T. WHEATLEY.

AIR VALVE FOR RADIATORS.

APPLICATION FILED OCT. 30, 1906.

903,250. Patented Nov. 10, 1908.

Fig. 1.

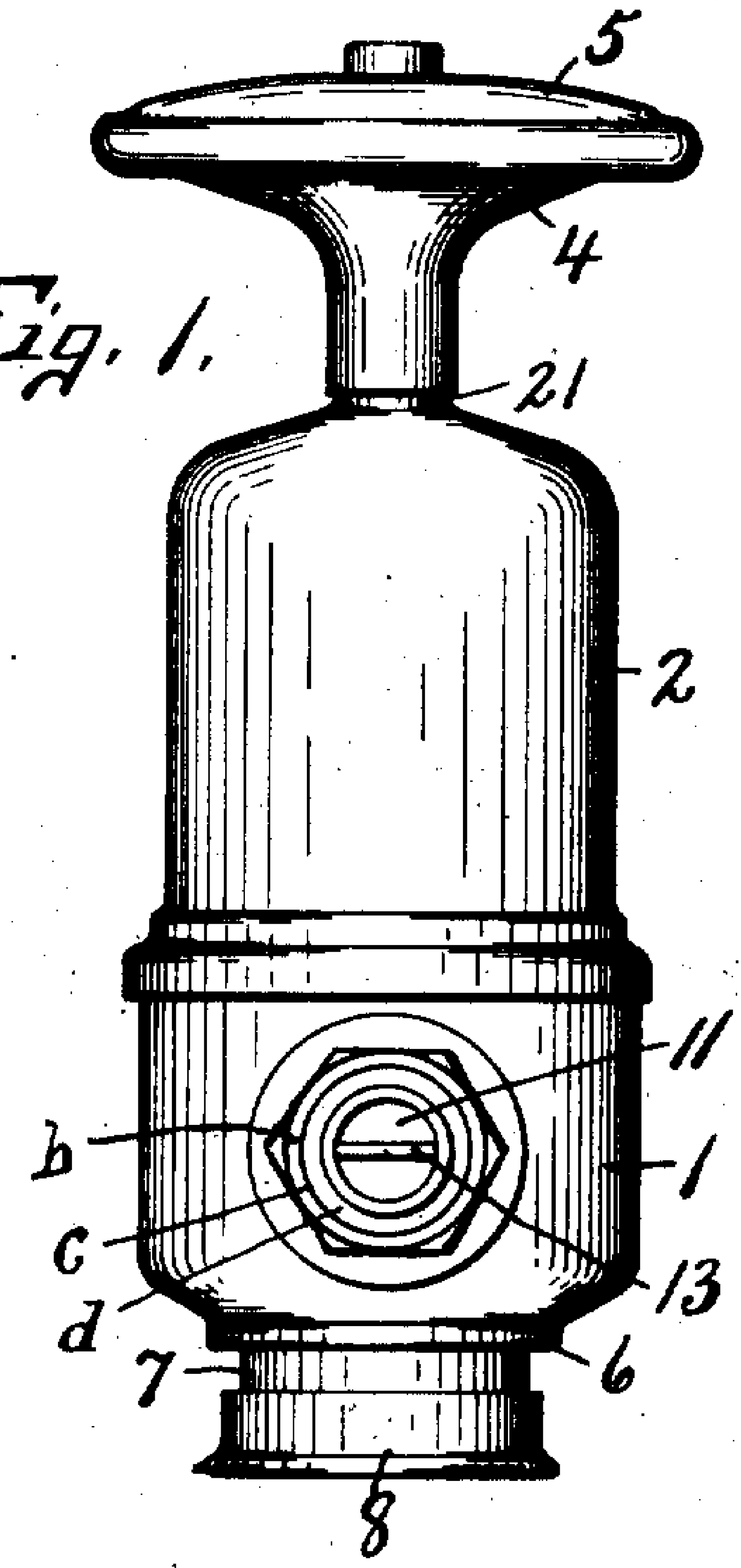


Fig. 2.

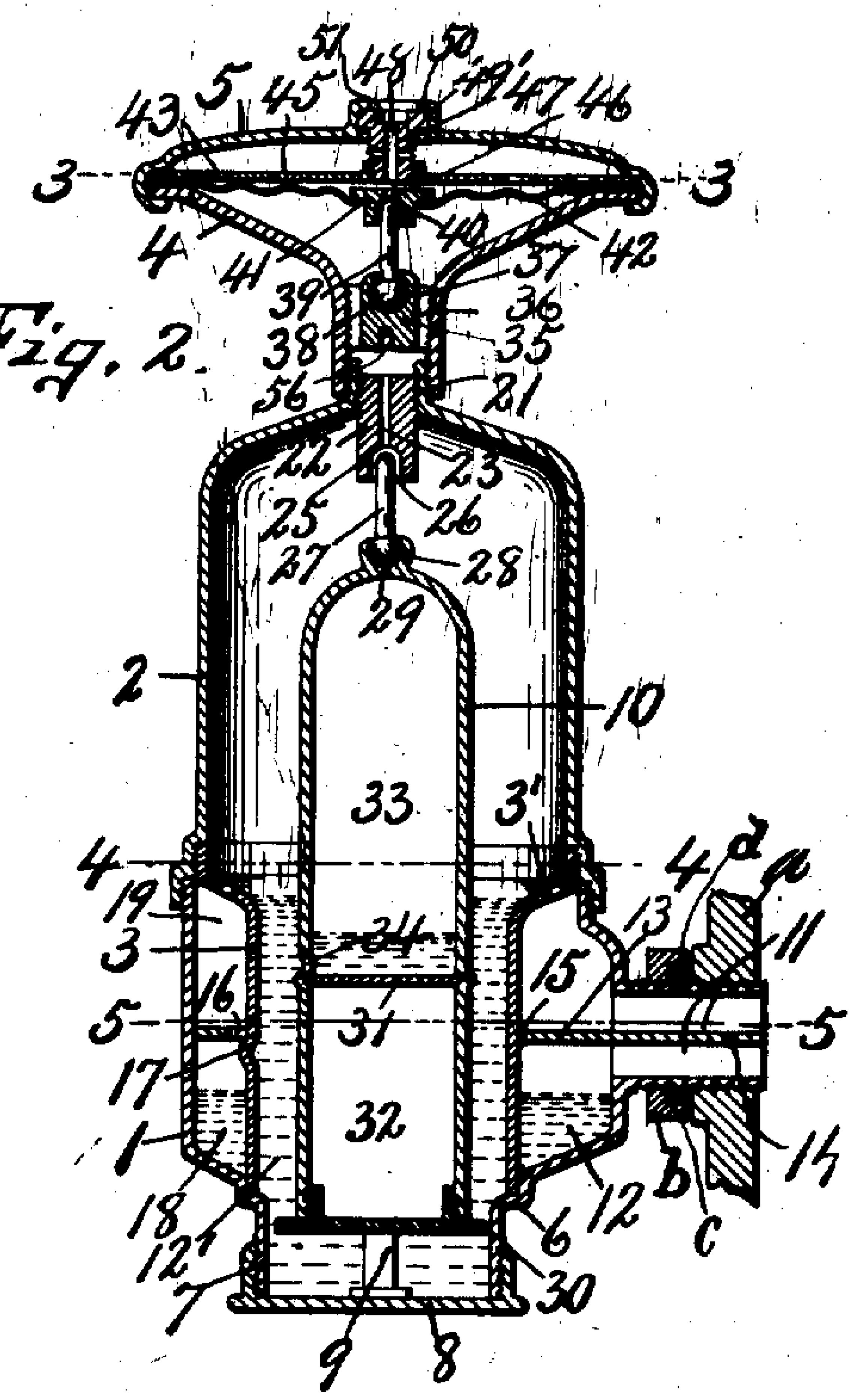


Fig. 3

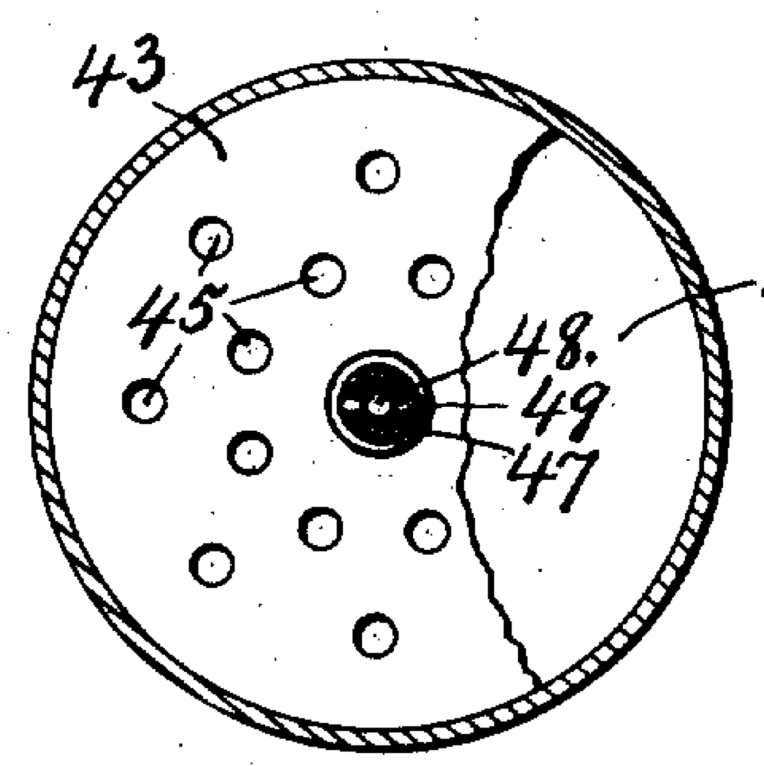


Fig. 4.

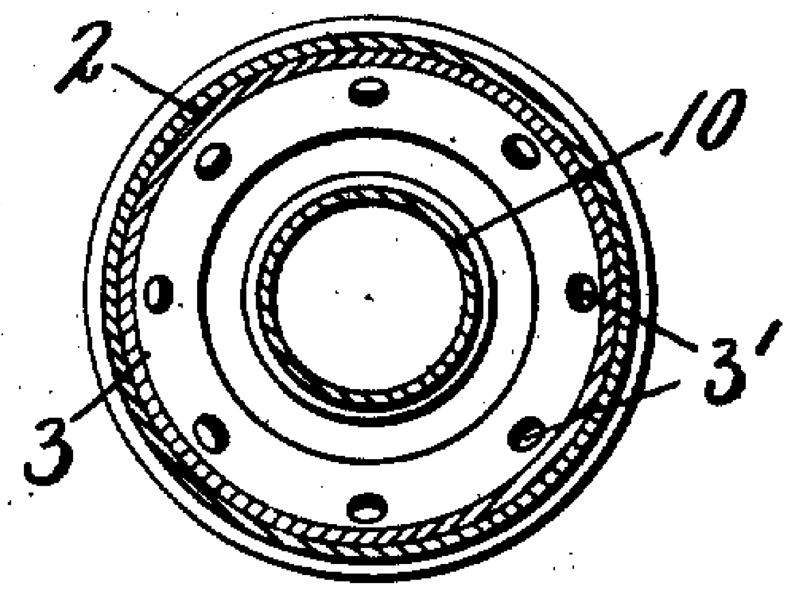
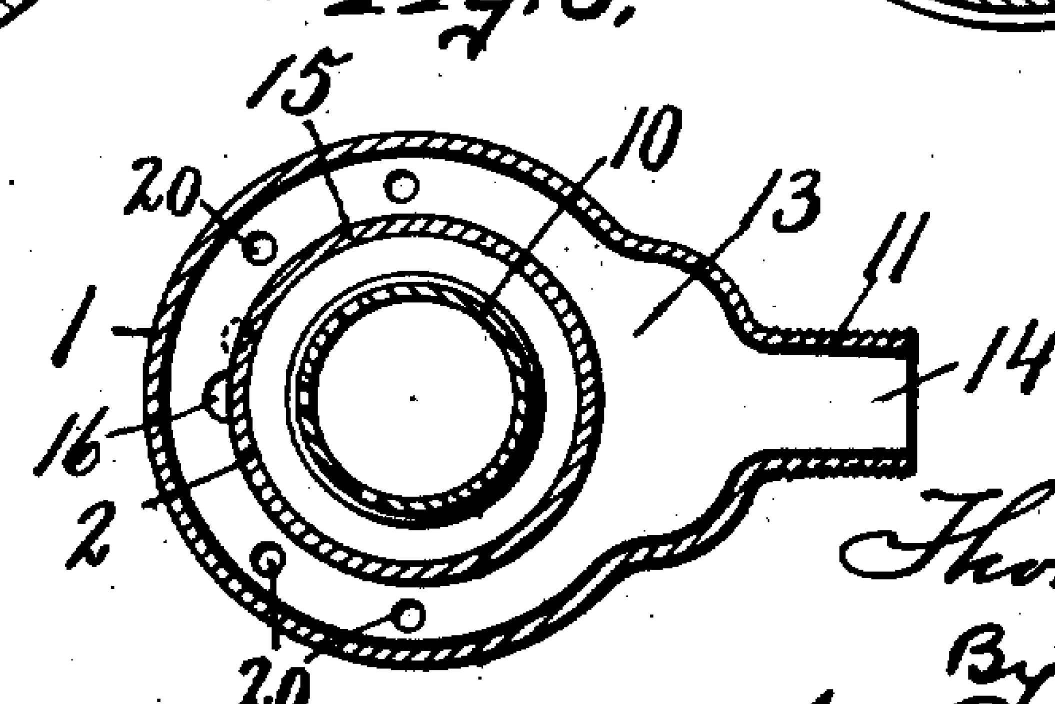


Fig. 5.



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UNITED STATES PATENT OFFICE.

THOMAS WHEATLEY, OF SYRACUSE, NEW YORK.

AIR-VALVE FOR RADIATORS.

No. 903,250. Specification of Letters Patent. Patented Nov. 10, 1908.

Application filed October 30, 1906. Serial No. 341,286.

To all whom it may concern:

Be it known that I, THOMAS WHEATLEY, of Syracuse, in the county of Onondaga, in the State of New York, have invented new and useful Improvements in Air-Valves for Radiators, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to certain improvements in air valves for radiators in which communication between the heating system and atmosphere is controlled through the medium of a float-actuated valve and a diaphragm whereby the cold air is allowed to escape during the upflow of the heating agent into the system, but is prevented from reëntering the system by the diaphragm and the partial vacuum which is created by the back-flow of the water in the heating system.

The one broad object of all devices of this character is to allow a displacement of the air from the system to atmosphere by the inflowing heating agent and to instantly close the air vent to atmosphere upon the entrance of the heating agent to that part of the device in which the air vent is located to prevent the escape of the heating agent into the room. Any contrivance, therefore, which will accelerate the closing action of the vent valve immediately upon the expulsion of air through the vent cannot but be regarded as an advance in the art, and in my present invention, I have sought to combine in the same device two methods of producing this accelerated action; first, by swiveling the valves so that they will more readily adjust themselves to their seats, and thereby produce a more positive and reliable closing of the vent, and second, to provide means brought into action by the recession of the water in the system for preventing reëntrance of air so that a partial vacuum is created between the system and atmosphere, which tends to hold the heating agent into that part of the system nearest the vent so that when the circuit is again opened there is less air to expel, and a corresponding acceleration in the closing of the vent valves.

A further object is to provide means for adjusting the diaphragm against one of the valves in the vent so as to positively close communication between the heating system and atmosphere, which would cause an air cushion between the inflowing heating agent and atmosphere, thereby prevent the upflow of the heating agent and serving substantially the same function as the usual valve with which the radiator is provided for opening and closing the circuit of the heating agent.

A still further object is to provide the base of the float with a closed air chamber dipping into the well which receives the water of condensation and whereby the weight of the float is more evenly balanced by a predetermined volume of water in the well, and its action by the heated air and water is, therefore, more instantaneous. In other words, I am enabled to use a shallower well requiring a smaller water displacement for balancing the float so as to normally hold the valve carried thereby close to its seat, still leaving sufficient opening for the escape of air until the float is actuated by the heated air and water to close said valve against its seat.

A still further object is to provide a partition for separating the inflowing heating agent from the outflowing water of condensation and thereby facilitating circulation.

Other objects and uses relating to the specific structure of my particular valve mechanism will be brought out in the following description.

In the drawings—Figure 1 is a side elevation of my improved air valve. Fig. 2 is a sectional view taken on line 2—2, Fig. 1. Figs. 3, 4 and 5 are transverse sectional views taken respectively on line 3—3, 4—4, and 5—5, Fig. 2.

The particular device forming the subject matter of my present invention, comprises the outer shell or casing consisting in this instance of tubular sections, 1, —2— and —3— and cap sections —4— and —5—, all of which parts are made of thin sheet metal and are spun, pressed, or stamped to the desired form.

The section —1— which will hereafter be termed the base section, has its lower end reduced, forming an annular shoulder —6— and an annular flange —7— depending from the shoulder —6— and threaded to receive a screw-cap —8— which closes the lower end of the section —1—, said cap —8— being provided with a central raised abutment —9— forming a limiting stop adapted to engage the lower ends of a float —10—. This base section —1— is also provided with a lateral inlet —11—in one side some distance above its bottom or cap —8— forming a well —12— below the level of the inlet for receiving the water of condensation which may accumulate in the shell.

A horizontal partition —13— is inserted into and closely fitted within the base section —1— before the top section —2— is secured in position and is provided with a laterally extending arm —14— projecting centrally through and fitting closely within the inlet —11— so as to divide said inlet into lower and upper passages, the upper passage being adapted to admit steam in the base-section —1— while the lower passage provides for the return flow of the water of condensation to the heating system. This partition —13— is provided with a circular opening —15— co-axial with the inner tubular section which it receives, one side of the opening —15— being provided with a recess or notch —16— for receiving a corresponding shoulder —17— on the tubular section —3—.

After the partition —13— is properly located within the section —1— the tubular section —3— is inserted from the top downward through the opening —15— in the partition 13— within the section —1— until its lower end is seated upon the annular shoulder —6— by which the tubular section —3 is supported. In placing the section —3— in position, as just described, the outwardly projecting shoulder —17— is registered with the notch or recess —16— until the shoulder is brought just below the partition 13—, whereupon the section —3— is rotated slightly to shift the shoulder —17— out of registration with its respective notch or recess —16— so as to lie directly under the adjacent portions of the partition for supporting the latter in a plane at substantially right angles to the axes of the tubular section —1—. It is evident, however, that this recess —16— and shoulder —17— may be dispensed with by snugly fitting the arm 14— diametrically within the inlet —11— and similarly fitting the tubular section —3— within the opening 15—. In this case the arm 14— would be retained in the diametric plane of the inlet by the sides of such inlet, and the frictional engagement of the sides of the opening —15— with the periphery of the tubular section —3— would similarly hold the remaining part of the partition against vertical displacement.

The greater portion of the tubular section —3— within the base section —1— is smaller in its outer dimension than the interior diameter of the section —1— forming an intervening chamber which is divided transversely by the partition 13— into lower and upper compartments —18— and 19— which communicate with each other through the passage or recess —16— and additional passages —20— in the partition 13— to permit the drip of the water of condensation from the chamber 19— into the sub-chamber 18—. The essential purpose of this partition 13— is to separate the inflowing steam from the return flow of the water of condensation so that the latter will not be agitated and forced into the float chamber and vent ducts by the inflowing steam, but at the same time the passages —16— and 20— permit an equalization of the steam pressure within the chambers —19— and 18— which allows the water to gravitate from the well —18— backward through the lower side of the inlet —11— below the partition 13—. These passages —16— and —20— are preferably located at the side of the tubular section —3— opposite to the inlet where the sides of the shell are cooler, and therefore, the condensation is more rapid allowing the water to gravitate naturally beneath the partition where it returns with greater expediency through the lower side of the inlet to the heating system.

The upper end of the inner tubular section —3— is preferably expanded or enlarged to substantially the interior diameter of the base section —1— and is preferably screwed or otherwise secured into the lower end of the upper tubular section —2—, thereby dividing the upper compartment —19— of the section —1— from the interior of the upper section —2—, but communication is established between said compartment and interior of the section —2— through suitable openings —3′— in the upper expanded end of the section —3— some distance above the inlet —11—.

The lower end of the tubular section —3— is fitted with a water tight joint in the base section —1— upon the shoulder —6— some distance below the inlet, forming a well 12′— extending from the bottom cap —8— to the level of the apertures 3′—. These apertures 3′ allow the steam to enter the tubular sections —1— and —2— to envelop the float —10—, the water of condensation being precipitated along the inner sides of the section —2— into the well 12′. This upper tubular section —2— is co-axial with the sections —1— and —3—, and has its lower end screwed or otherwise secured to the upper end of the base section —1—, thereby forming a unitary shell composed of light sheet metal tubular sections which are adapted to be spun, pressed or stamped to the desired form so that they may be manufactured at a comparatively low cost.

The upper extremity of the section —2— is materially contracted forming a tubular nipple —21— which is in this instance, threaded interiorly and exteriorly for receiving respectively a threaded plug or bushing —22— and the lower reduced end of the cap section —4—. The bushing —22— is provided with a lengthwise passage or vent opening —23 having its lower end enlarged and rounded at the top forming a concave seat —25— for receiving the upper semi-spherical end —26— of a valve stem —27—. The lower end of this valve stem is swivel connected by ball —28— and socket —29— to the upper end of the float —10— so as to permit the valve —26— to more readily adjust itself to its seat —25— and thereby more positively close the vent —23— when the float 10— is actuated.

The float —10— consists of a tubular shell co-axial with, but somewhat smaller in diameter than the interior diameters of the shells 1, 2 and 3, in which it is movable, leaving ample clearance at the sides to prevent contact with the shell sections which might interfere with its free operation. This float is closed at the top and bottom, the bottom being provided with comparatively thin lateral projections —30—, the outer edges of which are disposed in close proximity to the inner sides of the tubular extension —7— of the base section —1— so as to guide the float in its vertical movement and keep the lower end substantially co-axial with the outer shell.

The interior of the float is divided horizontally by a transverse partition —31— forming lower and upper compartments —32— and —33—, which latter communicates at its lower end with the well 12′ through suitable ports —34— just above the partition —31—. The purpose of the air tight chamber —32— in the lower portion of the float —10— which dips into the well 12′ is to increase the buoyancy of the float and to make it possible to operate such float with a comparatively small amount of water of condensation which may collect in the well 12′—.

When no water is present in the well 12′ the bottom of the float rests upon the stop-pin —9— but as the water accumulates from the bottom upward and surrounds the lower end of the float having the air tight chamber —32 it tends to buoy or raise the float from its seat —9—, and the bushing —22— is also adjusted so that when the float is balanced in the water the valve —26— is slightly open or separated from its seat —25— said float being made of such specific gravity as to be substantially balanced by a quantity of water in the well sufficient to trap the air in the float. Under such conditions it is clearly obvious that the slightest heating of the air which is trapped in the chamber —33— of the float —10— by the water pressure at the ports —34—, the float will be instantly elevated to close the valve —26— against its seat 25—.

The ports —34— in the float —10— are preferably located in a plane above the inlet —11— close to the partition —31— and permit the entrance into the chamber —33— of just sufficient water from the well 12— to trap the air in the upper part of said chamber —33— so that as soon as the steam enters the compartment 19—, it not only heats and expands the water in the chamber 12′—, but at the same time it enters the shell —2— through the passages 3′—, and by enveloping the upper portion of the float it heats the trapped air therein, which operates to elevate the float and at the same time presses the water back under the float to further accelerate the closing of the valve —26— against its seat —25— to prevent the escape of the heating agent through the vent —23—.

I have now described the mechanism by which the air is allowed to escape from the heating system and by which the vent passage is closed immediately upon the entrance of steam into the valve shell, and I will now proceed to describe the means by which the air is prevented from reëntrance into the system, and also the means for positively closing the exit of the air from such system. These latter mechanisms are preferably incorporated within the cap-sections —4— and —5—. A bushing —35— is screwed into the lower reduced end of the cap section —4— and is provided with vertical air passages —36— and a socket —37— for receiving a ball —38— on the lower end of the valve stem —39—. The upper end of this valve stem —39— is semi spherical and is adapted to engage the concave valve seat —40— in a bushing —41— which is secured to a flexible diaphragm —42—. This diaphragm is preferably circular in top plan, and is seated upon the upwardly flaring end of the cap-section —4—, and is held in place by a circular metal disk or plate —43— and the upper cap section —5—.

The peripheries of the diaphragm —42— and plate —43— are, clamped between the cap sections —4— and —5—, leaving the central portion of the diaphragm to be moved vertically by the varying air pressures above and beneath the same, the disk —43— serving as a reinforcement to prevent undue buckling or upward movement of the diaphragm, and is provided with a series of apertures —45— therethrough to prevent the formation of an air cushion or partial vacuum between the diaphragm and disk which might interfere with the free action of the diaphragm. The bushing —41— moves with the diaphragm and is formed with a vent opening —46— leading from the valve seat —40—.

The disk —43— is provided with a central threaded aperture in which is movable a screw threaded bushing —47— having a central air passage —48— and lateral air passages —49— leading from the central passage —48— and communicating with the space between the upper cap section —5— and disk

—43— to permit the escape of air from the interior of the shell to atmosphere when the valves —26— and 39— are open.

The upper end of the bushing —47— is provided with an annular flange —49′— fitting in the annular grooves —50— in the cap section —5— so as to hold the bushing —47— against axial movement while it is being rotated to adjust the center of the disk —43—, said bushing being provided with a central angular socket —51— for receiving a suitable adjusting tool, not shown. The bushing —35— is also provided with a transverse slot —56— for receiving a suitable adjusting tool, as a screw driver, not shown, but by which the bushing —35— may be adjusted to move the valve —39— toward and from its seat —40— in the diaphragm —42—. This valve —39— is adjusted so that when the pressure on the opposite sides of the diaphragm is equal the valve seat —40— is engaged with the upper spherical end of the valve —39—, thereby closing communication between the system and atmosphere and preventing reëntrance of the air to said system.

When in action, to permit the escape of air from the system, the bushing —47— is adjusted to leave a slight separation or space between its lower end and the upper face of the diaphragm, or rather the upper face of the bushing —41— to allow a limited vertical movement or play of the diaphragm under unequal pressures on its opposite faces to unseat the valve —39— from its seat —40— thereby allowing the escape of the air from the system through the passages —46— and —48— to the atmosphere, or until the passage —23— is closed by the valve —26— under the action of the float —10—.

In operation, assuming that the float —10— is balanced in the water of condensation in the well 12′— with its lower end in close proximity to or engaging the limiting stop —9— and the valve —26— has opened or separated from its seat —25— and that the diaphragm —42— is depressed to engage its seat —40— with the valve —39— thereby closing the passage —46— against the reëntrance of air into the system—then as soon as the inlet of the radiator to which the air valve is attached is opened, the air will be forced through the upper side of the inlet —11— above the partition —13— and will find exit through the ports —3′— into the shell —2—, and thence, outwardly through the open passages —23— and —36— and will exert a lifting pressure upon the comparatively large area of the diaphragm —42— sufficient to elevate it and its seat —40— from the valve —39—, thereby opening a vent through the passages —46— and —48— to atmosphere. As soon as the air is practically all expelled from the system the steam enters the inlet —11— above the partition —13— into the compartment —19— surrounding the tubular section —3— and will escape through the ports 3′— into the section —2— surrounding the upper portion of the float —10—. The water of condensation which accumulates in the well —12′— surrounding the lower portion of the float —10— causes the air to be trapped in the upper portion of the float above the water inlet —44— in one side of said float. This water in the well 12′— and the trapped air in the upper part of the float —10— is immediately expanded upon the entrance of the heating agent, as steam, causing the float to instantly rise and close its valve —26— against its seat —25—, thereby cutting off the escape of the steam through the passage —23— to atmosphere, and relieving in a measure, the upward lift upon the diaphragm —42—, which latter immediately recedes and closes its seat —40— upon the valve —39— to prevent any possibility of reëntrance of air into the chamber. The excess water of condensation accumulating in the well 12 is forced backward into the system through the inlet —11— below the partition —13— in the manner previously described, and it is obvious that this backfall of the water of condensation into the system when the valve —39— is closed against its seat —40— causes a partial vacuum in the valve casing, which in turn, causes a recession or drop of the float —10—, thereby opening the valve —26— from its seat —25—. This partial vacuum keeps the heating agent in the upper part of the system, or nearest the air vent so that when the steam is again turned on to cause an upward pressure upon the diaphragm, the operation of permitting the escape of air is repeated.

The inlet of the steam to the radiating system is usually controlled by valves in close proximity to the radiator, but I have found that by making the bushing or plate —43— adjustable so that one of the parts may be forced downwardly upon the diaphragm —42—, the seat —40— may be firmly held against the valve —39—, thereby not only preventing reëntrance of air to the system, but also preventing the escape of the cold air therefrom. It is clearly obvious that under these conditions an air cushion is formed between the system and atmosphere which cannot be displaced, and therefore, operates to hold back the heating agent from advancing through the radiator. On the other hand, as soon as the bushing —47— is readjusted to permit the uplift of the diaphragm —42— to raise the valve seat —40— from the valve —39— the cold air may immediately escape and allow the heating agent to advance into the system, as previously described.

In Figs. 1 and 2 I have shown the threaded inlet nipple as screwed into a portion of a radiator —*a*— and as provided with a lock nut —*b*— having a recess —*c*— in which is fitted a packing or gasket —*d*—, the lock nut serving to clamp the air valve casing against turning in the radiator and the packing serving to prevent leakage of water or steam.

What I claim is:

1. In an air valve for radiators, a shell having an inlet opening and a vent opening and provided with a float chamber closed at the bottom and having a passage through one side above the inlet and communicating therewith whereby a well is formed in the bottom of the float chamber, a valve for the vent opening, and a hollow float for actuating said valve, said float having a closed bottom and a transverse partition above the bottom and also provided with an opening in one side below the passage in the float chamber and above the partition.

2. In an air valve for radiators, a shell having a float chamber and an additional chamber surrounding the lower portion of the float chamber, said shell having an inlet and an air vent, the inlet communicating with the additional chamber, the air vent leading from the float chamber, said shell also having a passage connecting said chambers above the inlet, a valve for the vent opening, and a float for actuating said valve, said float having a transverse partition dividing it into upper and lower compartments, the upper compartment having a lateral opening communicating with the float chamber.

3. In an air valve for radiators, a shell having an inlet and an air vent, a valve for the air vent, and a hollow float for actuating the valve, said float having a partition dividing its interior into lower and upper compartments, the lower compartment being air tight and the upper compartment having a lateral passage opening into the interior of the shell.

4. In an air valve for radiators, a shell having an inlet and an air vent, a valve for the air vent, and a hollow float for actuating the valve, said float having its lower and upper ends closed and its intermediate portion formed with a lateral passage opening into the interior of the shell and a transverse partition in the float below said passage and dividing the interior of the float into lower and upper compartments.

5. In an air valve for radiators, a shell having outer and inner tubular sections, the inner section being united at its top and bottom, the outer section forming with the outer shell an intervening space, the outer shell having an inlet communicating with said space, a partition dividing said space into lower and upper compartments and extending into the inlet, said partition having openings therethrough connecting said compartments to permit the water of condensation to collect and return to the radiator below the partition, the inner tubular section having a well extending above and beneath the plane of the inlet and having an opening communicating with the upper compartment to determine the level of the water in the well, a heat actuated float dipping in the well, and a valve for the air vent actuated by the float.

6. In an air valve for radiators, a shell having an inlet and an air vent, the inlet communicating with the interior of the shell above its bottom forming a well, said shell having outer and inner tubes, the inner tube being united at the top and bottom to the outer tube forming an intervening space, and also forming a well within the inner tube, a partition dividing said space into lower and upper compartments both communicating with the inlet, said inner tube having an opening in one side above the partition and determining the level of the water in the inner well, a float dipping in the inner well, and a valve for the air vent actuated by the float, said float being actuated by the heat of the heating agent.

7. In an air valve for radiators, a shell having an inlet in one side and an adjustable bushing in its top provided with an air vent, a valve for the air vent, a float for actuating the valve, a cap secured to the top of the shell and provided with an air vent, a diaphragm secured in the cap and having an air vent, a valve at the under side of the diaphragm coacting with said vent to allow the escape of air and prevent its reëntrance into the shell, and adjustable means above the diaphragm for limiting its upward movement.

8. In an air valve for radiators, a shell having an air vent opening in its top, a cap secured to the top of the shell and provided with an air vent, a diaphragm in the cap having an air vent, an adjustable bushing in the base of the cap having an air passage therein, a valve seated in said bushing and coacting with the lower end of the vent in the diaphragm to permit the escape of air and prevent its reëntrance into the shell, and a perforated plate across the upper side of and in close proximity to the diaphragm.

9. In an air valve for radiators, a shell having an air vent opening in its top, a cap secured to the top of the shell and provided with an air vent, a diaphragm in the cap having an air vent, an adjustable bushing in the base of the cap having air passages therein, a valve seated in said bushing and coacting with the lower end of the vent in the diaphragm to permit the escape of air and prevent its reëntrance into the shell, and a perforated plate across the upper side of and in close proximity to the diaphragm, and means for adjusting said perforated plate toward and from the diaphragm.

10. In an air valve for radiators, a shell having an air vent in its top, a cap secured to the top of the shell and provided with an air vent, a bushing adjustable in the base of the cap and provided with air passages therein, a valve connected by a universal joint to said bushing, a diaphragm in the cap having an air vent coacting with the valve to allow the escape of air and prevent its reëntrance into the shell, and a perforated plate extending across the upper side of the diaphragm, said cap and parts mounted therein being movable relatively to the shell.

11. In an air valve for radiators, a shell having an inner chamber and an outer chamber, the outer chamber having an inlet above its bottom forming a well, the inner chamber having a vent opening in its top, said outer chamber having an over-flow passage above the inlet forming a well in the inner chamber, a float in the inner chamber, and a valve for the air vent controlled by said float.

12. An air valve for radiators comprising a shell having an inlet and an air passage, the inlet communicating with the interior of the shell above its bottom forming a well, a float having a closed air chamber in its lower end dipping in the well, said float being closed at the top and having a water inlet just above the closed air chamber communicating with the well, whereby the inflowing water traps the air in the upper part of the float, a valve actuated by the float and controlling the passage of air through said passage, a cap on the shell inclosing said passage and provided with an air vent, a movable diaphragm in the cap between the air vent and passage, and provided with an opening therethrough, a second valve seated in said opening, and means for adjusting the second valve.

13. In an air valve for radiators, a shell having inner and outer chambers closed at the bottom, the outer chamber having an inlet above the bottom forming a well therein, said chambers being connected by an overflow passage above the inlet forming a well in the inner chamber of greater depth than that of the outer chamber, and a hollow float in the inner chamber having a closed bottom, and an opening in one side below the plane of the over-flow passage, said float having a transverse partition below its opening and dividing the interior of the float into lower and upper compartments.

14. In an air valve for radiators, a shell having an inner chamber and an outer chamber, the outer chamber having an inlet above its bottom forming a well, said chambers being connected by an over-flow passage above the inlet, and a transverse partition dividing the outer chamber into upper and lower compartments and extending into the inlet, said partition being provided with an opening connecting said compartments.

In witness whereof I have hereunto set my hand this 12th day of October 1906.

THOMAS WHEATLEY.

Witnesses:

H. E. CHASE,

M. M. NOTT.