(No Model.)

S. C. ARNOLD.

AIR VALVE.

No. 597,666. Patented Jan. 18, 1898.

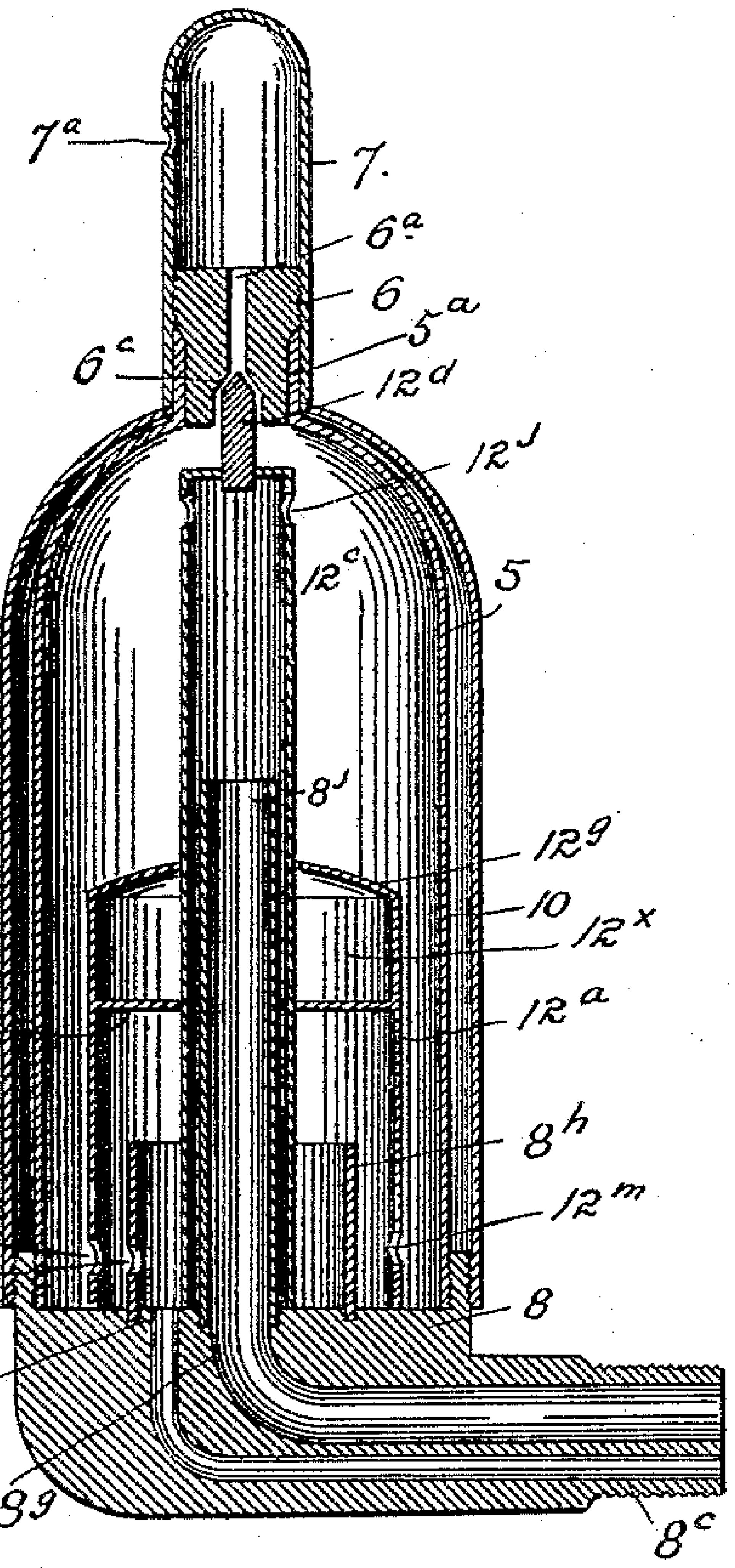

FIG. 1

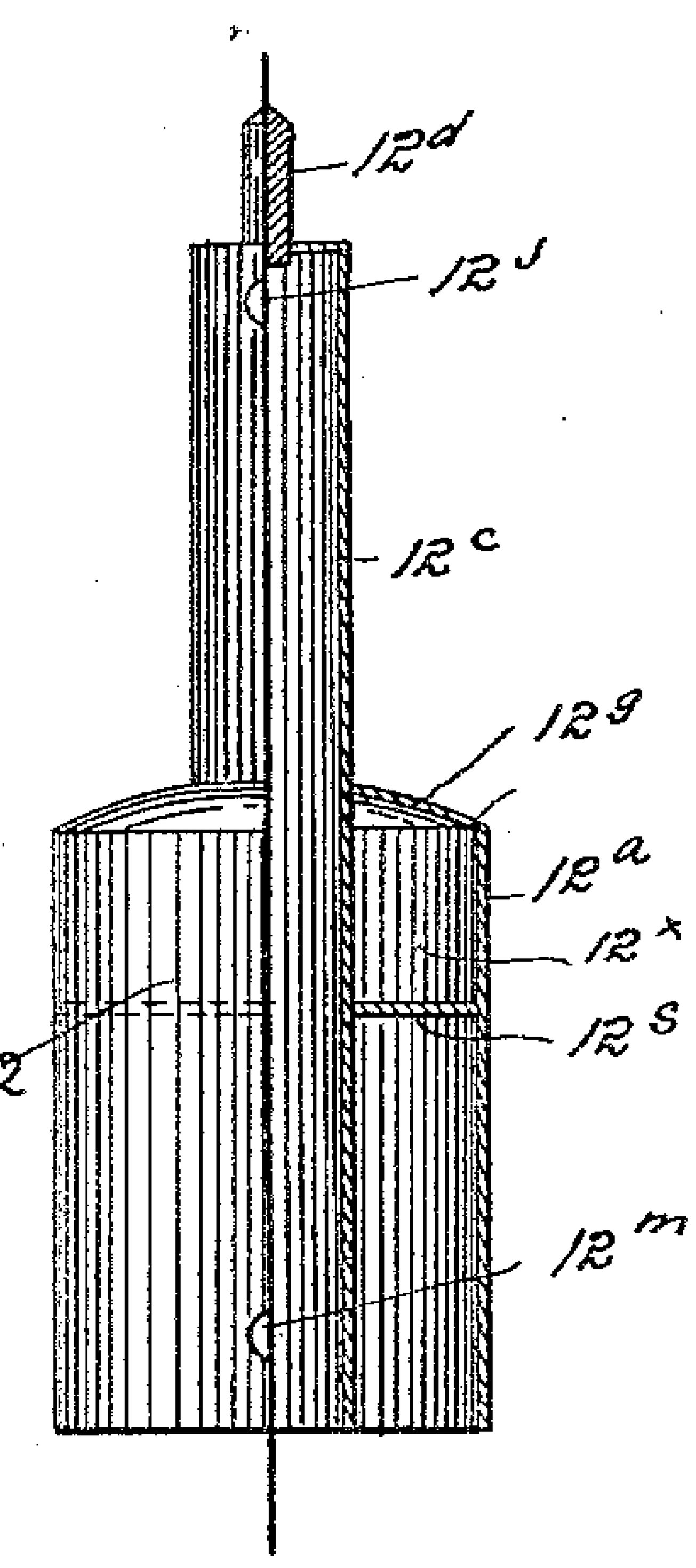

FIG. 2.

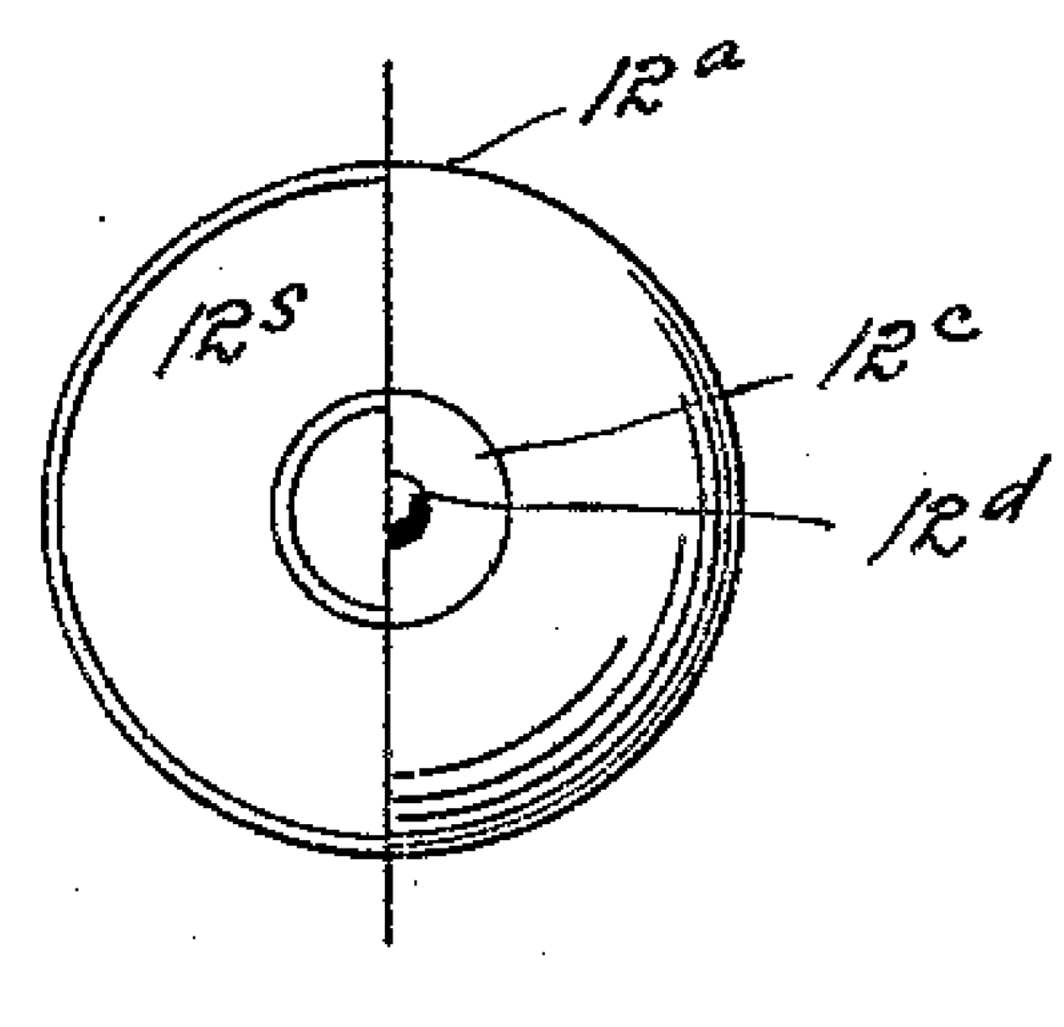

FIG. 3

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UNITED STATES PATENT OFFICE.

SAMUEL C. ARNOLD, OF DENVER, COLORADO, ASSIGNOR TO THE NATIONAL SPECIALTY MANUFACTURING COMPANY, OF SAME PLACE.

AIR-VALVE.

SPECIFICATION forming part of Letters Patent No. 597,666, dated January 18, 1898.

Application filed April 22, 1897. Serial No. 633,256. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL C. ARNOLD, a citizen of the United States of America, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Air-Valves; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in air-valves for use in connection with steam or hot-water radiators or in any other relation where a device of this character is needed.

My improvements will be described with reference to the use of the device with a steam-radiator, though, as before stated, it must be understood that the construction is equally applicable to hot-water radiators.

The construction set forth in this application may be considered an improvement on that shown and described in application, Serial No. 612,109, filed November 14, 1896. The improvements relate to the float or valve, and consist in forming an air-tight chamber in said float-valve, whereby the latter is compelled to float or rise upward in the shell and close the air-exit, thus preventing the escape of the water as the latter rises in the shell. Hence in my improved construction a positive air-chamber is always maintained in the valve-float when the device is in use. This is the theory of the construction set forth in the aforesaid application; but it has been demonstrated in the use of said construction that this theory is not always true. In other words, it sometimes happens, by reason of the agitation or churning of the water in the radiator, that the air is all driven out of the theoretical air-chamber of the old construction, allowing the valve to drop and leaving the water free to rush out through the air-exit at the top of the shell. The object of my present invention is to overcome this difficulty, and to this end I provide the float-valve with an air-tight diaphragm, thus forming a positive air-chamber above the diaphragm, which shuts out the water under all circumstances. Hence the main feature of my present invention consists in providing the valve-float with a positive or hermetically-sealed air-chamber, as contradistinguished from the open theoretical air-chamber of the old construction. There is also another feature introduced in my improved construction—namely, the top of the air-chamber is formed curved or sloping to prevent the lodgment of water thereon. If the top of this air-chamber is formed horizontal, as shown in the aforesaid application, a little water is liable to remain thereon after the water has settled below the same, and this water slightly increases the weight of the float-valve and to that extent interferes with its proper action. Hence the advantage of this feature in my improved construction.

The invention will now be described in detail, reference being made to the accompanying drawings, in which is illustrated an embodiment thereof.

In the drawings, Figure 1 is a vertical longitudinal section taken through an air-valve provided with my improvements. Fig. 2 is a detail view of the valve or float, partly in section. Fig. 3 is a combination view of the float, the right half being shown in plan, while the left half is an underneath view.

Similar reference-characters indicating corresponding parts in these views, let the numeral 5 designate a cylindrical shell nearly closed at the top, where it is provided with a short vertical neck 5^a, interiorly threaded to receive a screw-plug 6, having an air-passage 6^a leading from a valve-seat 6^c. This screw-plug is provided with a shoulder, which engages the neck of the shell. Above this shoulder the plug is exteriorly threaded to receive a cap 7, which is screwed thereon. This cap is provided with a small aperture 7^a. The lower end of the shell is open and threaded to screw into a flange 8^a, formed on the base 8. The shell 5 forms the valve-chamber. Outside of the shell 5 is located a casing 9 of corresponding shape, its upper extremity being contracted to engage the neck of the shell. The lower extremity of the cap 7 engages this casing, whose bottom or lower portion is interiorly threaded and screwed upon the flange 8^a, which is exteriorly threaded for the purpose. Between the shell and this exterior casing is an air-space 10. This casing, to-

gether with the shell, thoroughly insulates the valve and protects it from injurious exterior influences.

The base-piece 8 is provided with a projection 8^c, threaded to screw into the radiator. (Not shown.) This base-piece is also provided with the passages 8^d and 8^g, which connect the interior of the shell with the radiator. Projecting from the upper surface of the base into the valve-chamber are two cylindrical parts 8^h and 8^j, concentrically arranged, the part 8^h being exteriorly located and the shorter of the two cylindrical parts. The part 8^j communicates with the passage 8^g in the base, while the part 8^h communicates with the passage 8^d. The outer cylindrical part 8^h forms a partition between the part 8^j and the shell 5, separating the lower part of the valve-chamber into two liquid-chambers. The outer part 8^h is provided with an orifice 8^m, located near the base thereof. This orifice connects the annular space between the two parts 8^h and 8^j with the space between the shell 5 and the part 8^h.

Located within the valve-chamber or the shell 5 is a float-valve 12, which consists of two concentric cylindrical parts 12^a and 12^c, connected by the sloping or exterior convex part 12^g and the diaphragm 12^s, the latter being located a suitable distance below the part 12^g. This last-named part closes the upper extremity of the part 12^a. Between the part 12^g and the diaphragm 12^s is the hermetically-sealed air-chamber 12^x, which forms, as before stated, the essential feature of my improved invention.

The part 12^c of the float-valve projects above the roof 12^g of the air-chamber, its upper extremity being closed, except as hereinafter stated. The upper extremity of this part 12^c is provided with the valve proper, 12^d, which is adapted to engage the valve-seat 6^c and closes the passage 6^a in the plug 6 when the float rises. The part 12^c is provided with one or more orifices 12^j, preferably two, located near its upper extremity, one on each side. The part 12^c of the float surrounds and projects above the cylindrical part 8^j. Both parts of the float are open at the bottom. The outer part surrounds the cylindrical part 8^h, attached to the base. The part 12^a of the float is provided with openings 12^m, located near its base or lower extremity.

The operation of my improved air-valve will now be described.

Assuming that the pipes and radiators composing the system, as well as the air-valve shell, are free from water and steam and full of air, the operation of the valve is as follows: As the steam enters the system it drives the air before it. After passing through the radiator the air enters the valve by way of passages 8^g and 8^d and is of course distributed to all of the chambers of the valve, as these chambers intercommunicate. Hence the pressure within and without the float is equal, and the latter remains on the bottom of the shell, the valve-pin 12^d being unseated to allow the air perfect freedom of escape from the shell by way of the passage 6^a in the plug 6 and the opening 7^a in the cap 7. As soon as the air has been driven out of the radiator in the manner described the steam enters the radiator and condensation immediately commences. This water of condensation is carried upward by the steam and a quantity thereof forced into the valve-shell by way of the passage 8^d. As this water rises in the shell above the apertures 8^m and 12^m the air is entrapped within the float between the water and the diaphragm 12^s of the cylindrical part 12^a of the float. Hence the pressure of the water on this entrapped air raises the float and seats the valve-pin 12^d, preventing the escape of either water or steam. However if the conditions are such that the air is entirely expelled from the float below the diaphragm the air-chamber 12^x of the float will insure positive and continuous seating of the valve 12^d as the water rises in the casing above the plane of the diaphragm. Hence this air-chamber 12^x is a positive safeguard against the escape of water from the shell 5 under conditions which would entirely expel the air from the theoretical air-chamber of the construction covered by the aforesaid application. The valve-pin having been seated, as just explained, the steam enters the valve-shell outside of the float by way of the passage 8^g, the tube 8^j, the part 12^c of the float, and the orifices 12^j. The air is now accumulating in the top of the shell outside of the float, and as the shell, together with the tubes 12^c and 8^j, fill with air, the pressure in the valve becomes the same as the pressure in the radiator, since the steam from the radiator is brought in direct contact with the air in the tube 8^j. Hence the water passes out of the shell by its own pressure by way of the orifices 12^m and 8^m and the passage 8^d into the radiator. The float then falls, allowing the air to escape from the valve in the manner heretofore explained. The steam then enters the valve or shell through both passages 8^d and 8^g; but the steam condenses on the outside of the float and within the shell 5 faster than within the cylindrical portion 12^a of the float. Hence the pressure is greater on the inside of the float than above and around the float on the inside of the case or shell, the result being that the float is raised and the valve-pin 12^d again seated. The water of condensation now begins to accumulate in the shell, but the steam, entering the valve or shell by way of the passage 8^d, prevents the water from flowing back into the radiator, as the passage 8^d is too small to allow the steam and water to pass therethrough simultaneously. Hence the float will remain in the raised position and hold the valve-pin seated until the air again accumulates in the shell, the part 12^c of the float, and the tube 8^j. The steam then comes again in direct contact with the air, and the pressure in the valve becomes the

same as that within the radiator, and the water again flows from the shell back into the radiator, the float falls, and the air again escapes from the shell in the same manner as heretofore explained.

Having thus described my invention, what I claim is—

1. A float for use in valves, comprising two tubes, one inclosed within the other and connected by two separated diaphragms, which form an air-tight chamber, both tubes being open at the bottom, and the outer tube having an orifice in the lower part of its wall and being closed at the top by the upper diaphragm, the inner tube projecting above the upper diaphragm and having an orifice in its upper portion which is provided with a valve.

2. In a valve of the character described, the combination with the base having two passages communicating with the radiator, of the valve-chamber having an outlet at the top thereof, and an inlet-tube communicating with one of said passages, said tube projecting upwardly and opening into the said chamber a suitable distance above its base, the outer walls of said inlet-tube and the inner walls of the valve-chamber forming sides of a basin adapted to hold liquid and communicating with the other passage in the base, a partition surrounding said inlet-tube and dividing said base into two separate liquid-chambers, a float consisting of two inverted chambers inclosed one within the other, both being open at the bottom and connected by two separated diaphragms forming an air-tight chamber, the upper diaphragm closing the top of the outer chamber which has one or more orifices near its bottom, the inner chamber of the float having an orifice in its upper portion, the walls of said float-chamber penetrating into said liquid-chambers, and a valve operated by said float and inclosing the said air-outlet when the float rises.

In testimony whereof I affix my signature in presence of two witnesses.

SAMUEL C. ARNOLD.

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