K. F. TRIGGS.

THERMO SAFETY VALVE.

APPLICATION FILED SEPT. 24, 1919.

**1,346,791.** **Patented July 13, 1920.**

Fig. 2

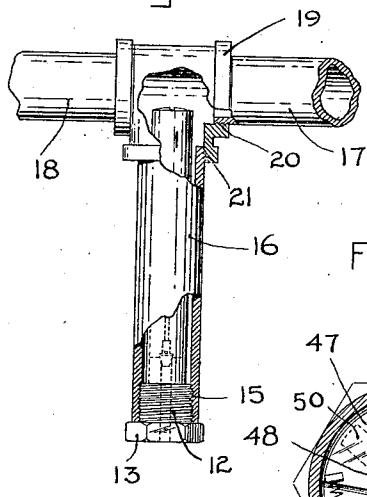



Fig. 1

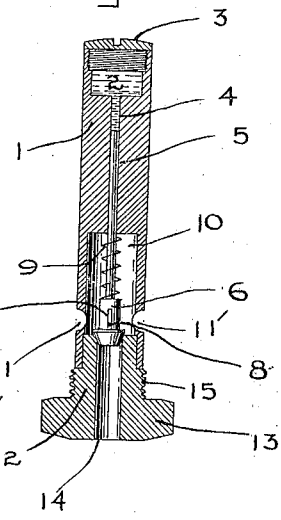



Fig. 5

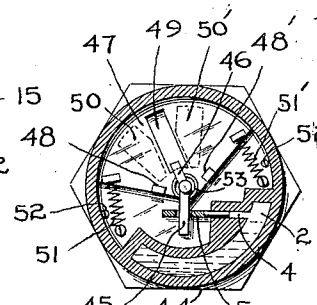



Fig. 4



Fig. 3

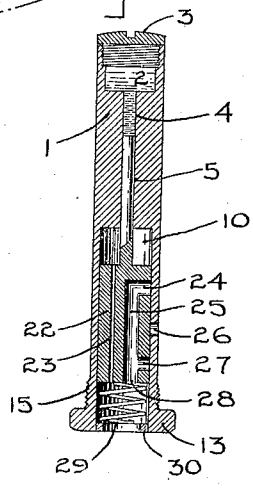
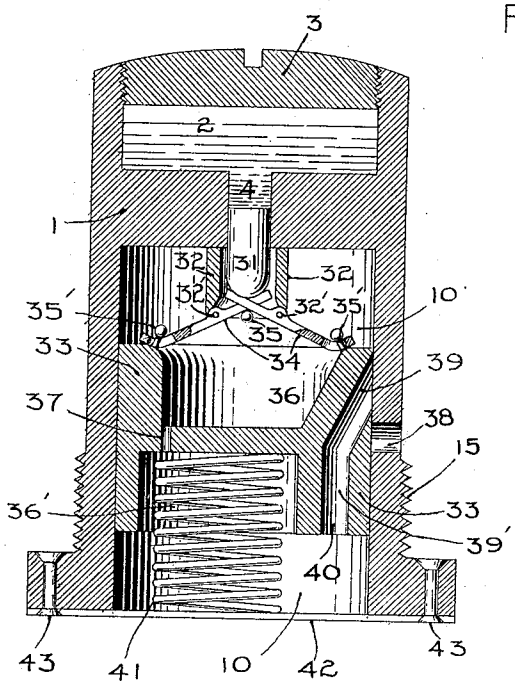



Fig. 6




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# UNITED STATES PATENT OFFICE.

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## THERMO SAFETY-VALVE.

1,346,791. Specification of Letters Patent. Patented July 13, 1920.

Application filed September 24, 1919. Serial No. 326,108.

*To all whom it may concern:*

Be it known that I, KENNETH F. TRIGGS, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Thermo Safety-Valves, of which the following is a specification.

My invention relates to a thermally operated safety valve.

The object of this invention is chiefly to produce an outlet for water or other liquid in a system of liquid distribution or circulation when its temperature approaches predetermined degrees, and thereby prevent the bursting of pipes and the consequent disablement of said system.

Another object of my invention is to provide means for causing the valve to function at a high and a low degree of temperature, for the prevention of pipe or system destruction, due to the freezing or boiling of the liquid therein contained.

An advantage of my invention resides in the capacity of the device (for many of its objects) to be so designed as to particularly not interfere with the flow of the contents in the system where used and to be only slightly visible on the outside.

Further objects and advantages will appear as the description proceeds.

In the drawings illustrating the preferred form of my invention,

Figure 1 shows a sectional view of the safety valve, of the type to open at a low temperature.

Fig. 2 represents the safety valve in position in a fluid system, parts being broken away to show the details within.

Fig. 3 represents the combination valve for draining the pipe line both at a high temperature and at a low temperature.

Fig. 4 is a section of the device, greatly enlarged, showing a modification.

Fig. 5 represents the combination valve as indicated in Fig. 3, with horizontal instead of vertical action.

Fig. 6 represents a projected view of Fig. 5.

Referring now to Fig. 1, which is a cross-sectional view of the valve, 1 indicates the casing which contains a reservoir of mercury 2, protected at the top by a cap 3, which is screwed into place after the said reservoir is filled. A cylindrical recess 4, communicating with the reservoir 2, also contains mercury from the reservoir 2 part way down toward the recess 10 in the casing. The mercury in the recess 4 bears against the rod or piston 5, positioned in a continuation of recess 4, so designed as to travel up and down in said recess. At the lower extremity of the rod 5 is a small conical valve 6, provided with a slot 7, to allow the free action of a pin 8 which is mounted in rod 5 and is inserted into the said slot. It should be noticed that the rod 5 may ride freely up and down in the recess 4 without moving the valve 6 until the pin 8 reaches the upper end of the slot 7.

A spring 9, which encircles the rod 5 and bears against the upper wall of the recess 10 and against the valve 6, operates on the valve 6 by pressing it down and keeping it in place until the action of the rod 5 hereinafter described becomes sufficient to move the said valve.

Openings shown at 11 and 11′ connect the liquid in the system (see Fig. 2) with the valve 6 through the larger recess 10, mentioned more in detail later in the description.

At the lower end of the valve casing 1, and which completes the construction of the same, is a base 12 terminating in a nut-shaped head 13 and containing a recess 14 larger than that shown at 4. The screw-threads 15 above the head 13 are required for screwing into a pipe line.

The parts just described operate as follows: As the liquid in the system (see Fig. 1) approaches the freezing point, the mercury in the reservoir 2 contracts and removes pressure from the piston 5. The rod 5, placed just below the mercury in the recess 4, rises with it. As soon as the pin 8, carried at the extremity of the rod 5 and advancing with it, reaches the upper end of the slot 7 of the valve 6, the said valve 6 also rises by atmospheric pressure, opening recess 14. The liquid escapes through the openings 11, 11′ and 14 to the open air.

Referring now to Fig. 2, the part 1 represents the casing of the safety valve, which is of cylindrical shape. The said casing terminates in the base 12 secured to it, said base being threadedly connected to the tube 16, as shown at 15, and operated by the head 13.

Tubes 16, 17 and 18 represent parts of the pipe line, the tube 16, however, intended simply to contain the safety valve.

while 17 and 18, connected by the T-flange 19, form the pipe line of the required liquid.

Sections are broken away at the top and bottom of tube 16 and a part of the flange 19 to show the method of assembly. Screw-threads are used, as indicated at 20 and 21, for this purpose.

It should be noticed that the top of the valve casing 1 does not extend much above the interior surface of the main pipe line 17 and 18 which would otherwise interfere with the flow of the contents; but far enough so as to come substantially in contact with the liquid and thereby make the action produced by the thermal condition of the said liquid possible. The construction disclosed in Figs. 1 and 2 I do not claim as my invention.

Turning now to Fig. 3, which represents a safety valve designed to drain the pipe line at either a minimum temperature or a maximum temperature, 1 as before represents the casing, 2 the reservoir of mercury, 3 the screw cap for the reservoir, and 4 the smaller recess connecting the reservoir 2 with the larger recess 10. 5 represents the piston rod, as shown in Fig. 1.

Valve 22 is of the piston type and is provided with an air passage 23, and liquid passages 24, 25, 27 and 28, the special functions of which will be described later. 29 shows a spring to balance the weight of valve 22, and 30 indicates a collar upon which the said spring rests.

The liquid passage 26 in the valve casing 1 is so positioned that when the temperature of the surrounding atmosphere is in normal state, the passages 24 and 27 are at equal distances on opposite sides of the said liquid passage 26. One liquid passage is all that is required in this design, as the construction peculiar to the present figure does not call for more than one as indicated in Fig. 1, parts 11 and 11′.

Referring now to the operation of this form of the invention, when the fluid in the system is at a normal temperature the passages 24 and 27 are so placed that the passage 26 is closed. When, however, the temperature changes and the contents of the system are in danger of freezing, the mercury in the reservoir 2 contracts and the piston shaped valve 22 rises, due to a partial vacuum in the recess 4 and atmospheric pressure on valve 22 until the passage 27 registers with the passage 26. In this position, when the device is installed as usual the flow of contents of the said system is started through the tube 16, Fig. 2, to the said passage 26 and the passage 27, through the exit 28 to the open air.

In the event of the liquid in the system advancing too near the boiling point, the mercury in the reservoir 2 will expand in the recess 4, thus forcing the rod 5 down and bringing the passage 24 into registry with the passage 26, and in this manner affording an outlet for the liquid of the said system from the passage 26 and the passage 24 through the passage 25 to the exit 28, and thence to the open air.

The air passage 23 is so located in the valve 22 as to connect the recess 10 with the lower section of the valve casing 1, and consequently with the open air. The dash pot or congested action in the recess 10 will thus be relieved.

In Fig. 4 the valve casing 1 is somewhat modified, the object being to reduce the length as much as possible, the chief alteration being in the length of the section between the reservoir 2 and the recess 10. The shoulder on the cap 3 has been removed to reduce its thickness.

I will now explain the characteristics of the novel construction. The piston rod 31, besides being considerably shortened, is rounded at the end. A cylinder 32 fastened to the valve casing 1 surrounds the piston rod 31 and is indicated in section. At the lower end of the said cylinder, a means 32′ has been provided to secure a pair of levers 34 and which may act as fulcrums for the same. The levers 34 are also slidably fastened by a means 35 to the piston rod 31 at one end and to the piston shaped valve 33 at the other, by like means indicated at 35′.

The piston shaped valve 33 contains cavities 36 and 36′, a connecting recess 37 between the cavities 36 and 36′, and passages 39 and 39′ and an exit or outlet 40.

A spring 41 corresponds to the one represented by 29 in Fig. 3 and is supported at the base by a strip 42 secured at each end by countersunk rivets 43.

The operation is as follows: The positions of the relative parts as shown in Fig. 4 are under normal conditions and operate in diametrically opposite directions to those of Fig. 3, which may be explained as follows: As the temperature approaches freezing, the piston rod 31 rises in the recess 4, due to the contraction of the mercury in the reservoir 2, thereby drawing the ends of the levers 34 which are fastened to the said piston rod by the means indicated at 35, upward. Now due to the fulcrum construction 32′ the opposite ends of the said levers will be forced down, and as they are fastened to the piston shaped valve 33 by a like means to that at 35, indicated by 35′, they will force the said piston shaped valve down and connect the opening in the valve casing 1, shown at 38, with the passage 39. The liquid contents of the system can then escape, (before freezing takes place) in the usual manner heretofore described from the tube 16, Fig. 2, through the opening 38, thence through the passages 39 and 39′ to

the exit 40 which is in contact with the open air.

When the temperature approaches boiling, the mercury in the reservoir 2 expands and forces its way down through the recess 4, thus in turn forcing the piston rod 31 down. This then carries the shorter ends of the levers 34 with it, and by means of the fulcrum at 32′ the longer ends of the said levers are forced up. The piston shaped valve 33, which is fastened to the said levers as indicated at 35′, now travels up and this time a registration for fluid escape is made by raising the bottom of the said piston shaped valve beyond the level of the opening 38, thereby forming a direct connection with the open air.

The spring 41 is employed as a balance for the piston shaped valve in this figure, the same as indicated at 29 in Fig. 3.

It should be noticed that when the heat action takes place, the cylinder 32 telescopes into the cavity 36; also that the air passage 37, the use of which has been indicated in the description of Fig. 3 at part 23, has been shortened considerably.

With reference to Fig. 5, 44 indicates the casing for the reservoir of mercury 2, which is protected as usual by a cap 3, not shown in the present figure. 4 again indicates the cylindrical recess designed to connect the mercury in the reservoir 2 with the piston 5.

Separate parts 45 and 46 comprise a lever which is pivoted in the center of the device and are attached to each other by a spring 53, which will be hereinafter more fully described.

A plate 47 is provided with knobs 48 and 48′ and an opening 49. Other openings 50 and 50′ are made in the casing 44 to connect with the said opening 49.

Springs 51 and 51′ are fastened at one end to the casing 44, and at the other to the plate 47 to neutralize the position of the said plate.

52 and 52′ represent obstructions secured to the casing 44 which prevent the plate 47 from passing either of these points when swinging to the right or left. A spring 53 unites the two parts of lever 45 and 46 and allows them to move independently of each other when required.

The mechanical action of Fig. 5 is as follows: As the temperature rises, the mercury in reservoir 2 expands (as previously described) and forces its way into the cylindrical recess 4; this in turn forces the piston 5 to the left (as viewed in the drawing) and carries the lever 45 with it.

The opposite end of lever 45, indicated at 46, then turns to the right and finally reaches the knob 48′ a few degrees before the danger point has been attained. The temperature continuing to rise, the lever end 46 forces the plate 47 also to turn to the right, thereby bringing the openings 49 and 50′ over each other and allowing an escape of the contents of the system.

This unequalizes the action of the springs 51 and 51′ and when the pressure has been released upon the knob 48′ the plate 47 will return to normal position.

If there is any tendency of the piston rod 5 to travel farther than is required to move the plate 47 so as to bring the openings 49 and 50′ completely over each other, the obstruction 52′ is so placed as to limit the action of the said plate; while the spring 53, which is holding the two parts of the lever 45 and 46 together, now allows them to move independently of each other and prevent the distortion of that portion of the device.

The opposite action will prevent the bursting of the pipes in the system when a tendency toward freezing occurs.

It will be noticed that V-shape construction has been provided in the openings 50 and 50′. This will allow a gradation of flow of the contents of the system when the device is in action.

In Fig. 6 the dot and dash lines indicate the relation of the device to the pipe, an opening having been made in the said pipe to admit the device by screw-threads.

While a safety valve has been described as opening at the boiling or freezing point, it should be understood that it is a matter of design to make the valve operate at any desired maximum or minimum temperature.

While I have illustrated certain embodiments of my invention, it should be understood that it may be carried out in other possible forms.

I claim as my invention:

1. A safety valve, comprising escape means, a valve controlling said escape means, and thermally responsive means controlling said valve, whereby the escape means is opened when a minimum temperature is reached, and is also opened when a maximum temperature is reached.

2. In a device of the character described, a housing, said housing being provided with an escape passage, a valve controlling said passage, thermally responsive means engaging said valve, whereby the valve is opened when a desired minimum temperature is reached, and is also opened when a maximum temperature is reached.

3. A safety valve, comprising a housing adapted to be set in a pipe line and to be in contact with the fluid in said line, said housing being provided with an escape passage, a valve controlling said passage, and thermally responsive means controlling said valve, whereby the valve is moved to open the escape passage when a desired minimum temperature is reached to drain the pipe line, said thermally responsive means further functioning to move said valve to open

said escape passage when a certain maximum temperature is reached.

4. A safety valve, comprising escape means open to the atmosphere, a valve controlling said escape means, and thermally responsive means to normally hold said valve closed, said thermally responsive means contracting when a desired minimum temperature is reached to allow atmospheric pressure to move the said valve to open said escape means, said thermally responsive means further functioning to move said valve to open said escape passage when a certain maximum temperature is reached.

In testimony whereof I affix my signature.

KENNETH F. TRIGGS.