May 7, 1929. J. E. COLEMAN 1,712,257

RADIATOR AIR VALVE

Filed April 24, 1923

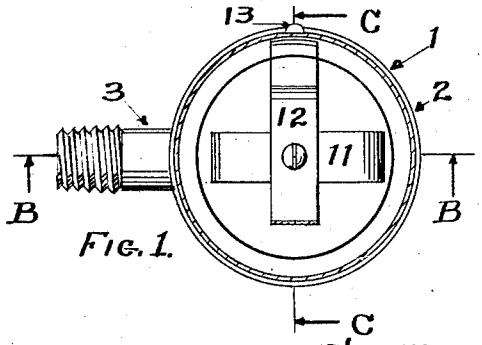


FIG. 1.

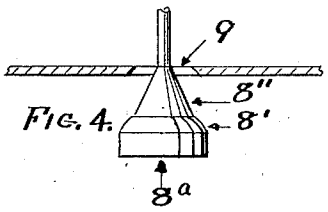


FIG. 4.

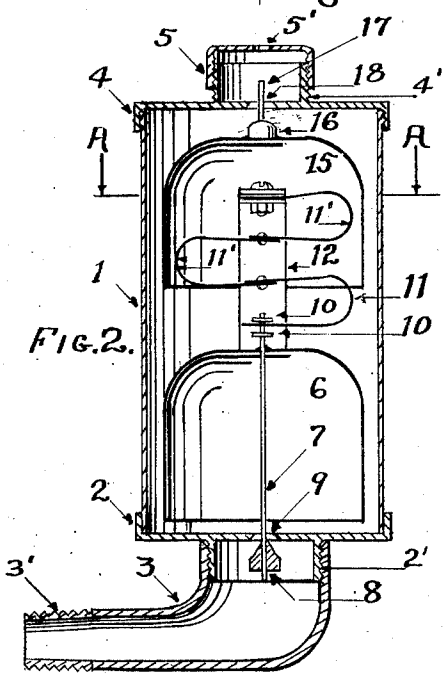


FIG. 2.

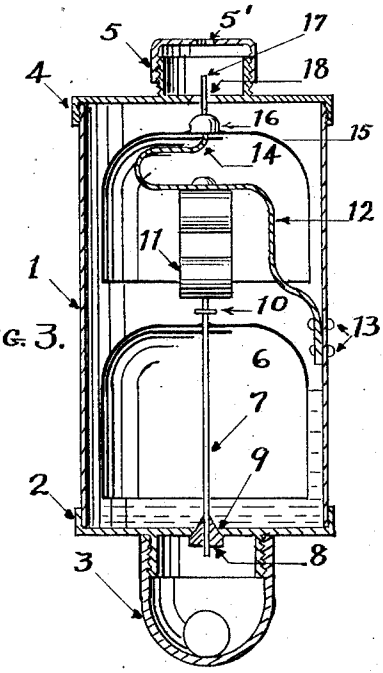


FIG. 3.

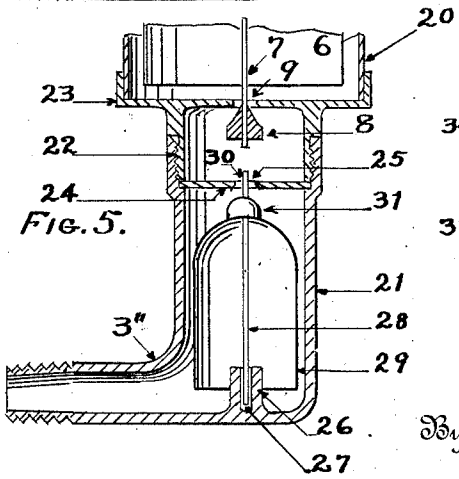


FIG. 5.

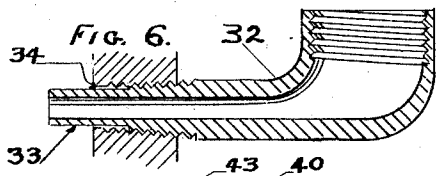


FIG. 6.

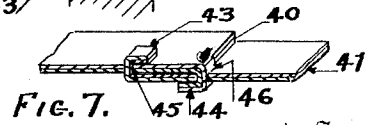


FIG. 7.

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UNITED STATES PATENT OFFICE.

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RADIATOR AIR VALVE.

Application filed April 24, 1923. Serial No. 634,412.

This invention relates to improvements in relief valves for steam radiators, and is more particularly directed to a type of valve utilizing forces developed hydraulically for accomplishing certain of the operations.

An object of the present invention is to provide an improved valvular device which will permit the free egress or ingress of air out of or into a radiator or the piping of a steam or vapor heating system and which will prevent the escape of steam or hot or cold water from the radiator or piping to which the device is attached.

Another object of the invention is to provide a valvular device for the above stated purposes, constructed in a simple manner, and which will not only operate successfully under the low steam pressures of "vapor systems" but will also operate successfully under the higher steam pressures of "steam systems".

Still further objects are to provide a relief valve which will be noiseless in operation throughout the whole range of steam pressures for which it is designed, and will be free from the common fault of "water logging"; i. e. a device such that, should the valve be seated by water entering it, the water will not be so trapped in the device that, when the conditions which forced the water into the device no longer exist, the water does not drain out. In some valves in use this water logging prevents the device from continuing automatic operation.

In the accompanying drawings, there are shown for purposes of illustration two embodiments of air valves, together with modifications of certain parts. It is intended that the drawings should be considered as illustrative of the invention, rather than limiting the same, as it is obvious that various other embodiments of the invention are possible.

In these drawings:

Fig. 1 is a sectional plan view taken on the line A A of Fig. 2;

Fig. 2 is a sectional elevation taken on the line B B of Fig. 1, showing the valve open;

Fig. 3 is a sectional elevation taken through the plane shown in Fig. 1 on the line C C, and shows the device in its normal operating position, that is with the thermostatic element contracted by heat and water in the chamber lifting the lower float and closing the lower valve against its seat;

Fig. 4 is a view of a slightly modified form of valve closing member;

Fig. 5 is a sectional view of a modified form of valve;

Fig. 6 illustrates a modified form of device for attaching the valve to the radiator, and

Fig. 7 illustrates a mode of attaching the thermostatic elements to one another.

Similar reference characters refer to similar parts throughout the several views.

The structure of Figs. 1, 2 and 3 will first be described. A cylindrical casing 1 is attached to a lower head 2, preferably by soldering, and this head is provided with a threaded extension 2′, as shown, by means of which it may be attached to a base member 3 having a threaded end 3′ for attachment to the radiator in the usual fashion. The upper end of the cylinder 1 is screw-threaded and attached to an upper head 4. This upper head is provided with a screw-threaded tubular portion 4′, onto which a protecting cap 5 may be threaded.

A float 6 is carried in the lower portion of the cylindrical casing by means of a stem 7, the lower end of which passes through a port or valve seat 9 in the center of the head 2. The lower end of stem 7 is provided with a closure member 8 for the port 9. This member is here shown in the form of a cone but one could readily substitute the device shown in Fig. 4. The upper end of the stem 7 projects through the top of the float 6 and is provided with two spaced apart nuts or lugs 10—10, by which the float and stem may be actuated by a thermostat 11. One form of said thermostat is shown in Fig. 1. It is preferably made of two metals having different coefficients of expansion. Steel and brass, which may be copper-plated so as to make them non-rusting, form a satisfactory thermostatic element. The thermostat has a number of bows 11′ which may be attached to one another in the fashion indicated in Fig. 2 or in Fig. 7. Each of these bows is a thermostatic element by itself. They are separate elements, however, in order that the movement of one may be added to the movement of the other, so that the free end of the thermostat may move a considerable distance. This free end is preferably bifurcated and passes about the stem 7 intermediate the two nuts 10—10. The thermostat may be supported on a member 12 riveted to the side wall of the casing as

shown at 13. This member is shown as being irregular in shape and is provided with an extension 14 in order to accommodate and carry an upper float 15.

The float 15 is provided with a valve stem 17 and an enlargement 16. The valve stem passes through a port 18 in the upper head 4, while the enlargement 16 is of such shape as to close this port in case the float 15 is raised in a manner to be described.

Assuming that the radiator is cold and the steam valve has been opened in the usual manner, the incoming steam will force the cold air out of the radiator through the base member 3, port 9, casing 1, port 18 and a port 5′ in the cap 5. Before all the air is out of the radiator, the valve begins to warm up on account of heat transmitted from the radiator. As the warm air passes out, the thermostatic element 11 will bend slightly raising the lower end. This will in turn lift the stem 7, float 6, and the valve member 8, thereby restricting the passage through the port 9.

The air from the radiator will gradually become warmer and mixed with more water vapor, and as it passes through the casing, the closing movement of the valve will continue, condensation from the vapor in the casing will collect in the chamber formed by the casing and the heads 2 and 4. This collection will start as soon as a certain event happens, to wit, further restriction, and a probably rather extreme restriction, of the passage through the port 9. The parts are so designed that at this stage of the operation the restriction of said passage, or the differential pressures above and below the same, or both, and the surface tension of the water of condensation, will have coacted to set up a condition to prevent such water from running out into the portion 3 through the opening or port 9. When there has been collected a sufficient quantity of water the float 6 will rise and completely close the valve 8. As this stops the admission of warm air and steam into the chamber, the thermostatic element tends to take its normal shape and move the free end downwardly. In ordinary operation the heat from the steam in the base 3 evaporates some of the water in the chamber, thus generating a small quantity of steam which maintains the thermostatic element in contracted position and the float in a balanced condition. Any air which may accumulate in the base 3 will form an air pocket and will permit the water in the chamber to cool sufficiently to allow the thermostat to expand and open the valve 8 so that the air can bubble up through the water into the chamber and pass out through the upper parts. When the steam is shut off from the radiator and the steam pressure is reduced so that there is no steam in the base 3, the device will cool off, the thermostatic element will move downward and will come in contact with the lower abutment 10 and will continue its downward movement so as to open the valve 8 so as to allow the water in the chamber to drain out. This water drains out freely without any seal as air is admitted through the ports 18 and 5′.

If for any reason warm water should be forced into the device the action would be as above described, but if cold water should be forced into the device, the float 6 might not completely close the valve 8 on account of the cold expanded thermostat. Should enough cold water, however, go into the device so as to reach the float 15, it is obvious that this float would be raised and that the enlargement 16 would be brought into the port 18 to close the same. This would prevent the escape of cold water through the air valve.

Fig. 4 shows an enlarged detail of a form of closure member suitable for actuation by the thermostat and float. The closure member 8^a has a conical section 8″ to cooperate with the conical port 9. It is also provided with a spherical portion 8′ which will serve to effectively close the port if the float should for any reason assume an oblique position. The tilting of the float would merely bring a different portion of the spherical part 8′ against the port 9.

According to the modified form of invention shown in Fig. 5, the upper float 15 is not placed in the chamber formed by the cylindrical casing 20. The lower float 6, stem 7, port 9 and closing member 8 and thermostatic operating member may be the same as shown in Figs. 2 and 4. In the present case, the base member 3″ has a comparatively long upright cylindrical portion 21 threaded at 22. The lower head 23 is fastened to the cylindrical casing 20 and to the threaded upper portion of the base member as shown. A plate 24 provided with a port 25 is clamped in place by threading the parts 21 and 23 together. The lower part of the base member 21 is provided with an upwardly projecting boss 26 having a hole 27 which acts as a lower guide for the stem 28 on which is mounted a float 29. This float is located inside the enlarged portion 21 of the base member 3″. The float is provided with a stem 30 which extends through the port 25 and with an enlargement 31 which will close the port 25 when the float 29 is lifted by reason of water being forced into the base member 3″.

The operation of the structure shown in Fig. 5 is substantially the same as that for the structure shown in Figs. 1, 2 and 3, except that in the present case the flooding of the device is prevented by the float valve 29 carried underneath the chamber.

Fig. 6 shows a modified form of base member 32. This base member may be the same

as the base member 3 or 3'' where it connects with the lower head of the chamber. The part of the base member 33 which extends through the threaded hole 34 in the radiator is of slightly reduced diameter and is so designed that it passes beyond the inner surface of the radiator. In this way any water which is trickling down the inside wall of the radiator is prevented from passing around into the inside of the base member and being sucked into the air valve. This arrangement will insure that, in the ordinary operation, steam only is admitted to the air valve.

Fig. 7 shows a modified form of mounting for the thermostatic element. According to this embodiment, each of the bi-metallic elements 40 and 41 is provided with reduced end portions 43 and 44 which are passed through apertures 45 and 46 and bent over as shown. In this manner the thermostatic elements may be readily and permanently fastened together without soldering and without the use of rivets.

What is claimed is:

1. A radiator air valve having a chamber, a port in the bottom of the chamber controlling access of vapor thereto, a thermostatic member in the chamber for controlling the opening and closing of the port, and a float in the chamber for controlling the opening and closing of the port at a predetermined stage of operation of the thermostat.

2. A radiator air valve having a chamber, a port in the bottom of the chamber controlling access of vapor thereto, a second port, a thermostatic member in the chamber for controlling the opening and closing of the lower port, a float in the chamber for controlling the opening and closing of the lower port, and a second float for opening and closing the second port.

3. A radiator air valve having a chamber, a port in the bottom of the chamber controlling access of vapor thereto, a second port in the top of the chamber, a thermostatic member in the chamber for controlling the opening and closing of the lower port, a float in the chamber for controlling the opening and closing of the lower port, and a second float in the top of the chamber for opening and closing the second port.

4. A radiator air valve having a casing, ports in the casing, means for closing one of the ports in response to rise in temperature or the presence of a small quantity of warm water, and means for closing the other port in response to the presence of a larger quantity of water.

5. A radiator air valve having a casing, a port in the top of the casing, a float for closing the port, a port in the bottom of the casing, a thermostat underneath the float, a second float below the thermostat, a closure member for the second port permanently connected to the second float, and a lost motion connection between the thermostat and the closure member.

6. A radiator air valve having a casing, a port in the top of the casing, a float for closing the port, a port in the bottom of the casing, a thermostat underneath the float, a second float below the thermostat, a closure member for the second port permanently connected to the second float, and a lost motion connection between the thermostat and the closure member, said closure member operating to close the lower port upon the raising of the second float by water in the bottom of the chamber, or the heating of the thermostat.

7. A radiator air valve having a casing, a port in the top of the casing, a float for closing the port, a port in the bottom of the casing, a thermostat underneath the float, a member fastened to the casing and supporting the float and the fixed end of the thermostat, a second float below the thermostat, a closure member for the second port permanently connected to the second float, and a lost motion connection between the thermostat and the closure member.

8. A radiator air valve having a casing, a port in the top of the casing, a float for closing the port, a port in the bottom of the casing, a thermostat underneath the float, a member fastened to the casing and supporting the float and the fixed end of the thermostat, a second float below the thermostat, a closure member for the second port permanently connected to the second float, and a lost motion connection between the thermostat and the closure member, said closure member operating to close the lower port upon the raising of the second float by water in the bottom of the chamber, or the heating of the thermostat.

9. A radiator air valve having a chamber, a port in the bottom of the chamber having a valve seat, a valve underneath the port, a thermostat in the chamber, a float in the chamber, and a stem connecting said valve and the thermostat, said thermostat acting to unseat the valve when the temperature is low, and to raise it against its seat when the temperature is high, said float being adapted to raise the valve independently of said thermostat.

10. A radiator air valve having a chamber, a port in the bottom of the chamber, a closure member underneath the port, a thermostat in the chamber, a stem connecting the closure member and thermostat, said thermostat acting to force the closure member down away from the port when the temperature is low, and to raise it against the port when the temperature is high, and a float in the chamber and connected to the closure member, said float acting to lift the member

against the port upon the presence of water in the bottom of the chamber.

11. A radiator air valve having a chamber, a port from the radiator to the chamber, a closure member for the port, a thermostat operatively connected to the closure member to hold the same in a position to open the port when the temperature is low and to close it when the temperature is high, and a float in the chamber connected to the closure member to move the member to close the port upon the presence of water in the chamber.

12. A radiator air valve having a chamber, a port formed with a valve seat located in the bottom of the chamber, a valve underneath said port, a thermostat in the chamber, and a stem connected to the valve and to the thermostat through a lost motion connection, said thermostat acting to unseat the valve when the temperature is low, and to seat it when the temperature is high, and means independent of said thermostat for seating the valve.

13. A radiator air valve having a chamber, a port in the bottom of the chamber, a float in the chamber, a closure member carried by the float and adapted to close the port as the float is raised, and a thermostat in the chamber, the thermostat being connected to the float to lift it to close the valve upon the reaching of a predetermined temperature.

14. A radiator air valve having two float valves, and a thermostat, the thermostat and one of the float valves cooperating to effect a closure of the air valve under predetermined condition of temperature, irrespective of the presence of water, and the other float valve closing the air valve when a predetermined quantity of water is present, irrespective of its temperature.

15. A radiator air valve having a chamber, a port in the bottom of the chamber, a closure member underneath the port, a bi-metallic thermostat in the chamber, and a stem connecting the closure member and thermostat, a float in the chamber actuated responsive to the movement of the stem, said thermostat acting to force the closure member down away from the port when the temperature is low, and to raise it against the port when the temperature is high, the closure member and port having such configuration that the closing of the port is gradual with increasing temperature, said float being adapted to close the valve responsive to the presence of water in the valve.

16. A radiator air valve having a chamber, a port from the radiator to the chamber, a closure member for the port, and a bi-metallic thermostat operatively connected to the closure member to hold the same in a position to open the port when the temperature is low and to close it when the temperature is high, the closure member and port having such configuration that the closing of the port is gradual with increasing temperature, and a float connected to the closure member operative responsive to the level of condensate in the chamber.

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