May 2, 1939. J. A. PARKS, JR 2,156,865

VALVE FOR HEATING SYSTEMS

Filed Feb. 12, 1936

Fig. 1.

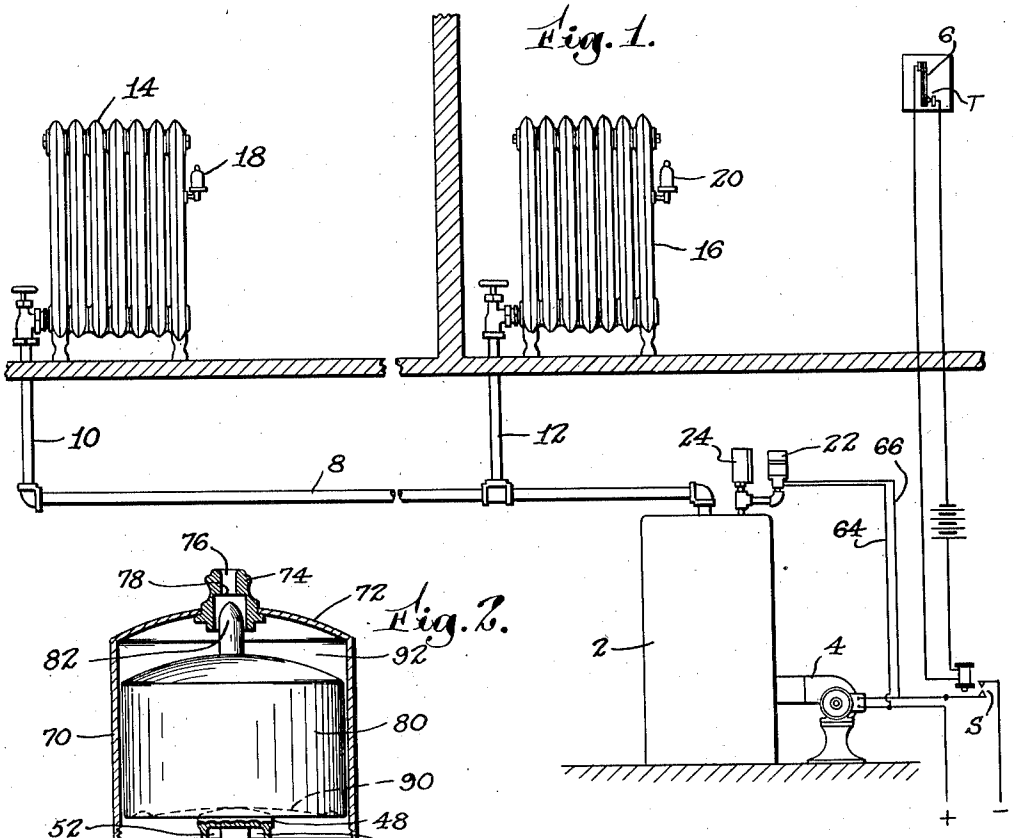


Fig. 2.

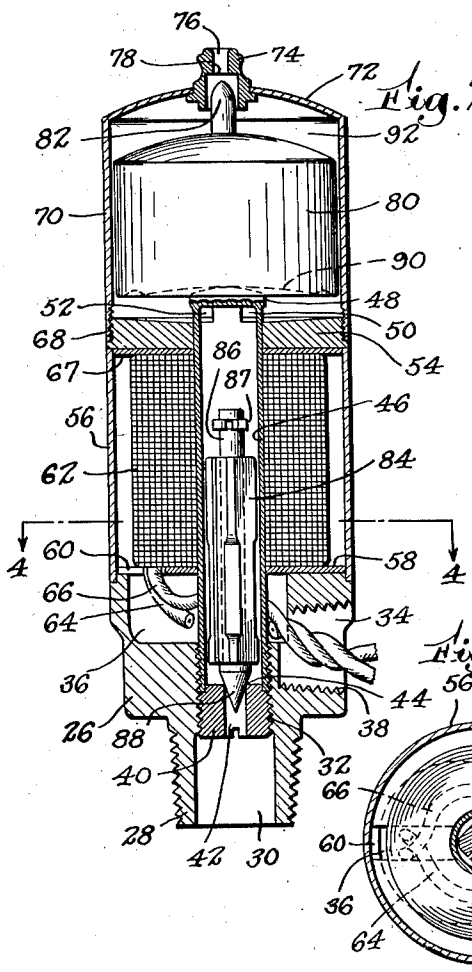


Fig. 3.

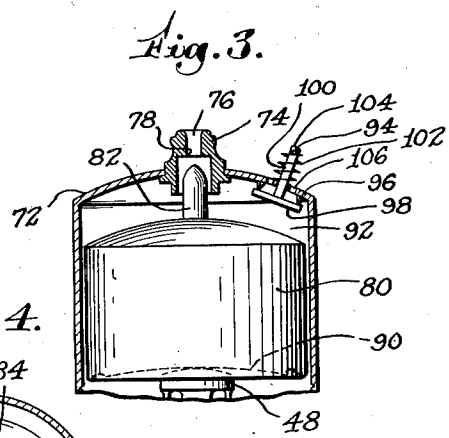
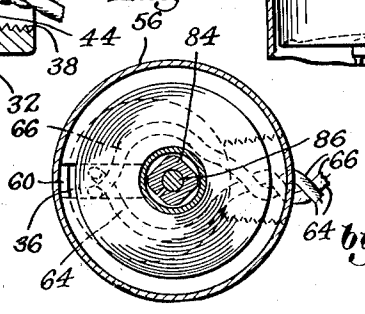


Fig. 4.



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VALVE FOR HEATING SYSTEMS

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Application February 12, 1936, Serial No. 63,628

12 Claims. (Cl. 277—49)

This invention is concerned with steam heating systems. More particularly it is concerned with a one-pipe steam heating system in which steam is generated periodically under the influence of a thermostat located in one of the enclosed spaces to be heated.

One of the problems involved in any heating system is the proper distribution of heat to the various rooms or enclosed spaces so that the entire structure may be heated uniformly or as desired.

In the typical one-pipe steam heating system this problem has been solved to a practical degree by the use of adjustable air-venting valves on the various radiators whereby the time of arrival of steam to a given radiator may be accelerated or retarded by opening or closing the vent as the case may be. By suitably adjusting the vents on the several radiators, the steam during any given heating cycle can be distributed to the radiators at varying rates to give the desired heating effect.

When adjustable air venting valves, incorporating the so-called vacuum-maintaining feature whereby the valves automatically close under the influence of the negative pressure that develops in a steam heating system at the end of any given heating cycle, are used, an additional problem is presented. In such cases it frequently happens that sub-atmospheric pressure steam will be created and delivered to the various radiators after the start of the next heating cycle in sufficient quantity to satisfy the controlling thermostat without the re-opening of any of the air vents on the radiators. Under such circumstances the sub-atmospheric pressure steam is delivered to the several radiators without the operation of the air vents, but not at the rates that would prevail were the air vents functioning. Thus, on such a heating cycle, the desired distribution of steam is not obtained.

The only way proper distribution can be obtained is to bring the pressure within the system at the start of each heating cycle back to atmospheric, whereby the air vents during the heating cycle will discharge air from the various radiators to give the proper distribution of steam.

In the co-pending application of Ferguson et al., Serial No. 33,838, filed July 30, 1935, which issued as Patent No. 2,062,565, on December 1, 1936, a one-pipe steam heating system, having adjustable, vacuum-maintaining, air-venting valves on the radiators and additional valve means for automatically restoring the pressure within the system to atmospheric at the start of each heating cycle, whereby the proper distribution of steam may be obtained, is disclosed.

One feature of the invention involved in this application pertains to a new and improved valve for use on a steam heating system whereby the pressure within the system may be restored to atmospheric at a suitable time during each heating cycle.

As the description proceeds, other objects and accomplishments of my invention will become apparent.

In the accompanying drawing

Fig. 1 shows a typical one-pipe steam heating system, automatically controlled by a thermostat located in one of the heated spaces.

Fig. 2 is a vertical, cross-sectional view of my improved valve.

Fig. 3 shows a modification of the construction of Fig. 2.

Fig. 4 is a cross-sectional view on the line 4—4 of Fig. 2.

In Fig. 1 is shown a steam boiler 2 to which the heat is supplied by an oil burner 4. The operation of the oil burner is automatically controlled by the thermostat 6 located in one of the rooms or spaces to be heated. Extending from the boiler is the main 8 having the risers 10 and 12 to which are connected the radiators 14 and 16 located in the various rooms. On the radiators are air venting valves 18 and 20. A suitable air venting valve for use in connection with a system of this type is shown in the co-pending application of Lasher et al., Serial No. 739,424, filed August 11, 1934. Connected directly with the boiler 2 is the valve 22 mounted by suitable pipe and fittings on a T interposed between the safety valve 24 and the boiler. This form of mounting is used so as to obviate the necessity of tapping an additional hole into the boiler.

The valve 22, which is electrically operated in part, is connected in parallel with the circuit of the motor that operates the oil burner 4. Thus, when current is supplied to the motor of the oil burner, current is also supplied to the valve 22.

The details of the construction of my valve are shown in Fig. 2. The base 26 has a threaded nipple 28 extending therefrom with a passage 30 therethrough. This passage is threaded for part of its length at 32. An orifice 34 extends through one wall of the base to permit access to a cavity 36 in the upper part of the base. Orifice 34 is threaded, as at 38, to receive the threaded end of an electric conduit if the use of such a device is found desirable. Screwed into position in the passage 30 is a plug 40 having a vertically-extend-

ing, centrally-located orifice 42 of which the upper edge 44 acts as a valve seat.

Screwed downwardly into the base 26 and coaxial with the plug 40 is a tube 46. The threaded engagement of tube 46 and plug 40 with base 26 is such as to be air and steam-tight. Covering the upper end of tube 46 is a cap 48, but immediately therebelow are several openings or ports in the tube around its circumference, as at 50 and 52. Centrally mounted on tube 46 below these openings is a circular disc 54 of substantial thickness. Disc 54 and tube 46 are secured together by means of a forced fit or by soldering or otherwise so as to produce an air and steam-tight union.

Mounted on base 26 is a cylindrical shell 56 of such length as to fill the space between the base 26 and the disc 54. On top of base 26 and within shell 56 is a disc-like plate 58 having a radially extending slot 60.

Resting on plate 58 and surrounding tube 46 is a solenoid coil 62, having leads 64 and 66 extending to the exterior of the valve through slot 60, cavity 36 and orifice 34. The cavity 36 is of sufficient diameter to enable leads 64 and 66 to pass around tube 46, as shown in Fig. 4.

Between coil 62 and disc 54 is a circular plate 67 which, with plate 60, provides a path for the flux of coil 62.

Disc 54 is externally threaded at 68 to which is screwed the internally-threaded shell 70 to make a fluid-tight joint. Shell 70 is closed at its upper end by means of the head 72, which has at its center and co-axial with passage 30, a plug 74 with an orifice 76, the inner edge of which forms a valve seat 78.

It will be observed that the passage from orifice 76 to orifice 42 formed by plug 74, shell 70, disc 54, tube 46 and plug 40 is a fluid-tight conduit.

Within shell 70 and resting on cap 48 is a hollow, cylindrical, sealed float 80 on the top of which is mounted a valve pin 82 which is adapted to engage against valve seat 78.

In my preferred construction, float 80 is what is known as a vacuum-packed float. That is to say, before the float is sealed, a negative pressure of suitable magnitude is created within the float. The purpose of this construction will be explained hereinafter. In addition, float 80 usually contains a small amount of some liquid that boils at a relatively low temperature, as for example, alcohol.

Positioned within tube 46 is a freely moving armature 84 of any desired cross-sectional configuration, having a longitudinal bore through which extends a valve stem 86. Valve stem 86 is free to move within armature 84. On the upper end of valve stem 86 is a ring in the form of a split washer 87 of greater diameter than the bore of armature 84 to prevent armature 84 from sliding beyond the end of valve stem 86. On the lower end of valve stem 86 is a conically-shaped valve pin 88 axially aligned with orifice 42 and adapted to engage valve seat 44 to prevent the passage of fluids. The diameter of valve pin 88, adjacent armature 84, is greater than the bore of armature 84, whereby the downward movement of armature 84 with respect to valve stem 86 is limited.

From the foregoing it will be seen that valve stem 86 can be moved longitudinally of armature 84 a limited amount. The purpose of this construction will shortly appear.

The operation of my valve and system is as follows: When the thermostat 6 is closed under the influence of a falling temperature, the circuit to the motor of the oil burner and the circuit to valve 22 are closed simultaneously. Prior to the closing of the circuit, the valve 22 is in the normal position shown in Fig. 2, orifice 42 being closed while orifice 76 is open. As soon as the solenoid coil 62 is energized, armature 84 is immediately driven upward in tube 46. The momentum of armature 84 is so great that upon striking washer 87 valve stem 86 and the associated valve pin 88 are carried upwardly by armature 84 to a position at or near the upper end of tube 46. If a negative pressure exists in the system, air will immediately enter through orifice 76, pass downwardly through space 92 by float 80, through the ports 52, downwardly through tube 46, past armature 84 which, preferably, in cross section is square or hexagonal or fluted or otherwise constructed so as not to unduly impede the passage of air, through orifice 42 and thus on into the system.

In this way at the start of each heating cycle, the pressure within the system may be brought to atmospheric within a few minutes, and prior to the generation of steam. The time, of course, will vary with the size of the orifice.

Shortly thereafter steam will be generated in the boiler 2, and under the pressure created thereby, some of the steam will obviously advance to valve 22, entering through the passage 30, the orifice 42, passing upwardly through tube 46, through ports 50 and 52, to encounter and to raise the temperature of float 80. When the temperature of float 80 reaches a pre-determined point, the volatile liquid within float 80 will be vaporized causing the concave bottom 90 of float 80 to snap downwardly to a convex position, thus driving valve pin 82 upwardly to seat against valve seat 78 to prevent the escape of steam. In this way valve 22 is automatically closed when steam is generated. In the meanwhile, the current in the solenoid coil 62 continues to flow and valve pin 88 remains suspended above orifice 82.

Thereafter, steam will pass through the main 8 and the risers 10 and 12 to heat the radiators 14 and 16 at rates determined by the adjusted venting capacities of air venting valves 18 and 20. Subsequently, the room or space in which the thermostat 6 is located will be heated to a sufficient degree to cause the thermostat to open the thermostat circuit, thereby in turn opening the circuit to the motor of the oil burner 4 and the circuit to the valve 22. Thereupon, the solenoid 62 will no longer operate to hold armature 84 in an elevated position so that under the force of gravity valve pin 88 and armature 84 drop, armature 84 acting as a hammer to drive valve pin 88 firmly against valve seat 44 to effectively seal orifice 42. At this point orifice 76 is still sealed by valve pin 82. Thereafter, due to the condensing of the steam in the system, a negative pressure is created which operates to automatically close air venting valves 18 and 20 against inflowing air, and if all of the joints of the system are tight, a substantial negative pressure will be created and maintained.

After the cessation of the generation of steam, valve 22 will gradually cool and the temperature of float 80 will drop below the boiling point of the volatile liquid contained therein. Thereupon, bottom 90 of float 80 will resume its concave position, as shown in Fig. 2, and orifice 76 will be reopened. However, it is clear that no air can enter the system, even though orifice 76 is re-

opened, since orifice 42 is still closed by valve pin 88.

Thereafter the temperature of the room in which the thermostat 6 is located will fall as the heat is radiated therefrom, and thermostat 6 will again operate to close the circuit to the motor of the oil burner and the circuit through the conductors 64 and 66 to valve 22. When this takes place the foregoing cycle will be repeated.

In the preceding description it was said that float 80 was preferably arranged so as to have a negative pressure within when in its normal position and at room temperature as shown in Fig. 2. The purpose of this construction is as follows: When orifice 76 has been closed by valve pin 82, due to the expansion of float 80, under the influence of the surrounding steam and orifice 42 has been closed by valve pin 88 upon the breaking of the circuit through conductors 64 and 66, it will be apparent that the space 92, within the valve between orifice 76 and orifice 42, is completely sealed and full of steam at the moment orifice 42 is closed. As valve 22 thereafter cools, the steam in this sealed space will condense to create a negative pressure of considerable magnitude. If the normal pressure within float 80 were atmospheric, the negative pressure surrounding float 80 would be sufficient to hold bottom 90 in a convex position, even though the temperature of the float had receded to a point below that necessary for condensation of the volatile liquid contained within. By constructing float 80 with a negative pressure within, the foregoing possibility is eliminated and bottom 90 will return to its normal concave position regardless of the negative pressure in the space 92 between orifices 76 and 42.

If, however, it is desired to use a float in which the normal pressure is atmospheric, the construction shown in Fig. 3 may be utilized. In this construction, the valve works in exactly the same manner described heretofore, but means is provided to eliminate the possibility of a negative pressure developing in the space 92 which would be of such magnitude as to hold bottom 90 in a convex position after the temperature of float 80 had receded to the point at which bottom 90 would normally snap back to its concave position. This means is in the form of a one-way valve 94 which may be of any desired construction. In the form shown there is a circular valve seat 96 against which is seated the disc 98 having mounted thereon a stem 100 surrounding which is a weak spring 102 held under slight compression against the head 72 by means of a pin 104 extending transversely through stem 100. Obviously, when a negative pressure is developed in space 92, the excess atmospheric pressure, entering through ports 106, will cause valve 94 to open until such time as equilibrium is established.

While I have described my invention by reference to a specific form, I wish it to be understood, however, that I intend to be limited only by the appended claims.

I claim:

1. A device of the type described for use in a steam heating system comprising a single unit including two valves in series and connected by a fluid-tight conduit, one of said valves operated electrically and the other of said valves operated by a float positioned in said conduit, said float operative under the influence of rising temperature of the fluid in said conduit.

2. A device of the type described for use in a steam heating system comprising a single unit including two valves in series and connected by a fluid-tight conduit, one of said valves opened and closed by the operation of a solenoid the coil of which encircles said conduit, the other of said valves opened and closed by the operation of a thermostatic float positioned directly in said conduit.

3. A device of the class described comprising a unit with a fluid-tight conduit having an orifice at either end, a thermostatic float in said conduit having valve closing means mounted thereon to close one of said orifices under the influence of heat or rising water, other valve closing means including a solenoid to close and open said other orifice.

4. A device of the class described comprising a single unit having a base adapted for connection with a steam heating system, a fluid-tight conduit mounted on said base, a passage through said base connecting with said conduit, valve means for closing said conduit from said passage, a solenoid having its coil encircling said conduit and its armature within said conduit, said valve means opened when the solenoid is energized and closed when the solenoid is de-energized, other valve means controlling the flow of fluids from said conduit to the atmosphere, said other valve means operated by an expansible thermostatic float arranged to close said other valve when the temperature of said thermostatic float is above a predetermined point, said first valve means and said thermostatic float being positioned in the same fluid-tight conduit.

5. A valve for use on a steam heating system comprising a base with a nipple extending therefrom and having a bore therethrough, an orificed plug in said bore, a tube mounted above said plug and connected with said orifice, a valve pin, having a valve stem associated therewith, for closing said orifice and an armature connected with said valve stem positioned in said tube, a disc mounted on said tube, a solenoid coil surrounding said tube and between said base and disc, a shell mounted on said disc having a port to the atmosphere, a thermostatic float with a valve pin mounted thereon and adapted to close said port positioned in said shell, the passage between said orifice and port being fluid-tight.

6. An article of manufacture comprising a unit having a base with a fluid tight conduit mounted thereon, a solenoid operated valve to control the passage of fluid to or from said conduit at one end whereby said valve is closed when the solenoid is deenergized and open when energized, and a thermostatic float to operate a second valve to control the passage of fluid to or from said conduit at the other end, both valves being open only when said solenoid is energized and the temperature at said other thermostatically operated valve is below a predetermined point, said thermostatic float positioned directly in said conduit between said valves.

7. An article of manufacture comprising a fluid tight conduit, valves at the ends of said conduit, one of said valves controlled by a solenoid, whereby said valve is open when the solenoid is energized and closed when deenergized, the other valve controlled by a thermostatic element, said thermostatic element comprising a hollow sealed float in which the normal pressure is less than atmospheric, and positioned directly in said conduit to be controlled by the temperature of the fluid passing therethrough.

8. An article of manufacture adapted for use in a steam heating system comprising a unit hav-

ing a passage therethrough, one end of which is adapted to be connected to said system, the other end extending to the atmosphere, two valves in series in said passage, one operated by a solenoid, the other by a thermostatic float positioned directly in said passage, said thermostatic float providing means for closing said passage while said solenoid-operated valve is open.

9. An article of manufacture adapted for use in a steam heating system comprising a vertically disposed fluid-tight conduit having a valve at each end, the lower end valve operated by a solenoid surrounding said conduit and the upper end valve operated by a thermostatic float positioned directly in said conduit, said conduit having an auxiliary valve arranged to open when the pressure within said conduit is less than a predetermined amount.

10. A valve device for use on a steam heating system, comprising a base having a bore and means for connection with a pipe, a restricted orifice associated with said bore, a tube mounted above said restriction, a valve pin having a valve stem positioned in said tube, an armature connected with said valve stem, an enlarged tube mounted on the upper end of said first tube, a solenoid coil surrounding said first tube between said base and said enlarged tube, said enlarged tube having a closure at its upper end, a port to the atmosphere through said closure, a float in said enlarged tube, said float having means associated therewith for closing said port upon upward movement of said float, thermostatic means for causing upward movement of said float, the passage between said orifice and port being fluid-tight.

11. A valve device for use in a steam heating system comprising a fluid-tight conduit having two valves in series, one end of said conduit adapted for connection with said system, the other end venting to the atmosphere, a restricted orifice at the system end of said conduit, one of said valves being solenoid operated for opening and closing said orifice, the other of said valves forming means for closing the atmospheric end of said conduit and comprising a float and thermostatic means, both valves being within said conduit and operating in opposite directions to close their respective ports.

12. A device of the class described, comprising a unit with a fluid-tight conduit having an opening at either end, a plurality of valves in series in said conduit, temperature operated means positioned in said conduit for causing one of said valves to close when the temperature of the fluid in said conduit rises above a predetermined point, electrically operated means associated with said unit for causing the opening of one of said valves, and buoyant means for closing one of said valves when water rises above a predetermined point in said conduit.

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