Nov. 22, 1955 C. P. KRUPP 2,724,418

FLUID-RECEIVING CONTAINER WITH VOLUME-RESPONSIVE PRESSURE-RELIEF AND OVERFLOW VALVE ASSEMBLY

Filed March 2, 1953 2 Sheets-Sheet 1

Fig-1

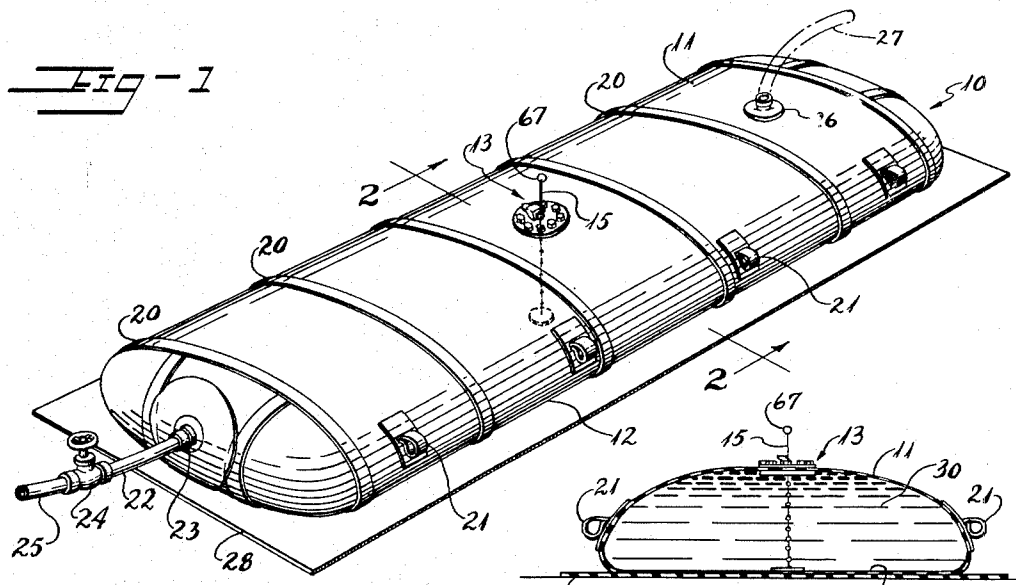


Fig-2

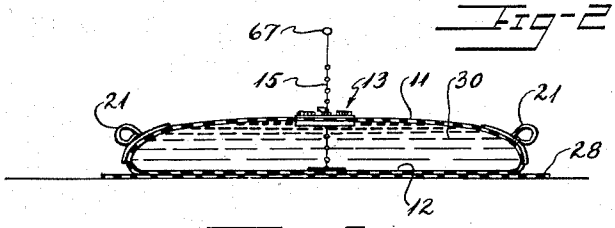


Fig-3

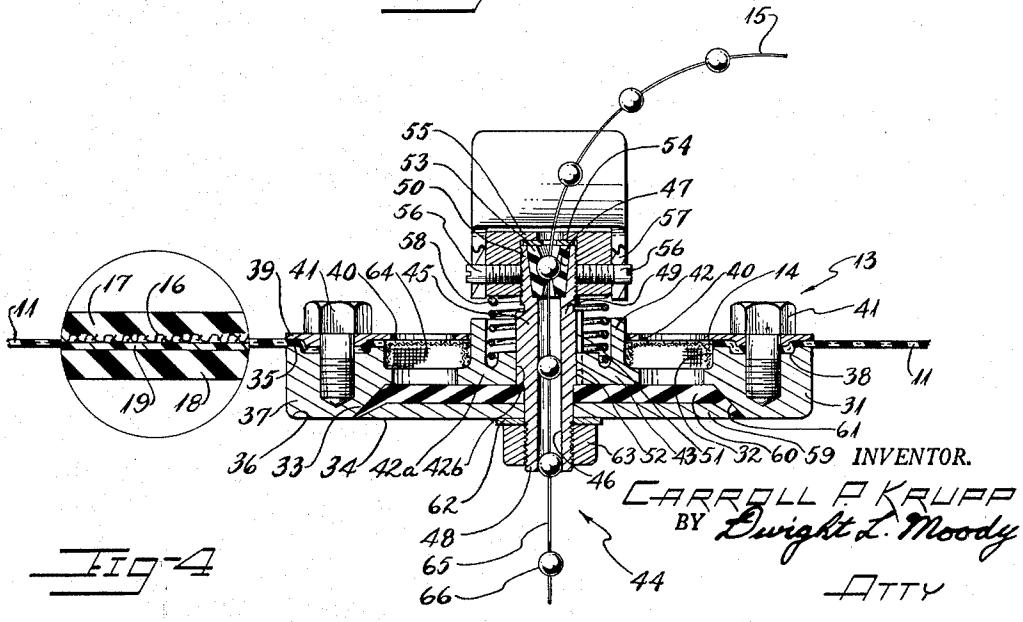


Fig-4

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Fig-5

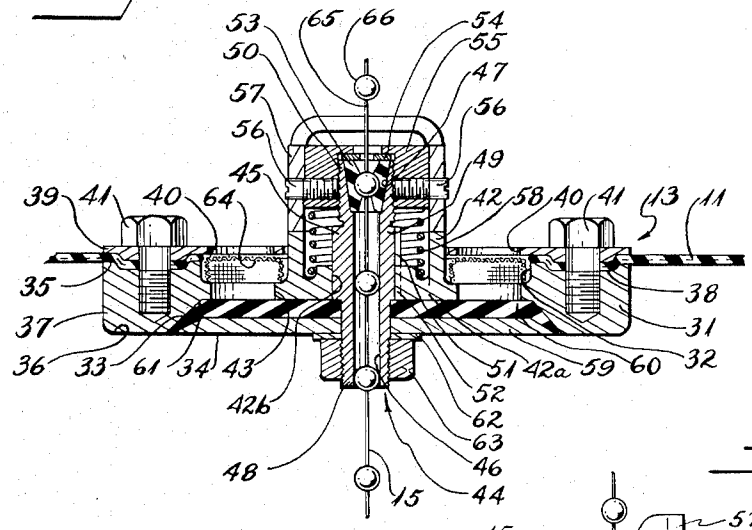


Fig-6

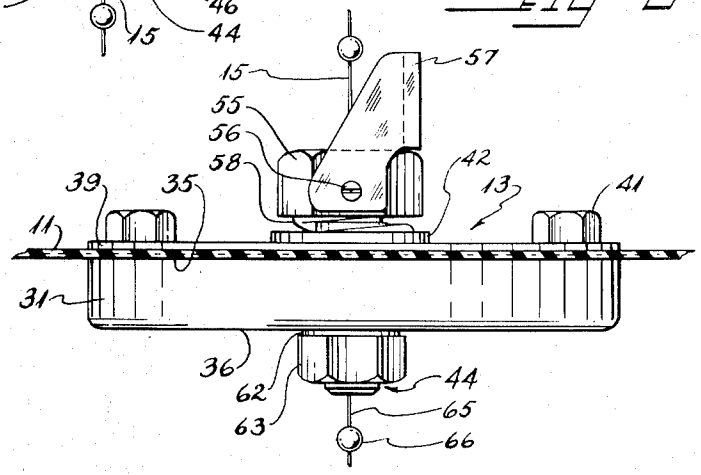
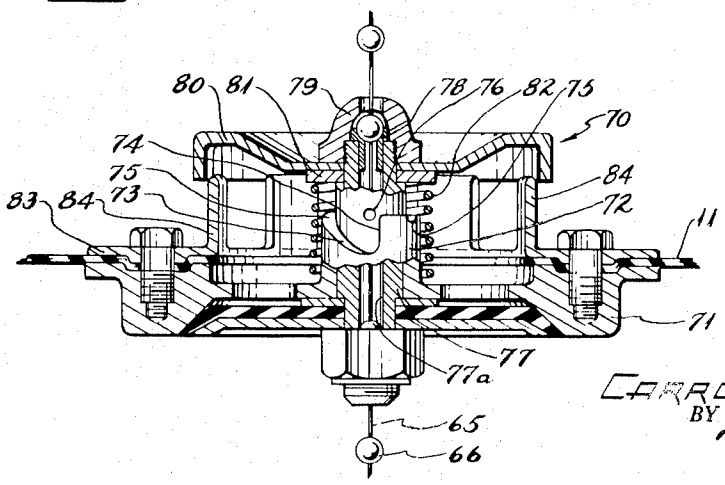


Fig-7



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FLUID-RECEIVING CONTAINER WITH VOLUME-RESPONSIVE PRESSURE-RELIEF AND OVER-FLOW VALVE ASSEMBLY

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10 Claims. (Cl. 150—.5)

The invention relates to fluid containers and safety valve assemblies therefor, and especially to a container of the movable wall type having a volume-responsive pressure-relief and over-flow valve assembly.

Objects of the invention are to provide an improved fluid container having provision for relative wall movement or distensibility and for avoidance of bursting from internal fluid pressure, especially when being filled; to provide for overflow of contained fluid in response to a determinate volume of fluid in the container and for variation in the determinate volume at which overflow occurs; to provide for relieving the internal fluid pressure; to provide for visually indicating the presence of a determinate volume of fluid in the container when it is receiving fluid; to provide for internal pressure-relief and overflow of fluid when the container is being partially or entirely filled; and to provide for simplicity and imperviousness of construction, convenience of manufacture and for effectiveness of operation.

Other objects are to provide an improved distensible container suitable for receiving and temporary storage of fluid such as a liquid; to provide for exhausting trapped air or gas from within the container especially when it is receiving the liquid; to provide for collapsibility, portability and compactness of packaging of the container; to provide an improved safety or pressure-relief and overflow valve assembly operative in response to determinate movement of a movable wall of the container; and to provide for simplicity and durability of construction and for reliability and effectiveness of operation of the valve assembly.

These and other objects and advantages of the invention will be apparent from the following description.

In the accompanying drawings which form a part of this specification and in which like numerals are employed to designate like parts throughout the same,

Fig. 1 is a perspective view of a fluid-receiving distensible container in its filled condition having a pressure-relief and overflow valve assembly and constructed in accordance with and embodying the invention,

Fig. 2 is a sectional view of the container taken along line 2—2 of Fig. 1,

Fig. 3 is a sectional view like Fig. 2 but showing the container in a partially filled condition,

Fig. 4 is a sectional elevational view of the pressure-relief and overflow valve assembly mounted as shown in Fig. 1 and arranged in its normal non-locked operative condition, parts being broken away,

Fig. 5 is a sectional view like Fig. 4 but showing the valve assembly in its locked condition, parts being broken away,

Fig. 6 is a side elevational view of the valve assembly shown in Fig. 4, parts being broken away and in section, and

Fig. 7 is a sectional elevational view like Fig. 4 but showing a modified valve assembly in its normal non-locked operative condition.

In the illustrative embodiment of the invention shown

in Figs. 1 to 6, inclusive, the construction includes a closed container **10** having an apertured wall **11** movable toward and away from an opposite wall **12** of the container, in combination with a pressure-relief and overflow valve means or assembly **13** mounted on the movable wall **11** at the aperture **14** therein and movable therewith, and manipulating means **15** connected to the opposite wall **12** and to the valve means **13** operative to open the valve means for communication therethrough of the interior of the container with exterior thereof upon movement of the movable wall **11** and the valve means **13** a determinate extent away from the opposite wall **12**. The closed container **10** and valve assembly **13** structure is suitable for receiving fluid **30** such as a gas or liquid and for storing the contained fluid temporarily or as long as may be required for the intended service without objectionable leakage and without bursting under internal fluid pressure. The container may be of suitable design and construction having the apertured movable wall **11** for providing a distensible structure, and may be of spherical, cylindrical or generally so, oval, or other suitable shape.

For the particular embodiment shown especially in Figs. 1, 2 and 3, the closed container **10** is elongate and of the flexible distensible portable type adapted to be collapsed and compactly folded and packaged as for transportation and shipping purposes, and adapted to receive and store a fluid **30** such, for example, as a liquid which may be water, oil, gasoline and the like. The closed container **10** is capable of use as a water tank or a gasoline or other fuel tank and suitable for the transportation of gasoline by automotive trucks, or for temporary installations such, for example, as emergency or temporary military air field bases or troop bases and the like, where portability, collapsibility, inexpensiveness, ease of assembly and use, and durability are important.

To these ends, the container **10** may be of elongate tubular form and may be of generally rounded or oval shape in lateral cross-section with generally rounded closed ends in the fully filled condition as shown especially in Figs. 1 and 2, so that the upper wall constitutes the movable wall **11** and the base or lower wall constitutes the opposite wall **12**.

The wall of the container may be made of suitable flexible sheet material having an intermediate layer **16** or a plurality thereof of square-woven textile fabric sheet material of cotton, nylon, rayon, glass fibers or other suitable filamentary material having the desired strength characteristics, and desirably coated or calendered or otherwise treated on both sides with a suitable natural or synthetic rubber composition. The wall sheet material of the container may also have an outer protective layer **17** of suitable rubber composition having age-resisting and abrasion-resisting characteristics, an inner layer **18** of gasoline-resistant rubber composition such, for example, as a copolymer of butadiene and acrylonitrile, or a neoprene (polymerized chloroprene) material, and a thin nylon barrier layer **19** between the inner layer **18** and the intermediate fabric layer **16** for increased imperviousness.

The container may be produced by assembling, joining and adhering together, in a suitable known manner and as shown in Fig. 1, a plurality of pre-cut patterns of suitable flexible sheet material having the respective layers **16** to **19**, inclusive, and then suitably vulcanizing the assembled parts of the container providing the generally oval shape shown in Fig. 1, so as to unite integrally the fabric and rubber materials. The laterally-extending seams **20, 20** at the joinder of the patterns may be of overlapped, fabric tape reinforced construction for increased burst-resisting purposes. To facilitate handling the container **10**, a plurality of longitudinally spaced-apart flexible handles **21, 21** desirably of rubberized fabric construc-

tion, may be secured and bonded to each of the longitudinal side portions of the container.

For filling and emptying purposes, a short length of reinforced rubber hose **22** having at one end a separable connector fitting **23** may be centrally and sealingly secured to an end wall of the container **10**, the hose **22** having at its other end a suitable shut-off valve **24** for controlling the flow of fluid or liquid **30** to and from the container through the hose **22** and fitting **23** and for connection to a suitable conduit **25** associated with a source of fluid supply or a fluid consumer station. In some applications it may be desirable to use the hose **22** and valve **24** for emptying purposes only, in which case the container may be provided with a filler and detachable cap fitting **26** mounted on the movable or upper wall **11** of the container for connection to a suitable source of fluid through a suitable hose **27** (shown in broken lines in Fig. 1).

The fabric reinforced, impervious rubber construction of the container advantageously makes feasible a completely collapsible, impervious, distensible container adapted to be arranged or folded in a transportable compact package and subsequently disposed lengthwise in an extended collapsed condition upon a supporting surface which may be an impervious cover or ground cloth **28** of suitable rubberized fabric resting upon level ground, a concrete floor, a wood platform or other stiff flat surface preferably of horizontally level contour. Also, such a construction has provision for sustaining a ten per cent (10%) overload in rated normal capacity of the container without bursting from internal fluid pressure, by virtue of limited stretchability of the wall material especially at the closed ends of the container.

To the ends of eliminating effectively bursting of the container as from accidental objectionable overloading of the container, together with venting trapped gas or air and visually indicating the presence of a determinate volume of fluid or liquid **30** within the container especially during the filling operation, the invention provides the pressure-relief and overflow valve means or assembly **13** mounted on the margin of the movable upper wall **11** at the aperture therein in communication with the interior of the container **10** and operatively associated with the manipulating means **15** within the container. The valve assembly **13** may be spaced from each closed end, desirably centrally therebetween, and may be located to overlie the longitudinal axis of the container in its distended condition.

The construction of the valve assembly **13** as shown in Figs. 4, 5 and 6, includes a body member **31** having a fluid-conducting passage **32** therethrough and a seat **33** for a closure element **34**. The body member is preferably of ring-like form and stiff corrosion-resistant material such, for example, as aluminum alloy, stainless steel or other suitable metal, or a suitable stiff plastic material. The body member has spaced-apart annular or circular end faces **35**, **36** of substantial width and a continuous annular or circular wall **37** therebetween of substantial lateral thickness and stiffness and short longitudinal or axial length defining the internal fluid-conducting passage **32** from end face **35** to end face **36** and providing the seat **33** in a continuous annular form at the region of the lower end face **36** for facing toward the base or lower wall **12** of the container to facilitate increased sealing with increased internal fluid pressure. The annular seat **33** may be inclined or of frusto-conical shape in cross-section and may intersect the lower end face **36** and the inner peripheral surface of the annular wall **37** of the body member **31**.

The upper end face **35** may have a shallow annular depression **38** of substantial width for receiving therein part of the margin of the upper wall **11** in sealing relation thereto and for registering therein a peripheral part of an attaching flange **39** of aluminum alloy, for example. The attaching flange constitutes in part means for mounting and attaching sealingly and adhesively as by a suitable rubber cement, the valve assembly **13** to the upper wall **11** for movement therewith, as shown in Figs. 4, 5 and 6.

The attaching flange **39** may be of circular plate-like form having a central circular opening and adjacent thereto a plurality of circumferentially spaced-apart relatively smaller circular openings or ports **40**, **40** for conducting fluid and for disposition in the passage **32**. The attaching flange **39** has radially outward of the ports **40**, **40** a plurality of circumferentially spaced-apart holes for alignment with internally threaded holes in the upper end face **35** of the body member **31** so as to receive suitable threaded bolt fasteners **41**, **41** which threadedly engage the body member and press the attaching flange **39** and margin of the upper wall **11** tightly against the upper end face **35** of the body member **31**.

The body member **31** has a tubular open-ended guide element **42** having a lower end wall **42***a* and disposed axially and centrally of the passage **32**. The guide element is fixedly supported from the annular wall **37** by means of a suitable multi-ported internal web **43** interconnecting such guide element **42** at the lower end wall **42***a* thereof and the annular wall **37** as shown especially in Fig. 4, the web **43** being desirably between the end faces **35**, **36** and adjacent the annular seat **33** to provide space between the web and the attaching flange **39** for the passage of fluid. The guide element **42** is desirably cylindrical, and has a stepped bore **42***b* axially therethrough for accommodating yieldable actuating means or valve stem structure **44**, and projecting upwardly through the central opening of the attaching flange **39**.

The valve stem structure **44** includes an elongate tubular stem **45** of aluminum alloy, for example, having a uniform bore **46** extending from its lower end and terminating short of its upper end in an enlarged outwardly tapered bore **47**. The tubular stem **45** has a reduced uniform diameter, externally threaded in part, lower end portion **48**; an externally threaded upper end portion **50**; and a relatively larger uniform diameter, smooth, cylindrical intermediate portion **49** having a keyway **51** therein for slidably engaging a key portion **52** of the guide element **42** in the smaller diameter lower end bore thereof to prevent rotation of the stem **45** relative to the guide element, while facilitating axial sliding movement of the stem relative to the guide element.

A uniform diameter tubular sealing gasket or plug **53** of suitable resilient rubber is detachably wedged in the tapered end bore **47** of the stem **45** at its upper end portion **50** for detachable gripping and sealing engagement with the manipulating means **15**. A thin, circular, flat retaining washer **54** of steel, for example, having a radial slot therein overlies the upper end of the sealing gasket **53** and of the stem **45**. An internally threaded hollow hexagon nut **55** of aluminum alloy, for example, having a centrally apertured upper wall is telescopically and threadedly engaged with the threaded upper end portion **50** of the stem, so that the gasket **53** and the retaining washer **54** are enclosed within the nut and held securely in engagement with the stem. The arrangement provides for axial movement of the stem, gasket, washer and nut as a unit, and also for separation of such parts as for adjustment purposes to be discussed more fully hereinafter.

The hexagon nut **55** may be provided with radially projecting, diametrically opposite mounting pins **56**, **56** of steel, for example, which may have threaded engagement with the nut as shown especially in Fig. 4. Locking means or a cam lock **57** may be pivotally mounted on the pins **56**, **56** to provide for a normally yieldable closed setting as shown in Figs. 4 and 6, and a locking setting of the valve stem structure **44** as shown in Fig. 5.

The actuating means or valve stem structure **44** includes yieldable or resilient means associated with the body member **31** and comprising desirably a coiled metal

spring 58 of uniform diameter and compression type disposed telescopically about and along the stem 45 at its smooth cylindrical intermediate portion 49 and disposed within the tubular guide element 42. The spring 58 is supported at its lower end or base by the bottom end wall of the guide element and supported at its upper end by the lower face of the hexagon nut 55, while the adjacent annular wall of the guide element 42 facilitates maintaining the axial alignment of the coils of the spring 58 i. e. prevents tilting of the spring. The arrangement makes feasible resiliently urging the axially movable valve stem structure 44 in the axial direction outwardly away from the upper end of the tubular guide element 42, so that in the normally yieldable closed setting of the valve assembly, shown especially in Figs. 4 and 6, the movable closure element 34 associated with the valve stem structure 44 is urged toward and resiliently and sealingly pressed against the annular seat 33, and increased internal fluid pressure within the container increases the effectiveness of the seal.

The closure element 34 may be formed of a circular, flat, centrally apertured backing plate 59 of aluminum alloy, for example, having its continuous upper face and sloping peripheral edge entirely covered by a sealing element 60 of suitable gasoline-resistant resilient rubber material bonded throughout to the backing plate 59. The sealing element 60 at its periphery has an annular, inclined or conical sealing surface 61 of resilient rubber for mating contact with the annular, inclined seat 33. The closure element 34 is detachably mounted on the valve stem 45 at its lower end portion 48 by means of an aluminum washer 62 and an aluminum hexagon nut 63 threadedly engaging the threads of the end portion 48, so that the closure element is clamped tightly and sealingly between the lower end of the larger intermediate portion 49 of the stem 45 and the washer 62 and nut 63. This compels axial movement of the closure element 34 toward and away from the annular seat 33 upon corresponding movement of the actuating means or valve stem structure 44 to close and open the passage 32 in the body member 31, and thus prevent or permit the flow of fluid from within the container through the ports of the web 43 and of the attaching flange 39 to the exterior of the container.

Desirably, an annular or ring filter 64 of 20 mesh copper screen material, for example, and inverted U-shape in cross section may be disposed in the annular space between the web 43 and the attaching plate 39 to prevent the entrance of dirt or other foreign material through the ports of the valve assembly 13 and into the container.

To operate the valve assembly 13 in response to a determinate extent of movement of the upper wall 11 away from the base or lower wall 12 of the container, or in response to a determinate volume of fluid or liquid within the container, the manipulating means 15 may be a flexible tension member or pull element 65 such, for example, as a cable of stainless steel wire having a series of spaced-apart, small diameter, stainless steel adjustment balls 66, 66 swedged on or otherwise suitably secured to the wire cable. The spacing between the adjustment or position-indicating balls 66, 66 may be substantially regular and desirably such as to indicate approximately equal increments in volume of contained fluid or liquid such, for example, as increments of 50 gallons of liquid for containers of several thousand gallon capacity.

The pull element or cable 65 may be fixedly attached in a suitable manner at its one end to the lower wall 12 so as to underlie directly the valve assembly, and extends from such attachment upwardly entirely through the bore 46, 47 of the valve stem 45 and beyond the valve stem structure 44 as shown in Figs. 1 to 6, inclusive, and may terminate at its other end exteriorly of the container in a suitable handling loop 67. A desired adjustment ball 66 is gripped or jammed firmly and sealingly in the bore of the sealing gasket 53, so that the ball and cable cannot move axially relative to the gasket 53 and stem 45 under either downward or upward pull on the cable 65, when the washer 54 and nut 55 are threadedly engaged with the stem 45 as shown.

Adjustment of the position of engagement of the valve assembly 13 with the pull cable 65 i. e. the length of the connection between the lower wall 12 and the valve assembly as shown in Figs. 2 and 3, which length establishes the maximum height to which the upper wall 11 can rise before the valve assembly automatically opens, is accomplished as follows.

Assuming the valve assembly in the condition shown in Figs. 4 and 6, the nut 54 having the cam lock 57 pivotally mounted thereon is unscrewed from the threaded upper end portion 50 of the valve stem 45, and then the radially slotted retaining washer 54 is slipped sidewise off the cable 65 to uncover the sealing gasket 53. Outward pull on the cable 65 forces the gasket 53 out of the tapered end bore 47 of the stem 45, after which the gasket 53 and remaining parts of the valve assembly can be slid along the cable to any desired adjustment or position-indicating ball 66. Then the gasket 53 and ball 66 therein are forced back into the tapered end bore 47 of the stem 45, and the retaining washer 54 and nut 54 are re-assembled with the stem.

In the operation of the container 10 having the pressure-relief and overflow valve assembly 13 in its normally yieldable closed condition or setting mounted on the flexible distensible upper wall 11 of the container, and also connected to the manipulating means 15 and to the base or lower wall 12 of the container as shown in Fig. 2, for example, with the container being empty and fully collapsed, the upper wall 11 and valve assembly 13 rise initially from a position against the base wall 12 in accordance with the increase in height of the level of contained gasoline, for example, while the container is being filled with gasoline through the inlet hose 22, for example, or alternatively through the hose 27 and fitting 26. The upper wall 11 in a tensioned condition and the valve assembly 13 will rise to a determinate heighth at which the pull cable 65 is taut, whereupon slight additional upward movement or lifting of the upper wall 11 and valve assembly 13 as a consequence of a slight amount of trapped air within the container, or as a consequence of additional gasoline, or both, overcomes the compressive resistance of the valve spring 58 and produces automatic opening of the valve assembly 13 to reduce the internal fluid (air and/or liquid) pressure, or to permit overflow of excess contained gasoline, or both, until the upper wall and valve assembly return to the determinate heighth to facilitate automatic closing of the valve assembly. Such functioning of the valve assembly occurs whether the container is being completely filled with gasoline as shown in Fig. 2, or only partially filled with gasoline of determinate volume as shown in Fig. 3. When the container is filled as desired, the valve 24 of the inlet pipe 22 is closed, or the hose 27 removed and fitting 26 closed.

It is to be noted that when the upper wall 11 in a tensioned condition and valve assembly 13 have moved away from the base wall 12 a determinate extent established by the determinate volume of contained gasoline and under the influence of the rising level of contained gasoline, the pull cable 65 is taut and exerts some downward pulling force on the valve stem structure 44, which pulling force is resisted effectively by the compression spring 58, so that the closure element 34 remains seated against the seat 33. However, additional upward movement of the upper wall and valve assembly as from distension of the upper wall by trapped air, or from greater volume of contained gasoline due to extra and continued filling of the container, increases both the tautness and the downward pulling force of the pull cable 65 sufficiently to overcome the resistance of the compression spring and produce limited axial sliding movement of the valve stem structure 44 such that the closure element 34

moves away from the seat 33 to break the seal and thus permit the passage of fluid outwardly through the valve assembly 13.

When the container is being filled to its full capacity or to its determinate partial capacity, the valve assembly 13 advantageously opens when the upper wall 11 has distended or moved, under the influence of the rising liquid level, to a very slight extent beyond the desired determinate position above the base 12, whereby trapped air, if any, may escape to the outer atmosphere. This is advantageous to eliminate trapped air for the fully filled condition, or to minimize the volume of trapped air for the partially filled condition. The valve assembly functions similarly when the upper wall is distended as by gasoline vapor or gaseous mixture above the body of contained liquid gasoline resulting from the heat of the sun, for example, on the container, to facilitate the escape of the gasoline vapor or mixture to the outer atmosphere where it is greatly diffused to reduce the explosive hazard.

Also, when the level of the liquid gasoline in the container reaches the predetermined height established by the desired volume, the valve assembly 13 automatically opens under the influence of additional gasoline producing increased downward pulling force exerted by the pull cable 65, so that the gasoline flows out of the valve assembly to the exterior of the container and serves as a visual indication that the desired volume of gasoline is within the container. This indicia function is produced whether the container is partially or fully filled, and is dependent on the setting of the pull cable relative to the valve assembly.

Although the container described hereinabove is designed to accommodate a 10% overload of rated capacity by virtue of the limited stretchability of the fabric and rubber walls, it is advantageous to avoid this and the resultant bursting stresses. The automatic functioning of the valve assembly 13 permitting the overflow of excess gasoline serves effectively to protect the container against such overload and such bursting stresses.

The valve assembly 13 may be left in its normally yieldable closed setting while gasoline, for example, is stored within the container, so as to avoid undue internal fluid pressures as from gasoline vapor. However, if the container with gasoline therein is to be moved to a new location, the valve assembly 13 may be placed in its locked condition by means of arranging the cam lock 57 in its lock setting as shown in Fig. 5. For the lock setting, it is impossible for downward pull on the cable 65 to move the valve stem structure 44 and its associated closure element 34 and open the valve assembly, and the container may be lifted and moved without loss of gasoline as by use of the flexible handles 21, 21.

If the container is mounted upon an inclined supporting surface so as to extend lengthwise down the surface, the valve assembly 13 will open and permit overflow of gasoline before sufficient internal liquid pressure can be produced on the downhill side or end portion to burst the container. However, under such conditions it may be that the valve assembly will permit overflow before the desired volume of gasoline is filled into the container.

It will be noted that the valve assembly 13 advantageously functions as a safety valve for avoiding excessive internal fluid pressure due to a gas or a liquid, and at the same time permits overflow of excess contained fluid whenever a desired determinate volume of fluid is within the container. Also, with the valve assembly 13 in its normally yieldable closed setting, the functioning of the valve assembly is automatic and responsive to internal pressure and/or liquid conditions within the container, once the desired operative connection of the manipulated means 15 to the valve assembly 13 has been effected in the manner described hereinabove.

The modified construction 70 of the pressure-relief and overflow valve assembly shown in Fig. 7 in the normally yieldable closed condition or setting, differs in several aspects from the valve assembly 13 shown in Figs. 1, 4, 5 and 6. The body member 71 is constructed and arranged substantially like that of the body member 31, except that its tubular open-ended guide element 72 of uniform cylindrical shape has a bore of uniform diameter throughout its length. The continuous annular wall of the guide element 72 at the upper end portion thereof is cut away to provide diametrically opposed, oppositely generally inclined cam surfaces 73, 73 merging with and intersecting axially-extending or vertically-extending, circumferentially spaced-apart guide surfaces 74, 74, all of which surfaces 73, 74 intersect the upper end face of the guide element 72. The guide element 72 at its upper end face has diametrically opposed narrow slots 75, 75 therein adjacent the cam surfaces 73, 73 for receiving and holding temporarily therein opposed projecting pins 76, 76 of a tubular valve stem 77 to provide for a locked setting of the valve assembly 70. The valve stem 77 is constructed and arranged without a keyway like keyway 51 but otherwise is much the same as the valve stem 45, and is rotatable and axially slidable within the guide element 72 in close fitting relation to the continuous annular wall of the guide element 72.

The externally threaded upper end portion of the valve stem 77 does not have an enlarged tapered bore like the valve stem 45. The valve stem 77 has desirably a bore 77*a* of uniform diameter from end to end to accommodate at its upper end portion a flanged solid plug 78 of metal having a radial slot therein for the cable 65, the flange being normally seated against the upper end of the valve stem.

A suitable internally threaded hollow nut 79 engages telescopically the upper end portion of the valve stem 77 and provides with the plug 78 a spherical seat for retaining the desired metal ball 66 of the pull cable 65 which extends axially through the valve stem, plug and nut to the exterior of the valve assembly. The nut 79 is also utilized to hold in place on the valve stem 77 a metal circular cap 80 and a metal washer 81 as shown in Fig. 7.

The valve stem structure constituted by the valve stem 77, plug 78, nut 79, cap 80, and washer 81, also includes a coiled metal spring 82 of substantially uniform diameter and of the compression type. The spring 82 is disposed about the exterior of the annular wall of the guide element 72 and about the valve stem 77, and is supported by the ported web of the body member 71 and by the washer 81 of the valve stem structure.

A further difference of the modified valve assembly 70 is that the attaching flange 83 does not have an apertured and multiported web or central portion, but instead is provided with a plurality of circumferentially spaced-apart upstanding segments 84, 84 arranged in telescopically removable relation to the cap 80. The segmented attaching flange 83 makes feasible the passage of fluid such as overflow gasoline through the spaces between the segments.

In the operation of the modified valve assembly 70 with the projecting pins 76, 76 in the generally V-shaped spaces defined by the inclined cam surfaces 73, 73 and the vertical guide surfaces 74, 74, the compression spring 82 normally exerts upward force against the washer 81, so that the valve stem 77 and the closure element 34 are urged upwardly and the closure element seats against the conical seat of the body member 71 to close the valve assembly. However, after determinate movement of the upper wall 11 and the valve assembly 70 relative to the base 12 of the container 10, further movement causes the downward pull exerted by the pull cable 65 to overcome the compressive resistance of the spring 82, and both pins 76, 76 move axially downward until they reach the bottom junctions of the cam surfaces 73, 73 with the vertical guide surfaces 74, 74 at which point the closure element 34 has moved substantially away from the

conical seat of the body member 71 and the valve assembly 70 is open, so that trapped air, or excess gasoline, or both, can flow through the valve assembly to the exterior of the container.

To place the valve assembly 70 in its locked condition the cap 80 and valve stem structure are rotated clockwise so that both pins 76, 76 ride on the cam surfaces 73, 73 up to the end face of the guide element 72 and then seat in the opposed slots 75, 75 of such guide element. This prevents any accidental opening of the valve assembly during transportation, for example, of the container 10 in a filled condition.

Variations may be made without departing from the scope of the invention as it is defined in the following claims.

I claim:

1. An article of the class described comprising a closed container for receiving fluid, the said container including a first wall portion movable toward and away from an oppositely disposed second wall portion throughout a plurality of positions in response to a change in the volume of fluid in the container to provide for a wide range of fluid-capacities of said container, one of said wall portions having an aperture therein, a pressure-relief and overflow valve assembly including a body member mounted on said one wall portion at the aperture therein, said body member having a passage therethrough for conducting the fluid and including a seat for a closure element, a closure element movable toward and away from said seat to close and open said passage, said closure element including a tubular valve stem with a bore therein communicating with the interior of the container, resilient means engaging said body member and said closure element to urge the closure element sealingly against said seat to close said passage, sealing and retaining means mounted on said tubular valve stem in sealing relation thereto and having an opening therethrough in alignment with the valve stem bore, and a flexible tension member connected to the other wall portion of the container and extending through the bore in said valve stem and said opening in said sealing and retaining means in movable relation thereto and extending substantially outward beyond said valve assembly at the exterior of said container, said sealing and retaining means engaging said tension member in sealing and releasable holding relationship to facilitate external adjustment of said tension member to a particular predetermined length between the movable said first wall portion and said second wall portion within the range of said plurality of positions of said movable said first wall portion, motion of said movable said first wall portion away from said second wall portion to a position past that sufficient to take up slack in said tension member causing said closure element to move away from said seat and open said passage to the exterior of the container to reduce the fluid-pressure internally of said container and facilitate overflow of excess contained fluid through said passage of the valve assembly.

2. An article of the class described comprising a closed container for receiving fluid, the said container including an apertured first wall portion movable toward and away from an oppositely disposed second wall portion throughout a plurality of positions in response to a change in the volume of fluid in the container to provide for a wide range of fluid-capacities of said container, a pressure-relief and overflow valve assembly including a body member sealingly mounted on the movable first said wall portion at the aperture therein for movement therewith, said body member having a passage therethrough for conducting the fluid and including a seat for a closure element, a closure element movable toward and away from said seat to close and open said passage, said closure element including a tubular valve stem with a bore therein communicating with the interior of the container, resilient spring means engaging said body member and said closure element to normally urge the closure element resiliently and sealingly against said seat to close said passage, sealing and retaining means mounted on said tubular valve stem in said bore thereof in sealing relation thereto and having an opening therethrough in alignment with the valve stem bore, and a flexible tension member secured to said second wall portion of the container and extending through the bore in said valve stem and said opening in said sealing and retaining means in movable relation thereto and extending substantially outward beyond said valve assembly at the exterior of said container, said sealing and retaining means engaging said tension member in sealing and releasable holding relationship to facilitate external adjustment of said tension member to a particular predetermined length between said movable first wall portion and said second wall portion within the range of said plurality of positions of said movable first wall portion, motion of said movable first wall portion away from said second wall portion to a position past that sufficient to take up slack in said tension member causing said closure element to move away from said seat and open said passage to the exterior of the container to reduce the fluid-pressure internally of said container and facilitate overflow of excess contained fluid through said passage of the valve assembly.

3. A portable distensible-collapsible closed container for temporary storage of fluid, said closed container comprising a bottom wall and a distensible upper wall of flexable impervious rubber-like material sealingly united with said bottom wall, one of said walls having an aperture therein, said upper wall being upwardly distensible relative to said bottom wall, under the influence of contained fluid, to a plurality of positions starting at said bottom wall and terminating remote therefrom to provide for a wide range of fluid-capacities of the closed container, a pressure-relief and overflow valve assembly including a body member mounted on said one of said walls at the aperture therein, said body member having a passage therethrough for conducting the fluid and including a seat for a closure element, a closure element movable toward and away from said seat to close and open said passage, said closure element including a tubular valve stem with a bore therein communicating with the interior of the closed container, resilient means engaging said body member and said closure element to urge the closure element sealingly against said seat to close said passage, a flexible tension member connected to the other of said walls of the container and extending through the bore in said valve stem in movable relation thereto and extending substantially outward beyond said valve assembly at the exterior of said container, and sealing and retaining means mounted on said tubular valve stem in sealing relation thereto and having an opening therethrough in alignment with the valve stem bore accommodating said tension member and said sealing and retaining means engaging said tension member in sealing and releasable holding relationship to facilitate external adjustment of said tension member to a particular predetermined length between said bottom wall and said upper wall of the container within the range of said plurality of positions of said upper wall, upward distension of said upper wall relative to said bottom wall to a position past that sufficient to take up slack in said tension member causing said closure element to move away from said seat and open said passage to the exterior of the container to reduce the fluid-pressure internally of the container and facilitate overflow of excess contained fluid through said passage of the valve assembly.

4. A portable distensible-collapsible closed container for temporary storage of fluid, said closed container comprising a base of flexible impervious rubber-like material and a distensible upper wall of said rubber-like material integrally united with said base, said upper wall having an aperture therein and being upwardly distensible relative to said base, under the influence of contained fluid, to a plurality of positions starting at said base and terminating remote therefrom to provide for a wide range of fluid-

capacities of the closed container, a pressure-relief and overflow valve assembly including a body member sealingly attached to said distensible upper wall at the aperture therein for movement therewith, said body member having a passage therethrough for conducting the fluid and a seat for a closure element, a closure element movable toward and away from said seat to close and open said passage, said closure element including a tubular valve stem with a bore therethrough communicating with the interior of the closed container, a resilient metal spring engaging said body member and said closure element to normally urge the closure element resiliently and sealingly against said seat to close said passage, a flexible tension member secured to said base of the container and extending through the bore in said valve stem in movable relation thereto and extending substantially outward beyond said valve assembly at the exterior of said upper wall, said tension member including a plurality of spaced-apart adjusting elements fixedly mounted in series thereon, and resilient sealing and gripping means mounted in the bore in said tubular valve stem in sealing relation thereto and having a bore in alignment with the valve stem bore accommodating said tension member and being in resilient sealing and releasable gripping relation to an adjusting element of said tension member to facilitate external adjustment of said tension member to a particular predetermined length between said base and said upper wall of the container within the range of said plurality of positions of said upper wall, upward distension of said upper wall relative to said base to a position past that sufficient to take up slack in said tension member causing said closure element to move away from said seat and open said passage to the exterior of the container to reduce the fluid-pressure internally of the container and facilitate overflow of excess contained fluid through said passage of the valve assembly.

5. A portable distensible-collapsible closed container for temporary storage of fluid, said closed container comprising flexible, impervious, textile fabric reinforced, rubber-like sheet material arranged in elongate tubular form with closed ends to provide a flexible base and a distensible upper wall and flexible end walls of the container, said upper wall having an aperture therein intermediate said closed ends and being upwardly distensible relative to said base, under the influence of contained fluid to a plurality of positions starting at said base and terminating remote therefrom to provide for a wide range of liquid-capacities of the closed container, a pressure-relief and overflow valve assembly comprising a ring-like body member having a relatively thick continuous annular wall, means for sealingly attaching said annular wall directly to said upper wall at the aperture therein for movement therewith, said body member having a passage therethrough for conducting the fluid and an annular seat for a closure element, a closure element of circular disc shape including a peripheral sealing face of elastic material movable toward and away from said seat to close and open said passage, said closure element including an outwardly projecting tubular valve stem with a bore therethrough communicating with the interior of the closed container, a resilient metal spring engaging said body member and said valve stem to normally urge said closure element resiliently and sealingly against said seat to close said passage, a flexible tension member attached to said base of the container and extending through said bore in said valve stem in movable relation thereto and extending substantially outward beyond said valve assembly at the exterior of said upper wall, said tension member including a plurality of spaced-apart ball elements fixedly mounted in series thereon, resilient sealing and gripping means removably mounted in said bore in said tubular valve stem at the outer end thereof in sealing relation thereto and having a bore in alignment with the valve stem bore accommodating said tension member and being in sealing and releasable gripping relation to a ball element of said tension member to facilitate external adjustment of said tension member to a particular predetermined length between said base and said upper wall of the container within the range of said positions of said upper wall, upward distension of said upper wall relative to said base to a position past that sufficient to take up slack in said tension member causing said closure element to move away from said seat and open said passage to the exterior of the container to reduce the fluid-pressure internally of the container and facilitate overflow of excess contained fluid through said passage of the valve assembly, and releasable locking means at the exterior of the container mounted on said body member and engaging said body member and said valve stem, in the locked setting of said locking means, to temporarily yet fixedly hold said closure element against said seat and close said passage.

6. A pressure-relief and overflow valve assembly for a closed container wherein a first wall portion of the container is movable toward and way from an oppositely disposed second wall portion of the container throughout a plurality of positions in response to a change in the volume of fluid in the container and one of said wall portions having an aperture therethrough, said valve assembly comprising a body member for mounting on the said one wall portion at the aperture therein, said body member having a passage therethrough for conducting the fluid and including a seat for a closure element, a closure element movable toward and away from said seat to close and open said passage, said closure element including a tubular valve stem having a bore therein for communication with the interior of the container, resilient means engaging said body member and said closure element to urge the closure element sealingly against said seat to close said passage, a flexible tension member for attachment to the other said wall portion of the container at the interior thereof, said tension member extending through said bore in said valve stem in movable relation thereto and extending substantially outward beyond said valve assembly for disposition at the exterior of the container, and sealing and retaining means mounted on said tubular valve stem in sealing relation thereto and having an opening therethrough in alignment with the valve stem bore accommodating said tension member and said sealing and retaining means engaging said tension member in sealing and releasable holding relationship to facilitate adjustment of said tension member externally of the container to a particular predetermined length between the movable said first wall portion and the said second wall portion of the container within the range of said plurality of positions of the movable said first wall portion of the container, whereby movement of said movable said first wall portion relative to said second wall portion to a position past that sufficient to take up slack in said tension member causes said closure element to move away from said seat and open said passage for communication with the exterior of the container.

7. A pressure-relief and overflow valve assembly for a portable distensible-collapsible closed container of flexible impervious material wherein an apertured distensible upper wall of the container is movable toward and away from a base of the container throughout a plurality of positions starting at said base and terminating remote therefrom to provide for a wide range of fluid-capacities of the container, said valve assembly comprising a body member for mounting on the distensible upper wall of the container at the aperture therein for movement therewith, said body member having a passage therethrough for conducting the fluid and a seat for a closure element, a closure element movable toward and away from said seat to close and open said passage, said closure element including a tubular valve stem having a bore therein for communication with the interior of the container, resilient spring means engaging said body member

and said closure element to normally urge the closure element resiliently and sealingly against said seat to close said passage, a flexible tension member for attachment to the base of the container at the interior thereof, said tension member extending through said bore in said valve stem in movable relation thereto and extending substantially outward beyond said valve assembly for disposition at the exterior of said upper wall of the container, said tension member including a plurality of spaced-apart adjusting elements fixedly mounted in series thereon, sealing and retaining means mounted in said bore in said valve stem in sealing relation thereto and having an opening therethrough in alignment with the valve stem bore accommodating said tension member and being in sealing and adjustable retaining relation to an adjusting element of said tension member to facilitate adjustment of said tension member externally of the container to a particular predetermined length between the base and the upper wall of the container within the range of said plurality of positions of the upper wall of the container, whereby distension of said upper wall relative to said base, under the influence of contained fluid, to a position past that sufficient to take up slack in said tension member causes said closure element to move away from said seat and open said passage for communication with the exterior of the container, and locking means for engaging said body member and said closure element to temporarily hold said closure element against said seat and close said passage.

8. A pressure-relief and overflow valve assembly for a portable distensible-collapsible closed container of flexible impervious material wherein an apertured distensible upper wall of the container is movable toward and away from a base of the container throughout a plurality of positions starting at said base and terminating remote therefrom to provide for a wide range of fluid-capacities of the container, said valve assembly comprising a body member for sealing attachment to the distensible upper wall of the container at the aperture therein for movement therewith, said body member having a relatively thick continuous annular wall defining a passage for conducting the fluid and providing an annular seat for a closure element, a closure element including a peripheral seating surface thereof movable toward and away from said seat to close and open said passage, said closure element including a tubular valve stem projecting outwardly therefrom and having a bore therein for communication with the interior of the container, a resilient metal spring mounted on said body member and engaging said body member and said valve stem to normally urge said seating surface of the closure element resiliently and sealingly against said seat to close said passage, a flexible tension member for attachment to said base of the container at the interior thereof, said tension member extending through said bore in said valve stem in movable relation thereto and extending substantially outward beyond said valve assembly for disposition at the exterior of said upper wall of the container, said tension member including a plurality of spaced-apart ball elements fixedly mounted in series thereon, and resilient sealing and gripping means mounted in said bore in said valve stem in sealing relation thereto and having a bore in alignment with the valve stem bore accommodating said tension member and being in sealing and releasable gripping relation to a ball element of said tension member to facilitate external adjustment of said tension member to a particular predetermined length between the base and the upper wall of the container within the range of said plurality of positions of the upper wall, whereby distension of said upper wall relative to said base, under the influence of contained fluid, to a position past that sufficient to take up slack in said tension member causes said closure element to move away from said seat and open said passage for communication with the exterior of the container.

9. A pressure-relief and overflow valve assembly for a portable distensible-collapsible closed container of flexible impervious material wherein an apertured distensible upper wall of the container is movable toward and away from a base of the container throughout a plurality of positions starting at said base and terminating remote therefrom to provide for a wide range of fluid-capacities of the container, said valve assembly comprising a ring-like body member for sealing attachment to the distensible upper wall of the container at the aperture therein for movement therewith, said body member having a relatively thick continuous annular wall defining a passage for conducting the fluid and providing a continuous annular seat for a closure element, a closure element of generally round disc shape including a continuous annular elastic peripheral seating surface thereof movable toward and away from said seat to close and open said passage, said closure element including a tubular valve stem projecting axially outward therefrom and having a bore therethrough for communication with the interior of the container, a resilient coil spring disposed telescopically about said valve stem and engaging said body member and said valve stem to normally urge said closure element including its seating surface resiliently and sealingly against said seat to close said passage, a flexible tension member for attachment to the base of the container at the interior thereof, said tension member extending through said bore in said valve stem in movable relation thereto and extending substantially outward beyond said valve assembly for disposition at the exterior of said upper wall of the container, said tension member including a plurality of spaced-apart ball elements fixedly mounted in series thereon, and a resilient rubber sealing and gripping element mounted in said bore in said valve stem in sealing relation thereto and having a bore in alignment with the valve stem bore accommodating said tension member therethrough and being in sealing and releasable gripping relation to a ball element of said tension member to facilitate external adjustment of said tension member to a particular predetermined length between the base and the upper wall of the container within the range of said plurality of positions of the upper wall of the container, whereby distension of said upper wall relative to said base, under the influence of contained fluid, to a position past that sufficient to take up slack in said tension member causes said closure element to move away from said seat and open said passage for communication with the exterior of the container.

10. A pressure-relief and overflow valve assembly for a portable distensible-collapsible closed container of flexible impervious material wherein an apertured distensible upper wall of the container is movable toward and away from a base of the container throughout a plurality of positions starting at said base and terminating remote therefrom to provide for a wide range of fluid-capacities of the container, said valve assembly comprising a ring-like body member for mounting on the upper wall of the container at the aperture therein for movement therewith, said body member having axially spaced-apart end faces and a relatively thick continuous annular wall therebetween defining a passage extending axially from one end face to the other end face of said body member for conducting the fluid and said wall providing a continuous annular seat at and inwardly inclined relative to one end face for disposition at the interior of the container and for contacting a closure element, said body member including a tubular guide element extending axially in said passage with an axial bore therethrough and including a multi-ported internal web interconnecting said annular wall and said guide element, a closure element of circular disc shape including a continuous annular elastic peripheral seating surface thereof inwardly inclined relative to said one end face of said body member movable toward and away from said seat to close and open said passage, said closure element including a tubular valve stem slid-

ably mounted in said bore in said guide element and extending outwardly beyond the guide element and having a bore therethrough for communication with the interior of the container, a resilient coil compression spring mounted on said guide element and disposed telescopically about and along said valve stem and engaging said body member and said valve stem to normally urge said closure element including said seating surface thereof sealingly against and in mating relation to said seat to close said passage, a flexible tension member of metal wire material for attachment to said base of the container at the interior thereof, said tension member extending through said bore in said valve stem in movable relation thereto and extending substantially outward beyond said valve assembly for disposition at the exterior of the upper wall of the container, said tension member including a plurality of spaced-apart metal ball elements fixedly mounted in series thereon, sealing and retaining means mounted in said bore in said valve stem in sealing relation thereto at the end thereof outwardly beyond said guide element and having a bore in alignment with the valve stem bore accommodating said tension member and being in sealing and releasable retaining relation to a ball element of said tension member to facilitate external adjustment of said tension member to a particular

predetermined length between the base and the upper wall of the container within the range of said plurality of positions of the upper wall of the container, whereby distension of said upper wall relative to said base, under the influence of contained fluid, to a position past that sufficient to take up slack in said tension member causes said closure element to move away from said seat and open said passage for communication with the exterior of the container, and cam locking means supported by said body member at the exterior of said valve assembly for engaging said valve stem and said guide element, in the locked condition of said locking means, to fixedly yet temporarily hold said closure element matingly against said seat for preventing accidental spillage of contained fluid when moving the filled container.

References Cited in the file of this patent

UNITED STATES PATENTS

1,645,313	Wiggins	Oct. 11, 1927
1,917,623	Wiggins	July 11, 1933
2,168,891	Wiggins	Aug. 8, 1939
2,355,084	Kurrle	Aug. 8, 1944
2,612,924	Cunningham	Oct. 7, 1952