve assembly but is substantially non-refillable after conversion of the convertible means.

**2**. A fluid dispensing valve assembly having a body one end of which is formed for securement to a container, said body forming a conduit for filling and discharge flow of fluid, a shut-off valve operable for controlling the flow of fluid through said conduit, said shut-off valve having an externally accessible control, and convertible means in said body in condition initially to accommodate the flow of fluid through said conduit in both filling and discharge directions, a portion of said conduit including two passages in parallel, a check valve in one of said two passages arranged to pass fluid only in the discharge direction and said convertible means including means for sealing permanently the other of said two passages when the valve assembly is to be rendered non-refillable, said sealing means being operable by the shut-off valve from the exterior of the valve assembly into its sealing condition, said sealing means including an initially open readily deformable device in said other of said two passages and said sealing means further including a part operable by said shut-off valve for deforming said deformable device into a passage closure, said valve assembly when secured to a container having means including said body and said shut-off valve for securely enclosing and guarding said sealing means against access from the exterior of the valve assembly for reopening the conduit to the flow of fluid in the filling direction, whereby a container equipped with the valve assembly may be evacuated and then filled with fluid in the initial condition of the valve assembly but is substantially non-refillable after conversion of the convertible means.

**3**. A fluid dispensing valve assembly having a body one end of which is formed for securement to a container, said body forming a conduit for filling and discharge flow of fluid, a shut-off valve operable for controlling the flow of fluid through said conduit, said shut-off valve having an externally accessible control, and convertible means in said body in condition initially to accommodate the flow of fluid through said conduit in both filling and discharge directions, said convertible means being convertible permanently into means obstructing the flow of fluid selectively in the filling direction, said shut-off valve including a part cooperable with said convertible means for effecting conversion thereof into said obstructing means in the closing operation of the shut-off valve, said valve assembly when secured to a container having means including said body and said shut-off valve for securely enclosing and guarding said obstructing means against access from the exterior of the valve assembly for reopening the conduit to the flow of fluid in the filling direction, whereby the first closing operation of the shut-off valve following a filling of the container causes automatic conversion of the valve assembly to its non-refillable condition, and whereby a container equipped with the valve assembly may be evacuated and then filled with fluid in the initial condition of the valve assembly but is substantially non-refillable after conversion of the convertible means.

4. A fluid dispensing valve assembly having a body one end of which is formed for securement to a container, said body forming a conduit for filling and discharge flow of fluid, a shut-off valve operable for controlling the flow of fluid through said conduit, said shut-off valve having an externally accessible control, and convertible means in said body in condition initially to accommodate the flow of fluid through said conduit in both filling and discharge directions, a portion of said conduit including two passages in parallel, said convertible means including a check valve in one of said two passages arranged to pass fluid only in the discharge direction and said convertible means including means for sealing permanently the other of said two passages when the valve assembly is to be rendered non-refillable, said shut-off valve including a part operable during the closing motion of the shut-off valve for causing the sealing means to seal said other of said two passages, said valve assembly when secured to a container having means including said body and said shut-off valve for securely enclosing and guarding said sealing means against access from the exterior of the valve assembly for reopening the conduit to the flow of fluid in the filling direction, whereby a container equipped with the valve assembly may be evacuated and then filled with fluid in the initial condition of the valve assembly but is substantially non-refillable after conversion of the convertible means.

5. A fluid dispensing valve assembly having a body one end of which is formed for securement to a container, said body forming a conduit having only one through passage for filling and discharge flow of fluid, a shut-off valve operable for controlling the flow of fluid through said passage, said shut-off valve having an externally accessible control, and convertible means in said body comprising an initially inactive check valve initially in condition to accommodate the flow of fluid through said passage in both filling and discharge directions, said check valve being convertible after an initial filling operation into an active check valve in said passage in series with said shut-off valve, said initially inactive check valve including a movable valve member, a valve seat, means for biasing said valve member toward said valve seat, and detent means effective initially to prevent the cooperation of said valve member with said valve seat, said detent means being defeatable after an initial filling operation to enable said valve member to engage said seat, said check valve when active being operative to pass fluid only in the discharge direction, said check valve after being rendered active to obstruct the flow of fluid selectively in the filling direction being guarded against access from the exterior of the valve assembly when secured to a container for reopening the passage to the flow of fluid in the filling direction, whereby a container equipped with the valve assembly may be evacuated and then filled with fluid in the initial condition of the valve assembly but is substantially non-refillable after conversion of said convertible means.

6. A valve assembly in accordance with claim 5, wherein said shut-off valve has means for releasing said movable check-valve member from said detent means for thereby activating the check valve.

7. A valve assembly in accordance with claim 5, wherein said shut-off valve has a stem bearing an external manual operating knob constituting said external control, and a movable member carried by said stem for driving said movable check-valve member past said detent means during the initial closing operation of the shut-off valve.

8. A valve assembly in accordance with claim 5, wherein said shut-off valve has a movable valve member and a seat, the movable member being normally biased against said seat, and wherein said externally accessible control is a valve stem arranged to lift said movable valve member from said seat, and an internal part operable by said valve stem for driving said movable check-valve member past said detent means during the operation of the movable valve member in the valve-opening direction.

9. A valve assembly in accordance with claim 5, wherein said detent means is of a material related to the liquefied fluid fill of the container on which the valve assembly is to be used so as to be rendered soft and thus to be disabled as detent means after substantial exposure to the liquefied fluid fill.

10. A valve assembly in accordance with claim 5, wherein said movable check-valve member is adapted to be shifted into active cooperation with its seat due to its inertia in response to an impact-induced shift of the valve assembly.

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