(No Model.)

C. F. PAIGE & S. C. ARNOLD.

AIR VALVE.

No. 601,213. Patented Mar. 22, 1898.

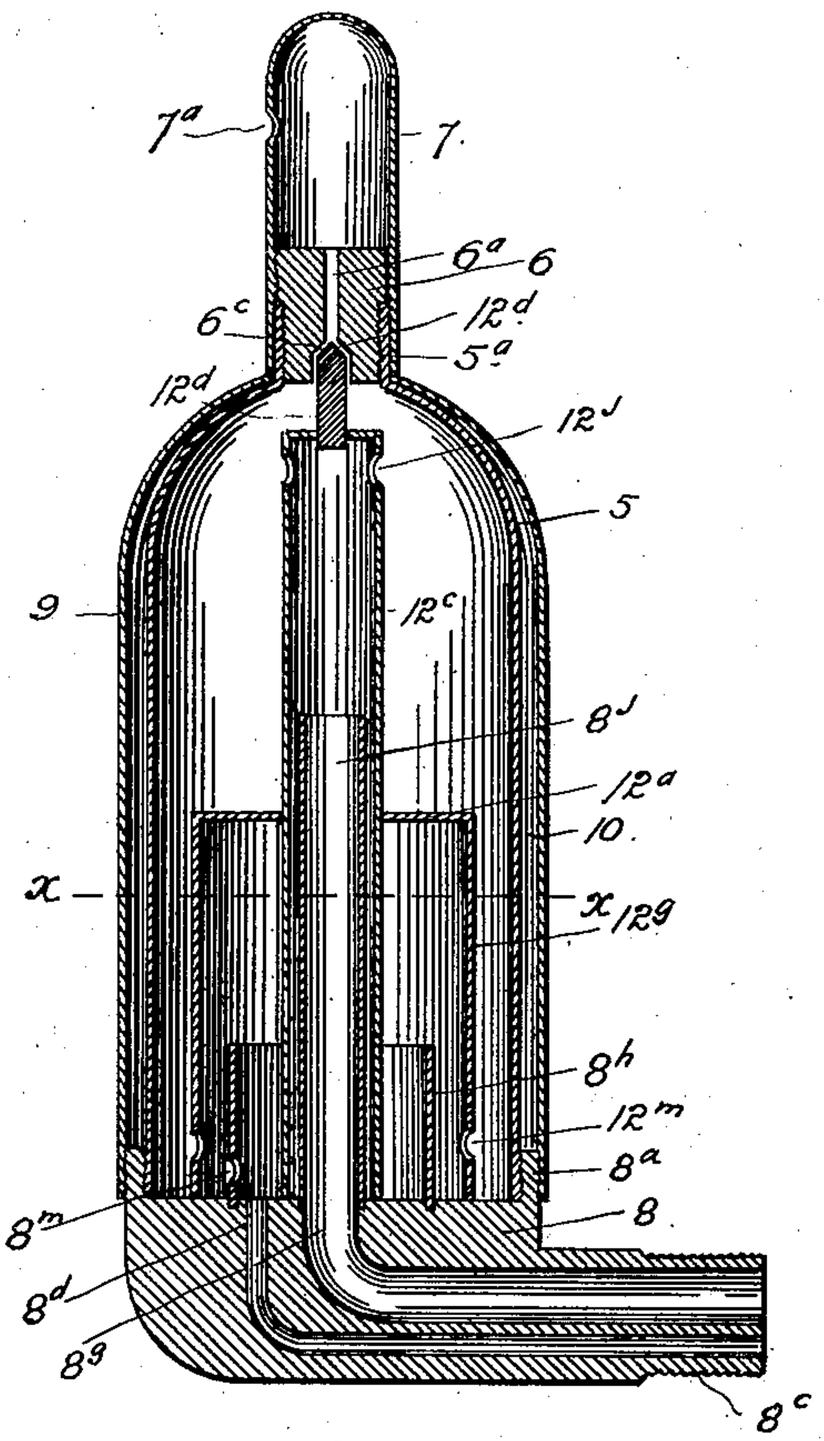

FIG. 1

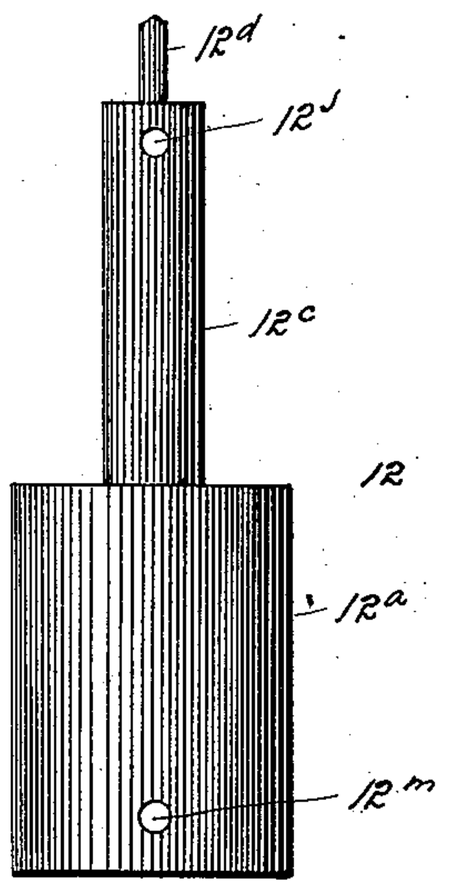

FIG. 3.

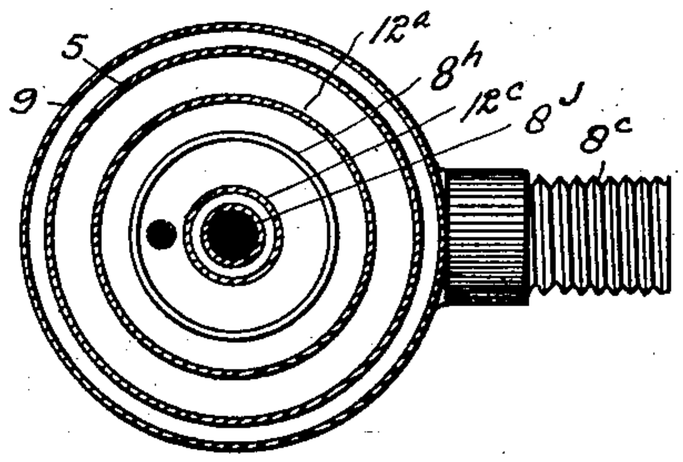

FIG. 2.

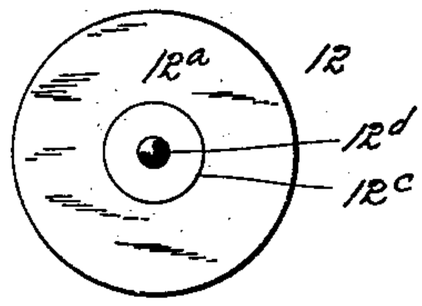

FIG. 4

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UNITED STATES PATENT OFFICE.

CHARLES F. PAIGE AND SAMUEL C. ARNOLD, OF DENVER, COLORADO, ASSIGNORS TO THE NATIONAL SPECIALTY MANUFACTURING COMPANY, OF SAME PLACE.

AIR-VALVE.

SPECIFICATION forming part of Letters Patent No. 601,213, dated March 22, 1898.

Application filed November 14, 1896. Serial No. 612,109. (No model.)

To all whom it may concern:

Be it known that we, CHARLES F. PAIGE and SAMUEL C. ARNOLD, citizens 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 we 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.

Our invention relates to improvements in air-valves for steam or hot-water radiators or any of the other uses to which air-valves may be put, our object being to provide a valve which will satisfactorily allow the air to escape from the radiator and at the same time prevent the egress of water or steam. The device will, however, in this specification be described with special reference to its use in connection with steam-radiators, and the language employed must be so construed. Hence when the term "water" is used and undefined, water of condensation must therefore be understood in the description of the operation of the device.

Our present invention consists of certain improvements in the class of air-valves shown in Letters Patent Nos. 535,016 and 541,876, dated March 5, 1895, and July 2, 1895, respectively; and to this end the invention consists of the features hereinafter described and claimed, all of which will be fully understood by reference to the accompanying drawings, in which is illustrated an embodiment thereof.

In the drawings, Figure 1 is a vertical section taken through our improved valve. Fig. 2 is a horizontal section taken on the line xx, Fig. 1. Fig. 3 is a side elevation of the float or valve detached from the casing or shell. Fig. 4 is a top or plan view of the same.

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 the 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 lower extremity 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, together with the inclosed air-space, thoroughly insulates the valve and protects it from injurious exterior influences. For instance, it is not desirable that the shell 5 and its inclosed chamber shall be exposed to rapid changes of temperature, such as result from sudden drafts of cold air. Radiators are very often located near windows and in halls where cold-air drafts are frequent in consequence of the opening of adjacent windows and doors in cold weather. Without the protection of the case 9 and the interposed air-space 10 the shell 5 would be entirely unprotected against the sudden changes of temperature incident to such air-drafts. In other words, in order to obtain the best results from the use of the valve it is desirable that the temperature of the shell 5 be as nearly equable as possible so far as external atmospheric changes or influences are concerned. This is what is meant by protection against injurious exterior influences heretofore mentioned. This function is accomplished by the use of the case 9.

The base 8 is provided with a projection 8^c, threaded to screw into the radiator. (Not shown.) This base-piece is also provided with passages 8^d and 8^g, which connect the interior of the shell with the radiator. The cross-sectional area of the passage 8^d is relatively small in order to prevent the passage of water in one direction and the steam in the opposite direction at the same time. 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 12, which consists, essentially, of two concentric cylindrical parts 12^a and 12^c, connected by a disk 12^d, which closes the upper extremity of the part 12^a. The part 12^c projects above this disk. Its upper extremity is also closed, except as hereinafter stated, and provided with the valve part 12^d, which is adapted to engage the valve-seat 6^c and close 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 our 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 top 12^g 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. The steam then 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 our invention, what we claim is—

1. In an air-valve, the combination with the base, the float, and the inclosing shell, of the outer casing attached to the base and surrounding the shell, an air-space being left between the shell and the casing, and a cap applied to the top of the shell and engaging the outer casing whereby the latter is held securely in place.

2. In a valve of the character described, the combination of a base connected with the radiator and having two passages, the valve-chamber having an outlet at the top thereof and an inlet-tube communicating with one of the passages in the base, said tube projecting upward and opening into said chamber at some distance from the base, the outer walls of the said inlet-tube and the inner walls of the valve-chamber forming the 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 basin into two separate liquid-chambers, said partition having one or more orifices, a float consisting of two inverted chambers inclosed one within the other, both

being open at the bottom, the outer chamber being closed at the top and having one or more orifices near its bottom, the inner chamber of the float having a small orifice in its upper portion, the walls of said float-chamber penetrating into said liquid-chambers, and a valve operated by said float and closing the said outlet when said float rises.

3. In a valve of the character described, the combination of a base connected with the radiator and having two passages, the valve-chamber having an outlet at the top thereof, an inlet-tube communicating with one passage of the base and projecting upward from the bottom thereof and opening in the said chamber at a suitable distance above the base, the outer walls of the inlet-tube and the inner walls of the valve-chamber forming the sides of a basin adapted to hold liquid and communicating with the other passage in the base, a partition surrounding said inlet-tube and of a less height than said tube and dividing said basin into two separate liquid-chambers, said partition having one or more orifices formed a short distance from its bottom, a float consisting of two inverted chambers inclosed one within the other and both open at the bottom, the outer chamber being closed at the top and having one or more orifices near its bottom, the inner chamber 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 closing said inlet when the float rises.

4. In a valve of the character described, the combination of a base connected with the radiator and having two passages, a valve-chamber having an outlet at the top thereof and an inlet-tube connected with one passage of said base and projecting upward from its bottom and opening into said chamber at a suitable distance above the base, the outer wall of said tube and the inner wall of said chamber forming the sides of a basin adapted to hold liquid and communicating with the other passage in the base, a float open at the bottom and having an air-chamber in its upper portion and a separate chamber communicating with the inlet-tube connected with the base and provided with one or more small orifices, said float projecting downward into said basin and having one or more orifices located near its bottom, and a valve operated by said float for closing said outlet in the valve-chamber.

In testimony whereof we affix our signatures in presence of two witnesses.

CHARLES F. PAIGE.
SAMUEL C. ARNOLD.

Witnesses:
JAS. R. HICKS,
ALFRED J. O'BRIEN.