Oct. 21, 1930. J. ELLBERG ET AL 1,779,228

RELIEF VALVE FOR HEATING SYSTEMS

Filed Oct. 12, 1929

Fig. 1.

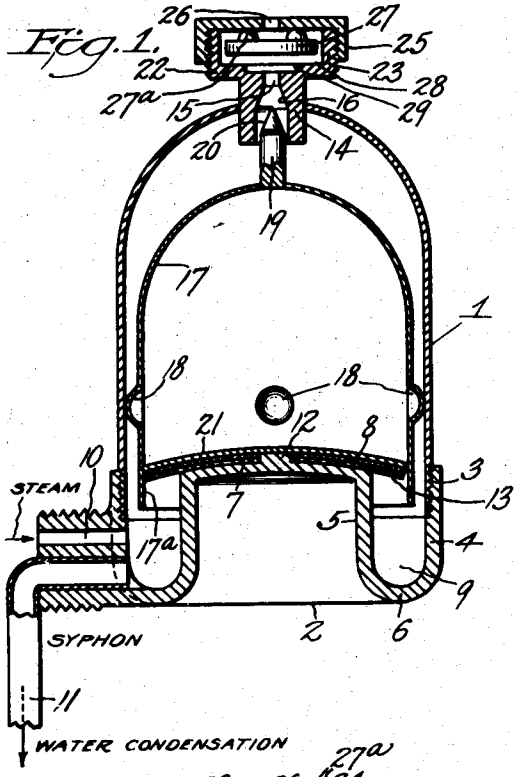


Fig. 3.

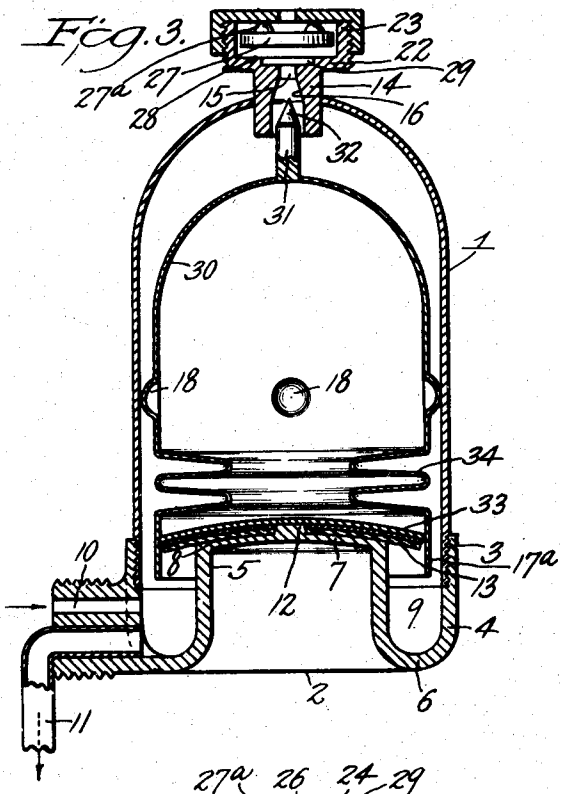


Fig. 2.

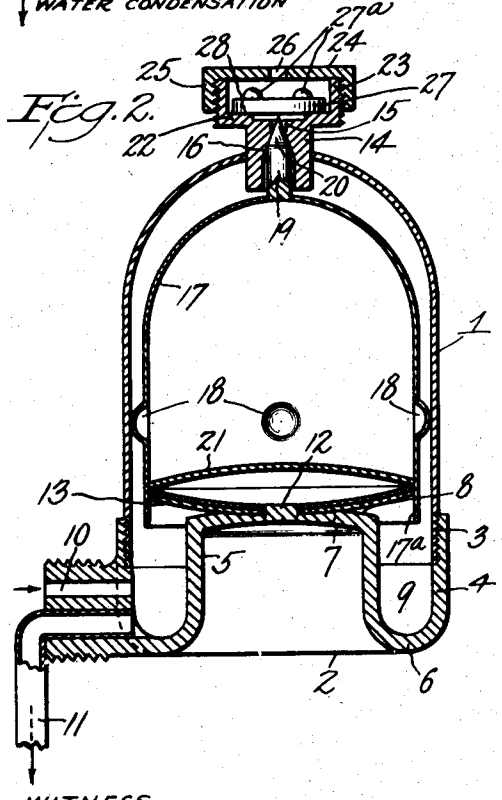
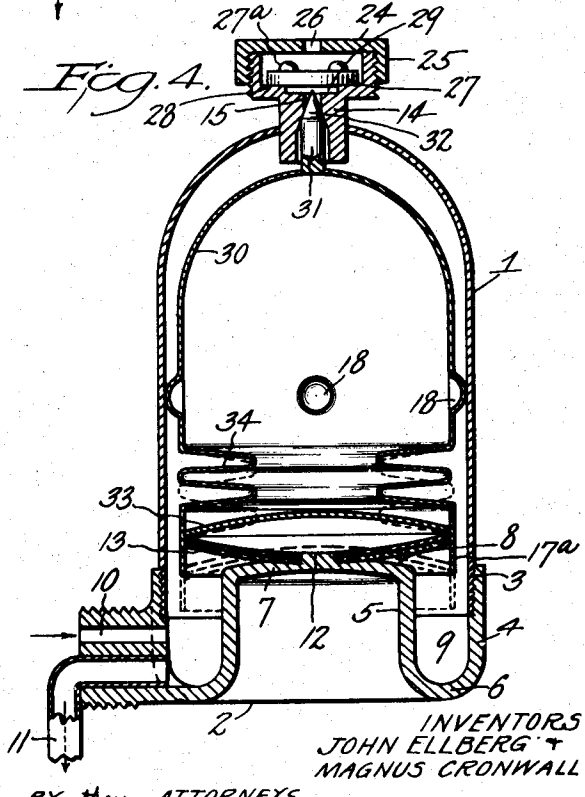


Fig. 4.



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RELIEF VALVE FOR HEATING SYSTEMS

Application filed October 12, 1929. Serial No. 399,248.

This invention relates more especially to that class of relief valves which are employed in steam and vapor heating systems for eliminating air and drawing off the water from the heat-radiating units.

The primary object of our invention is to construct valves of this kind of a relatively small number of parts of simple and inexpensive construction of improved form and to provide an improved arrangement of said parts in such a way as to render a valve more sensitive in its automatic response to temperature changes, as well as more positive in its action than known devices of a similar character at the present time.

Another object of our invention is to provide an improved construction and arrangement of parts in a device of this character by means of which certain temperature effects within and without the valve housing can be employed in an effective manner for controlling the automatic operation of the valve.

Other and more specific objects of invention will appear in the specification, the particular features relating thereto being recited in the appended claims and shown on the drawings which illustrate two forms in which our invention may be embodied in a steam heating system or in the so-called vacuum steam heating system.

In the drawings,

Figure 1 is a vertical axial section of one form of our improved valve and shows the relative positions of the parts when the radiator is cold, say, for example, below 80 degrees Fahrenheit.

Figure 2 is a similar vertical axial section of the same with the parts shown in their relative positions after the heating unit has been made active so that the radiator may be termed hot or heated to a temperature in excess of 80 degrees Fahrenheit for example.

Figure 3 is a vertical axial section similar to Figure 1 of another embodiment of our invention.

Figure 4 is a vertical axial section of the valve shown in Figure 3, the parts being shown in changed positions.

According to the embodiment of our invention shown in Figures 1 and 2, the valve housing comprises an upper portion 1 in the form of a bell-jar and a lower portion 2 of peculiar form which is connected to the bell-jar portion 1 by a threaded connection 3. The lower portion 2 of the housing is preferably constructed of a single piece of metal and comprises an outer cylindrical wall 4; an inner cylindrical wall 5 which is connected to the outer cylindrical wall by an annular wall 6 of channeled cross-section; and a closed top plate 7 provided with an upwardly-presented convex surface or table 8. The inner cylindrical wall 5 and integrally-formed top plate 7 are preferably formed as a reentrant portion of the bottom wall of the housing and are thus exposed to the outer air over an extended area in such a way as to facilitate cooling of the top plate 7. Furthermore, this reentrant portion of the bottom wall forms an annular trough 9 between the inner cylindrical wall 5 and the outer cylindrical wall 4. As shown on the drawings, the lower portion of the housing is provided with a steam inlet 10 suitably arranged to discharge into the annular trough 9 and against the inner cylindrical wall 5. Leading from the bottom of annular trough 9 is a water discharge or suction outlet pipe 11. A centrally formed nib or lug 12 on the top plate 7 is adapted to loosely center a bimetallic disk 13 which when cold assumes a downwardly-flexed position as shown in Figure 1, said disk being adapted when hot to assume an upwardly-flexed position as shown in Figure 2. As indicated in Figure 1, the convex upper surface of plate 7 is made to conform to said bimetallic disk in its normal cold or downwardly-flexed position.

Centrally disposed in the dome-like upper end of the upper portion of the housing is a valve-block 14 provided with an air relief port 15 and a downwardly-presented frusto-conical valve-seat 16. Interposed between the valve-block 14 and the bimetallic disk 13, is a float 17 of smaller diameter than the inner wall of the housing, said float being provided with bulb-like protuberances 18 formed in

the cylindrical wall thereof, and slidably engaging the inner wall of the housing for guiding the float during its rising and falling movements. Presented upwardly from the top wall of said float is a post 19 provided with a conical upper end 20 which constitutes a valve which in the raised position of float 17 engages the frusto-conical valve-seat 16 for closing the lower end of relief port 15. The float 17 which is hermetically sealed, is provided with an arched bottom wall 21 which conforms to the top plate 7, as well as to the bimetallic disk 13 when cold. The cylindrical side wall of float 17 is extended below the arched bottom plate 21 to form a depending flange 17^a.

Surmounting the valve-block 14 is a check-valve housing comprising a flat annular bottom wall 22, a cylindrical flange 23, and a cap 24 with its depending flange 25 threaded to the flange 23. Said cap is provided with a port-opening 26 to permit the escape of air from the valve-housing prior to the closing of the valve 20 upon its seat 16. Arranged within the check-valve housing is a valve disk 27 provided with upwardly-presented nibs 27^a which prevent said valve-disk from closing the port-opening 26 whenever said valve-disk is forced upwardly by the escaping air. In its lower position as shown in Figure 2, the valve-disk 27 closes upon an annular valve-seat 28 extending around the outer edge of a circular pressure chamber 29 at the outer end of port-opening 26.

Referring now to the embodiment of our invention shown in Figures 3 and 4, all of the parts are substantially similar in construction to corresponding parts shown in Figures 1 and 2, with the exception that the hermetically sealed float in Figures 3 and 4 is provided with an accordion or bellows section which modifies its operation. The description of the parts shown in Figures 3 and 4 therefore may be confined more especially to the float construction. Thus, the dome-like upper portion 30 of the float carries a central post 31 provided with a conical upper end 32 adapted to close a relief port in the valve-block whenever said dome-like upper portion is raised sufficiently for this purpose. Said float is provided with an arched bottom wall 33 which conforms to the bimetallic disk when cold and the top plate of the support therefor. Extending between the dome-like upper portion of the float and the arched bottom wall thereof is an expansible accordion or bellows section 34, by virtue of which the effective length of the float is varied under variations in pressure within and without said float. According to this embodiment of our invention, therefore, the float varies in length as well as being subject to an endwise displacement by the thermo-responsive action of the bimetallic disk.

Operation

According to the embodiment of our invention shown in Figures 1 and 2, when the steam or vapor is shut off, the several parts are in their respective positions shown in Figure 1 with the exception that the check-valve-disk 27 would be at rest upon its valve-seat. As the steam or vapor is turned on, the cold air is driven upwardly through the housing, lifting the check-valve 27 from its seat and passing outward through the port-opening 26. As the steam, for example, enters the housing, there will be an initial condensation which sooner or later is drawn off by the siphon or vacuum discharge outlet. Should there be an undue accumulation of water in the housing, the float will be forced upwardly to temporarily close the relief port 15 until such excess water has drained off sufficiently to permit the float to drop and thus to again open the relief port. Eventually the bimetallic disk becomes heated by the presence of steam and as it becomes flexed upwardly, the float is raised to close the relief port. As soon as this happens, the check-valve disk 27 remains seated and due to a partial vacuum which is created within the housing by a continued condensation of the heating fluid, said check-valve disk is held to its seat by an excess pressure from the outside and is thus adapted to prevent the entrance of outside air. In this way, an admission of outside air is effectively prevented even though the float and bimetallic disk have again assumed their normal lowered position and the partial vacuum is maintained provided the system is otherwise tight.

According to the embodiment of our invention shown in Figures 3 and 4, the operation is somewhat changed. After a sufficient period of rest in its cold position, the air within the float will have substantially the same temperature as that of the surrounding air as well as that of the air or vapor within the housing and outside the float due to the metal intervening walls which are good conductors of heat. As steam is admitted to the housing, air is displaced therefrom until the bimetallic disk is flexed upwardly to close the relief port. If the steam supply is now shut off, the check-valve disk drops to its seat and thus prevents the admission of air into the system. As condensation continues and the system cools, the bimetallic disk flexes back to its original position while at the same time a partial vacuum is created within the housing in consequence of which the air which is confined within the float under atmospheric pressure, naturally expands and in doing so elongates the float in such a way as to again close the relief valve at the top. As long as the partial vacuum continues within the system, both of said valves operate together to exclude the outside air.

We claim:—

1. In a valve of the character described, the combination of a housing having a centrally-disposed reentrant portion of its bottom wall provided with a convex upper surface, said housing being provided with steam-inlet and suction-outlet openings, a float arranged within said housing and having a bottom wall conformable to the convex upper surface of said reentrant portion of the bottom wall of said housing, a dished bimetallic disk interposed between and normally conformable to said reentrant portion of the bottom wall of said housing and the bottom wall of said float, said disk being adapted when heated to assume an oppositely-dished form for raising said float, and a relief-valve movable to and from its seat by the rise and fall of said float.

2. In a valve of the character described, the combination of a housing provided with a steam-inlet and drain-outlet at the bottom and with an air-relief valve-seat at the top, a hollow thermo-disk support disposed opposite to the steam-inlet in the lower portion of said housing, the top and side walls of said thermo-disk support being exposed to the outside air, a thermo-disk mounted on said thermo-disk support, said thermo-disk being adapted when cold to assume a downwardly-dished form and when heated to assume an upwardly-dished form, a float arranged in said housing between said valve-seat and thermo-disk, and a valve operated by said float for engaging said valve-seat, the top wall of said thermo-disk support and the bottom wall of said float being conformed to said thermo-disk when cold.

3. In a valve of the character described, the combination of a housing provided with a steam inlet and suction outlet at the bottom and with an air-relief valve-seat at the top, a thermo-disk support disposed in the lower portion of said housing, a thermo-disk mounted on said thermo-disk support, said thermo-disk being adapted when cold to assume a downwardly-dished form and when heated to assume an upwardly-dished form, said thermo-disk support having an upper convex surface conforming to said thermo-disk when cold, a float arranged in said housing between said valve-seat and thermo-disk, said float being provided with a dished bottom wall conforming to the thermo-disk when cold, and a valve operated by said float for engaging said valve-seat.

4. In a valve of the character described, the combination of a housing provided with a steam-inlet and suction-outlet and with an air-relief valve-seat, a hollow thermo-disk support centrally disposed in the lower portion of said housing and exposed to the outside atmosphere, a thermo-disk mounted on said thermo-disk support, said thermo-disk being adapted when cold to assume a downwardly-dished form and when heated to assume an upwardly-dished form, a float arranged in said housing between said valve-seat and thermo-disk, said float comprising an upper rigid portion and a lower collapsible portion, and a valve operated by said float for engaging said valve-seat, said float being hermetically sealed to enclose a body of air.

5. In a valve of the character described, the combination of a housing, the bottom wall of said housing being provided with an upwardly-presented convex surface, a bimetallic thermo-disk having an initial curvature normally conforming to that of said convex surface and adapted when heated to assume an oppositely-presented curvature, a float arranged in said housing upon said bimetallic disk, the top wall of said housing being provided with a downwardly-presented valve-seat and an upwardly-presented valve-seat, a valve operated by said float and adapted in the raised position of said float to seat on the first-mentioned valve-seat, a siphon pipe leading from said housing at the bottom, an inlet for steam connected up to said housing, and a check valve for the second-mentioned valve-seat.

6. In a valve of the character described, the combination of a housing, a thermo-disk support provided with an upwardly-presented convex surface, a bimetallic thermo-disk having a curvature when cold normally conforming to that of the upper surface of said thermo-disk suport and adapted when heated to assume an oppositely-presented curvature, a valve block mounted in the top wall of said housing, said valve block being provided with a downwardly-presented valve-seat, a float arranged in said housing between said bimetallic disk and said valve block, a valve operated by said float and adapted in the raised position of said float to seat on said valve-seat, an outlet pipe leading from said housing, an inlet for steam connected up to said housing, a check valve housing surmounting said valve block, said check valve housing being provided with an outwardly-presented valve-seat, and a check valve movable to and from said valve-seat within said check valve housing.

7. In a valve of the character described, the combination of a housing provided with an inwardly-presented relief valve-seat and an outwardly-presented check valve-seat, a check valve for said check valve-seat, a thermo-disk support provided with an upwardly-presented convex surface, a bimetallic thermo-disk normally conforming to said upwardly-presented convex surface of the thermo-disk support, and adapted when heated to assume an oppositely-presented convexity, a float arranged in said housing between said bimetallic disk and said valve block, said float being provided with a bellows section and with a bottom wall conform-

ing when cold to the upper surface of said bimetallic disk-support, a valve operated by said float and adapted in the raised position of said float to seat on said inwardly-presented relief valve-seat, a siphon pipe leading from said housing, and an inlet for steam connected up to said housing.

8. In a valve of the character described, the combination of a housing having a bottom wall provided with a centrally-disposed raised portion, a valve block mounted in the top wall of said housing, said valve block being provided with a downwardly-presented valve-seat, a bimetallic thermo-disk having a normally downward curvature, said thermo-disk resting upon the raised portion of said bottom wall and adapted when heated to assume an upwardly-presented curvature, a float arranged in said housing between said bimetallic disk and said valve block, said float being provided with a bellows section and with a bottom wall conforming to the curvature of said bimetallic disk when cold, a valve operated by said float and adapted in the raised position of said float to seat on said valve-seat, a siphon pipe leading from said housing, and an inlet for steam connected up to said housing.

9. In a valve of the character described, the combination of a housing having a bottom wall provided with a centrally-disposed raised portion, said raised portion being provided with an upwardly-presented convex surface, a valve block mounted in the top wall of said housing, said valve block being provided with a downwardly-presented valve-seat, a bimetallic thermo-disk having a curvature normally conforming to that of the upper surface of the raised portion of said bottom wall and adapted when heated to assume an oppositely-presented curvature, a float arranged in said housing between said bimetallic disk and said valve block, said float being provided with a bellows section having a bottom wall conforming to the curvature of said bimetallic disk when cold, a valve operated by said float and adapted in the raised position of said float to seat on said valve-seat, a siphon pipe leading from said housing at the bottom, and an inlet for steam connected up to said housing.

10. In a valve of the character described, the combination of a housing having a bottom wall provided with a centrally-disposed reentrant portion, said reentrant portion of the bottom wall being provided with an upwardly-presented convex surface, a valve block mounted in the top wall of said housing, said valve block being provided with a downwardly-presented frusto-conical valve-seat and an outwardly-presented annular valve-seat, a bimetallic thermo-disk having a curvature normally conforming to the curvature of the convex upper surface of said reentrant portion of the bottom wall of the housing and adapted when heated to assume an opposite curvature, a check-valve for the annular valve-seat of said valve-block, a float arranged in said housing between said bimetallic disk and said valve block, said float being provided with an upwardly-presented conical valve adapted in the raised position of said float to seat on said frusto-conical valve-seat of the valve-block, a siphon pipe leading from said trough, and an inlet for steam connected up to said housing.

11. In a valve of the character described, the combination of a housing having a bottom wall provided with a reentrant portion, said reentrant portion of the bottom wall being provided with an upwardly-presented convex surface, a valve block mounted in the top wall of said housing, said valve block being provided with an inwardly-presented relief valve-seat and an outwardly-presented check valve-seat, a bimetallic thermo-disk having a curvature normally conforming to the curvature of the convex upper surface of said reentrant portion of the bottom wall of the housing and adapted when heated to assume an opposite curvature, a check-valve for the outwardly-presented check valve-seat of said valve block, a float arranged in said housing between said bimetallic disk and said valve block, said float being provided with a downwardly-presented concave bottom wall conforming to the curvature of said bimetallic disk when cold, a relief valve connected to said float and adapted in the raised position of said float to seat on said relief valve-seat of the valve block, a siphon pipe leading from said trough, and an inlet for steam connected up to said housing.

12. In a valve of the character described, the combination of a housing having a bottom wall provided with a centrally-disposed reentrant portion forming a trough around and between it and the lateral wall of said housing, said reentrant portion of the bottom wall being provided with an inwardly-presented convex surface, a valve block mounted in the top wall of said housing, said valve block being provided with a relief valve-seat, a bimetallic thermo-disk having a curvature normally conforming to the curvature of the convex upper surface of said reentrant portion of the bottom wall of the housing and adapted when heated to assume an opposite curvature, a float arranged in said housing between said bimetallic disk and said valve block, said float being provided with a downwardly-presented concave bottom wall conforming to the curvature of said bimetallic disk when cold and with an upwardly-presented relief valve adapted in the raised position of said float to seat on said relief valve-seat of the valve block, a siphon pipe leading from said trough, and an inlet for steam connected up with the annular space surround-

ing said reentrant portion of the bottom wall of said housing.

13. In a valve of the character described, the combination of a housing having a bottom wall provided with a centrally-disposed reentrant portion, said reentrant portion of the bottom wall being provided with an inwardly-presented convex surface, a valve block mounted in the top wall of said housing, said valve block being provided with an inwardly-presented frusto-conical valve-seat, a bimetallic thermo-disk having a curvature normally conforming to the curvature of the convex upper surface of said reentrant portion of the bottom wall of the housing and adapted when heated to assume an opposite curvature, a float arranged in said housing between said bimetallic disk and said valve block, said float including a bellows section provided with a downwardly-presented concave bottom wall conforming to the curvature of said bimetallic disk when cold and with an upwardly-presented conical valve adapted in the raised position of said float to seat on said frusto-conical valve-seat of the valve-block, a siphon pipe leading from said trough, and an inlet for steam connected up to said housing.

14. In a valve of the character described, the combination of a housing having a bottom wall provided with a centrally-disposed reentrant portion forming a trough around and between it and the lateral wall of said housing, said reentrant portion of the bottom wall being provided with an inwardly-presented convex surface, a valve block mounted in the top wall of said housing, said valve block being provided with an inwardly-presented frusto-conical valve-seat and an outwardly-presented annular valve-seat, a bimetallic thermo-disk having a curvature normally conforming to the curvature of the convex upper surface of said reentrant portion of the bottom wall of the housing and adapted when heated to assume an opposite curvature, a check-valve for the annular seat of said valve block, a float arranged in said housing between said bimetallic disk and said valve block, said float being provided with a downwardly-presented concave bottom wall conforming to the curvature of said bimetallic disk when cold and with an upwardly-presented conical valve adapted in the raised position of said float to seat on said frusto-conical valve-seat of the valve block, a siphon pipe leading from said trough, and an inlet for steam connected up with the annular space surrounding said reentrant portion of the bottom wall of said housing and arranged to discharge against the lateral wall of said reentrant portion.

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