May 12, 1959 P. A. SMITH ET AL 2,886,061

LOCK TYPE EXCESS FLOW VALVE

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Fig. 1

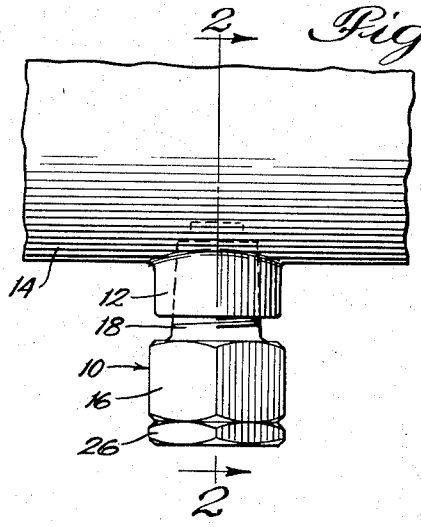


Fig. 2

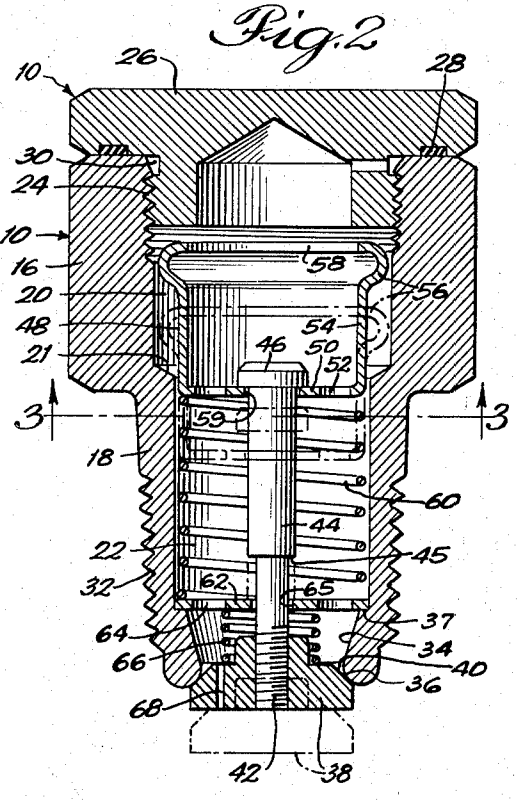
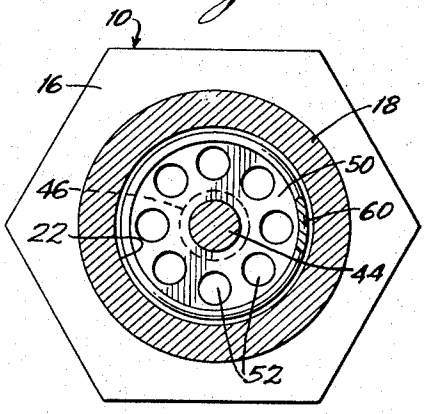


Fig. 3



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Fig. 4

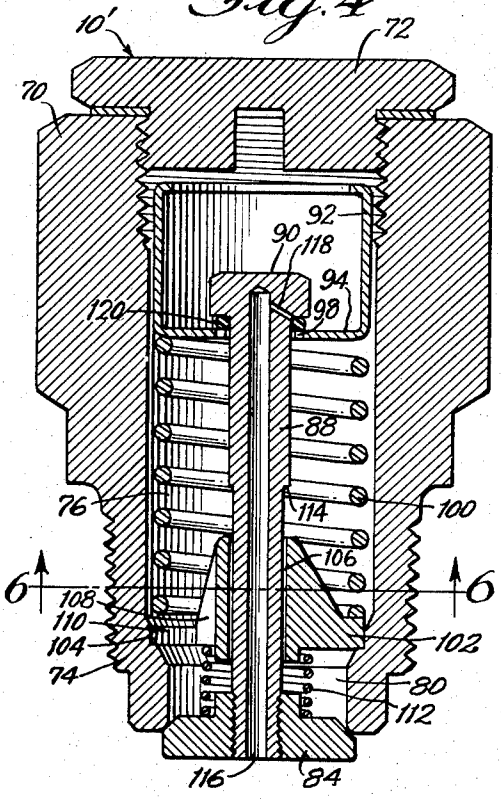


Fig. 5

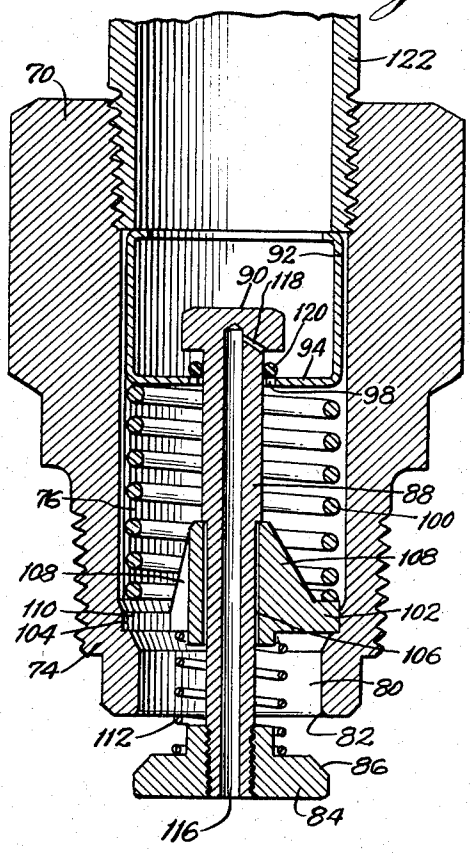
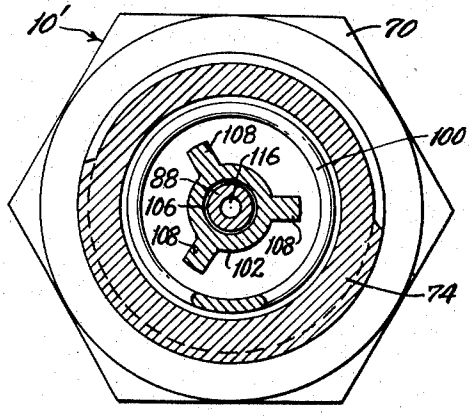


Fig. 6



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LOCK TYPE EXCESS FLOW VALVE

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Application August 4, 1958, Serial No. 752,784

7 Claims. (Cl. 137—517)

This invention relates generally to an excess flow valve, and more particularly to an improved lock type excess flow valve structure for use in the storage and dispensing of liquefied petroleum gas.

In liquefied petroleum gas systems, such as those employing a storage tank of liquefied propane and butane gases, it is often necessary to provide a supplemental outlet or supply means. Such outlets require excess flow check valve structures therein for insuring regulated supply flow therethrough. Ordinarily, when a liquefied petroleum gas tank is first installed, the user has no immediate need for the supplemental outlet which is customarily provided, but such outlets are desirable in order to permit possible future expansion of the installed system. In practice, such supplemental use requirements may not be necessary until as long as several years following initial installation of the tank. When it becomes necessary to "unplug" such supplemental outlet connections and add a new user coupling for the supply of gas to another point of use, it is very important to insure utmost safety and complete control of gas flow through the excess flow check valve of the outlet connection unitil the new line couplings are completed.

There has been a marked trend in recent years toward vapor space filling in connection with liquefied petroleum gas storage, and many domestic storage systems omit the use of the previously conventional dip pipe for communicating the access fitting with the liquid content of the tank. In order to effect liquid transfer or system evacuation in such installations, it is necessary to provide a safe and reliable means for coupling a shut-off valve to the tank fitting without interruption of the system service.

Although excess flow valve structures have been suggested in the past for application to liquefied petroleum gas systems, as in our copending application Serial No. 669,188, filed July 1, 1957, it has often been necessary to insure that the threaded coupling of a pipe nipple to the excess flow valve device, for either transfer and evacuation purposes or for added gas dispensing purposes, must be made with careful attention to the number of pipe thread turns in order to insure proper valving action and safety control.

It is a primary object of the present invention, therefore, to provide a new and improved lock type excess flow valve, providing a safe and efficient connecting means for both vapor and liquid transfer from liquefied petroleum gas storage tanks during system service.

It is another object to provide a lock type excess flow valve which is not limited to the use of a correctly threaded pipe nipple or a special adaptor to insure that correct thread engagement is attained.

Further objects and advtantages of this invention will become apparent as the following description proceeds, and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

A preferred embodiment of the invention is shown in the accompanying drawing, in which:

Figure 1 is a fragmentary side elevation view of an excess flow valve, embodying the present invention, mounted in a wall of a conventional liquefied petroleum gas storage tank;

Figure 2 is a vertical cross sectional view of the valve of Figure 1; and

Figure 3 is a horizontal cross sectional view taken substantially as indicated along the line 3—3 on Figure 2;

Figure 4 is a vertical cross sectional view, similar to Figure 2, of a modified form of excess flow valve having a sealable equalizing port showing the parts thereof in locked relation;

Figure 5 is another vertical cross sectional view of the valve of Figure 4, showing the parts thereof in an open flow relation; and

Figure 6 is a horizontal cross sectional view taken substantially as indicated along the line 6—6 on Figure 4.

Referring now more particularly to Figures 1 to 3 of the drawing, we have designated generally at **10** a first embodiment of a lock type excess flow valve constructed in accordance with the present invention. In Figure 1, the valve **10** is shown threadedly coupled to a suitable boss or fitting **12** of an outer wall portion of a conventional liquefied petroleum gas storage tank **14**. For purposes of illustration, the valve has been shown oriented in a typical bottom mounting in the cylindrical shell of a conventional LPG storage tank, and it will be understood that the same valve may be readily adapted for bottom mounting in generally horizontal alignment in the end or head wall of a tank, and also in association with a dip tube for top mounting in vertical alignment in the top wall of a tank.

Referring now to Figures 2 and 3, the valve **10** comprises a generally cylindrical hollow body **16** having an axially elongated collar portion **18** of reducted diameter at one end thereof. A chamber **20** is defined within the body **16** in coaxial alignment with a smaller diameter bore **22** within the collar portion **18** thereof. An intermediate tapered shoulder **21** is defined between the chamber **20** and bore **22**. The upper end of the body **16** is internally threaded at **24** to receive the correspondingly threaded neck of a pipe plug or cap **26**. A gasket or seal ring **28** insures fluid-tight coupling of the cap **26** within an outlet opening **30** of the chamber **20**. It will be apparent that upon removal of the cap **26**, the outlet opening **30** and threaded portion **24** will be adapted to receive a correspondingly threaded nipple or coupling member.

The collar **18** is externally threaded for cooperation with a threaded boss or tank opening fitting, as indicated at **12** in Figure 1. The free end of the collar **18** defines therein a tapered outlet opening **34** terminating in a rounded annular valve seat **36**. An intermediate annular shoulder **37** is defined between the opening **34** and the bore **22** thereabove.

A poppet **38** provides a frusto-conical valve surface **40** adapted to sealingly engage the valve seat **36**. The poppet **38** is centrally secured to the lower threaded end **42** of an elongated stem member **44** having an enlarged head portion **46** at the upper end thereof. An annular shoulder **45** is defined intermediate the ends of the stem **44**. It will be understood that the stem **44** may vary depending upon the requirements of manufacturing convenience. For example, the stem **44** may be formed as an integral member with the poppet **38**, and the head **46** may constitute a separate member connected to the stem **44**.

A retainer member is generally indicated at **48**, and is normally disposed within the chamber **20**. The retainer **48** provides a transverse bottom wall **50** having a plurality

of flow apertures 32 therein. A generally cylindrical side wall 54 extends upwardly from the bottom wall 50 and defines an outwardly enlarged annular bead 56 terminating in a top edge defining an enlarged opening 58. The diameter of the side wall portion 48 is slightly less than that of the bore 22 for slidable movement therein. The diameter of the bead 56 is substantially larger than that of the bore 22 but slightly less than that of the chamber 20 so as to enable slidable movement within the latter while providing limited engagement against the shoulder 21. The stem 44 slidably extends through a central opening 59 in the retainer bottom wall 50, and the enlarged head portion 46 thereof extends substantially laterally beyond the periphery of the opening 59 for limiting engagement against the bottom wall 50.

A compression spring 60 engages the retainer bottom wall 50 at its one end, and engages a stem guide 62, which is seated upon the annular shoulder 37, at its other end. It will be understood that the stem guide 62 may be formed as an integral spider portion of the body collar 18 if desired for manufacturing convenience, and has been shown as a separate member for illustration purposes only. The stem guide 62 provides a plurality of flow ports 64, and a central opening 65 through which the lower end 42 of the stem 44 slidably extends. An excess flow spring 66 is disposed in compression between the stem guide 62 and the poppet 38. An equalizing pressure port 68 extends through the poppet 38 for bleed flow communication of the tank interior with the bore 22 and chamber 20.

In the normal assembled relation of parts as shown in Figure 2 of the drawing, the compression spring 60 exerts a sufficient lifting force against the retainer 48 so as to raise the stem 44 against the biasing force of the excess flow spring 66 and insure tight seated engagement of the poppet valve surface 40 against the annular valve seat 36. This serves to lock all fluid flow through the valve except for the restricted leakage through the equalizing port 68 of the poppet 38.

When the pipe cap 26 is removed, leakage of liquid or vapor may be readily detected through the equalizing port 68. A pipe nipple with a suitable cooperating shut-off valve, or a shut-off valve device having an integral pipe thread portion, may then be threaded into the outlet opening 30 at 24. As such a member is threaded into the upper chamber 20, it will engage the retainer 48 and slide it downwardly in a guided manner within the bore 22. This serves to release the head 46 of the stem 44 from engagement with the retainer bottom wall 50, and to enable the excess flow spring 66 to effect an opening movement of the poppet 38, thereby permitting fluid flow between the valve surface 40 and the seat 36. Under conditions of excessive rate of flow from the opening 34 to the opening 30, the bias of spring 66 will be overcome in the well-known manner to interrupt flow by seating of the valve surface 40 upon the seat 36.

Any amount of "over travel" of the retainer 48 due to extra length or tolerance variations in the engagement of the pipe threads within the body 16 will have no effect on the operation of the present valve structure. Travel of the excess flow check valve poppet 38 to its open flow position will be limited by engagement of the shoulder 45 upon the stem guide 62.

In order to remove the valve 10 from service, it is only necessary to remove the previously coupled shut-off device and "slug" the excess flow valve. In this way, the retainer 48 will be permitted to return to its normal position substantially fully within chamber 20 in response to the biasing action of the compression spring 60. The cap 26 may then be replaced to complete the seal of the fluid bleed escape permitted by the equalizing port 68.

Referring now to Figures 4 to 6 of the drawing, we have designated generally at 10' a second embodiment of a lock type excess flow valve, similar to the valve 10 previously described but embodying the added feature of a sealable equalizing port.

The valve 10' comprises a generally cylindrical hollow body 70 internally threaded at its upper end to receive a closure cap 72, and externally threaded at its lower end to define a collar portion 74. An elongated chamber 76 is defined within the body 70 and terminates at the opposite ends thereof in outlet openings 78 and 80. The outlet opening 80 provides a rounded annular valve seat 82. A poppet 84 provides a frusto-conical valve surface 86 adapted to sealingly engage the valve seat 82. An elongated stem member 88 is secured to the poppet 84 at its lower end and terminates in an enlarged head portion 90 at its upper end. A retainer member 92, having a perforated bottom wall 94 and an apertured top wall 96, is normally disposed within the upper end of the chamber 76 for slidable movement therein. The stem 88 slidably extends through a central opening 98 in the bottom wall 94 of the retainer, and the enlarged head portion 90 thereof extends substantially laterally beyond the periphery of the opening 98 for limiting engagement against the bottom wall 94.

A compression spring 100 engages the retainer bottom wall 94 at its one end, and engages a stem guide member 102 at its other end. The stem guide member 102 is seated upon an internal annular shoulder 104 of the hollow body 70, but may be formed as an integral spider portion thereof for manufacturing convenience. The stem guide 102 provides a bore 106 of substantial length surrounding the stem member 88 for slidable guiding support thereof. The stem guide 102 is formed with a plurality of radial reinforcing ribs 108 and a plurality of flow apertures 110 arranged circumferentially between the ribs 108. An excess flow spring 112 is disposed in compression between the stem guide 102 and the poppet 84. An annular shoulder 114 is formed on the stem member 88 for limiting engagement against the upper end of the stem guide 102.

The structure of the modified form 10' as thus described corresponds substantially identically in form and function with the embodiment 10 of Figures 1 to 3. In certain practical applications of excess flow valves in liquefied petroleum gas systems, however, it may be desirable to maintain sealing closure of any internal pressure equalizing ports provided by the valve structure until such time as a pipe nipple or a shut off valve is threaded into the outlet opening for releasing the locking engagement between the retainer 92 and the poppet stem member 88. In order to accomplish this purpose, the valve 10' provides a sealable equalizing port in place of the open port 68 of the valve 10.

An elongated bore 116 extends through the poppet 84 and along substantially the full length of the stem member 88, terminating within the enlarged head portion 90 thereof. A small port 118 extends from the bore 116 angularly to the under surface of the head portion 90. An O-ring or similar resilient sealing element 120 annularly surrounds the stem member 88 intermediate its head portion 90 and the apertured bottom wall 94 of the retainer 92.

In the normal assembled relation of parts as shown in Figure 4 of the drawing, the compression spring 100 exerts a sufficient lifting force against the retainer 92 so as to raise the stem 88 against the biasing force of the excess flow spring 112 and insures tight seated engagement of the poppet valve surface 86 against the annular valve seat 82. At the same time, the O-ring 120 is tightly engaged between the lower surface of the stem head portion 90 and the retainer bottom wall 94. In this way, the O-ring 120 effects sealing engagement and closure of the port 118.

Upon removal of the cap 72 and insertion of a threaded pipe nipple 122 or a corresponding portion of a shut off valve into the outlet opening 78, the retainer 92 will be slidably shifted downwardly within the chamber 76 against the pipe of the spring 100, as indicated in Figure 5 of the

drawing. The stem member **88** will be released so as to enable valve opening of the elements **82** and **86** in response to the spring **112**. The sealing compression against the O-ring **120** will also be released, enabling equalizing flow to pass freely through the bore **116** and port **118**.

While there have been shown and described two particular embodiments of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention and, therefore, it is intended in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A lock-type excess flow valve comprising an open-ended hollow tubular body providing a valve seat adjacent its one end, a valve member operatively associated with said valve seat for sealing engagement thereagainst, a valve stem within said body extending from said valve member toward the other open end of said body, retainer means reciprocable within said body, said valve stem being slidably supported by said retainer means for relatively free movement in a valve-closing direction and for limiting retention in a valve-opening direction, first resilient biasing means normally urging said retainer means and valve stem in a valve closing direction, and second resilient biasing means of lesser force than said first biasing means normally urging said valve member in a valve opening direction, said retainer being normally positioned by said first biasing means to effect seating of said valve member against said valve seat, whereby said valve member and second biasing means cooperate to perform an excess flow valving action only upon shifting of said retainer means toward said one end of the body to release said valve stem for free slidable movement.

2. A lock-type excess flow valve comprising an open-ended hollow tubular body providing a valve seat adjacent its one end, a valve member operatively associated with said valve seat for sealing engagement thereagainst, a valve stem within said body extending from said valve member toward the other open end of said body, retainer means reciprocable within said body, said valve stem being slidably supported by said retainer means for relatively free movement in a valve-closing direction and for limiting retention in a valve-opening direction, guide means within said body slidably supporting said valve stem, first resilient biasing means normally urging said retainer means and valve stem in a valve-closing direction, second resilient biasing means of lesser force than said first biasing means normally urging said valve member in a valve-opening direction, said retainer being normally positioned by said first biasing means to effect seating of said valve member against said valve seat, whereby said valve member and second biasing means cooperate to perform an excess flow valving action only upon shifting of said retainer means toward said one end of the body to release said valve stem for free slidable movement, and stop means provided by said valve stem for engagement with said guide means to limit the extent of valve member opening.

3. A lock-type excess flow valve comprising an open-ended hollow tubular body providing a valve seat adjacent its one end, a valve member operatively associated with said valve seat for sealing engagement thereagainst, a valve stem within said body extending from said valve member toward the other open end of said body, retainer means reciprocable within said body, said valve stem being slidably supported by said retainer means for relatively free movement in a valve-closing direction and for limiting retention in a valve-opening direction, first resilient biasing means normally urging said retainer means and valve stem in a valve-closing direction, second resilient biasing means of lesser force than said first biasing means normally urging said valve member in a valve-opening direction, said retainer being normally positioned by said first biasing means to effect seating of said valve member against said valve seat, whereby said valve member and second biasing means cooperate to perform an excess flow valving action only upon shifting of said retainer means toward said one end of the body to release said valve stem for free slidable movement, and bleed port means for restricted fluid flow into said valve body when said valve member is in its closed position.

4. A lock-type excess flow valve comprising an open-ended hollow tubular body defining a chamber at one end, a flow communicating bore of relatively smaller cross section at the other end, said body defining a valve seat at the outlet opening of said bore, a valve member operative to seal against said valve seat, a valve stem within said body extending from said valve member toward said chamber, retainer means reciprocable within said chamber and slidable into said bore, the end of said valve stem opposite said valve member being slidably supported by said retainer means for relatively free movement in a valve closing direction and for limiting retention in a valve opening direction, first resilient biasing means normally urging said retainer means and valve stem in a valve closing direction, and second resilient biasing means of lesser force than said first biasing means normally urging said valve member in a valve opening direction, whereby said valve member and second biasing means cooperate to perform an excess flow valving action only upon shifting of said retainer means into said bore to release said valve stem for free slidable movement.

5. A lock-type excess flow valve comprising an open-ended hollow tubular body defining a chamber at one end, a flow communicating bore of relatively smaller cross section at the other end, and an intermediate annular shoulder therebetween, said body defining a valve seat at the outlet opening of said bore, a valve member operative to seal against said valve seat, a valve stem within said body extending from said valve member toward said chamber, retainer means reciprocable within said chamber and slidable into said bore, the end of said valve stem opposite said valve member being slidably supported by said retainer means for relatively free movement in a valve closing direction and for limiting retention in a valve opening direction, first resilient biasing means normally urging said retainer means and valve stem in a valve closing direction, and second resilient biasing means of lesser force than said first biasing means normally urging said valve member in a valve opening direction, said retainer means providing stop means adapted to engage said annular shoulder for limiting sliding movement thereof into said bore against the force of said first resilient biasing means, whereby to release said valve stem for free slidable movement and enable said second biasing means and said valve member to perform an excess valving action.

6. A lock-type excess flow valve comprising an open-ended hollow tubular body providing a valve seat adjacent its one end, a valve member operatively associated with said valve seat for sealing engagement thereagainst, a valve stem within said body extending from said valve member toward the other open end of said body, retainer means reciprocable within said body, said valve stem being slidably supported by said retainer means for relatively free movement in a valve-closing direction and for limiting retention in a valve-opening direction, first resilient biasing means normally urging said retainer means and valve stem in a valve-closing direction, second resilient biasing means of lesser force than said first biasing means normally urging said valve member in a valve-opening direction, said retainer being normally positioned by said first biasing means to effect seating of said valve member against said valve seat, whereby said valve member and second biasing means cooperate to perform an excess flow valving action only upon shifting of said retainer means toward said one end of the body to release said valve stem for free slidable movement, and bleed port means

extending through said valve member for restricted fluid flow into said valve body when said valve member is in its closed position.

7. A lock-type excess flow valve comprising an open-ended hollow tubular body providing a valve seat adjacent its one end, a valve member operatively associated with said valve seat for sealing engagement thereagainst, a valve stem within said body extending from said valve member toward the other open end of said body, retainer means reciprocable within said body, said valve stem being slidably supported by said retainer means for relatively free movement in a valve-closing direction and for limiting retention in a valve-opening direction, first resilient biasing means normally urging said retainer means and valve stem in a valve-closing direction, second resilient biasing means of lesser force than said first biasing means normally urging said valve member in a valve

opening direction, said retainer being normally positioned by said first biasing means to effect seating of said valve member against said valve seat, whereby said valve member and second biasing means cooperate to perform an excess flow valving action only upon shifting of said retainer means toward said one end of the body to release said valve stem for free slidable movement, and bleed port means extending through said valve stem for restricted fluid flow into said valve body when said valve member is in its closed position, said bleed port means including sealing means supported intermediate said valve stem and said retainer means and operative to close said bleed port means when said valve stem and said retainer means are in limiting engagement with each other.

No references cited.