B. E. VAN AUKEN.

VALVE MECHANISM FOR DISCHARGING AIR AND WATER OF CONDENSATION FROM STEAM HEATING SYSTEMS.

APPLICATION FILED MAR. 12, 1906.

951,751.

Patented Mar. 8, 1910.

3 SHEETS—SHEET 1.

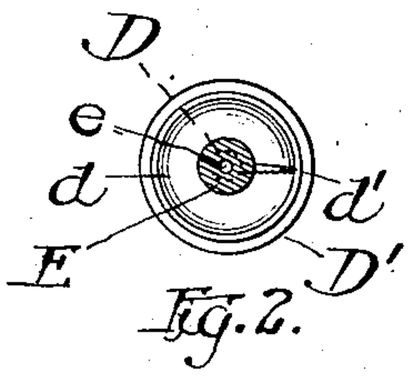

Fig. 2.

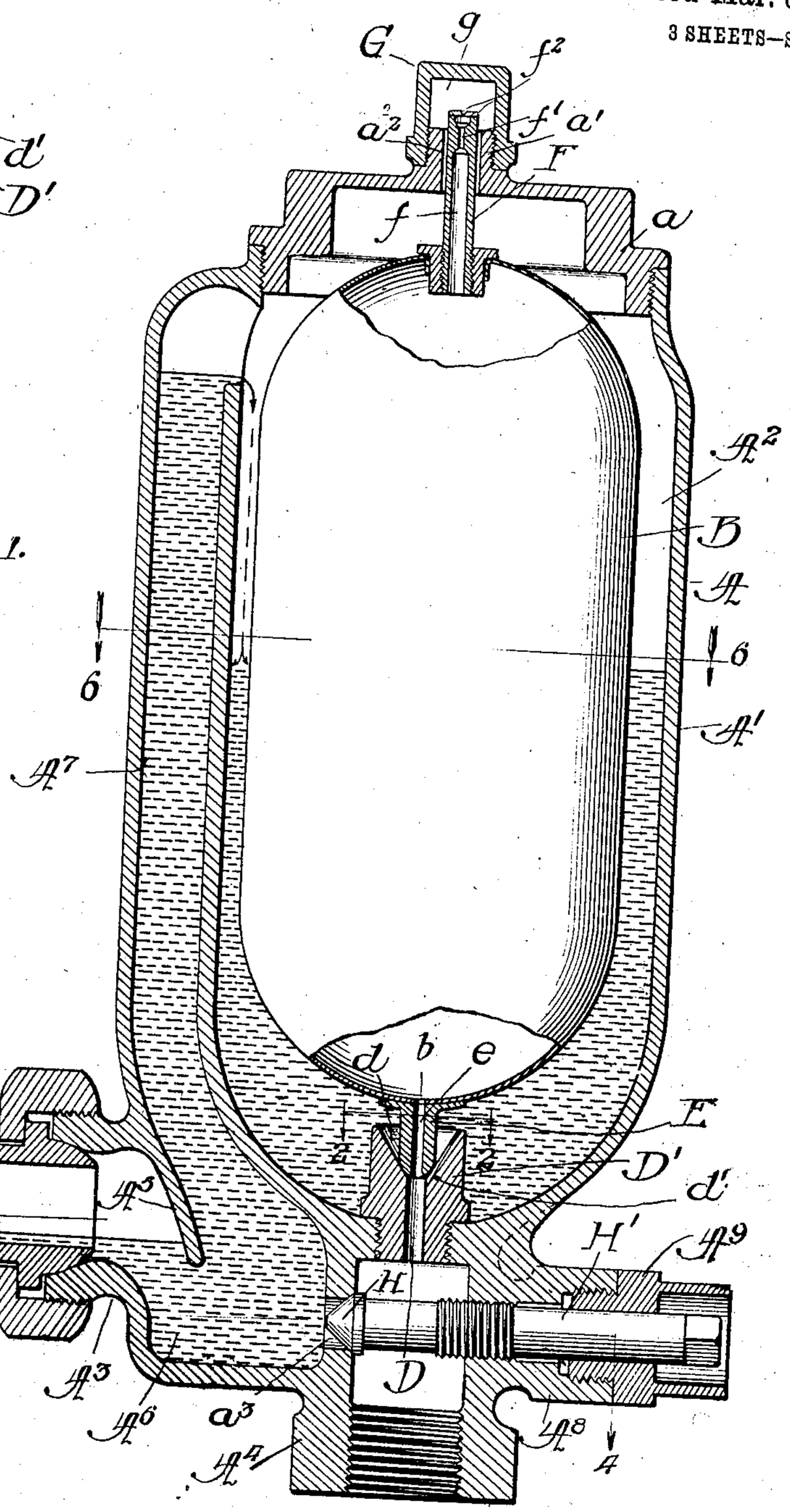

Fig. 1.

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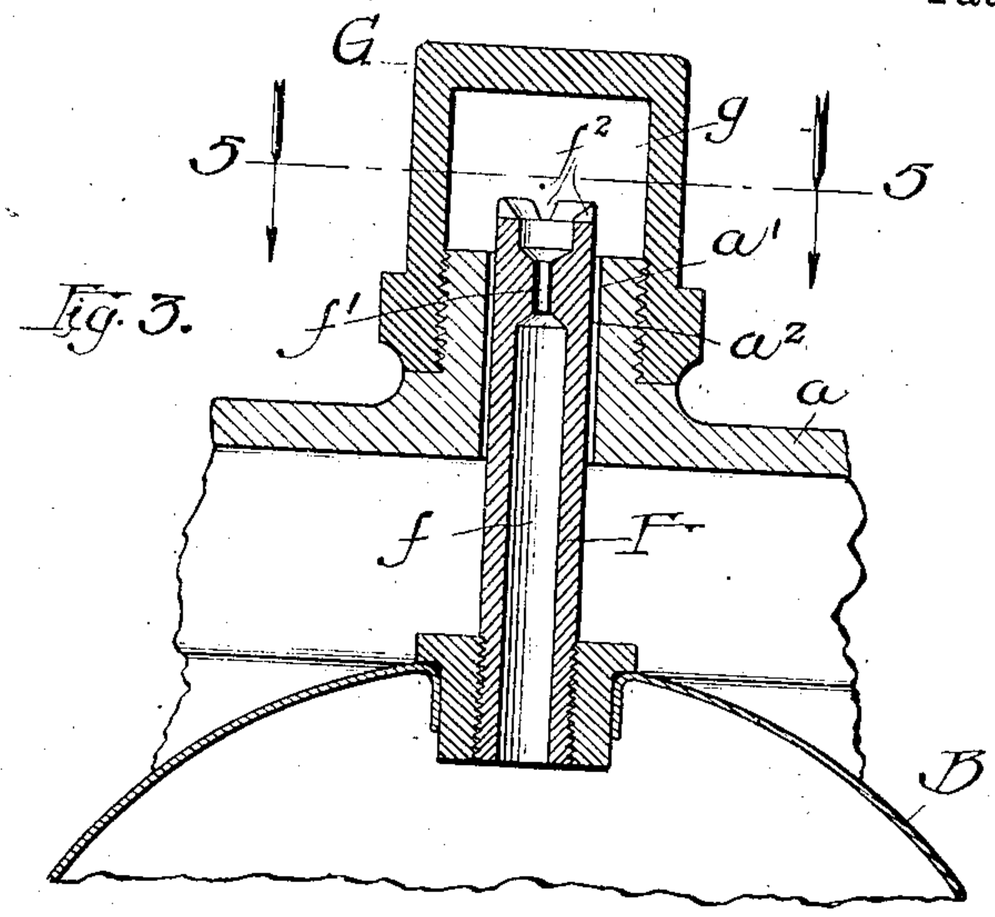

Fig. 3.

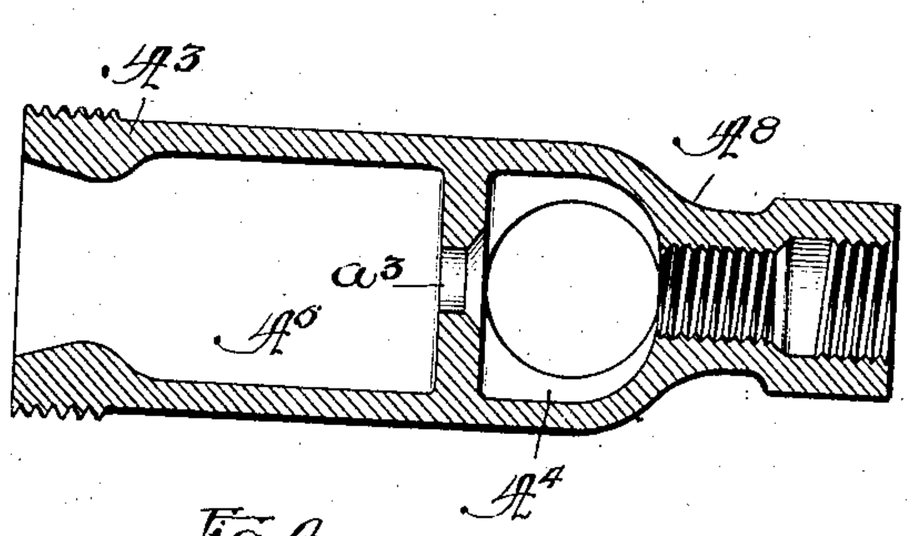

Fig. 4.

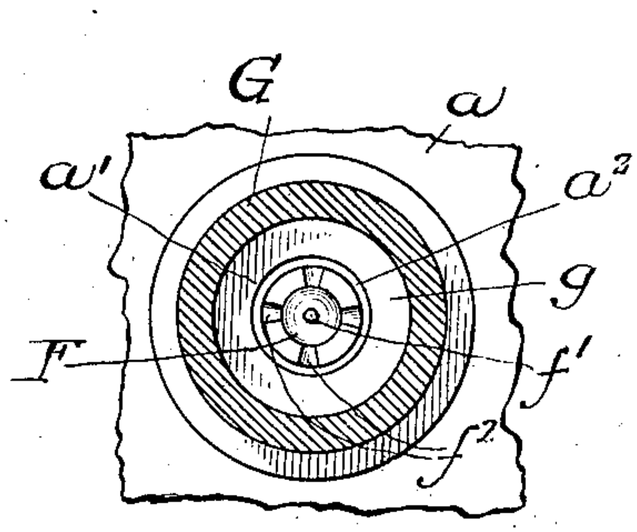

Fig. 5.

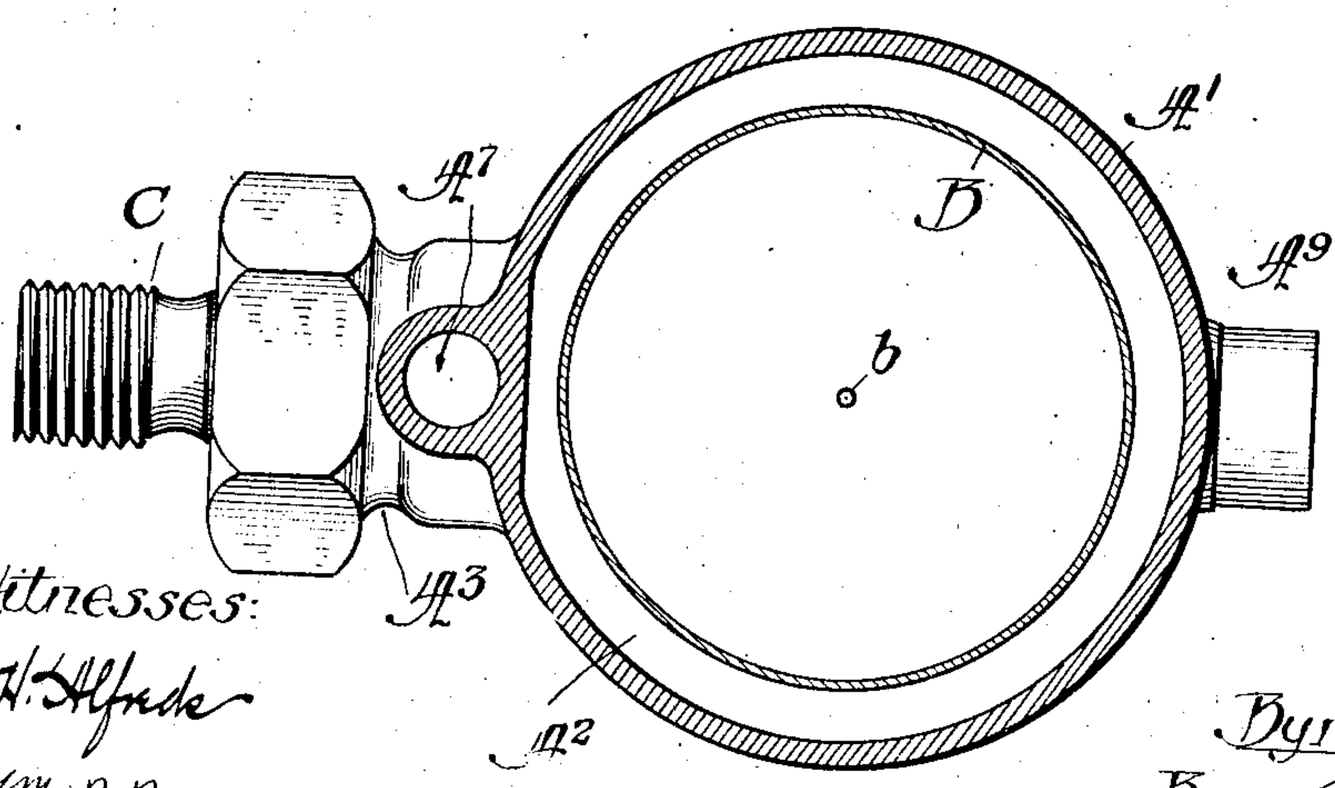

Fig. 6.

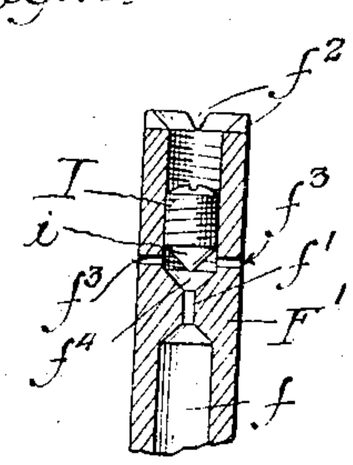

Fig. 7.

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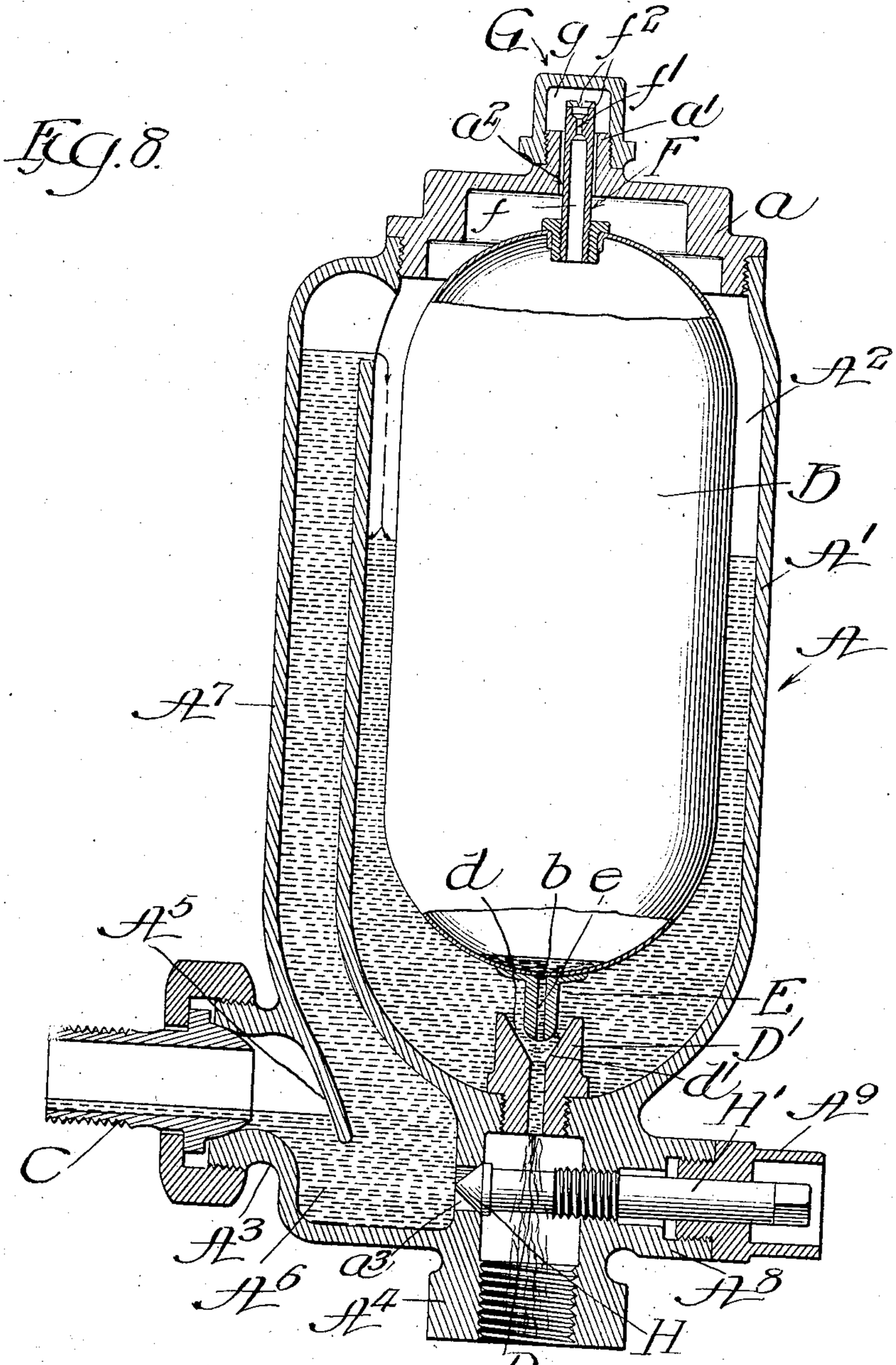
Fig. 8.



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UNITED STATES PATENT OFFICE.

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VALVE MECHANISM FOR DISCHARGING AIR AND WATER OF CONDENSATION FROM STEAM-HEATING SYSTEMS.

951,751. Specification of Letters Patent. **Patented Mar. 8, 1910.**

Application filed March 12, 1906. Serial No. 305,657.

To all whom it may concern:

Be it known that I, BYRON E. VAN AUKEN, a citizen of the United States, and a resident of the city of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Valve Mechanism for Discharging Air and Water of Condensation from Steam-Heating Systems; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in valve mechanisms, in the nature of a float controlled steam trap, for discharging, by differential pressure, air and water of condensation from steam heating systems or from other inclosures or devices in which steam condenses.

My improved valve mechanism, when applied to steam heating systems, is located between the return side of a heating unit or radiator of the system and the condensation water return pipe, which latter operates under a pressure less than that of the radiating or heating unit.

Among the objects of my invention is to produce a valve mechanism of this character which may be attached to a radiator of ordinary depth of leg or base, and so constructed as not to extend below the general level of the radiator base; to simplify and cheapen the cost of construction of such valve mechanism; to reduce the cost of maintenance thereof, and to improve and render certain its operation.

The invention consists in the matters herein set forth and more particularly pointed out in the appended claims.

As shown in the drawings,—Figure 1 is a vertical section of a valve mechanism made in accordance with my invention. Fig. 2 is a detail section, taken on line 2—2 of Fig. 1. Fig. 3 is an enlarged, fragmentary detail section of the upper part of the valve mechanism. Fig. 4 is a section, taken on the indirect line 4—4 of Fig. 1, with parts removed. Fig. 5 is a horizontal section, taken on line 5—5 of Fig. 3. Fig. 6 is a horizontal section, taken on line 6—6 of Fig. 1 Fig. 7 illustrates a modification of the means for discharging air. Fig. 8 is a vertical section of the valve mechanism, illustrating the device in the act of discharging water from the float chamber, the float being slightly raised.

In said drawings, A designates the valve mechanism, as a whole. It consists of a vertically elongated, chambered casting A^1 in which is formed a float chamber A^2. Said float chamber contains a vertically elongated, hollow float B, preferably made of thin sheet metal. The upper wall of the chamber comprises, as herein shown, a removable cap or closure *a*, which permits the ready insertion and removal of the float. The casing or shell is provided near its bottom with a laterally directed inlet branch A^3, and at its bottom with a vertically directed, liquid discharge branch A^4, the latter adapted for communication with a condensation water return pipe through which water of condensation is discharged from the float chamber. The said liquid discharge pipe operates under a pressure considerably less than the normal pressure of the radiating units of the heating system. The said inlet branch is adapted for connection with a radiator, or other condensing device, through a short pipe C removably connected with the branch A^3. The conduit formed by said pipe C and the branch A^3 communicates with the float chamber through a seal at the inner end of the branch, arranged to be sealed by the accumulation of water of condensation, and the air space in the upper part of the float chamber is adapted for open communication with the liquid discharge passage of the device, preferably through a restricted opening, in a manner hereinafter to be described, thereby establishing and maintaining a differential pressure on opposite sides of the seal whereby a portion of the accumulated water is intermittently discharged into said float chamber. The float chamber A is provided with a discharge passage D through which water, which collects in the float chamber, is intermittently discharged from the float chamber to the discharge passage A^4 and thence to the condensation water pipe adapted for communication therewith. The said opening D is herein shown as formed in a vertical short tube or nipple D^1 that extends upwardly into the float chamber and is exteriorly screw-threaded at its lower end to engage a screw-thread opening in the lower wall of said float chamber. The discharge opening D of the float chamber is governed

by a valve E controlled by the float B. As herein shown, said valve consists of a short plug fixed rigidly to and depending from the lower end of the float B and formed at its lower end to close the discharge passage D. The upper end of the tube or nipple D^1, in which is formed the discharge passage D, is provided with an upwardly and outwardly flaring recess *d*, and the lower end of the valve E is correspondingly tapered to engage the flaring wall of said recess. The presence of said flaring or conical recess is advantageous, inasmuch as it guides the valve to its seat at the time the float is inserted into the chamber and facilitates the insertion of the float in the chamber. The float is provided at its upper end with a guide-stem F which enters a suitable guide opening in a boss a^1 formed on the upper wall of the removable cap or closure *a* of the float chamber, whereby the float is guided in its vertical movements.

In accordance with one of the principal features of the present invention, the discharge passage of the device communicates with the air space in the upper part of the float chamber through suitable ports in the hollow float B. For this purpose, the stem F is shown as made hollow to provide a passage *f* which communicates at its upper end with the float chamber and at its lower end with the interior of the hollow float; and the valve E is made hollow to provide a passage *e* which communicates at its upper end with the interior of the hollow float through an opening *b* in the bottom wall thereof and communicates at its lower end with the outlet passage D of the float chamber. The air passage through the float is restricted at one point. As herein shown, the passage *f* is formed with a restricted portion or port f^1 which constitutes a contracted vein that limits the passage of air or air and vapor therethrough.

It will be observed by reference to the drawings that the cross-sectional area of the said restricted opening or contracted vein f^1 is, relatively, very considerably less than the area of the discharge opening *b* whereby, when the valve is seated and the interior of the float is in communication with the exhaust device through said opening *b*, there will exist a difference of pressure on opposite sides of the float wall. That is to say, there will be less pressure in the interior of the float B than in the interior of the surrounding float chamber A^2. There may, for example, be atmospheric pressure in the float chamber and several inches of vacuum within the hollow float. It will thus be manifest that when the float B is raised, (see Fig. 8), and the opening *b* sealed by the temporary inrush of water of condensation, the air will continue to flow into the float through the restricted opening f^1.

The seal in the conduit, through which water of condensation is discharged from the radiator into the float chamber, is shown as formed by a lip or weir A^5 located just inside the inlet branch A^3 and dipping into a pocket A^6 formed in the shell at the inner end of said branch, the lower edge of said weir being shown as located below the floor or bottom of the pipe C, or the radiator connected therewith. The location of the lower edge of said lip or flange determines the water level in the pipe C and the base of the radiator adapted for communication therewith. Said seal may, however, be otherwise produced. In the present construction, the pocket A^6 communicates with the float chamber above the line of flotation of the float through a vertical passage A^7 located at one side of the float chamber, said passage discharging at its upper end into the float chamber near the upper end of the latter. The said passage A^7 and pocket A^6 constitute, therefore, together with the pipe C and branch A^3, a conduit designed to provide communication between the heating system and the float chamber, and in which is located a liquid seal that is arranged to be sealed by the accumulation of the water of condensation in said conduit, whereby the superior pressure in the heating system serves to force a portion of the water accumulating in said conduit into the float chamber and to discharge the air from said heating system with a minimum loss of steam.

The illustrated construction for establishing communication between the upper end of said hollow stem F and the upper part of the float chamber, is made as follows: The said stem extends loosely through an aperture in the boss a^1 into, and communicates with, a chamber *g* formed in a hollow cap G that fits over and has screw-threaded engagement with the boss a^1. The said chamber *g* communicates with the upper end of the float chamber through an annular passage a^2 formed between the loosely fitting stem F and the wall of the aperture through which it extends. The upper end of said stem is provided with notches f^2 adapted to be engaged with a screw driver or like implement to turn the stem out of its screw-threaded engagement with the float. Said notches also prevent the air passage being entirely closed when the float is raised to such height to engage the end thereof with the upper wall of the closing cap G.

Means are provided for discharging the water of condensation from the pocket A^6 and vertical passage A^7 when desired, consisting, as herein shown, of a port or opening a^3 affording communication between the pocket and the discharge branch A^4, said port being normally closed by a conical valve H, the stem H^1 of which extends across the discharge passage of the device and laterally

outwardly through a branch A^8 and has screw-threaded engagement therewith. A stuffing box A^9 prevents the leakage of vapor, air, and water around said stem. A leakage passage is provided at the lower end of the float chamber to permit the escape of water therefrom at times when the valve is out of service. As herein shown, the leakage passage is provided at the outlet valve for the chamber by forming a groove d^1 (Fig. 2) in the conical face of the valve seat. Obviously, the forming of such groove in the valve E at this point will produce the same result.

In the operation of the valve mechanism, the upper part of the float chamber is in open communication with the discharge passage thereof through the hollow float at times when the valve governing the discharge of water from the float chamber is closed. The water of condensation from the heating system accumulates in the conduit leading to the float chamber and said conduit is sealed by the accumulation of said water of condensation therein, thereby operating, in connection with the lower pressure of the discharge side of the valve mechanism, to increase the differential pressure on the opposite sides of said seal. The superior pressure on the radiator side of the seal operates periodically to force the accumulated water of condensation into the float chamber until a sufficient quantity of water has been deposited in said chamber to raise the float and the outlet valve E, whereupon water escapes from said float chamber through the discharge passage thereof until the body of water in said chamber is lowered below the line of flotation of the float. Thereupon the float is lowered by gravity and the valve E is seated to cut off the escape of water from the float chamber. During the period of accumulation of water in the float chamber, air and vapor finding their way into the upper part of said chamber are conducted therefrom through the hollow float and the ports or passages thereof, and the differential pressures on the opposite sides of the seal, caused by the combined action of the seal and the lower pressure into which the air and vapor is discharged, cause the water to be gradually forced into the float chamber until it accumulates therein in sufficient quantity to raise the float and valve and permit the escape of a portion of the water from said float chamber, as described. In the normal operation of the form of the valve mechanism herein shown, wherein the water of condensation is directed into the top of the float chamber through the vertical passage A^7, the water finds its level at the top of said passage, as shown in Fig. 1, and overflows into the float chamber, due to the superior pressure on the radiator side of the seal, assisted also by the disturbance of the column of water in said passage A^7, due to the momentary breaking of the seal and the passage of slugs of air and small quantities of steam beneath the weir A^5 and upwardly through said water column. The agitation of the water in said passage A^7, caused by the rising of air and steam therethrough in the manner stated, has the effect of spilling water over the upper edge of the inner wall of said passage in greater or less quantities, depending upon the violence of the disturbance of said water by the passage of the air and steam therethrough, as described. So long as the normal operation of the apparatus continues, therefore, the passage A^7 will be substantially filled with water, as shown in Fig. 1. During the time the float is raised and the valve is open to permit the escape of water from the float chamber, the lower end of the hollow valve is cut out of communication with the liquid discharge pipe, so that at this time the escape of air through the hollow float is cut off. When the valve is seated the escape of water from the float chamber is cut off. It will thus be seen that the action of the mechanism is intermittent to alternately discharge air and water therefrom. That is to say, the air is continuously drawn from the float chamber into the interior of the hollow float through the restricted opening f^1 but is intermittently discharged from the hollow float through the opening b, the latter being alternately sealed or closed (see Fig. 8) by water and opened to the discharge D, (see Fig. 1) while the contracted passage or vein f^1 is always open.

By reason of the fact that the interior of the hollow float is subject to the pressure of the discharge passage of the valve mechanism when the float is down (see Fig. 1), and the water discharge valve is closed, and is cut off from said passage when the float is raised (see Fig. 8), and the valve is open, the pressure in said float is subject to considerable variation during a given cycle of the operation of the valve mechanism. That is to say, when the valve is closed, by reason of the restricted size of the opening f^1 the interior pressure of the float is less than that of the float chamber, so that, when the float is raised and the passage of air cut off through the hollow valve E, the superior pressure in the float chamber outside the float forces the air into the space of lower pressure within the float, thereby decreasing the differential pressure on the opposite sides of the wall of the float. When the float drops and the valve E again seats, the pressure will be again decreased to correspond with the outlet side of the valve mechanism, thereby increasing the differential pressures on the opposite sides of the wall of the hollow float. It will thus be seen that air or air and vapor is constantly passing from the

float chamber to the interior of the float, and that it is intermittently discharged from the float at times when the valve E is seated.

The extension of the stem F into the chamber formed in the removable cap, as described, or other construction exposing the end of the stem when the cap is removed, affords ready access to the passage or port thereof to clear the same of any obstruction that may lodge therein. Such passage may be conveniently cleared by inserting therethrough a wire or like implement without removal of the float or stem from place.

The provision of a passage at the lower end of the hollow float is of considerable advantage, aside from forming part of the passage for the escape of air from the float chamber, inasmuch as this construction avoids the disadvantage of the leakage of water into the hollow float, such as occurs in constructions wherein the hollow float is without such outlet. In the present construction, water leaking into the hollow float is drawn off as rapidly as it accumulates therein, whereas in a construction wherein the float has no such opening, the leakage of water thereinto acts to vary the weight of the float, with the result of varying its action.

In Fig. 7 I have shown a construction in the air passage leading to the upper end of the hollow float whereby the capacity of the passage may be varied or regulated. In this construction, the stem F^1, corresponding to the stem F shown in the other figures, is provided with a screw-threaded plug I which enters the same and has screw-threaded engagement therewith. In this instance, the communication between the interior of the stem and the float chamber is provided through the medium of radial ports f^3 f^3 leading through the walls of the stem below the screw-threaded plug I. Said plug has a conical end i that opposes a conical surface f^4 in the stem F below said ports. By moving said plug upwardly or downwardly the capacity of the passage may be varied, as is obvious.

It will be noted that by reason of the restricted opening leading from the float chamber to the interior of the float and by reason of the larger opening leading from the interior of the float to the liquid discharge passage, water will more freely pass through the lower opening from the float chamber into the float when the float is raised than air or vapor will pass from the float chamber into the float through the upper restricted opening. The construction is such that the upper opening leading from the float chamber into the float is so restricted as compared to the lower opening that water will more freely pass through the lower opening than will the air or vapor through the upper opening. It follows that when the float is raised it is light but when the water flows into the lower end of the float the float becomes heavy. The float is thus rendered more certain of operation because the buoyancy of the water is assisted by the lightness of the float and the weight of the water within the lower end of the float assists in returning the float so as to close the discharge opening from the float chamber.

I claim as my invention:—

1. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure comprising a float chamber, a liquid discharge passage communicating therewith, a conduit adapted to provide communication between a radiator and said float chamber, a liquid seal arranged to be sealed by the accumulation of water of condensation in said conduit thereby increasing the differential pressure on opposite sides of said liquid seal whereby a portion of the accumulated water of condensation is forced into said float chamber, a hollow float for governing said discharge passage, said float being provided with a restricted air inlet opening and with a comparatively unrestricted outlet opening affording communication, through the hollow float, between the float chamber and a zone of lower pressure, whereby a partial vacuum is established in the float when said liquid discharge passage is closed and whereby water is forced into the float when the latter is raised and said liquid discharge passage is in open communication with the float chamber.

2. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure comprising a float chamber, a liquid discharge passage communicating therewith, a hollow float having a valve for governing said liquid discharge passage, a conduit adapted to provide communication between a radiator and said float chamber, a liquid seal arranged to be sealed by the accumulation of water of condensation in said conduit thereby increasing the differential pressure on opposite sides of said liquid seal whereby a portion of the accumulated water of condensation is forced into said float chamber, the said float being provided with a restricted air inlet opening and with a comparatively unrestricted outlet opening affording communication, through the hollow float, between the float chamber and a zone of lower pressure whereby a partial vacuum is established in the float when said liquid discharge passage is closed and whereby water is forced into the float when the latter is raised and said liquid discharge passage is in open communication with the float chamber.

3. Valve mechanism for discharging air and water of condensation from steam heat-

ing systems by differential pressure comprising a float chamber, a liquid discharge passage communicating therewith, a conduit adapted to provide communication between a radiator and said float chamber, a liquid seal arranged to be sealed by the accumulation of water of condensation in said conduit thereby increasing the differential pressure on opposite sides of said seal whereby a portion of the accumulated water of condensation is forced into said float chamber, a hollow float in said float chamber provided with a valve for controlling said liquid discharge passage, said float being provided with an air passage extending through the float and valve and discharging into said liquid discharge passage, the upper part of said air passage being a restricted inlet opening and the lower part being a comparatively unrestricted outlet opening through the valve whereby a partial vacuum is established in the float when the valve is seated and whereby water is forced into the float from the float chamber when the valve is raised from its seat.

4. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure comprising a shell formed with a float chamber, a liquid discharge passage communicating with said float chamber, a hollow float in said chamber, a valve carried by the float which governs the liquid discharge passage, a conduit adapted to provide communication between a radiator and said float chamber, a liquid seal arranged to be sealed by the accumulation of water of condensation in said conduit thereby increasing the differential pressure on opposite sides of said liquid seal whereby a portion of the accumulated water of condensation is forced into said float chamber, a liquid discharge passage communicating with the float chamber, a hollow guide stem extending upwardly from said float and having guiding engagement with said shell and providing a restricted opening for the passage of air from the float chamber to the hollow float, said float being provided also with a comparatively unrestricted outlet opening affording communication between the hollow float and a zone of lower pressure than that of the float chamber whereby a partial vacuum is established in the float when the valve carried thereby is seated and water is forced into the float from the float chamber when said valve is raised.

5. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure comprising a shell, a float chamber therein, a conduit adapted to provide communication between a radiator and said float chamber, a liquid seal arranged to be sealed by the accumulation of water of condensation in said conduit thereby increasing the differential pressure on opposite sides of said liquid seal whereby a portion of the accumulated water of condensation is forced into said float chamber, a liquid discharge passage communicating with the float chamber, a hollow float adapted to govern said discharge passage and provided with an air passage extending through the float and discharging into said liquid discharge passage, the upper part of said air discharge passage being a restricted inlet opening and the lower part being a comparatively unrestricted outlet opening affording communication between the hollow float and a zone of lower pressure than that of the float chamber, whereby a partial vacuum is established in the float when the liquid discharge passage is closed against communication with the float chamber and whereby water is forced into the float from the float chamber when the float is raised, and means for partially closing the upper part of the air discharge passage, whereby the flow of air from the float chamber into the hollow float becomes more restricted when the float is raised.

6. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure comprising a float chamber, a conduit adapted to provide communication between a radiator and said float chamber, a liquid seal arranged to be sealed by the accumulation of water of condensation in said conduit thereby increasing the differential pressure on opposite sides of said liquid seal whereby a portion of the accumulated water of condensation is forced into said float chamber, a liquid discharge passage communicating with the float chamber, a hollow float, a valve carried by said float for governing said discharge passage, said float being provided at its upper end with a restricted opening through which air is discharged from the float chamber to the interior hollow float and being provided at its lower end with an opening through which air is discharged from the hollow float, through said valve, to the liquid discharge opening the lower opening of the float being sealed by the water in the float chamber when the float is raised.

7. A valve mechanism for the purpose described, comprising a float chamber provided with liquid inlet and discharge passages, the latter operating under a pressure less than that of the former, a hollow float in said chamber, a valve closure attached to said float for controlling the liquid discharge passage, said float being provided at its upper end with a restricted opening through which air is discharged from the float chamber to the interior of the hollow float and being provided at its lower end with an opening through which air is discharged from the hollow float to the liquid

discharge opening, the lower opening of the float being sealed by the water in the float chamber when the float is raised.

8. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure, comprising a float chamber, a liquid discharge passage communicating therewith, a hollow float for governing said discharge passage, a conduit adapted to provide communication between a radiator and said float chamber, a liquid seal arranged to be sealed by the accumulation of water of condensation in said conduit, thereby increasing the differential pressure on opposite sides of said liquid seal, whereby a portion of the accumulated water of condensation is forced into said float chamber, said float being provided with a continuous air passage extending as an entirety through the float and discharging into said liquid discharge passage, the upper part of said passage being a restricted opening, and the lower part of said passage being adapted to be sealed by water in the float chamber when the float is raised to release the water from said float chamber to said liquid discharge passage.

9. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure comprising a shell, a float chamber therein, a conduit adapted to provide communication between a radiator and said float chamber, a liquid seal arranged to be sealed by the accumulation of water of condensation in said conduit thereby increasing the differential pressure on opposite sides of said liquid seal whereby a portion of the accumulated water of condensation is forced into said float chamber, a liquid discharge passage communicating with said float chamber, a hollow float provided with a valve for controlling said liquid discharge passage, a stem extending upwardly from said float and provided with a restricted opening for the passage of air from the float chamber to the hollow float, said stem having guiding engagement with the top wall of the float chamber, a cap having detachable engagement with said top wall and inclosing the upper end of said stem, said float being provided with a comparatively unrestricted outlet opening through the valve carried by the float to afford communication between the hollow float and a zone of lower pressure than that of the float chamber, whereby a partial vacuum is established in the float when the valve is seated and water is forced into the float from the float chamber when the valve is raised from its seat.

10. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure, comprising a float chamber, a conduit adapted to provide communication between a radiator and said float chamber, a liquid discharge passage communicating with said float chamber, a liquid seal arranged to be sealed by the accumulation of water of condensation in said conduit, thereby increasing the differential pressure on opposite sides of said seal whereby a portion of the accumulated water of condensation is forced into said float chamber, a hollow float in said float chamber provided with a valve closure for controlling said discharge passage and provided also with an upper restricted air and vapor opening and a larger lower opening whereby water will more freely pass through the lower opening from the float chamber into the float when the float is raised than the air or vapor will pass from the float chamber into the float through the said restricted opening.

11. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure comprising a float chamber, a conduit adapted to provide communication between a radiator and said float chamber, a liquid seal arranged to be sealed by the accumulation of water of condensation in the conduit thereby increasing the differential pressure on opposite sides of said liquid seal whereby a portion of the accumulated water of condensation is forced into said float chamber, a liquid discharge passage communicating with the float chamber, a hollow float for governing said discharge passage, said float being provided with an air passage whereby air may be forced continuously from the float chamber to the interior of the float and being also provided with an air passage whereby air may be intermittently discharged from the interior of the float into the liquid discharge passage, the air inlet passage being a restricted opening and the air outlet passage being a comparatively unrestricted opening.

12. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure comprising a float chamber, a liquid discharge passage communicating therewith, a conduit adapted to provide communication between a radiator and said float chamber and opening into said float chamber above the line of flotation of said float, a liquid seal arranged to be sealed by the accumulation of water of condensation in said conduit thereby increasing the differential pressure on opposite sides of said liquid seal whereby a portion of the accumulated water of condensation is forced into said float chamber, a hollow float for governing said discharge passage, said float being provided with a restricted air inlet opening and with a comparatively unrestricted outlet opening affording communication, through the hollow float, between the float chamber and a zone of lower pressure

whereby a partial vacuum is established in the float when said liquid discharge passage is closed and whereby water is forced into the float when the latter is raised and said liquid discharge passage is in open communication with the float chamber.

13. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure comprising a float chamber, a liquid discharge passage communicating therewith, a conduit adapted to provide communication between a radiator and said float chamber and opening into said float chamber above the line of flotation of said float, a liquid seal arranged to be sealed by the accumulation of water of condensation in said conduit thereby increasing the differential pressure on opposite sides of said liquid seal whereby a portion of the accumulated water of condensation is forced into said float chamber, a hollow float chamber having a valve adapted to govern the liquid discharge passage and being provided with a restricted air inlet opening and with a comparatively unrestricted outlet opening affording communication, through the hollow float, between the float chamber and a zone of lower pressure, whereby a partial vacuum is established in the float when said liquid discharge passage is closed and whereby water is forced into the float when the latter is raised and said liquid discharge passage is in open communication with the float chamber.

14. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure comprising a float chamber, a liquid discharge passage communicating therewith, a conduit adapted to provide communication between a radiator and said float chamber and opening into said float chamber above the line of flotation of said float, a liquid seal arranged to be sealed by the accumulation of water of condensation in said conduit thereby increasing the differential pressure on opposite sides of said seal whereby a portion of the accumulated water of condensation is forced into said float chamber, a hollow float provided with a valve for controlling said liquid discharge passage and being also provided with an air passage extending through the float and valve and discharging into said liquid discharge passage, the upper part of said air passage being a restricted inlet opening and the lower part being a comparatively unrestricted outlet opening through the valve, whereby a partial vacuum is established in the float when the valve is seated and whereby water is forced into the float from the float chamber when the valve is raised from its seat.

15. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure comprising a shell formed with a float chamber, a liquid discharge passage communicating with said float chamber, a hollow float in said chamber, a valve carried by the float which governs the liquid discharge passage, a conduit adapted to provide communication between a radiator and said float chamber and opening into said float chamber above the line of flotation of said float, a liquid seal arranged to be sealed by the accumulation of water of condensation in said conduit thereby increasing the differential pressure on opposite sides of said liquid seal whereby a portion of the accumulated water of condensation is forced into said float chamber, a hollow guide stem extending upwardly from said float and having guiding engagement with said shell and providing a restricted opening for the passage of air from the float chamber to the hollow float, said float being provided also with a comparatively unrestricted outlet opening affording communication between the hollow float and a zone of lower pressure than that of the float chamber, whereby a partial vacuum is established in the float when the valve carried thereby is seated and whereby water is forced into the float from the float chamber when said valve is raised.

16. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure comprising a shell, a float chamber therein, a conduit adapted to provide communication between a radiator and said float chamber and opening into said float chamber above the line of flotation of said float, a liquid seal arranged to be sealed by the accumulation of water of condensation in said conduit thereby increasing the differential pressure on opposite sides of said liquid seal whereby a portion of the accumulated water of condensation is forced into said float chamber, a liquid discharge passage communicating with the float chamber, a hollow float for governing the liquid discharge passage and provided with an air passage extending through the float and discharging into said liquid passage, the upper part of said air discharge passage being a restricted inlet opening and the lower part being a comparatively unrestricted outlet opening affording communication between the hollow float and a zone of lower pressure than that of the float chamber, whereby a partial vacuum is established in the float when the liquid discharge passage is closed against communication with the float chamber and whereby water is forced into the float from the float chamber when the float is raised, and means for partially closing the upper part of the air discharge passage whereby the flow of air from the float chamber into the hollow float becomes more restricted when the float is raised.

17. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure comprising a float chamber, a conduit adapted to provide communication between a radiator and said float chamber and opening into said float chamber above the line of flotation of said float, a liquid seal arranged to be sealed by the accumulation of water of condensation in said conduit thereby increasing the differential pressure on opposite sides of said liquid seal whereby a portion of the accumulated water of condensation is forced into said float chamber, a liquid discharge passage communicating with the float chamber, a hollow float in said float chamber, a valve carried by said float for governing said discharge passage, said float being provided at its upper end with a restricted opening and through which air is discharged from the float chamber to the interior of the hollow float and being provided at its lower end with an opening through which air is discharged from the hollow float through said valve to the liquid discharge opening, the lower opening of the float being sealed by the water in the float chamber when the float is raised.

18. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure comprising a shell, a float chamber therein a conduit adapted to provide communication between a radiator and said float chamber and opening into said float chamber above the line of flotation of said float, a liquid seal arranged to be sealed by the accumulation of water of condensation in said conduit thereby increasing the differential pressure on opposite sides of said liquid seal whereby a portion of the accumulated water of condensation is forced into said float chamber, a liquid discharge passage communicating with said float chamber, a hollow float in said float chamber provided with a valve for controlling said liquid discharge passage, a stem extending upwardly from said float and providing a restricted opening for the passage of air from the float chamber to the hollow float, said stem having guiding engagement with the top wall of the float chamber, a cap having detachable engagement with said top wall and inclosing the upper end of said stem, said float being provided with a comparatively unrestricted outlet opening through the valve carried by the float to afford communication between the hollow float and a zone of lower pressure than that of the float chamber, whereby a partial vacuum is established in the hollow float when the valve is seated and whereby water is forced into the float from the float chamber when the valve is raised from its seat.

19. Valve mechanism for discharging air and water of condensation from steam heating systems by differential pressure comprising a float chamber, a conduit adapted to provide communication between a radiator and said float chamber and opening into said float chamber above the line of flotation of said float, a liquid seal arranged to be sealed by the accumulation of water of condensation in the conduit thereby increasing the differential pressure on opposite sides of said liquid seal whereby a portion of the accumulated water of condensation is forced into said float chamber, a liquid discharge passage communicating with the float chamber, a hollow float for governing said discharge passage, said float being provided with an air passage whereby air may be forced continuously from the float chamber into the interior of the float and being provided also with an air discharge passage whereby air may be intermittently discharged from the interior of the float into the liquid discharge passage, the air inlet passage being a restricted opening and the air outlet passage being a comparatively unrestricted opening, the float being adjusted whereby the said outlet opening of the float is sealed by the water in the float chamber when the float is raised.

In testimony, that I claim the foregoing as my invention I affix my signature in presence of two witnesses, this 9th day of March A. D. 1906.

BYRON E. VAN AUKEN.

Witnesses:
TAYLOR E. BROWN,
GERTRUDE J. BRYCE.