

[54] HIGH PRESSURE VALVES

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[22] Filed: Feb. 12, 1971

[21] Appl. No.: 114,863

[52] U.S. Cl.137/614.19, 137/543.21, 137/460

[51] Int. Cl.....F16k 21/04

[58] **Field of Search**.....127/460, 459, 461, 614.19,
127/480, 543.21, 543.23

[56] **References Cited**

UNITED STATES PATENTS

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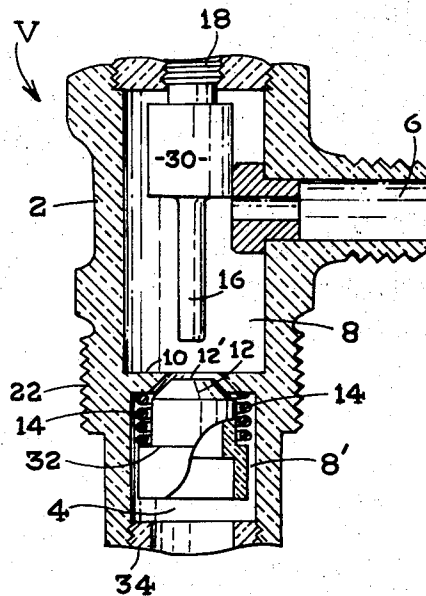
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[57] **ABSTRACT**

The present safety valve is installable in the mouth of a pressurized fluid container from which the fluid exits through an inlet, outlet and connecting passageway in the valve casing. A plug is provided in the passageway to close and completely seal it when a significant imbalance occurs between the fluid pressures in the valve inlet and the valve outlet respectively. The plug is then restorable to open position only by first closing and then reopening the safety valve, after which the plug will continue to remain in its open position subject to the precedent correction and subsequent absence of the pressure imbalance.

4 Claims, 4 Drawing Figures



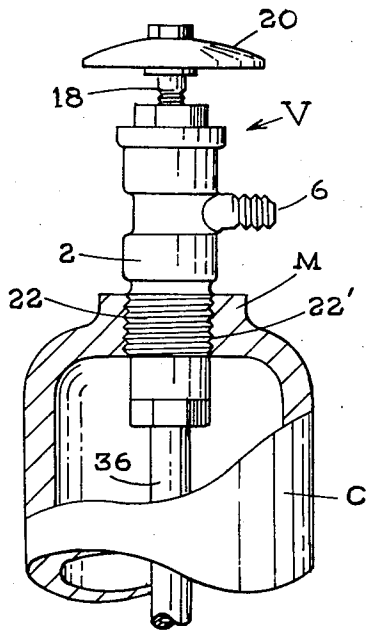


Fig. 1.

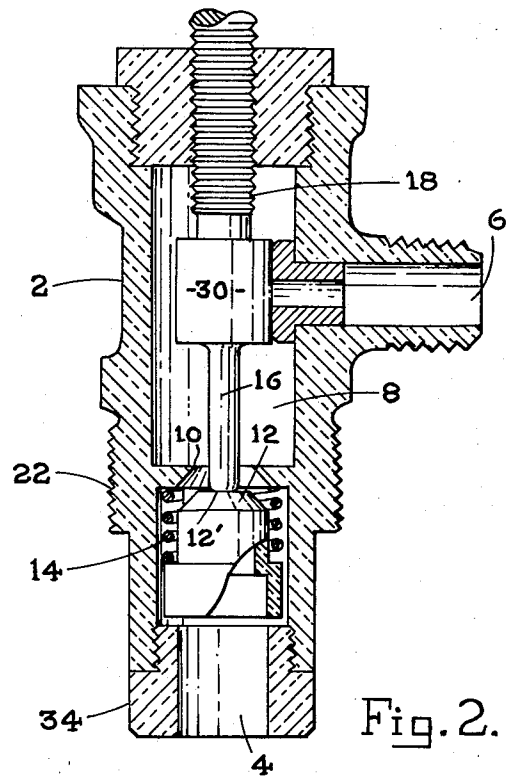


Fig. 2.

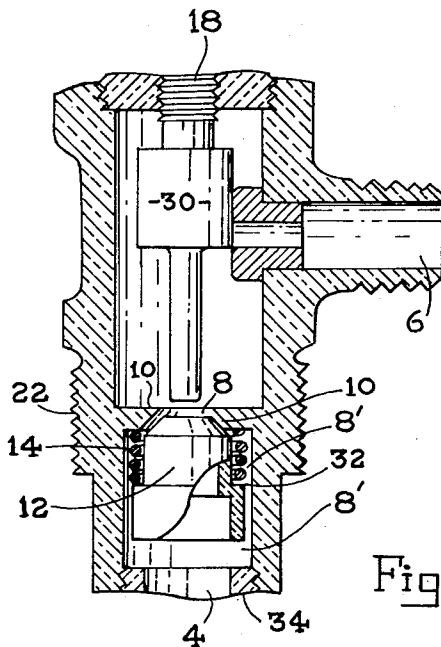


Fig. 3.

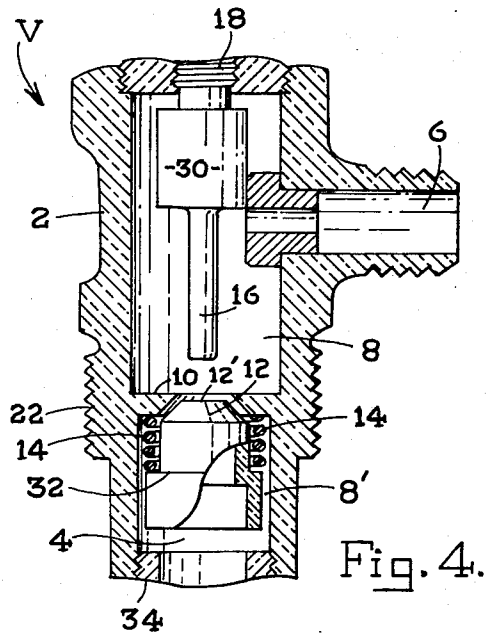


Fig. 4.

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HIGH PRESSURE VALVES

FIELD OF INVENTION

The invention relates to valves installable in the mouths of pressurizable containers and which act both as filling and dispensing valves for the fluid contained under great pressure in such containers.

BACKGROUND OF THE INVENTION

Valves of this nature are known in the art — e.g. COULBOURN — U.S. Pat. No. 2,376,124 in which there is provided a plug to close off communication between the interior of the container and the valve outlet when a significant imbalance in fluid pressures develops therebetween; the plug being thereafter restorable to normally open position when the circumstances conducing to the pressure imbalance have been corrected.

In the past, such plugs were usually provided with small pores permitting very low fluid leakage therethrough which was required to restore the plugs to their normal open attitude following correction of the causes of the pressure imbalance.

It is noteworthy, however, that the leakage continued to persist in each instance pending such correction and, when such correction was long delayed, virtually the entire contents of the container were obviously capable of being vented to the environment.

Of further interest to the invention is a Water Gage Valve as disclosed in STULP — U.S. Pat. No. 469,336 in which the plug element was not perforated as aforesaid. However, the STULP valve construction, described in this patent as being intended for use with water gages, appears to be quite unsuited to the highly pressurized conditions visualized by the present invention having regard, for example, to the specific location of the plug element in the valve.

MAIN OBJECT OF THE INVENTION

It is a main object of the invention to provide an improved safety valve, installable in a container and through which the said container may first be charged with and subsequently emptied of fluid under relatively high pressure; said safety valve embodying emergency means for plugging and sealing it to prevent all further emptying of fluid from the container when the fluid flow through the valve becomes excessive; the emergency plugging means being thereafter restorable to normal open condition only by first closing and then reopening the safety valve after correction of the conditions conducing to the excessive flow aforesaid.

THE INVENTION

The invention consists, therefore, of a safety valve as and for the purpose aforesaid which includes a casing installable within the mouth of a said container whose contents are thereafter dischargeable through a communicating valve inlet, valve outlet, and an interconnecting passageway within the casing. In the intermediate regions of the passageway, there is provided a seat for a valve element or plug which is not perforated so that when seated by a pressure imbalance, it will provide a leak-proof seal blocking all leakage of fluid through said passageway. Thereafter, to restore the valve element to its unseated, neutral position, the

safety valve requires to be first closed, then reopened; separate closure means being provided for closing and re-opening the outlet when the safety valve is manipulated to closed and open positions as aforesaid.

The objects sought to be achieved by the invention are to provide structure capable of performing the functions above set forth and others, both stated and unstated, which will be apparent from the hereinafter following description of the elements, parts and principles constituting the invention of which a preferred embodiment is shown, by way of example only, in the hereunto annexed drawings, wherein like parts of the invention are identified by like reference devices throughout the several views and wherein:

FIG. 1 is a schematic view in elevation showing a safety valve as herein visualized installed in the mouth of a pressurizable container; parts of which have been broken away to reveal its structures, and

FIGS. 2, 3 and 4 are sectional views along the longitudinal axis of the safety valve shown in FIG. 1, the views differing from each other only in the arrangement of the valve parts illustrated thereby.

Referring now to the drawings in greater detail, the present safety valve V will be seen to comprise a valve casing 2 which is installable in a pressurizable container C and which is provided with an inlet 4 at one end and an outlet 6 spaced therefrom and, in this embodiment, at an intermediate point along the length of the casing 2. The inlet 4 and outlet 6 are interconnected in the interior of casing 2 by a passageway 8 which, in effect, is a succession of chambers and ducts which need not be separately identified at this juncture. Disposed immediately of the passageway 8 is a valve seat 10 accommodating fluid flow from container C through said inlet 4, passageway 8 and outlet 6 in an understood manner.

Within the portion of the passageway between inlet 4 and valve seat 10, hereinafter referred to as the upstream passageway 8', there is disposed a valve element 12 which is movable therein to seat on valve seat 10, in which seated position, it blocks all fluid flow and acts as an effective seal, stopping all loss of fluid from container C.

Said valve element 12 is capable of being unseated from valve seat 10 by means hereinafter described and moved to a neutral location as shown in FIG. 2, in which it has no effect whatever on said fluid flow except as hereinafter described. Said valve element 12 is lightly biased to this neutral position by a spring 14 interposed, in this instance, between it and valve seat 10.

The means for unseating said valve element 12 is constituted by a prod or probe 16 which is movable by a stem 18 manipulable externally of the casing 2, as by hand wheel 20, to advance through valve seat 10 and engage and unseat said valve element 12 as aforesaid; said stem 18 being reversely manipulable thereafter to the position shown in FIG. 4 to procure release of valve element 12 by probe 16.

As herein visualized, container C is of the type which is intended to contain a fluid such as gas at very high pressures. In use, the present safety valve V is adapted for installation in the container mouth M, the valve casing C being intermediately threaded as at 22 for co-operation with a mating screw thread 22' in the said container mouth M. When safety valve V is so installed, the stored gas exits from container C through inlet 4, passageway 8 and outlet 6.

It need hardly be added at this point, that gas leaving outlet 6 usually passes through conventional metering facilities attached to or otherwise associated with, a gas-burning appliance (not shown).

Referring now to valve element 12, it will be seen that this member is shaped and dimensioned to provide an obstruction in upstream passageway 8 limiting, in a sense, the flow of gas therethrough. As will be appreciated, the effect of this obstruction will be to create a pressure differential in the passageway 8 on the upstream and downstream sides of the said valve element 12; said differential increasing according to the actual gas flow.

In other words, the differential aforesaid is constituted by a drop in pressure as between the upstream and downstream sides of passageway 8 which said drop increases and decreases proportionately to increase or decrease in fluid flow.

When the drop is of major proportions — i.e. when the drain of fluid through outlet 6 and the consequent pressure drop at this point is excessive — the pressure on the upstream side of valve element 12 will so far override the pressure on the downstream side as to overcome the bias of spring 14 and move valve element 12 into its seated position on valve seat 10, thereby blocking all further fluid flow therethrough and the valve element 12 will remain so seated until the upstream and downstream pressures recover an acceptable equilibrium at which time the light bias of spring 14 will be adequate to move valve element 12 to its neutral position.

On the other hand, it will be appreciated that no equilibrium can be reached until gas has entered the passageway on the downstream or outlet side of valve seat 10 and it is to meet this contingency that the present probe 16 is provided. That is to say, when conditions conducing to equilibrium have been created or re-established, the probe 16 is then advanced by valve stem 18 through valve seat 10 to engage and unseat valve element 12, as shown progressively in FIG's. 4, 3 and 2, thus allowing gas to pass through said valve seat 10 and restore the equilibrium aforesaid after which probe 16 may be retracted to the position of FIG. 4 to release valve element 12. As will be obvious from the drawing, the presence of said probe 16 in valve seat 10 does not block flow of gas therethrough; the probe 16 being deliberately thinned to prevent this contingency. At all events, after restoration of equilibrium and the movement of valve element 12 to its neutral location as in FIG. 2, the probe 16 may be withdrawn altogether from valve seat 10 by manipulation of valve stem 18 in a manner which will be understood.

Thus it will be seen that upon the drain of fluid through outlet 6 becoming excessive with a consequent pressure imbalance, the overriding pressure in container C will promptly procure seating of valve element 12 upon its seat 10 where it will remain so seated until probe 16 has been advanced to move it to its unseated, neutral location as described. At that point, the probe 16 may be withdrawn to release valve element 12 which will thereafter remain in its neutral location if equilibrium as aforesaid has been attained or will promptly move back to its seated flow-blocking location if such equilibrium has not been attained.

In the present embodiment of the invention, a separate closure 30 is provided for outlet 6; the said

closure 30 being operable to effect progressive closing of said outlet 6, preferably simultaneously with the movement of probe 16 to engage and unseat said valve element 12 and, thereafter, to effect progressive re-opening of said outlet 6 upon release of said valve element 12 as aforesaid; the movement of closure 30 being also illustrated in FIGS. 2, 3 and 4 of the drawing.

As will be appreciated, probe 16 and valve stem 18 form a single unit on which said closure 30 is strategically positioned to effect closing and re-opening of outlet 6 as aforesaid while the probe 16 is being moved by valve stem 18, as aforesaid.

It need scarcely be explained that this construction permits the outlet 6 to be re-opened sufficiently slowly so that the outlet gas pressure will have an opportunity to build and thus attain equilibrium with the inlet pressures.

In this connection, it will be appreciated that "equilibrium" within the content hereof need not be exact but only relative having regard to other factors such as, for example, the bias on valve element 12 by spring 14.

In the form presently preferred, the valve element 12 is a hollow elongated body with closed end 12' which is seatable on valve seat 10 as aforesaid. Moreover, said valve element 12 is shaped conformingly to the upstream passageway 8' which thus constitutes a bearing for valve element 12 to retain it in its functional orientation with its closed end 12' aimed at the valve seat 10.

In the present embodiment, the closed end of valve element 12 is somewhat reduced in diameter or girth defining a flange 32 which provides one abutment for spring 14, the valve seat 10 providing the second abutment.

Said valve element 12 is retained in its encagement within the upstream passageway 8' by a fitting 34 installed in the inlet 4 of casing 2. Said fitting may be threaded for connection to a tubing 36 on the interior of container C more or less as shown in FIG'S. 1 and 2 or it may be merely a ring of the proper shape, as in FIG. 2.

The specific intermediate location of screw-threading 22 on casing 2 is selected by the invention as a further safeguard against fluid leakage from container C in the event of an accident causing breakage of the casing.

That is to say, said threading 22 is located in the zone which intervenes between valve seat 10 and outlet 6 so that when safety valve V is installed in container C, that portion of the casing which houses the upstream passageway and valve seat 10 will be protectively submerged in the interior of container C while the remainder of the casing 2 will project from container C, as shown in FIG. 1.

It is apparently not unusual for a container with a safety valve installed in its mouth to become involved in an accident resulting in the fracture or even the complete destruction of the safety valve, thereby conducing to extraordinary loss of the container contents. On the other hand, it has been observed that such damage to the valve casing occurs only exteriorly of the container C. Thus, by locating the screw-thread 22 so that valve element 12 and its seat 10 are disposable within the protection of container C, any loss of fluid occasioned by subsequent damage to the safety valve V

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will result, immediately, in a pressure imbalance procuring seating of valve element 12 on its seat 10 and concomitant sealing of container C to prevent all loss or leakage of fluid.

I claim:

1. A safety valve installable in a pressurizable container comprising:
 - a valve casing;
 - a fluid inlet in said casing;
 - a fluid outlet in said casing;
 - a passageway communicating therebetween;
 - a valve seat intermediately disposed in said passageway accommodating fluid flow therethrough from said inlet to said outlet;
 - a valve element engaged in said passageway and disposed between said valve seat and said inlet and movable therein between a seated position on said valve seat in which it blocks all such fluid flow, and an unseated neutral location;
 - a probe movable through said valve seat to engage and unseat said valve element;
 - a valve stem manipulable externally of the said casing to move the probe to engage and unseat the said valve element as aforesaid and thereafter to effect release of said valve element, and
 - a spring biasing said valve element towards its unseated neutral position;
- the said valve element being dimensioned to restrict said passageway to induce a drop in fluid pressure therein between its upstream and its downstream sides with said drop increasing and decreasing proportionately to increases and decreases in fluid flow; the valve element being movable to the seated position aforementioned when the pressure on its upstream side materially overrides the pressure on its downstream side, and the bias of said spring being insufficient to withstand such materially overriding pressures;

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- a secondary closure for said fluid outlet co-operable with said probe to effect closing and re-opening of said outlet when the probe is manipulated as aforesaid; the said secondary closure effecting progressive closing of said outlet while the probe is being moved to engage and unseat said valve element and effecting progressive re-opening of said outlet with the release of said valve element.
2. A safety valve in accordance with claim 1 wherein: the parts are arranged to procure final closing and initial re-opening of said outlet substantially simultaneously with the engagement and release of said valve element.
 3. A safety valve in accordance with claim 1 wherein: the probe is attached to said stem and forms an integrated unit therewith and said closure is carried by said integrated unit.
 4. A safety valve in accordance with claim 1 wherein: the said valve element is a hollow elongated body closed at one end and seatable upon said valve seat the passageway between the inlet and the valve seat being shaped conformingly to said valve element to constitute a bearing therefor to retain it in functional orientation within the passageway; said valve element also including an external radial flange serving as an abutment for said spring; a retainer installed in the casing inlet completing engagement of said valve element in said passageway; the valve stem and said probe forming an integrated unit carrying said secondary closure, and the facilities for installing said safety valve include means on the exterior of said casing co-operable with corresponding means on said container, the means on the valve casing being located at a level which will dispose the portion thereof between the fluid inlet and the valve seat, at least, within the interior of the container when the safety valve is installed therein.

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