

G. D. HOFFMAN.
 AUTOMATIC AIR VALVE FOR STEAM RADIATORS.
 APPLICATION FILED JUNE 5, 1914.

1,132,009.

Patented Mar. 16, 1915.

Fig. 1

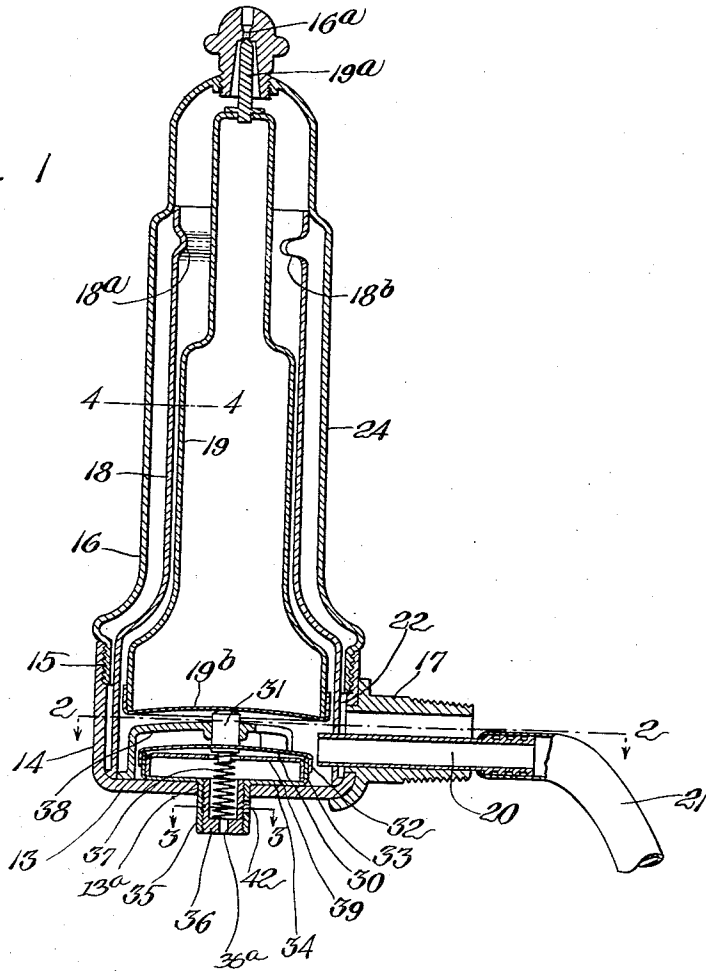


Fig. 4.



Fig. 2.

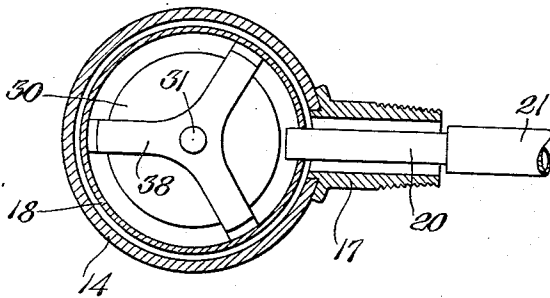
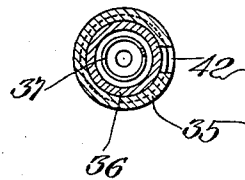


Fig. 3.



Witnesses:
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UNITED STATES PATENT OFFICE.

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AUTOMATIC AIR-VALVE FOR STEAM-RADIATORS.

1,132,009.

Specification of Letters Patent.

Patented Mar. 16, 1915.

Application filed June 5, 1914. Serial No. 843,159.

To all whom it may concern:

Be it known that I, GEORGE D. HOFFMAN, a citizen of the United States, residing at Pasadena, in the county of Los Angeles and State of California, have invented certain new and useful Improvements in Automatic Air-Valves for Steam-Radiators, of which the following is a specification.

This invention has for its object to provide an automatic valve for venting a steam radiator of air, adapted not only to automatically close against the emission of steam and water, but also to automatically close against the entrance of outside air into the radiator when the pressure in the radiator and valve goes off temporarily.

The invention consists in the improvements which I will now proceed to describe and claim.

Of the accompanying drawings, forming part of this specification,—Figure 1 represents a longitudinal section of an air valve embodying my invention. Fig. 2 represents a section on line 2—2 of Fig. 1. Fig. 3 represents a section on line 3—3 of Fig. 1. Fig. 4 represents a section on line 4—4 of Fig. 1.

The same letters of reference indicate the same parts in all of the figures.

The casing of my improved air valve is composed of a lower or base member and an upper member, said members being detachably connected. The base member comprises a bottom 13 and a circular wall 14, rising from the bottom and internally screw-threaded at 15 to engage an external thread on the upper casing member 16. To the wall 14 of the base member is attached a screw-threaded nipple 17 adapted to engage a tapped orifice in a steam radiator.

18 represents a tubular member seated at its lower end on the bottom 13 and extending upwardly within the upper casing member 16 above the float 19 hereinafter described, said member and the bottom 13 constituting a float chamber.

The float 19 is provided with an acting member 19^a adapted to close an air vent 16^a in the upper end of the casing member 16.

The float chamber is provided with a draining stem 20, extending through the nipple and having a swiveled terminal 21 adapted to project downwardly into the radiator.

The lower portion of the tubular member 18 is separated from the base wall 14 by an

annular air space 22 outside the float chamber and communicating with the nipple.

The air space 22 forms a part of an air conduit extending from the nipple 17 to the upper portion of the casing member 16, entirely outside the float chamber and adapted to conduct air expelled from the radiator through the nipple to the upper portion of the casing and to discharge air into the casing below the vent 16^a, said conduit being preferably formed partly by the member 18 and partly by longitudinal bosses 24 formed on the member 16. The portions of the member 16 between said bosses have a close fit on the cylindrical portion of the tubular member 18 above the casing base, so that the bosses form the outer walls and the member 18 the inner walls of a plurality of air passages. The float 19 is preferably of the expandible hermetically closed type and is provided with a flexible bottom 19^b adapted to be deflected or bulged outwardly by the expansion by heat of a liquid, such as alcohol, inclosed in the float. The deflection of said bottom which takes place when steam enters the casing, lifts the float and closes the air vent.

The construction thus far described is in all respects excepting the bearing on which the flexible bottom 19^b rests, substantially like that described in my pending application for Letters Patent of the United States, filed March 29, 1913, Serial No. 757,531. In the air valve shown by said application, the bottom 19^b of the float bears directly on the rigid bottom 13 of the casing, said bottom being of crowning form so that its central portion is elevated and forms a fixed seat or bearing for the float bottom. The tubular member 18 differs from that shown by said application in that its upper end is extended above the bosses 24, and is provided with an annular bead 18^a having an air port 18^b.

In carrying out the present invention, I provide a yielding seat for the float bottom, said seat being adapted to be depressed by pressure within the casing to lower the float and the acting member 19^a, and thus open the air vent 16^a, and normally elevated to hold the member 19^a closed. Said yielding seat is preferably composed of a concavo-convex sheet metal diaphragm of phosphor bronze, or other suitable metal, supported by the bottom 13, with its convex

side uppermost, and a pin 31 attached to and projecting upwardly from the central portion of said diaphragm and bearing on the central portion of the float bottom 19^a.

5 The diaphragm 30 has a marginal flange 32 which is soldered to the rim 33 of a circular cup, the bottom 34 of which bears on the casing bottom 13, and has a tubular stem 35 which projects through an opening 13^a in the bottom 13 and is internally threaded to engage an externally threaded adjustable spring abutment 36.

10 37 represents a spring bearing at one end on the abutment 36 and at its other end on the pin 31, said spring exerting a degree of upward pressure on the pin and on the diaphragm 30, which is determined by the adjustment of the abutment, the latter being rotatable in the stem 35 and raised or lowered by such rotation.

15 The cup formed by the bottom 34 and rim 33 constitutes a diaphragm holder bearing on the bottom 13 and of smaller diameter than said bottom. The abutment 36 is tubular and has an opening 36^a in its bottom, so that the abutment and stem cooperate with the bottom opening 13^a in forming an air inlet communicating with the diaphragm and with the atmosphere.

20 The diaphragm is therefore free to be depressed by pressure within the casing. The escape of water through said air inlet is prevented by the diaphragm and its holder, the latter having a water-tight connection with the casing bottom 13. The pin 31 is preferably guided by a spider 38 having legs bearing on the bottom 13 between the margin of the diaphragm holder and the base portion of the member 18, and having a central orifice in which the pin is movable.

25 I have shown a stop piece or spider 39 below the diaphragm 30, having a central orifice through which the spring 37 passes. Said stop piece serves to limit the depression of the diaphragm 30 and prevent it from being sprung too far downwardly. The diaphragm 30 and pin 31 by exerting a constant upward pressure on the float, normally hold the valve member 19^a closed against its seat independently of the action of heat.

30 The diaphragm is adapted to be depressed or deflected downwardly by a predetermined degree of pressure within the casing, and when so depressed the float and the valve member 19^a are correspondingly depressed to open the vent 16^a. The vent is therefore adapted to be automatically opened by a given increase of cold air pressure in the casing, and is automatically closed by the diaphragm when the pressure decreases.

35 It will be seen therefore, that when cold air from the radiator filling the casing is under pressure from approaching steam, the air pressure depresses the diaphragm 30 and opens the vent. When the air pressure is

released the diaphragm returns to its normal position and causes the closing of the vent. The action of the diaphragm is independent of temperature, the diaphragm being depressed by pressure alone and returned to its normal position when the depressing pressure is absent.

The function of any air valve is to vent the radiator of air when steam enters it and then close when steam fills the radiator. It happens however, that when the steam pressure goes off and the steam in the radiator begins to condense, an air valve not provided with a pressure-controlled device, such as the diaphragm 30, will open and allow cold outside air to enter the radiator through the vent. Since it has taken fuel to get up sufficient pressure to push cold air out of the radiator, the exclusion of the cold air after it has been once expelled, is very desirable. This exclusion is accomplished by the diaphragm 30, and its adjuncts.

The general operation of the valve is as described in my former application, the vent being automatically closed against the emission of steam and water, by the expansion of the float by steam heat and by the lifting of the float by water. The operation of the present valve goes a step further by automatically closing the vent against the entrance of air through the valve into the radiator, when the pressure goes off, and as long as the temperature in the casing is relatively high. The spring 37 and the adjustable abutment 36 enable the resistance of the diaphragm to pressure in the casing to be exactly regulated, so that the diaphragm will yield to a predetermined degree of pressure and remain fixed under a lower pressure. It is practically impossible to secure uniformity of tension and resistance to pressure in all the diaphragms made in the usual manner in large quantities. Prior to the adoption of adjustable resistance regulating means, such as the abutment 36 and the spring supported thereby, it was necessary to discard many diaphragms because they were not inherently responsive to the desired predetermined pressure and had either an excess or a deficiency of resistance. This difficulty is overcome by the said resistance regulating means.

In adjusting an air valve of the described construction for service, the inspector by turning the abutment 36, which may be provided with any suitable means for engaging a wrench or other tool, applies just the amount of pressure through the spring 37 to the diaphragm to hold the valve member 19^a closed and resist an internal pressure on the diaphragm of say six ounces. Every valve is adjusted to resist the same pressure, and the result in practice, is that every radiator equipped with the air valve, freely vents when the internal pressure

reaches six ounces, and the internal temperature is insufficient to expand the float, as presently described. When the pressure falls below six ounces, the diaphragm 30 reacts and closes the vent against entrance of air therethrough, without regard to the temperature. The flexible bottom 19^b of the float (which is in effect a diaphragm), is deflected by heat when the temperature in the casing rises to about one hundred and ninety degrees F. This deflection of the float diaphragm 19^b holds the diaphragm 30 at the limit of its downward movement, so that the pin 31 becomes an unyielding seat or support for the float diaphragm 19^b, and the valve member 19^a keeps the vent closed as long as the temperature in the casing remains above one hundred and ninety-five degrees. If there is a decrease of internal pressure below the six ounces and the temperature in the casing remains above one hundred and ninety-five degrees, the valve member 19^a remains closed in spite of the decrease of pressure, but when the temperature falls sufficiently, the float diaphragm 19^b reacts or rises, and the diaphragm 30 returns to its normal position, and holds the valve member 19^a closed, even under the conditions last described, until there is again an internal pressure of cold air sufficient to displace the diaphragm 30.

After the abutment 36 has been adjusted it may be secured against the possibility of future adjustment. To permit this the stem 35 may be provided with an orifice 42 through which portions of the screw-thread on the abutment are exposed. Said exposed portions may be distorted to prevent further rotation of the abutment.

The diaphragm and the cup or holder on which it is mounted may be conveniently assembled outside the casing and inserted as one part in the casing, so that it is not necessary to secure the diaphragm by a soldering or brazing operation after it is inserted in the casing and when it is in a relatively inaccessible position. The abutment 36 is in effect a part of the diaphragm holder and is applied to the casing therewith. The opening 36^a in the diaphragm holder (said inlet being formed in the abutment portion of the holder) coöperates with the bottom opening 13^a in the casing in forming the described air inlet communicating with the diaphragm. The relatively small diameter of the cup or holder and diaphragm provides room for the legs of the pin-guiding spider which therefore bear directly on the casing bottom within the base of the member 18, as shown by Fig. 1.

I claim:

1. An air valve for steam radiators comprising a casing having an air outlet at its upper portion and an opening in its bottom, a float movable by heat and by an accumu-

lation of water in the casing and having an outlet-closing member, a diaphragm holder bearing on the bottom of the casing, and a float-supporting diaphragm mounted on said holder and coöperating therewith to prevent the escape of water through said bottom opening, the said holder and opening forming an air inlet communicating with the diaphragm.

2. An air valve for steam radiators comprising a casing having an air outlet at its upper portion and an opening in its bottom, a float movable by heat and by an accumulation of water in the casing and having an outlet-closing member, a diaphragm holder bearing on the bottom of the casing, a float-supporting diaphragm mounted on said holder and coöperating therewith to prevent the escape of water through said bottom opening, the said holder and opening forming an air inlet communicating with the diaphragm, and a diaphragm-reinforcing spring carried by the diaphragm holder.

3. An air valve for steam radiators comprising a casing having an air outlet at its upper portion and an opening in its bottom, a float movable by heat and by an accumulation of water in the casing and having an outlet-closing member, a diaphragm holder bearing on the bottom of the casing, a float-supporting diaphragm mounted on said holder and coöperating therewith to prevent the escape of water through said bottom opening, the said holder and opening forming an air inlet communicating with the diaphragm, a diaphragm-reinforcing spring carried by the diaphragm holder, and an adjustable abutment for said spring also carried by the diaphragm holder.

4. An air valve for steam radiators comprising a casing having an air outlet at its upper portion and an opening in its bottom, a float movable by heat and by an accumulation of water in the casing and having an outlet-closing member, a diaphragm holder bearing on the bottom of the casing, and a float-supporting diaphragm mounted on said holder and coöperating therewith to prevent the escape of water through said bottom opening, the said holder and opening forming an air inlet communicating with the diaphragm, the said holder being provided with means for limiting the downward movement of the diaphragm.

5. An air valve for steam radiators comprising a casing having an air outlet at its upper portion and an opening in its bottom, a float movable by heat and by an accumulation of water in the casing and having an outlet-closing member, a diaphragm holder bearing on the bottom of the casing, a diaphragm mounted on said holder and coöperating therewith to prevent the escape of water through said bottom opening, the said holder and bottom opening forming an

air inlet communicating with the diaphragm, a pin interposed between the diaphragm and the bottom of the float, and a pin-guiding spider having legs bearing on the bottom of the casing between the base wall thereof and the diaphragm holder.

6. An air valve for steam radiators, comprising a casing having an air outlet in its upper portion, a float movable by heat and by an accumulation of water in the casing and having an outlet-closing member, a diaphragm supported by the bottom of the casing and yieldingly supporting the float, the casing having an air inlet communicating with the diaphragm, and a cup having a water-tight connection with the casing bottom and the diaphragm.

7. An air valve for steam radiators, comprising a casing having an air outlet in its

upper portion, a float movable by heat and by an accumulation of water in the casing and having an outlet-closing member, a diaphragm supported by the bottom of the casing and yieldingly supporting the float, the casing having an opening in its bottom, a cup marginally connected with the diaphragm and having a tubular stem projecting through the said opening, a spring abutment adjustably engaged with said stem, and a spring interposed between said abutment and the diaphragm.

In testimony whereof I have affixed my signature, in presence of two witnesses.

GEORGE D. HOFFMAN.

Witnesses:

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H. G. LITTLEJOHN.