

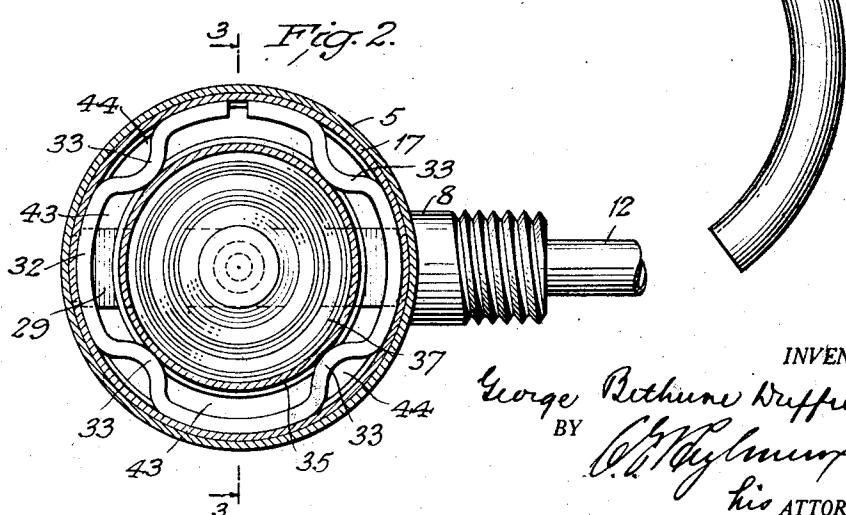
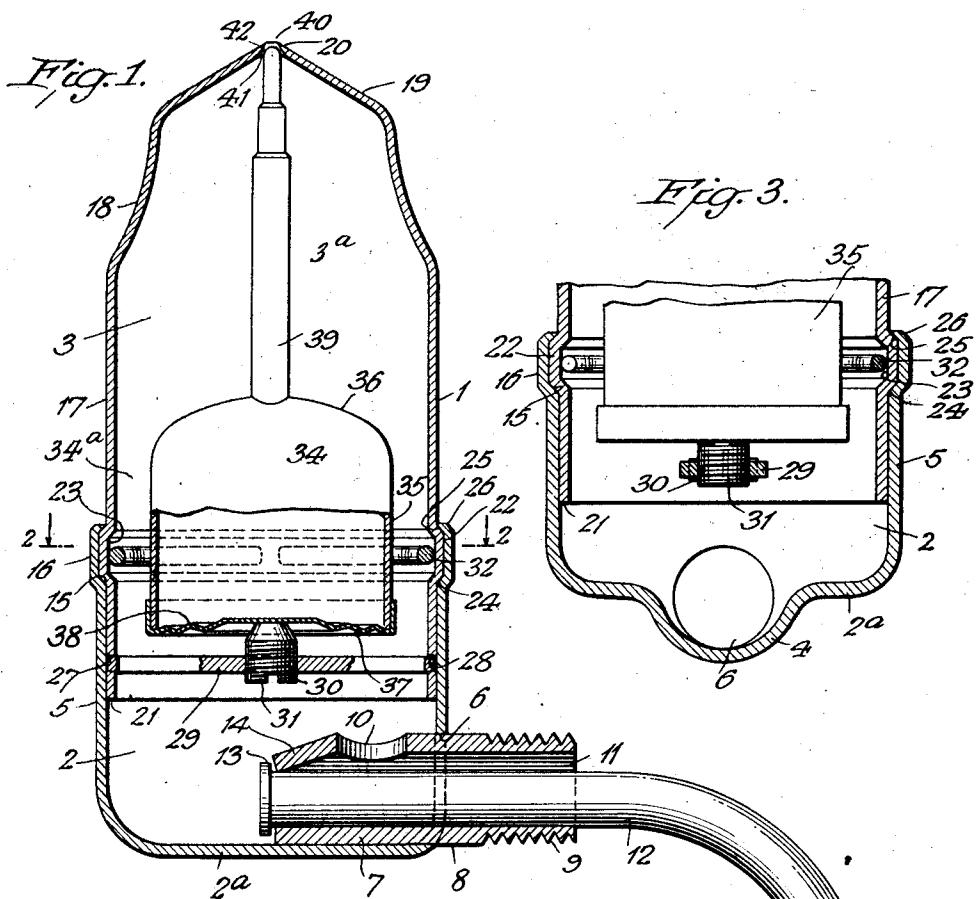
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## AIR VALVE

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## UNITED STATES PATENT OFFICE

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## AIR VALVE

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My invention relates to new and useful improvements in air valves, and more particularly to an air relief valve adapted for use in radiators employed in heating systems.

5 An object of my invention is to provide an air valve of simple construction which is efficient in operation.

Another object is to provide a valve which will freely vent air from the interior of a 10 radiator and prevent the escape of steam or water of condensation therefrom.

The invention consists in the improved construction and combination of parts, to be more fully described hereinafter, and the 15 novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawings, I have fully and clearly illustrated a preferred embodiment of my invention, to be taken as a part 20 of this specification, and wherein—

Figure 1 is a vertical central section of the valve;

Fig. 2 is a horizontal section on the line 2—2 of Fig. 1, and 25

Fig. 3 is a detail section on the line 3—3 of Fig. 2.

Referring to the drawings by characters of reference, 1 designates, generally, the casing of an air relief valve comprising a bottom 30 member 2 and a top member 3, preferably of brass. The bottom member 2 has a base 2<sup>a</sup> in which is a central transverse channel 4 substantially semi-cylindrical in cross-section. Extending upward from the periph-

35 ery of the base 2<sup>a</sup> is a substantially cylindrical side wall 5 having a circular opening 6 therethrough, the lowermost point of said opening being substantially tangent to the channel 4. Fixed in the channel 4 is one end 40 7 of a nipple 8 forming the valve inlet and which is sealed in and projects through the opening 6. The outer end of the nipple 8 is threaded, as at 9, for connection to a radiator vent. The nipple 8 has an aperture 10 in

45 its top side within the member 2 and terminates at its inner end 7 adjacent the longitudinal center line of casing 1. Through the bore 11 of the nipple 8 is a siphon tube 12 having a flange 13 at its inner end within

50 the member 2. At its end 7 the nipple 8 is

punched or bent, as at 14, to prevent withdrawal of the siphon tube through the nipple, but not clamping the tube so as to prevent rotative and endwise play. The wall 5 is offset radially near its top to form a 55 shoulder or seat 15 above which is a band or ring 16 of enlarged internal diameter.

The top member 3 serves as a cap for member 2 and is substantially cylindrical, having a side wall 17 which converges slightly, as at 18, near its upper end, and then converges sharply, as at 19, to an apex 20 to form the top proper of the cap. The external diameter of the top member 3 is sub-

stantially equal to the internal diameter 65 of the bottom member 2 so that the top member may be telescoped within the bottom member. At a determined distance from the bottom edge 21 of wall 17, the wall

is bent outwardly or otherwise formed with 70 an external annular bead 22 which provides an internal annular recess or socket 23. The diameter of the bead 22 is preferably made slightly larger than the internal diameter of

the band or ring 16 of the bottom member 2. 75 The top and bottom members 2, 3, respectively, are joined to form the hollow casing 1 by

inserting the top member 3 into the bottom member 2, and then forcing bead 22 within ring 16 until the lower edge 24 of the bead abuts the shoulder 15, thus forming a tight fit. In order to lock the members together and to strengthen the joint, the top edge of the bottom member 2 is burnished or rolled over the upper edge 25 of bead 22, as at 26.

85 Adjacent the bottom edge 21 of wall 17, I preferably provide diametrically opposed sockets 27, 28 to receive the opposite ends, respectively, of a plate or cross-bar 29. Through the midpoint of this cross-bar 29

and in the longitudinal center line of the casing 1 is an internally threaded hole 30 in which is threaded a supporting and adjusting screw 31. The socket or recess 23, above described, receives a guide member 32, pref-

erably of resilient wire and in the form of a split-ring having radially reentrant or inwardly curved portions 33 which serve as guide fingers. The ring 32 is compressed and 95 snapped into the recess 23 and held therein by 100

its own resilience, expanding it outwardly against the side wall 17 of the casing.

Within the casing 1 and supported on the screw 31 is a power element 34 which is preferably a thermostatic float having a side wall 35, preferably cylindrical, and a rigid upper end wall 36. The bottom or lower end of the element 34 is sealed by a diaphragm 37, preferably of spring tempered bronze, which 10 is dished or concave, and preferably corrugated in concentric rings, as at 38, to provide greater flexibility of the diaphragm. The element 34 is charged in any well known manner with a suitable volatile fluid which will 15 expand when subjected to steam temperature to act on the diaphragm 37 to force it outward. The weight of the volatile charge, however, is insufficient to prevent free floating of the element 34. Carried rigidly by the 20 end wall 36 is an elongated plunger or valve stem 39 having a valve 40 at its free end, which is adapted to close a port 41 in the apex 25 of member 3 by cooperation with a valve seat 42. The element 34, valve stem 39 and 30 valve 40 constitute the valve member. The valve member is guided for movement longitudinally of the casing 1 to insure proper seating of valve 41 on its seat 42 by sliding engagement of the side wall 35 of element 34 with the reentrant portions or fingers 33 of the guide member 32.

The operation of the valve is as follows: The adjusting screw 31 is first set during assembly of the valve so that the port 41 will 35 be open, i. e., valve 40 will be off its seat, when the volatile fluid in element 34 is cold and contracts; but screw 31 is so set that the outward movement of the diaphragm 37 acting against screw 31, when the volatile fluid expands in response to temperature of steam in casing 1, will raise the valve member to seat the valve 40 and close the port 41. The device is applied to a radiator (not shown) by inserting the siphon tube 12 through the radiator vent and then screwing the nipple 8 tightly into the vent. When steam is admitted to the heating system, which includes the radiator, air and water of condensation may be forced by the steam through vent and nipple passage 11 into the casing 1. Any air which is above the water will pass freely through casing 1 and out of port 41. As the water of condensation rises in the casing 1, the element 34 will float, thus seating the 45 valve 40 and preventing the escape of water from port 41. This water may surge into and out of the casing 1, and I therefore employ the nipple and siphon tube construction, shown and described, for as water leaves casing 1 it will pass back through tube 12 into the radiator and permit air to enter the casing 1 through nipple 8 and aperture 10, and pass through casing 1 and out into the atmosphere through port 41. If there is sub- 55 atmospheric pressure in the system when the 60

float drops and opens the port 41, air may pass therethrough into the casing 1 and the system. It will be noted that the annular passage 34<sup>a</sup> around the element 34 has been made of large area, and that by employing my novel guide member 32 (see Fig. 2) which occupies a minimum of space within the passage 34<sup>a</sup>, the passage is substantially unrestricted, there being main passages 43 and supplemental passages 44. Above the element or float 34 is a large separating chamber 3<sup>a</sup> provided in the cap 3, which is elongated for this purpose. As water leaves and air enters the casing 1, as above described, the air must pass through the water, and due to the large area of the annular passage 34<sup>a</sup> the velocity of the escaping air will be cut down, thus preventing a jet action which would force water out of the open port 41. Any water, however, which may be entrapped by the air and carried above element 34, will, due to the height of chamber 3<sup>a</sup>, be broken up and released from the air stream to fall back to the lower portion of the casing 1 and not be expelled with the air from the port 41. As steam fills the radiator, any water of condensation will be vaporized, and the float 34 will drop, thus opening the port 41. Any air forced into casing 1 ahead of the steam in the system will be expelled through port 41, and momentarily some steam may also issue with the air from port 41 until the heat of the steam expands the volatile fluid in element 34 to bulge the diaphragm 37 outward to thereby raise the valve member slidably through fingers 33 to seat the valve 40 and close port 41. 95

What I claim and desire to secure by Letters Patent of the United States is:—

1. A valve of the character described, comprising a substantially cylindrical hollow casing having a bottom member and a top member, one of said members having a radially offset portion adjacent its open end, the other of said members having an annular external bead of slightly greater external diameter than the internal diameter of said offset portion, said other member being telescoped within said one member with a force fit forming a tight joint, said casing having an inlet and an outlet, a thermostatic float within said casing, and a valve carried by said float adapted to close said outlet. 110

2. A valve of the character described, comprising a substantially cylindrical hollow casing having a bottom member and top member, one of said members having a radially offset portion adjacent its open end, the other of said members having an annular external bead of slightly greater external diameter than the internal diameter of said offset portion, said other member being telescoped within said one member with a force fit forming a tight joint, said end of said one member overlying a face of said bead to lock said 125

members together, said casing having an inlet and an outlet, a thermostatic float within said casing, and a valve carried by said float adapted to close said outlet.

5 3. A valve of the character described, comprising a hollow casing having a top member and a bottom member, one of said members being telescoped within the other of said members, said one member having oppositely disposed sockets in the telescoped portion, a cross-bar having its ends respectively seated in said sockets, said bottom member having an inlet, said top member having an outlet, a thermostatic float within said casing and supported on said cross-bar, and a valve carried by said thermostatic float adapted to close said outlet.

10 4. A valve of the character described, comprising a hollow casing having a top member and a bottom member, one of said members being telescoped within the other of said members, said one member having oppositely disposed sockets in the telescoped portion, a cross-bar having its ends respectively seated in said sockets, said cross-bar having a centrally disposed adjustable supporting member, said bottom member having an inlet, said top member having an outlet, a thermostatic float within said casing and supported on said adjustable supporting member, and a valve carried by said thermostatic float adapted to close said outlet.

15 5. A valve of the character described, comprising a hollow casing having a top member and a bottom member, one of said members being telescoped within the other of said members, said one member having oppositely disposed sockets in the telescoped portion, a cross-bar having its ends respectively seated in said sockets, said cross-bar having a centrally disposed adjustable supporting member, said bottom member having an inlet, said top member having a port, a thermostatic float within said casing and supported on said adjustable supporting member, guide means within said casing for said thermostatic float, and a valve carried by said thermostatic float adapted to close said port.

20 6. A valve of the character described, comprising a hollow casing having an inlet and an outlet, a longitudinally reciprocable valve member within said casing adapted to close said outlet, and means in said casing to guide said valve member, said means being held in position in said casing by expansion against said casing.

25 7. A valve of the character described, comprising a hollow casing having an inlet and an outlet, said outlet having a valve seat, a valve member in said casing adapted to engage said seat to close said outlet, and means within said casing to guide said valve member to its seat, said means comprising a split ring held in position by its expansion against said casing.

8. A valve of the character described, comprising a hollow casing having an inlet and an outlet, a resilient split ring compressed within said casing and held in position by its outward expansion against said casing, said ring having guide means, and a valve member positioned within said ring and guided in longitudinal movement by said guide means, said valve member being adapted to close said outlet. 75

9. A valve of the character described, comprising a hollow casing having an inlet and an outlet, an internal recess extending around said casing, guide means expanded outwardly into said recess, and a valve member having sliding engagement with said guide means and adapted to close said outlet. 80

10. A valve of the character described, comprising a hollow casing having an inlet and an outlet, oppositely disposed sockets in said casing, a cross-bar having its ends respectively seated in said sockets, a longitudinally reciprocable thermostatic float within said casing supported on said cross-bar, a valve carried by said thermostatic float to close said outlet, and resilient guide means for said thermostatic float positioned in said casing and held in position by outward expansion against said casing. 90

11. A valve of the character described, comprising a hollow casing having an inlet and an outlet, oppositely disposed sockets in said casing, a cross-bar having its ends respectively seated in said sockets, a longitudinally reciprocable thermostatic float within said casing supported on said cross-bar, a valve carried by said thermostatic float to close said outlet, a resilient split ring secured in said casing by outward expansion against said casing, said ring surrounding said thermostatic float, and guide fingers on said ring for said thermostatic float. 100 95

12. A valve of the character described, comprising a hollow casing having an inlet and an outlet, oppositely disposed sockets in said casing, a cross-bar having its ends respectively seated in said sockets, an annular recess in said casing above said sockets, a resilient split ring secured in said recess by outward expansion against said casing, said ring having pairs of oppositely disposed reentrant curved portions, a thermostatic float supported on said cross-bar and projecting through said ring in slideable engagement with said reentrant portions, and a valve carried by said float adapted to close said outlet. 110 105

13. A valve of the character described, comprising a hollow casing having a top member and a bottom member, one of said members having an annular bead forming an internal annular recess, the other of said members having a radially offset annular portion adjacent its open end forming a surrounding shoulder, said one member being 125 115 120 130

telescoped within said other member with said bead engaging said shoulder, said casing having an inlet, and an outlet, a longitudinally reciprocable valve member within 5 said casing adapted to close said outlet, and guide means for said valve member positioned within said recess.

14. A valve of the character described, comprising a hollow casing having a top 10 member and a bottom member, one of said members having an annular bead forming an internal annular recess, the other of said members having a radially offset annular portion adjacent its open end forming a surrounding shoulder, said one member being telescoped within said other member with said bead engaging said shoulder, said casing having an inlet and an outlet, oppositely disposed sockets in said top member below said 15 recess, a cross-bar having its ends respectively seated in said sockets, a longitudinally reciprocable valve member within said casing supported by said cross-bar and adapted to close said outlet, and guide means for said 20 valve member positioned within said recess.

15. A valve of the character described, comprising a hollow casing having a top member and a bottom member, one of said members having an annular bead forming an internal 25 recess, the other of said members having a radially offset annular portion adjacent its top edge forming a surrounding shoulder, said one member being telescoped within said bottom member with said bead 30 engaging said shoulder, said casing having an inlet and an outlet, oppositely disposed sockets in said one member below said recess, a cross-bar having its ends respectively seated in said sockets, a thermostatic float supported 35 by said cross-bar and having a valve adapted to close said outlet, and guide means for said 40 float positioned in said recess and held therein by outward expansion of said guide means against said casing.

45. 16. A valve of the character described, comprising a hollow casing defining a float chamber having an inlet, said casing having a top member with an outlet port and having a bottom member, a float member 50 within said top member and having valve means cooperable with said port, said float member being directly subject to liquid level in said chamber such that said float member is lifted by and simultaneously with the rise 55 of liquid level in said casing, and means carried by said top member and supporting said float member.

60. 17. A valve of the character described, comprising a hollow casing having a top member with an outlet port and having a bottom member, a float member within said top member and having valve means cooperable with said port, and adjustable means carried by said top member and supporting 65 said float member.

18. A valve of the character described, comprising a hollow casing having a top member with an outlet port and having a bottom member, a float member within said top member and having valve means cooperable with said port, a cross-bar rigidly fixed in said top member, and an adjustable abutment on said cross-bar and supporting said float member.

19. A valve of the character described, comprising a hollow casing having a top member with an outlet port and having a bottom member, a float member within said top member and having valve means cooperable with said port, means carried by said top member and supporting said float member, and guide means cooperating directly with said float member and positioned within said top member and being independent of said supporting means and said valve 85 means.

In testimony whereof I have hereunto signed my name.

GEORGE BETHUNE DUFFIELD.

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