Jan. 10, 1961 D. A. DIEHL 2,967,540

LIQUID TYPE CHECK VALVE

Filed July 29, 1957

Fig. 1.

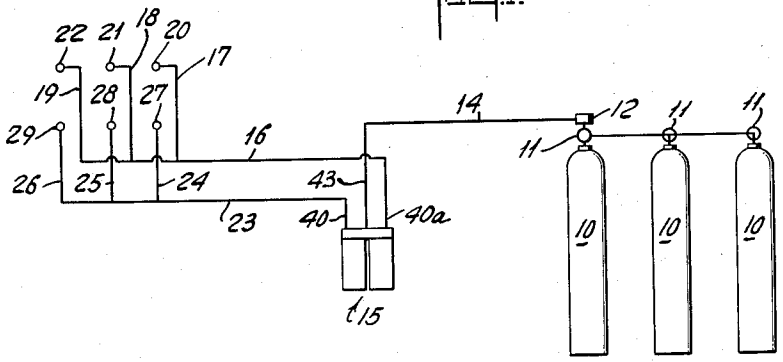


Fig. 2.

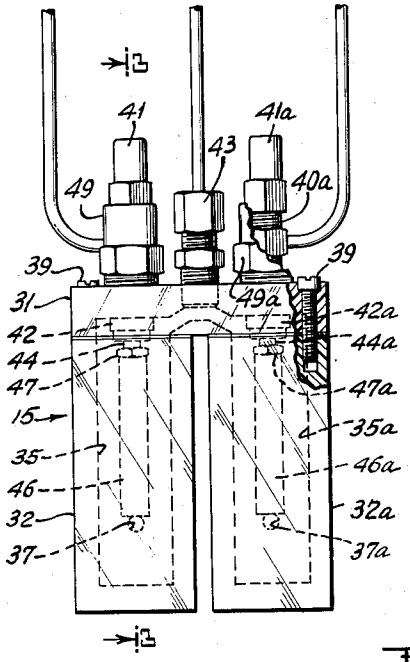


Fig. 3.

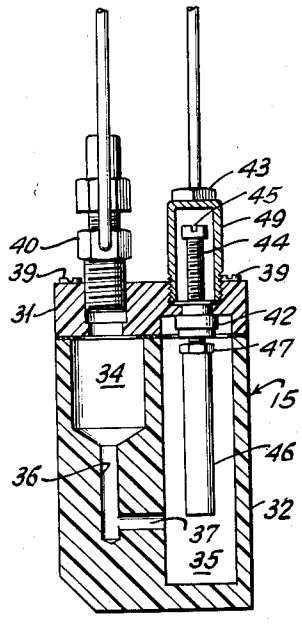
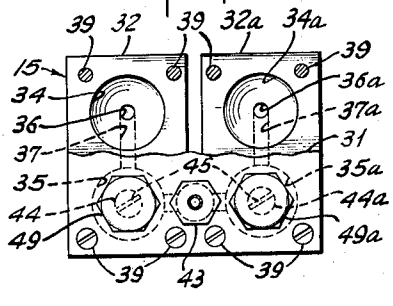


Fig. 4.



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LIQUID TYPE CHECK VALVE

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The present invention relates to fire extinguishing equipment, and particularly to an improved adjustable liquid type check adapted to be interposed in a pressure control line between a heat actuator and a discharge valve for a fire extinguishing agent.

The rate of rise type of automatic actuation of fire extinguishing equipment includes a chamber called a heat-actuator which is positioned at some suitable location such as near the ceiling in a space to be protected against fire. The chamber is connected by piping to a vented pressure actuated discharge valve of a fire extinguishing system. Upon a temperature rise in the protected space, the air within the chamber is expanded, thereby increasing its pressure within the chamber. In the case of a normal temperature rise, the pressure does not appreciably increase in the chamber as the vent in the discharge valve is of a predetermined size to release the expanded air and so prevent the build-up of pressure.

In the case of a fire, the air in the heat actuator chamber is expanded at a rate faster than it is bled off through the vent, and the pressure of the expanded air is transmitted through the piping to actuate the fire extinguishing system discharge valve.

In order to provide adequate protection in a large space, a plurality of heat detectors are used and connected to a common actuating line for the fire extinguishing system. It has been found that the actuation of the fire extinguishing system is delayed unduly in the event more than about six heat actuators are connected together, as the expanded air from one heat actuator is expanded into the other heat actuators connected with it. In order to utilize a single control line to the fire extinguishing system from a space requiring a large number of heat actuators, it has been the practice to install mercury check valve means between each group of six heat actuators and the pressure control line.

Because of the low available pressure, uniformity and dependability of operation depends to a large extent upon the accuracy of the adjustment of the liquid level in the check valves. Heretofore, adjustment means has been provided for the liquid level but the adjustment means has, in some cases, been subject to leakage. This is a serious difficulty as the system may not be inspected for long periods of time, and it is imperative that positive actuation be had in the case of a fire. In other cases, the adjustment means has been so positioned on the liquid check as to be difficult to set and thus the possible locations at which the check valve may be positioned has been limited.

It is important in the check valve that a non-volatizable liquid be used such as mercury, which, because of its high surface tension, provides an easily readable meniscus. However, because of the low viscosity of mercury, it is necessary that it be enclosed in a tight container without movable surfaces below the level of the mercury or leaks may develop.

In accordance with the present invention, the foregoing difficulties and disadvantages are overcome by providing leak-proof adjustment means positioned above the liquid level and readily accessible.

Another object of the invention is to provide a liquid check which is simple and economical in manufacture, efficient in operation, and durable in use.

Other objects and advantages of the invention will be apparent from the following description and from the accompanying drawings which show, by way of example, an embodiment of the invention.

In the drawings:

Figure 1 is a schematic view of a fire extinguishing system incorporating a liquid type check valve in accordance with the invention.

Figure 2 is a front view of a double liquid check valve each in accordance with the invention.

Figure 3 is a vertical sectional view taken along the line of 3—3 of Figure 2.

Figure 4 is a top view of the double check valve.

Referring to the drawings, there is shown in Figure 1 a plurality of fire extinguishing containers **10**, all of which are provided with discharge valves **11**. At least one of the discharge valves **11** is fitted with a pressure actuated release means **12**, the pressure actuating release means **12** being connected by piping **14** to a double liquid type check valve **15** each in accordance with the invention.

The double liquid check valve **15** is connected by a header pipe **16** to pipes **17**, **18** and **19** respectively attached to rate of rise heat actuators **20**, **21** and **22** positioned in a space to be protected against fire. Another header pipe **23** is connected through pipes **24**, **25** and **26** respectively to another set of rate of rise heat actuators **27**, **28** and **29**. Each of the headers **16** and **23** is connected to a separate part of the double check valve. While the invention is in a single liquid check valve, a double check valve is described and illustrated inasmuch as there probably would be no need for the use of a single check valve in the fire extinguishing system described.

The heat actuators **20**, **21** and **22**, and **27**, **28** and **29** are alike and are of the well known type in which chambers are provided each with a heat conducting thin metal wall, and the spaces within the chambers are in fluid communication with the respective pipes **17**, **18** and **19**, and **24**, **25** and **26**.

Under conditions of normal temperature rise, by reason of a vent in the check valve **15** and a smaller vent in the pressure actuated release means **12**, the pressure within the chamber follows very closely that of the atmosphere. However, under conditions of rapid temperature rise, such as may occur when fire is present, the air within the chamber is expanded at a faster rate than it is vented and accordingly the pressure within the chamber builds up and is transmitted through the pipe system to the liquid check valve **15**, thence, through the pipe **14** to the pressure actuating release means **12** to release the fire extinguishing agent from the containers **10** to a discharge pipe system, not shown, to the space wherein the rate of rise devices are positioned.

Obviously, in the event the space wherein the rate of rise actuators are positioned is large, a plurality of actuators would be required for adequate coverage to detect a fire in its early stages. In this event, if a small fire were to occur, probably the air in only one rate of rise actuator might be expanded, and would flow through the pipe system to the other rate of rise actuators, and thus be dissipated before enough pressure was produced in the pipe **14** to actuate the pressure actuated release device **12**. While ultimately enough pressure probably would be developed, the operation would be sluggish and the fire might gain considerable headway before the fire extinguishing system released. In order to overcome this difficulty, it has become the practice to connect not more than six rate of rise actuators together to a single header and to connect each header through a liquid check valve to the pipe **14**. The liquid check valve **15** presents only a slight resistance head against the flow of expanded air

in the direction from the rate of rise actuator to the pressure actuated release device, but presents a considerable resistance head to the passage of expanded air from one group of rate of rise actuators to another similar group. By this means a prompt actuation of the pressure actuated release head is assured.

The double liquid check valve **15** in accordance with the invention is an improvement over those heretofore provided in that it is leakproof and may be more easily adjusted. The double liquid check valve **15** includes a common cover member **31** and a pair of body members **32** and **32***a* each forming a housing. The body member **32** is preferably made of a transparent material and is formed with two chambers **34** and **35**. The lower end of chamber **34** is made of reduced diameter as indicated at **36** and the chambers **34** and **35** are interconnected by a fluid passage **37**, thereby forming a U-tube type construction.

The cover member **31** may be made of any suitable material either transparent or opaque and is secured in position on the body members **32** and **32***a* by screws **39** or by any other suitable attaching means. An inlet member T connection **40** is threadedly engaged in the cover member **31** in fluid communication with the inlet chamber **34** while a common outlet member **43** is provided in fluid connection with the other chamber **35**. The T connection inlet for the second chamber **32***a* is designated **40***a*. Vent members **41** and **41***a* are provided to close the upper end of the T connections **40** and **40***a* and may be of any conventional construction.

The double check valve member **15** is adapted to receive a liquid preferably of the non-volatizing type, such as mercury. The level of the liquid is such as to at least cover the fluid passage **37**. By reason of the construction used, it is obvious that if pressure is applied to the inlet **40**, the level of the mercury in reduced section chamber **36** is decreased an appreciable amount without an appreciable increase in the fluid level in the chamber **35** because of the relative difference in the cross-section areas of these chambers. However, if pressure is applied to the chamber **35** from the outlet **43**, by reason of the greater diameter of chamber **35** as compared to the diameter of the reduced section **36**, there will be an appreciable rise in the liquid level in the reduced portion **36** with a consequent increase in back pressure. Further pressure increase may raise the fluid level into the chamber **34** of comparatively large diameter to accommodate the overflow. The effect of this construction is to provide a much greater resistance head to fluid passage from the outlet to the inlet as compared with the passage of fluid from the inlet to the outlet.

Because of the comparatively large pressure head presented by a fluid of high specific weight such as mercury and because of the comparatively low operating pressure provided by the rate of rise actuators, it is important that the mercury level be adjusted so as to just fill the tube **37** by a slight overage into the chamber **36**. In accordance with the invention adjustment means for the liquid level is provided by a plunger which may be dipped into the liquid for the displacement thereof and thus to raise the pressure head within the U-tube chambers. Support for the adjustment means is provided by threaded members **42** and **42***a* which may be incorporated in the cover member in axial arrangement with the outlet chambers **35** and **35***a*. Adjustment rods **44** and **44***a* having slotted heads **45** may be threadedly engaged in each of the threaded members **42** and **42***a*. The lower end of the adjustment rods **44** and **44***a* may be threadedly engaged in plungers **46** and **46***a*, lock nuts **47** and **47***a* being used to provide a vibration-free attachment of the plungers **46** and **46***a*. The plungers **46** and **46***a* may be adjustably moved upward or downward to dip into the liquid by rotating the adjustment rods **44** or **44***a* by use of a screw driver in the slotted ends **45** or **45***a*. Cap members **49** and **49***a* are threadedly engaged in the cover member **31** over the adjusting rods **44** and **44***a* to prevent an unauthorized tampering with the adjustment. The body members **32** and **32***a* may be formed exactly alike and as many as desired attached to the cover member **31** which, of course, is specially fabricated for the number of check valves desired, a common outlet being provided for attachment to the pipe **14**.

Thus, it may seem that a liquid type check valve has been provided which is readily adjustable from the top thereof, the adjustment means not presenting any source of leakage for the mercury generally used as the fluid.

While the invention has been described and illustrated with reference to a specific embodiment thereof, it will be understood that other embodiments may be resorted to without departing from the invention. Therefore, the form of the invention set out above should be considered as illustrative and not as limiting the scope of the following claims.

I claim:

1. A dual liquid type check valve for use in a heat actuated pressure operated fire detecting system, the check valve comprising a pair of body members each having first and second chambers therein, the first chambers having lower portions of reduced diameter and upper portions of enlarged diameter, both chambers open at the top thereof, means forming a horizontally extending fluid passage between each said first and said second chambers and forming with said first and second chambers a U-tube construction adapted to receive liquid, said horizontally extending fluid passage means extending into said second chambers at points spaced from the bottom thereof, a cover member for the pair of body members and closing the chambers therein, inlet means in the cover member positioned above each first chamber, plunger means extending from the cover member into each of the second chambers, adjustment means for each plunger means manipulable from the exterior of the cover to raise or lower its plunger means in its chamber, a single outlet means positioned in the cover member, and means providing fluid passage from each of the top portions of said second chambers to the outlet through said cover member.

2. A dual liquid type check valve for use in a heat actuated pressure operated fire detecting system, the check valve comprising a pair of body members each having first and second chambers therein, the first chambers having lower portions of reduced diameter and upper portions of enlarged diameter, both chambers open at the top thereof, means forming a horizontally extending fluid passage between each said first and said second chambers and forming with said first and second chambers a U-tube construction adapted to receive liquid, said horizontally extending fluid passage means extending into said second chambers at points spaced from the bottom thereof, a cover member for the pair of body members and closing the chambers therein, inlet means in the cover member positioned above each first chamber, plunger means extending from the cover member into each of the second chambers, adjustment means for each plunger means manipulable from the exterior of the cover to raise or lower its plunger means in its chamber, a single outlet means positioned in the cover member, the outlet positioned between the plunger adjustment means in alignment therewith, and means providing fluid passage from each of the top portions of said second chambers to the outlet through said cover member.

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