No. 782,328. PATENTED FEB. 14, 1905.

A. E. DURAM.

# VACUUM AIR VALVE FOR RADIATORS, &c.

APPLICATION FILED MAR. 23, 1904.

*Fig. 1.*

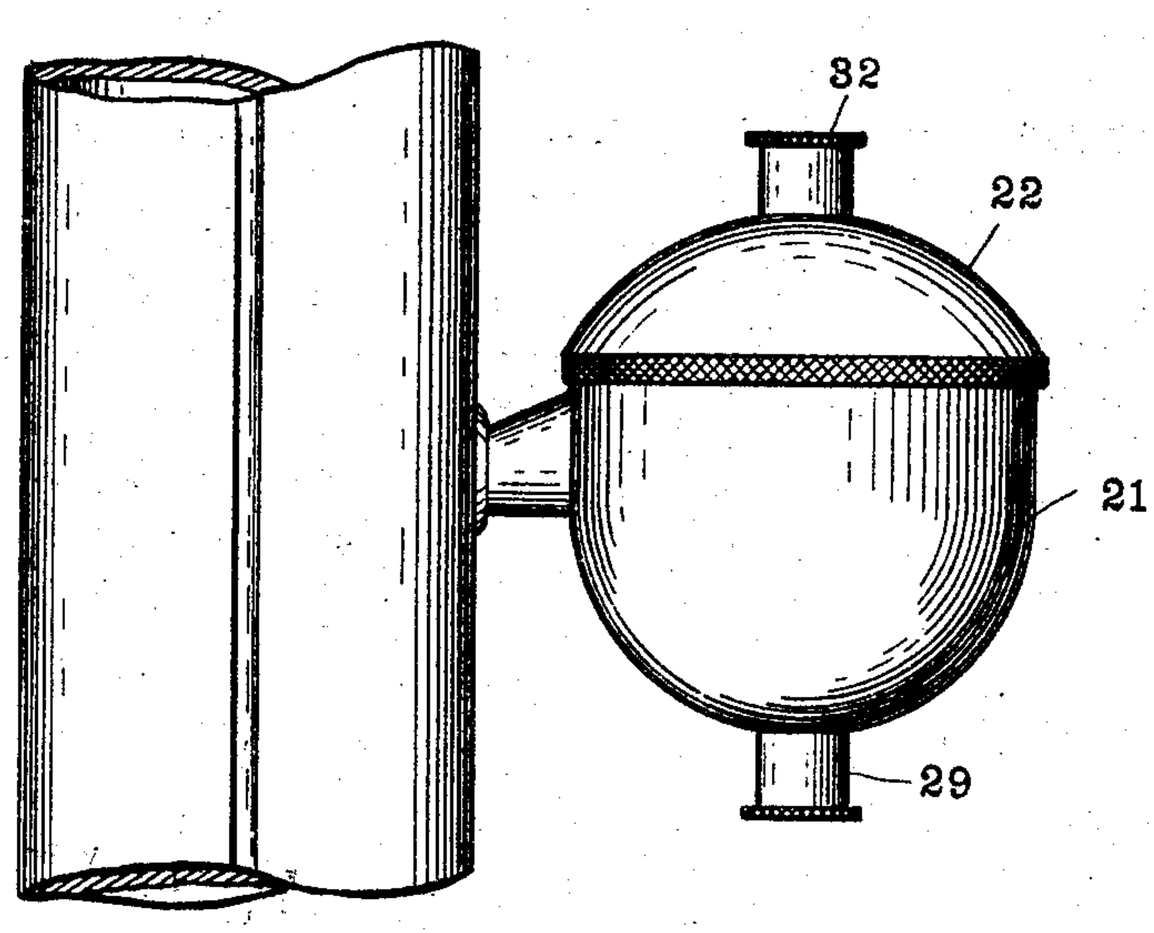



*Fig. 2.*

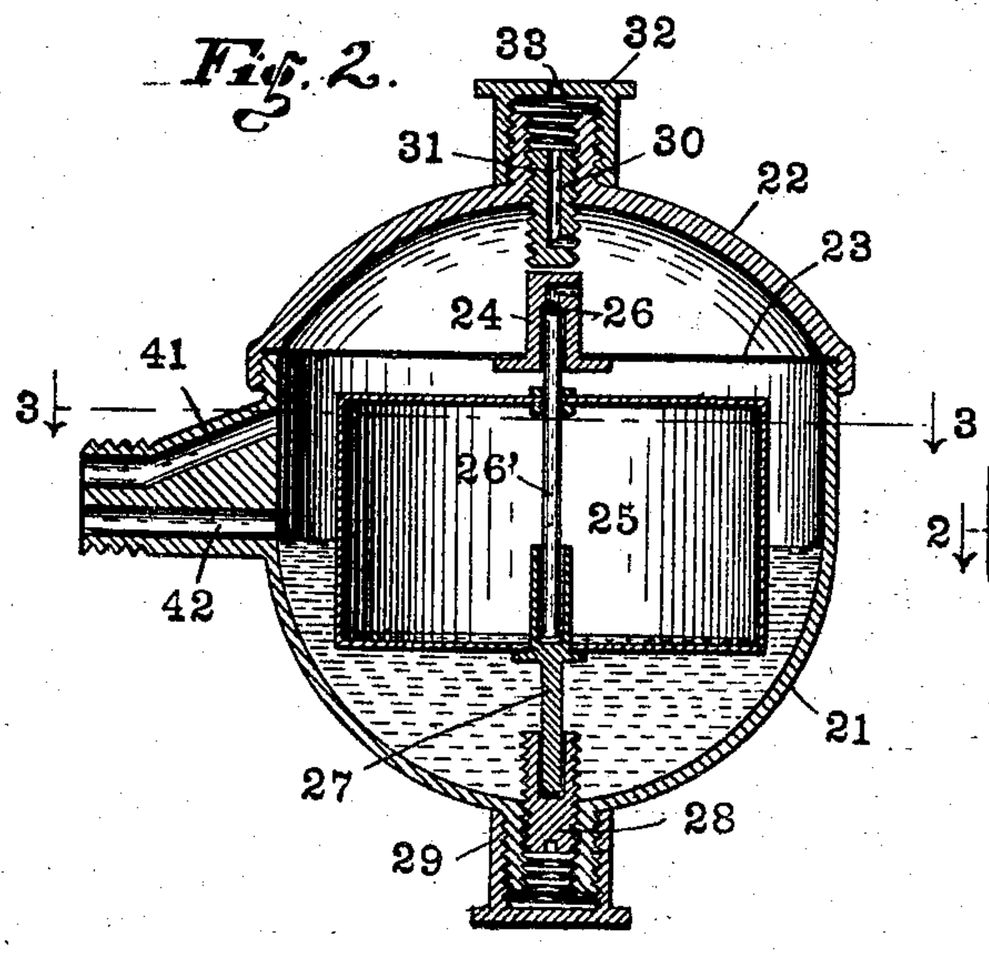
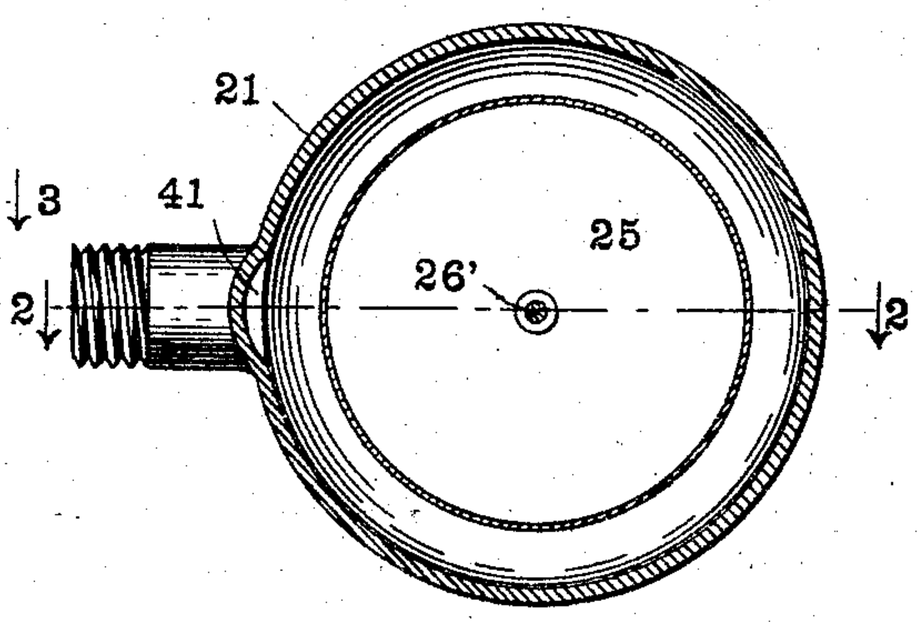



*Fig. 3.*

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No. 782,328. Patented February 14, 1905.

# UNITED STATES PATENT OFFICE.

ARTHUR E. DURAM, OF INDIANAPOLIS, INDIANA.

## VACUUM AIR-VALVE FOR RADIATORS, &c.

SPECIFICATION forming part of Letters Patent No. 782,328, dated February 14, 1905.

Application filed March 23, 1904. Serial No. 199,552.

*To all whom it may concern:*

Be it known that I, ARTHUR E. DURAM, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Vacuum Air-Valves for Radiators, &c., of which the following is a specification.

It is necessary (as is well known) to provide means for permitting the escape of air from heating-radiators in order that the heating fluid may enter the radiator freely and efficiently. It is also desirable that the valve through which the air escapes should automatically close as soon as the heating fluid has filled the radiator. It is further desirable to prevent so far as possible the return of air through the valve into the radiator when the heating fluid (as steam) is shut off in order that as nearly as possible a vacuum may be created, and that therefore the heating agent when turned on again shall have as little work as possible to do in expelling air before filling the radiator.

It is the object of my invention to produce an air-valve by means of which the results above indicated may be efficiently accomplished.

Referring to the accompanying drawings, which are made a part hereof, and on which similar reference characters indicate similar parts, Figure 1 is an elevation of an air-valve and a fragment of a radiator-section to which the same is attached, said air-valve being of a form suitable to embody my invention; Fig. 2, a central vertical sectional view on a somewhat-enlarged scale of such a valve separately at the point indicated by the dotted line 2 2 in Fig. 3, and Fig. 3 a horizontal sectional view as seen when looking downwardly from the dotted line 3 3 in Fig. 2.

The body of my improved valve is preferably a substantially semispherical shell 21, upon which is placed a suitable cap 22. Between the body and the cap I secure a flexible diaphragm 23, which divides the interior of the valve into two chambers. Secured to the diaphragm at a central point is a tubular member 24, containing a valve-seat. Below said diaphragm is an expanding device 25, which carries the valve 26 (which is preferably in the form of a needle-valve) and which and its stem 26′ may preferably be formed from a piece of small wire or rod.

The expanding member 25 has a stem 27, which extends down toward an adjustable support 28 and preferably into a longitudinal perforation in said support, and is thus held to a central position in the main chamber of the valve and guided in its vertical movement. Said expanding member is in the form of a tight drum having imperforate walls. The stem 26′ of the valve 26 extends down through the head of said drum, to which it is attached, to a point closely adjacent to the opposite head and at a point immediately above the support 27, so that when pressure is exerted upon the diaphragm from the upper side the structure 24, containing the valve-seat, will be supported rigidly from the support 28, and crushing or collapsing of the expandible member 25 thus prevented. The stem 27 is shown as prolonged up into the chamber of the drum and as containing a longitudinal perforation which is adapted to serve as a guide for the stem 26′. The base or support 28 is in the form of a screw-plug inserted into the body of the valve from below, and is preferably inclosed by a cap 29. When it is desired to adjust the position of these parts, the cap 29 is taken off and the screw-plug turned by means of a screw-driver, as will be readily understood, until the exact adjustment desired is obtained. At the opposite side of the valve is another screw-plug 30, which is directly above and in line with the structure 24 and which also contains a passage-way leading from the chamber above the diaphragm to the outside of the valve. I prefer also to inclose this with a cap 32, both for appearance and protection; but said cap when used is provided with a perforation 33, which forms the termination of the passage-way. The screw-plug 30 may be adjusted as desired and forms (in addition to its other functions) a stop limiting the movement in this direction of the part 24 and the diaphragm 23 to which it is attached.

As has already been stated, the interior of my improved valve is divided into two cham-

bers by means of the diaphragm 23, and there is a passage-way (containing a valve) from the lower chamber to the upper through the structure 24 and also a passage-way from the upper chamber to the outside through the plug 30. Both of these passages, as shown in Fig. 2, are L-shaped, so that there is no direct passage from the lower chamber to the outer air, and consequently the possibility of small jets of water being thrown out into the room through this valve in case of the sudden admission of steam to the valve (which is an objection in many forms of valves) is completely avoided and any such water will be retained in the upper chamber; but the slight amount of water which may thus be forced into the upper chamber will not remain there long, as it will speedily be vaporized by the heat of the steam which comes against the under side of said diaphragm.

The two passage-ways 41 and 42 insure comparatively dry steam (where steam is the heating fluid employed) within that portion of the main valve-chamber which is below the diaphragm and above the level of the passage-way 42. The parts are so arranged that the drum 25 will float at exactly the proper point for ordinary operation upon the water which the lower portion of said chamber below the level of said passage-way 42 contains, and this water is always maintained at this level by the condensation of the steam, which after this space is filled will ordinarily flow out through said passage 42. When, however, (because of mismanagement of the valves of the heating system or otherwise) there is an inflow of water into the valve under pressure, so that the level thereof is raised above the level of the passage 42, the buoyancy of the drum 25 will carry the valve 26 up into contact with its seat and prevent the escape of any such water through the valve, and when normal conditions are restored and the surplus water runs off the drum will return to its normal position, opening the valve and permitting the escape of air in the manner elsewhere stated.

In order to obtain the best results, I find it desirable to place within the drum 25 some expanding medium which will operate under the heat of the steam to expand the opposite heads of the drum, and thus close the valve 26, as elsewhere stated. For example, alcohol, which vaporizes at 170° (while steam is produced from water at 212°) and which in vapor form expands to about fifteen hundred times its liquid bulk, serves the purpose admirably. In an actual test in a full-sized valve I have used sixty drops of alcohol in one of these drums with excellent results.

The operation of my improved valve is as follows: The heating fluid enters through one or both the orifices 41 42 from the radiator, and as soon as the cold air has been expelled the heat will operate upon the expanding member 25 and cause it to expand, raising the needle-valve 26 and closing the valve. The diaphragm 23 will yield slightly under the pressure from the valve occasioned by the raising of the expanding member, but the upward movement is quickly stopped when the part 24 comes in contact with the screw-plug 30. This movement, however, does not take place until the cold air has been expelled and the temperature is raised, as stated. When the heating fluid is shut off from the radiator and the radiator cools down, the tendency of the air is to rush in through the orifice 31 and fill the vacuum which is thus being formed; but the pressure of the air from the outside defeats this purpose, as it creates a pressure upon the upper side of the diaphragm 23, and thus forces it downwardly, carrying the valve-seat in the part 24 tightly against the upper end of the valve 26, thus preventing any appreciable flow of air back into the radiator, as the parts will cool sufficiently to permit this movement almost immediately after the heating fluid has been shut off. A vacuum is therefore created in the radiator instead of its becoming filled with air, and when the heating fluid is turned on again it enters the radiator much more easily and quickly. The pressure within the drum 25 caused by the expanding medium therein will hold the valve 26 closed until the balance-point of pressure between the steam on the under side of the diaphragm and the outer pressure of the air is passed, and when the pressure of the expanding medium yields the pressure of the outer air immediately forces the diaphragm down, causing it to follow the valve in its descent. The pressure upon the outside rapidly increases as the vacuum is formed in the radiator and very shortly the walls of the drum 25 become compressed, and if it were not for the central post or stem 26′ extending from the valve 26 to a support below said drum would be crushed or would collapse. The supports provided, however, withstand the pressure, and the integrity of the parts is maintained, as will be readily understood.

Various changes in construction may be made without departing from my invention, and I therefore do not desire to be understood as limiting myself to the construction shown, but may vary the same as I may find expedient.

Having thus fully described my said invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, in an air-valve, of two chambers separated by a diaphragm, one of said chambers having communication with the radiator, a buoyant expanding member in the said chamber, and a valve and a valve-seat carried by said diaphragm and said expanding member.

2. The combination, in an air-valve, of the casing, a diaphragm separating the interior of

said casing into two chambers, one of which chambers communicates by means of passage-ways with the radiator and the other of which has a passage-way leading to the outer air, a diaphragm between the two chambers, a valve member forming a communication between the two chambers and carried by the diaphragm, a buoyant expanding coöperating valve member arranged in the lower chamber, and an adjustable stop above the diaphragm by which its movement is limited.

3. The combination, with a radiator, of an air-valve having a chamber, two passage-ways one higher than the other leading from the radiator to said chamber, a diaphragm within the chamber carrying one valve member, an expanding device consisting of a hollow drum and carrying the other valve member, said expanding device being buoyant and capable of floating on the liquid within the main chamber in the valve structure below the lower passage-way leading to the radiator.

4. A valve structure consisting of, a main body divided into two portions by means of a diaphragm, a passage forming a communication from one chamber to the other through the diaphragm, a coöperating valve member arranged in one of said chambers, and a buoyant expansible member acting upon said valve member.

In witness whereof I have hereunto set my hand and seal, at Indianapolis, Indiana, this 19th day of March, A. D. 1904.

ARTHUR E. DURAM. [L. S.]

Witnesses:
CHESTER BRADFORD,
JAMES A. WALSH.