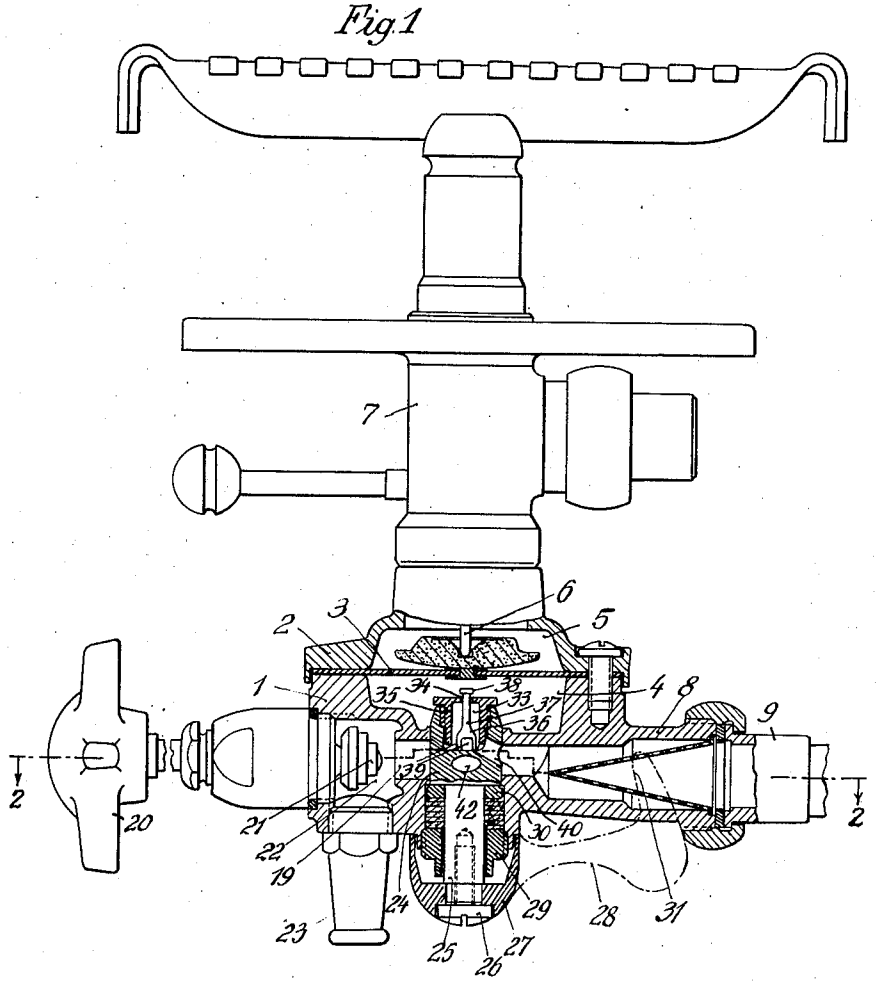
Feb. 24, 1942. F. WEBER 2,274,017

LACK-OF-LIQUID SAFETY DEVICE FOR LIQUID HEATERS

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Fig. 1



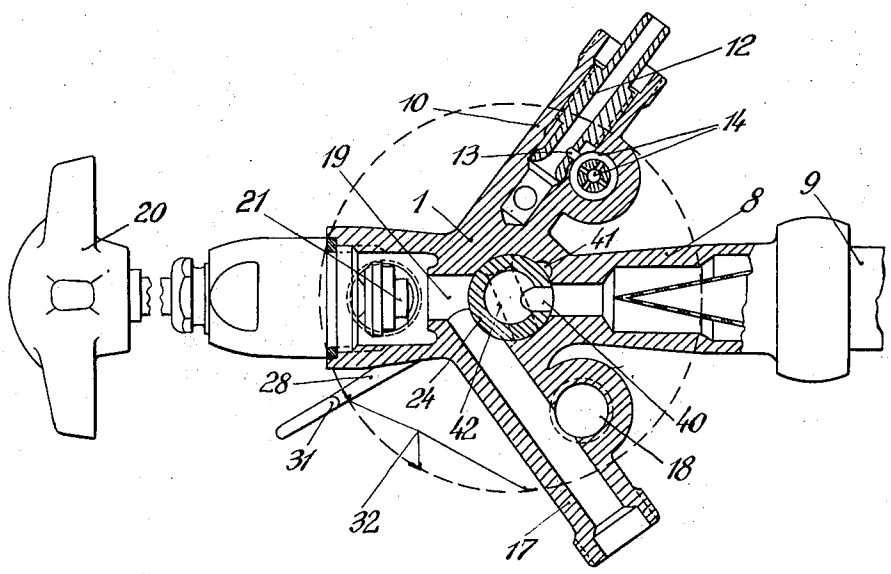
Inventor:
Friedrich Weber
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his attorney

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LACK-OF-LIQUID SAFETY DEVICE FOR LIQUID HEATERS

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Fig. 2



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LACK-OF-LIQUID SAFETY DEVICE FOR LIQUID HEATERS

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Fig. 3

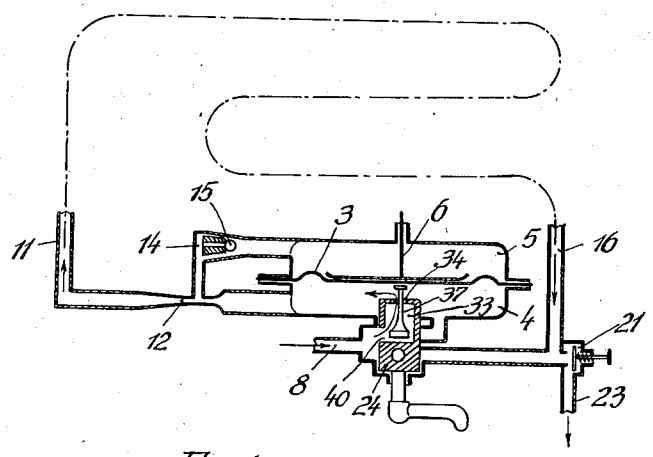


Fig. 4

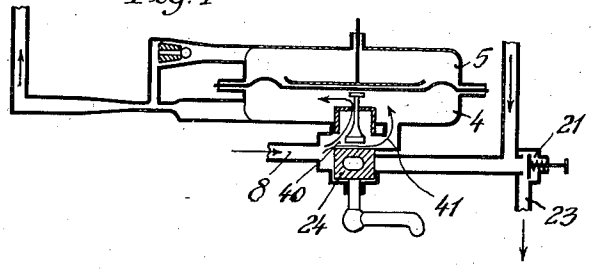
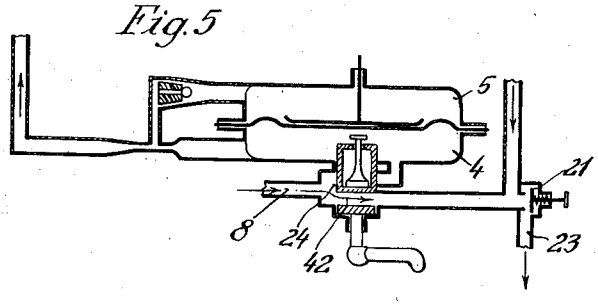


Fig. 5



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UNITED STATES PATENT OFFICE

2,274,017

LACK-OF-LIQUID SAFETY DEVICE FOR LIQUID HEATERS

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Application November 18, 1939, Serial No. 305,148
In Germany December 22, 1938

8 Claims. (Cl. 236—25)

This invention relates to a lack-of-liquid safety device for the fuel valves of liquid heaters, with a change-over device developed in form of a cock plug, by means of which it is possible to convey the fresh water to the heater, as well as to the warm-water discharge line of the heater.

With the hitherto known devices of this kind, the changeover is located at one side of the lack-of-liquid safety device, in approximately the same plane with the warm-water outlet and the fresh-water intake valves, thus requiring careful subdivisioning of the lateral space available for the valves and the change-over device, at the housing of the lack-of-liquid safety device. Moreover, with the known devices, the liquid regulating valve provided in the housing, and actuated by the adjusting member of the lack-of-liquid safety device, is not accessible until after the dismantling of the whole housing.

According to the invention the change-over device is located in the centre and in the axial direction of the adjusting member of the lack-of-liquid safety device, serving at the same time as a support for a liquid regulating valve influenced by the adjusting member.

All this results in an essential simplification, and cheapening in cost, of the whole lack-of-liquid safety device, because the location, in the sense of the invention, of the change-over device at the bottom side of the housing provides more space for the valves, or the like, to be located at one side of the housing, thus making it possible, in connection with a corresponding simplification of the housing, to locate the bores for these valves, or the like, in a simple and easily executable manner. An additional advantage is to be found in the fact that the liquid regulating valve may be withdrawn by simply withdrawing the plug of the change-over cock from the housing, and that at the housing of the lack-of-liquid safety device no spots or surfaces requiring machining for attaching the liquid regulating valve need be provided. Furthermore, the arrangement and development of the change-over device in the sense of the invention facilitates simple and accessible arrangement of the service handle of the change-over device, so that the manipulation of the service handle is not obstructed by any valves, or the like, located at close distance.

Further characteristic features of the invention are set forth in the following description.

To enable the invention to be fully understood it will now be described with reference to the accompanying drawings in which:

Figure 1 shows a vertical section through the lack-of-liquid safety device in connection with the gas section of a liquid heater and

Figure 2 a horizontal section through the lack-of-liquid safety device, along the line 2—2 in Figure 1, whilst

Figures 3 to 5 diagrammatically depict various positions of adjustment of the change-over device conforming to the invention.

Between the lower part 1 and the upper part 2 of the housing of the lack-of-liquid safety device, a diaphragm 3 is fastened in a generally known manner, such diaphragm subdividing the interior of the housing into a high-pressure chamber 4, located below the diaphragm, and a low-pressure chamber 5, located above the diaphragm. The diaphragm 3 is in mechanically controlled connection with a control stud 6 controlling the gas valve located in the housing 7.

As especially made visible in Figure 2, the lower part 1 of the housing is provided with a tubular connecting piece 8 for connecting the fresh-water supply line 9, and with a tubular connecting piece 10 for connecting the piping 11 (Figures 3 to 5) leading to the heater. The tubular connecting piece 10 is provided with a Venturi tube 12 of which, in a generally familiar manner, the narrowest part is in connection with the low-pressure chamber 5 by way of a bore 13 in the Venturi tube, and a bore 14 in the correspondingly developed tubular connecting piece 10 in which a check valve 15, diagrammatically indicated in Figures 3 to 5, is located. Furthermore, for the connection of a water line 16 (Figures 3 to 5) coming from the heater, still another tubular connecting piece 17 is provided which, in addition, may be equipped with a connecting point 18 for connecting a warm-water discharge line. At the lower part 1 of the housing, the tubular connecting piece 17 empties into a bore 19 developed as a valve seat, which bore can be shut off by means of a valve body 21 to be actuated by a handle 20. To the valve space 22, which can be shut off by the valve body 21, the water outlet 23 of the device is connected.

In the centre and in the axial direction of the adjusting member 3, the change-over device, developed in the form of a cock plug 24, is located in the lower part 1 of the housing. The cock plug 24 is provided with an under-cut tenon 25 protruding from the lower part 1 of the housing, to which tenon a cap 27 is fastened by means of a screw 26, this cap being provided with a service handle 28 for turning the cock plug 24. By means of a washer 30, which by the screw 29

for the stuffing box packing is firmly pressed against a shoulder in the bore of the cock plug, the cock plug is protected from withdrawal, whilst any movement of the cock plug toward the interior is prevented by means of the cap 27 slidingly butting up against the bottom side of the lower part 1 of the housing. The service handle 28 is provided with an attachment 31 which during the movement of the cock plug moves over an adjusting scale 32 provided on the circular side wall of the housing 1 indicated in a broken line in Figure 2. At the same time, attachment 31 serves as a handle and, together with the tubular connecting piece 17 and the housing of the valve 21, as a stop for limiting the movement of the cock plug. The inner end of the cock plug 24 is provided with a bore 33 serving as a water passage and, at the same time, as a regulating chamber; which bore is shut off toward the high-pressure chamber 4 by a threaded body 35 provided with a valve-seat bore 34; in such bore there being located also a movable valve body 37 developed in the form of a float regulator, the lower end of such valve body being provided with a valve seat surface 36. The upper end of the valve body 37 protrudes from the valve-seat bore 34 into the high-pressure chamber 4, and is provided with a head 38 smaller than the bore 34, so that the whole valve body 37 may be made in one piece, and that, after it has been inserted into the regulating chamber 33, the threaded body 35 can be screwed into the cock plug. The lower end of the valve body 37 is provided with flats 39 for water passage. By means of a cross bore 40 through the cock plug, the regulating chamber 33 can be connected to the freshwater supply line 8, 9. Furthermore, the cock plug seat in the lower part 1 of the housing is provided with a bore 41 (Figure 2) which, at a corresponding position of the cock plug 24, and, by way of bore 40 of the cock plug, can be made to connect with the fresh-water supply line, and empties directly into the high-pressure chamber 4. In addition, and below the regulating chamber 33, the cock plug 24 is provided with a continuous cross bore 42 through which the fresh water can directly reach the outlet 23.

After the lifting of the bonnet 27 and of the threaded connection 29, the cock plug, together with the whole liquid regulating valve, can be withdrawn from the housing 1.

The device described hereinabove works as follows, as especially made clear also by the drawings 3 to 5:

First of all, attention is drawn to the fact that, in Figures 3 to 5, contrary to Figures 1 and 2, and for the purpose of simplifying the diagrammatical description, the fresh-water intake 8, 9 is provided at the left side of the cock plug 24.

Figure 3 shows the cock plug 24 in the position for hot water. In this case, the fresh water coming from the supply line 8, 9 reaches the regulating chamber 33 by way of the bore 40 in the cock plug 24. When the water supply to the heater is opened the valve body 37 is lifted by the flow of the water so that the head 38 of the valve body is pressed against the lower surface of the diaphragm 3. In case the water flows at low speed to the heater, the diaphragm 3 is lifted only a little owing to the small suction effect of the Venturi tube 12. Consequently also the valve body 37 is lifted only a little so that the thin middle portion of the valve body 37 releases or provides the largest possible passageway through the valve-seat bore 34. When, however, the speed of the flowing water rises, the diaphragm 3 and accordingly the valve body 37 are lifted to a higher position so that the valve seat surface 36 of the valve body is brought close to the valve seat bore 34, and the passageway of said bore is more or less obstructed. In this manner the water flowing through the valve bore 34 to the high-pressure chamber 4 and then to the heater is automatically regulated. From the high-pressure chamber 4 the water flows through the Venturi tube 12 and through the piping 11 to the heater in Figure 3 diagrammatically shown as a broken and dotted line. In that connection, the diaphragm is adjusted in the generally known manner, and by means of the control stud 6 the gas valve actuated. The hot water, having passed the heater, reaches the outlet 23 by way of the water line 16 and the valve 21. If the water outlet valve 21 is now closed, this will stop the flow of water through the heater and through high pressure chamber 4 and Venturi tube 12 so that the pressures in chambers 4 and 5 are equalized, causing the gas valve to be closed by spring pressure. Also, when the water supply to the heater is shut off for any reason, that is to say, when a "lack-of-liquid" occurs, the same action takes place because due to a lack-of-liquid flow, the pressures on both sides of diaphragm 3 are equalized. The diaphragm therefore returns to its normal position and the gas valve is immediately closed to prevent any overheating or other damage to the water heater. Thus it will be seen that the lack-of-liquid safety device just described operates to prevent damage as soon as a "lack-of-liquid" occurs and that this device operates when flow of liquid through the heater is prevented either at the inlet or the outlet thereof.

Figure 4 shows the cock plug 24 adjusted for warm water. In that position, the bore 40 of the cock plug connects the fresh-water supply line 8, 9 with the bore 41 in the lower part 1 of the housing. Thus, the fresh water reaches the high-pressure chamber 4 not only by way of the liquid regulating valve, as shown in Figure 3, but part of the fresh water, by-passing the regulating valve, also and directly enters the high-pressure chamber 4 by way of the bore 41. Thereby, the quantity of water flowing to the heater is increased and the temperature of the discharged water decreased.

Figure 5 shows the cock plug 24 adjusted to such a position that the fresh-water supply line 8, 9 is directly connected with the outlet 23 by way of the bore 42 of the cock plug, so that the fresh-water supply for the heater is completely shut off.

Figure 2 of the drawings shows that a further turning to the left of the cock plug 24 away from its position according to Figure 5 results in completely shutting off the water supply. Consequently, with the arrangement conforming to the invention the hitherto required separate shut-off valve for the fresh-water supply is entirely dispensed with, resulting in an additional simplification, and cheapening of cost, of the whole device.

Naturally, the herein described liquid regulating valve may be developed in some other form also. For instance, in the place of the float regulator 37 the movable valve body may, in the generally known manner, by means of a spring be kept in mechanically controlled contact with the adjusting member actuated by the water

pressure. In such a case, with a device conforming to the invention, the spring would have to be arranged in such a manner that its lower end would rest upon that part of the cock plug 24 which protrudes into the high-pressure chamber 4, so that the spring, together with the liquid regulating valve and the cock plug 24, may be withdrawn from the housing 1.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, I declare that what I claim is:

1. A lack-of-liquid safety device for water heaters comprising a fuel valve for said heater, an adjusting member for actuating said fuel valve, a housing surrounding said adjusting member and including high and low water-pressure chambers on opposite sides of said adjusting member, a water regulating valve operable to automatically control the flow of water through said device and arranged centrally of and operable by said adjusting member, a change-over device including passages formed in said housing for flow of water to and from the heater and a cock-plug having water-passage bores for controlling said passages and operable to convey fresh water to the heater or to the warm water discharge line of said heater, said cock-plug being arranged centrally of and below said adjusting member and in coaxial alinement with said fuel valve and fitted into a bore formed in said housing and connecting the fresh water supply-passage with the high pressure chamber below said adjusting member, the inner end of said cock-plug supporting said water regulating valve.

2. A lack-of-liquid safety device as set out in claim 1 in which the bore in which the cock-plug and the water regulating valve supported thereby are mounted is formed as an opening provided in an outside wall of said housing and the cock-plug and water regulating valve can be mounted therein and withdrawn therefrom as a unit, and means for removably mounting and holding said cock-plug in said opening.

3. A lack-of-liquid safety device as set out in claim 1 in which said cock-plug contains horizontal and vertically extending bores which cooperate with the water inlet and discharge passages of said housing whereby said cock-plug is operable to direct fresh water either to the water heater inlet or to the discharge and to regulate the amount of water delivered to said water heater.

4. A lack-of-liquid safety device according to claim 1, in which the water passage of the cock-plug, through which the fresh water is directly conveyed to the warm-water outlet, comprises cross bores, while the water passage of said cock-plug leading to the high-pressure chamber comprises a longitudinal bore with a cross-wise running connecting bore.

5. A lack-of-liquid safety device as set out in claim 1 in which said cock-plug contain horizontal and vertically extending bores which cooperate with the water inlet and discharge passages of said housing whereby said cock-plug is operable to direct fresh water either to the water heater inlet or to the discharge and to regulate the amount of water delivered to said water heater, said liquid regulating valve controlling said vertical bore and being operated by the pressure of the water in said bore.

6. A lack-of-liquid safety device for liquid heaters as set out in claim 1 in which said liquid regulating valve is arranged in one of the passages in said cock-plug, the passages in said cock-plug and housing being arranged so that in one position of said cock-plug water flows from the fresh water supply passage to said heater inlet through said cock-plug and said regulating valve only and in another position of said cock-plug flows through said cock-plug and both through said regulating valve and through a by-pass thereof.

7. A lack-of-liquid safety device according to claim 1, in which the water regulating valve comprises a movable valve body which acts as a float regulator and is actuated by the water pressure, said movable valve body being in a valve-seat bore provided in a releasable sealing part mounted in the hollow end of said cock-plug and cooperating therewith to provide a float chamber, the upper head of such movable valve body being of smaller diameter than the valve-seat bore of said releasable sealing part.

8. A lack-of-liquid safety device according to claim 1, in which the cock-plug is provided with a service handle having an attachment extending from the bottom side of the housing around the latter's circular side wall, such attachment being movable over an adjusting scale provided on the circular wall of the housing, and serving as a handle portion and, together with corresponding parts of the housing, as a stop for limiting the movement on both sides.

FRIEDRICH WEBER.