(No Model.)

C. F. PAIGE & E. P. ALLEN.

AIR VALVE.

No. 541,876. Patented July 2, 1895.

FIG. 1.

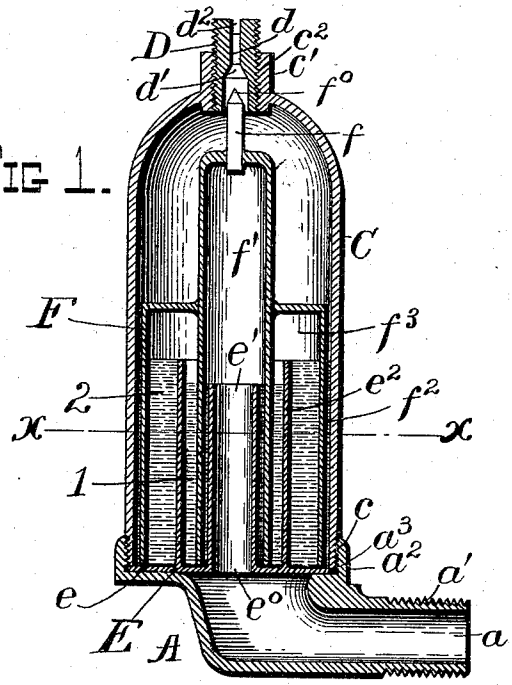


FIG. 4.

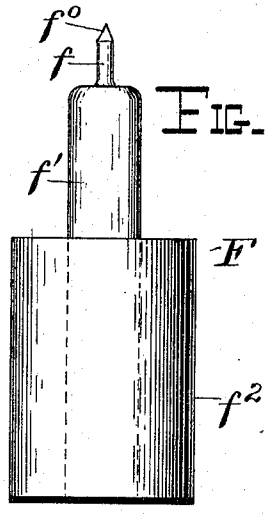


FIG. 5.

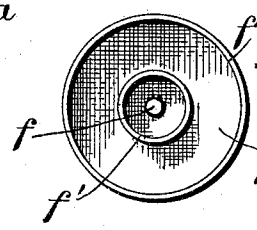


FIG. 2.

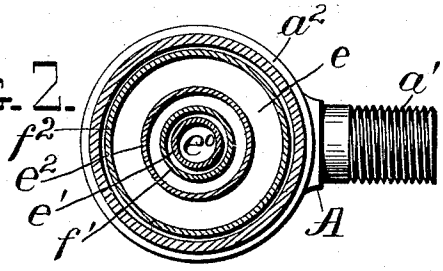


FIG. 6.

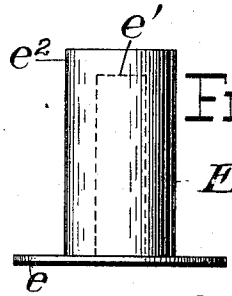


FIG. 3.

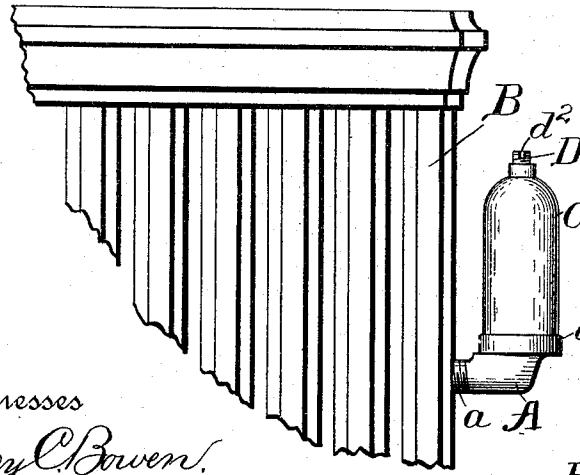
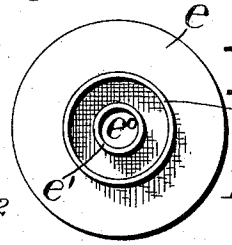


FIG. 7.



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UNITED STATES PATENT OFFICE.

CHARLES F. PAIGE AND EVERETT P. ALLEN, OF DENVER, COLORADO.

AIR-VALVE.

SPECIFICATION forming part of Letters Patent No. 541,876, dated July 2, 1895.

Application filed September 4, 1894. Serial No. 522,073. (No model.)

To all whom it may concern:

Be it known that we, CHARLES F. PAIGE and EVERETT P. ALLEN, citizens of the United States, 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 hereby 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.

Our invention relates to improvements in air-valves for steam or hot water radiators, or any of the uses to which air valves may be put and it is intended 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 said invention is especially intended to provide an improved form of valve over that shown in our application, Serial No. 501,493, filed February 26, 1894.

Reference is had to the accompanying drawings, wherein the same parts are indicated by the same letters and numerals throughout the several views.

Figure 1 represents a central longitudinal section through the valve, when it is in position to allow the escape of air. Fig. 2 represents a section along the line $x\,x$ of Fig. 1, and looking down. Fig. 3 represents a side elevation of a portion of the steam radiator showing the valve in position thereon, the said valve being somewhat enlarged in proportion to the radiator for the purpose of more clearly illustrating the valve. Fig. 4 represents a side elevation of our improved float, or valve proper, detached from its casing. Fig. 5 represents an inverted plan view of the float shown in Fig. 4. Fig. 6 represents the annular bottom piece forming the bottom of the valve-casing; and Fig. 7 represents a plan view of the device shown in Fig. 6.

A represents a hollow base piece provided with a passage a connecting the interior of the radiator with the valve chamber. This base piece is screw threaded as at a' to screw into the radiator B, and is provided with an annular lip a^2 screw threaded as at a^3 or plain, to which the shell C of the valve chamber is screwed or sweated as at c. This valve chamber or shell C terminates in a cylindrical head c' perforated and screw threaded as at c^2 to receive the valve seat D. This valve seat D is perforated as at d^2 conically chambered as at d', and slotted as at d for facility in screwing the same into position. The bottom of the valve chamber is closed by the bottom piece E which may be either detachably mounted in the chamber as shown, or may be secured therein after the float F is in position. This bottom piece E is provided with an annular bottom plate e perforated as at e^0 and supporting the two concentric tubes e' and e^2. It will be seen that between the two tubes e' and e^2 there will be an annular chamber 1 open at the top and closed at the bottom, while between the tube e^2 and the sides of the shell C there will be a second annular chamber 2 also open at the top and closed at the bottom, the two forming a basin for liquids at the base of the valve chamber.

The float F is movably mounted in the valve chamber C, and consists essentially of a central tube f' carrying the valve pin f terminating in a conical point f^0, and an outer tube f^2 connected to the inner tube f' by an air-tight annular plate f^3. The tube f' is closed at its upper end as shown, and its lower end forms, with the tube f^2 and the annular plate f^3, an annular chamber open at the bottom and closed at the top. The top of the tube e' should be somewhat lower than that of the tube e^2, and both tubes should be somewhat shorter than the tube f^2, for reasons hereinafter to be described.

While the various tubes e', e^2, and f' and f^2, and also the shell C are shown as cylindrical, the exterior shape of the said tubes is immaterial, and they may be angular, pyramidal, conical, or any other desired shape.

The operation of the device is as follows: The valve being full of air, and the radiator being full of air with the usual quantity of water of condensation therein, suppose steam be turned on to the radiator. The air in the radiator will blow through the passage a and tube e' up into the tube f' whence it will be cushioned downward beneath the tube f', then over the tube e^2, then beneath the tube f^2 and upward and out through the passage d. The back pressure of the air in the upper part of the shell C, supplemented by the weight of the float F will press the float down-

ward should it be temporarily closed by a sudden rush of air through the tube e'.

In operation the chamber 1 would soon become filled with water carried from the radiator, the said water filling up the chamber to the level of the top of the tube e'. Moreover, the chamber 2 would also soon become filled with water up to the top of the tube e^2, and this, as shown in Fig. 1, would be the normal state of the valve. Now when the valve is in this state it will operate as follows: The air from the radiator will pass up through the tube e' down beneath the tube f' and being cushioned by the air in the upper portion of the annular chamber of the float will be forced twice through the water; that is, down beneath the tube f', over the tube e^2 and then down beneath the tube f^2 and up through the valve chamber out through the orifice d. The back pressure on the top of the float will prevent the valve from becoming permanently closed so long as only air is passing. Now if water begins to flow into the valve chamber it will soon overflow the top of the tube e^2 and compress the air trapped in the top of the annular chamber of the float, thus causing the float to rise, and effectually closing the valve before the water has risen high in the valve chamber. The air trapped in the upper part of the chamber f' will also assist in lifting the valve.

The valve prevents steam from passing through as follows: The steam passing through the tube e' up into the tube f' forces the valve firmly on its seat, the pressure of the steam upward in the tube f' being more than sufficient to counterbalance the increase of the back pressure of the air in the upper part of the chamber. The steam cushioned downward from the tube f' into the chamber 1 will be condensed by the water in the chambers 1 and 2, and the increase of water will soon be sufficient to compress the air in the annular chamber of the float enough to keep the same closed against the back pressure which will ultimately be exerted by the steam on the back of the float. The tube e^2 will make the channel for the passage of the fluids more tortuous, and will form a partition between two independent chambers each acting as a chamber for a water seal. Moreover there being two chambers for water will lessen the likelihood of the latter's being blown up into the top of the chamber C, as by a sudden rush of steam.

The throw of the valve may be adjusted by screwing up or down on the valve seat D, and the said valve seat may be readily removed and cleaned out, should it become clogged with dirt.

As soon as the pressure of the steam is removed from the radiator, the excess of water will siphon back into the radiator leaving the levels of the liquid in the valve chamber as shown in Fig. 1.

By having the tube e^2 higher than the tube e', the tendency of the water sealing to entirely siphon out will be prevented, and moreover the contents of the annular air chamber above the water and beneath the plate f^3 may be more readily regulated.

It will also be evident that, should the pressure downward on the top of the float exceed the pressure upward beneath the same the lower edges of the tube f^2 will bear on the base plate e, and, with the water in the liquid chambers 1 and 2, will effectually seal the valve. This function of the float prevents the entrance of air into the radiator through the orifice d' when the steam pressure in the radiator falls below the pressure of the atmosphere. The lower edges of the tube f' may be made to serve as a seal, instead of the lower edges of the tube f^2, or both may fit snugly against the bottom plate e when the float is down.

It is our purpose to claim broadly the herein-described arrangement of chambers, but the details of the apparatus may be varied at will.

Having thus described our invention, what we claim, and desire to secure by Letters Patent of the United States, is—

1. In a valve of the character described, the combination with a valve chamber having an outlet at the top thereof, and an inlet tube projecting upward from the bottom thereof and opening into said chamber at some distance from its base, the outer walls of said inlet tube and the inner walls of said valve chamber forming the sides of a basin adapted to hold liquid, a float open at the bottom and closed at the top, with an air chamber in the upper portion thereof, projecting down into said basin and extending above and over the top of said inlet tube, and means operated by said float for closing said outlet when said float rises, substantially as described.

2. In a valve of the character described, the combination with a valve chamber having an outlet at the top thereof, and an inlet tube projecting upward from the bottom thereof and opening into said chamber at some distance from its base, the outer walls of said inlet tube and the inner walls of the valve chamber forming the sides of a basin adapted to hold liquid, a partition surrounding said inlet tube and dividing said basin into two separate liquid chambers, a float consisting of two inverted chambers inclosed one within the other and both open at the bottom and closed at the top, the walls of said float chambers penetrating into the said liquid chambers, and a valve operated by said float and closing said outlet when said float rises, substantially as described.

3. In a valve of the character described, the combination with a valve chamber having an outlet at the top thereof, and an inlet tube projecting upward from the bottom thereof and opening into said chamber at some distance from its base, the outer walls of said inlet tube and the inner walls of the valve chamber forming the sides of a basin adapted

to hold liquid, a partition surrounding said inlet tube somewhat higher than the walls of said inlet tube, and dividing said basin into two separate liquid chambers, a float consisting of two inverted chambers inclosed one within the other and both open at the bottom and closed at the top, the walls of said float chambers penetrating into the said liquid chambers, and a valve operated by said float and closing said outlet when said float rises, substantially as described.

4. In a valve of the character described, the combination with a cylindrical valve chamber having an outlet at the top thereof, and an inlet tube projecting upward from the bottom thereof and opening into said chamber at some distance from its base, the periphery of said tube and the inner walls of said valve chamber forming the sides of an annular basin adapted to hold liquid, a cylindrical float open at the bottom, with an air chamber in the upper portion thereof, projecting down into said basin and extending above the top of said inlet and means operated by said float for closing said outlet when said float rises, and for closing said inlet when said valve falls, substantially as described.

5. A float for use in valves, comprising two shells open at the bottom and closed at the top, the one inclosed within the other and both connected together as shown, with a valve carried by the central shell, substantially as described.

6. A float F for use in valves, comprising a central tube f' closed at the top and carrying a valve, and an inclosing tube f^2, shorter than the central tube, and connected to the same near the center thereof by an air-tight plate or diaphragm, both of said tubes being open at the bottom, substantially as and for the purposes described.

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

CHARLES F. PAIGE.
EVERETT P. ALLEN.

Witnesses:
JAMES H. THOMAS,
GEO. A. GODDARD.