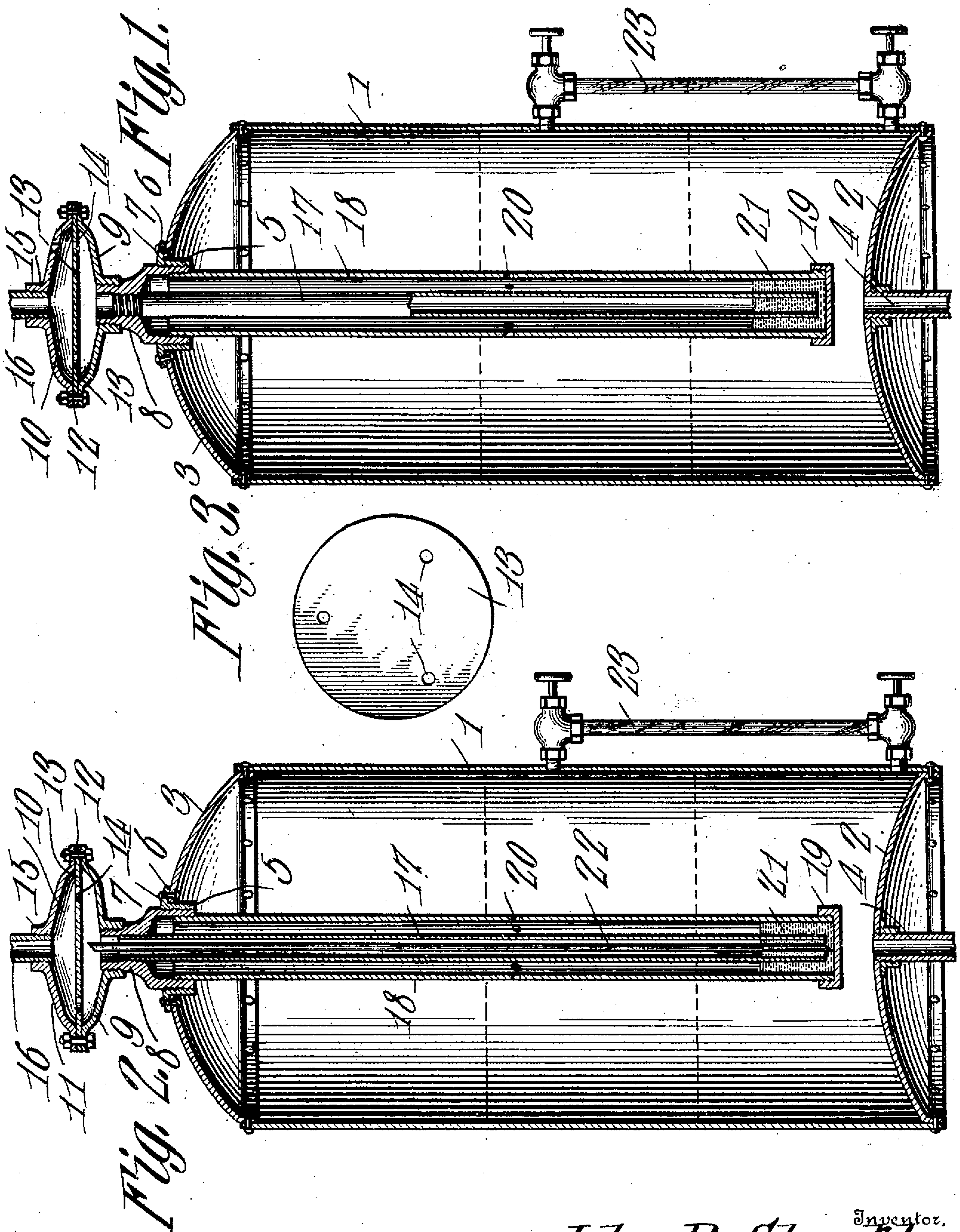
J. R. SHANKLIN.

EXPANSION TANK.

APPLICATION FILED JAN. 16, 1908.

920,672. Patented May 4, 1909.



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JOHN RICHARD SHANKLIN, OF CHARLESTON, WEST VIRGINIA.

EXPANSION-TANK.

No. 920,672. Specification of Letters Patent. Patented May 4, 1909.

Application filed January 16, 1908. Serial No. 411,200.

To all whom it may concern:

Be it known that I, JOHN RICHARD SHANKLIN, a citizen of the United States, residing at Charleston, in the county of Kanawha and State of West Virginia, have invented a new and useful Expansion-Tank, of which the following is a specification.

This invention relates to expansion tanks for hot water heating systems.

As is well known, there are two styles or characters of hot water heating systems in use, known, respectively, as closed systems and open systems, the two being differentiated by the fact that the former includes a safety valve to increase the pressure in the system, and to obviate danger of explosion when the pressure reaches the danger limit, and that the latter includes an open expansion tank in order to prevent the generation of undue pressure in the system. The closed system has a decided advantage over the open system from the fact that greater pressure can be secured and maintained, and thus more rapid circulation with enhanced heating capacity, but, owing to the liability of the safety valve to stick and thus fail to relieve pressure when the danger point is reached, this system has not been adopted to any very great extent.

It is the object of the present invention, in a novel and practical manner with perfect safety from explosions, to secure a greater pressure in a hot water heating system than that produced by gravity, or the weight of the water in the system, whereby more rapid circulation will result, with a corresponding increase in the radiation of heat. Furthermore, to render it possible, without any change in the system, to increase or diminish the pressure therein whereby to adapt it to meet the requirements of any locality in which it may be installed, whether such locality be subjected to extreme cold, moderate cold, or to relatively mild weather. Furthermore, to secure the above objects without necessitating any change in the existing arrangements of hot water heating systems.

With the above and other objects in view, as will appear as the nature of the invention is better understood, the same consists, generally stated, in a closed steam and water tight expansion tank depending from the top of which is a novel form of pressure regulator or safety valve comprising an influent tube sealed at its upper and lower ends and provided at an intermediate point with a plurality of orifices, and an effluent tube disposed preferably concentric of the influent tube and having its ends open, the lower end being terminated adjacent to the like end of the influent tube and its upper end being connected with a separating chamber including a perforated deflecting plate. The influent tube will contain a body of mercury which forms a seal for the lower end of the effluent tube, and the pressure in the system will be directly proportionate to the resistance to lifting presented by the mercury, as before the water or air, or both can escape from the expansion chamber, it will be necessary for the water followed by the air in the tank to lift the column of mercury upward into the separating chamber where the air and water separate from the mercury, and the former escapes through a suitable overflow or escape pipe and the latter returns to the lower end of the influent tube again to seal the effluent tube. As will be obvious, by augmenting the volume of the mercury, the pressure in the system can be increased, and, by decreasing its volume, the pressure will be diminished.

As a matter of further and specific improvement, and to secure increased pressure in the system without augmenting the volume of mercury, a liquid dividing member may be employed, in the nature of a tube, which will be disposed within the effluent tube and will operate to reduce its internal diameter and also to present an additional path of escape for the water and mercury from the seal upward to the separating chamber.

A further feature of the invention resides in the fact that by employing a hermetically sealed expansion tank and by disposing the outlet opening in the influent tube intermediate of its ends, there is provided a compressed air space above the level of the water in the tank, and the air thus confined will operate to check the expansion of the water until its pressure is sufficient to lift the mercury from the seal to the separating chamber. In addition, the compressed air operates to retain a pressure in the system for a greater length of time than could otherwise result, thereby materially augmenting the circulation of the water through the system.

The invention consists further in the various novel features of construction and combination and novel arrangement of parts of an expansion chamber for hot water heating systems, as will be hereinafter fully described and claimed.

In the accompanying drawings forming a part of this specification, and in which like characters of reference indicate corresponding parts, Figure 1 is a view in vertical section through an expansion chamber constructed in accordance with the present invention. Fig. 2 is a similar view of a slightly modified form. Fig. 3 is a plan view of a diaphragm used in connection with the apparatus.

Referring to the drawings, 1 designates the shell or body of the expansion chamber, 2 the bottom, and 3 the top thereof. These parts will be made preferably of galvanized boiler iron, and the chamber as a whole is constructed as an ordinary domestic range boiler The bottom 2 has connected with it an expansion pipe 4 that connects with the return pipe or with the heater in the basement of the building in which the tank is installed. The top 3 is provided at its center with an orifice through which projects an interiorly threaded nipple 5 provided with a flange 6 that bears upon the outer face of the top and is held assembled therewith by rivets 7. The nipple is engaged by a union 8 which is provided with exterior threads for the purpose, and the upper end of the union is reduced and exteriorly threaded and is engaged by the lower member 9 of a separating chamber, designated generally 10, the upper member 11 of which is connected with the member 9 by bolts or rivets 12 that pass through marginal flanges provided on the two members for the purpose. The flanges serve to hold in position a deflecting plate or diaphragm 13, which is constructed of a sheet of metal and is provided with any desired number of orifices 14, three being shown in this instance, which are preferably equally spaced and disposed adjacent to the walls of the chamber members or shells 9 and 11. The member 11 is provided with an upstanding interiorly threaded boss 15, that is disposed centrally thereof and is engaged by an ordinary overflow pipe 16.

The neck portion of the union is interiorly threaded, and is engaged by the upper threaded end of a tube 17, while that portion of the union that engages with the nipple 5 is interiorly threaded and is engaged by the upper threaded end of a tube 18, the lower end of which is hermetically sealed by a cap 19 held in place on the tube preferably by a threaded connection therewith. The tube 18 is provided at any desired point intermediate of its ends with a plurality of circumferentially alined orifices 20 that serve to establish communication between the interior of the tank and the tube. As clearly shown in Figs. 1 and 2, the tube 17 terminates short of the cap 19, and the lower end of the tube 18 is filled with a column of mercury 21, the volume of which will depend upon the pressure it is desired to maintain within the system.

As will be readily understood, the air and water in the tank pass through the outlet orifices 20 into the interior of the tube 18, which constitutes the latter an influent tube, and that the mercury, air and water pass upward through the tube 17 to the separating chamber, thereby constituting the latter tube an effluent tube, and these two tubes, in conjunction with the cap 19 and column of mercury 21, constitute the parts of a safety valve of which the mercury is the valve.

As will be obvious, the pressure in the system may be increased or diminished by varying the volume or bulk of the mercury; but, should it be desired to increase the pressure without adding to the mercury, the arrangement shown in Fig. 2 is employed. This consists of a tube 22, which is loosely disposed within the effluent tube 17, and has its ends oppositely beveled, in order to insure passage therethrough. The tube is somewhat less in length than the distance between the cap 19 and the deflecting plate, and rests upon the former, but is out of contact with the latter. Owing to the fact that a part of the mercury, air and water will pass through the tube 22, this constitutes the element a liquid dividing member, and, as will be perfectly obvious, the increased resistance presented to the passage of the mercury, air and water exteriorly and interiorly of the tube 22 will be equivalent to increasing the bulk of the mercury. In order to determine the level of the water in the tank at a glance, an ordinary glass gage 23 is employed.

The operation of the tank is as follows: So long as the pressure within the system is normal, the water in the tank will be below the outlet openings 20, but as soon as the pressure increases, the water will naturally expand and approach the openings, but will be retarded or held in check by the air in the tank above the water, thereby maintaining a relatively high pressure on the system with increased heat and circulation. Should the pressure reach a point that might be dangerous, the water will be forced through the openings 20 and in conjunction with the air will act upon the column of water already within the influent tube 18, and this pressure will gradually be exerted upon the mercury or safety valve 21, which will be forced upward through the effluent tube, and as soon as it enters the separating chamber, the water and air separate from the mercury, and the former escapes out through the openings 14 of the deflecting plate to the overflow pipe 16, and the latter returns to the lower end of the influent tube, and again establishes the seal.

As will be obvious, owing to the inherent property of the mercury to remain liquid under all normal conditions, it will be positive in operating at all times, so that any danger of excessive or dangerous pressure in the system will be positively precluded. It will also be obvious that as the mercury will not evaporate from the action of the water or heat, its use will continue indefinitely, in fact, as long as the expansion tank will last.

I claim:—

1. The combination with a closed expansion tank adapted for use in hot water heating systems, of a terminally sealed tube depending from the top thereof and communicating intermediate of its ends with the tank, a separating chamber supported by the tank, a second tube arranged within the first named tube and communicating at its upper end with the separating chamber and terminating short of the lower end of the outer tube, and a body of mercury in the outer tube for sealing the lower end of the inner tube.

2. The combination with a closed expansion tank adapted for use in hot water heating systems, of a safety valve arranged therein and embodying an influent tube having its terminals sealed and provided intermediate of its ends with outlet openings, an effluent tube arranged within the first-named tube and terminating short of the bottom thereof, a column of mercury normally sealing the lower end of the effluent tube, and means for varying the resistance to the lifting of the mercury, whereby to increase or diminish the pressure in the system employing the tank.

3. The combination with a closed expansion tank adapted for use in hot water heating systems, of a safety valve arranged therein and embodying an influent tube having its terminals sealed and provided intermediate of its ends with openings, an effluent tube arranged within the first-named tube and terminating short of the bottom thereof, means for dividing the column of liquid in the effluent tube, and a body of mercury normally sealing the lower end of the last-named tube.

4. The combination with a closed expansion tank adapted for use in hot water heating systems, of a safety valve arranged therein and embodying an influent tube having its terminals sealed and provided intermediate of its ends with openings, an effluent tube arranged within the first-named tube and terminating short of the bottom thereof, a liquid dividing tube disposed within the effluent tube, and a body of mercury normally sealing the lower end of the last-named tube.

5. The combination with a closed expansion tank adapted for use in hot water heating systems, of a safety valve arranged therein and embodying an influent tube having its terminals sealed and provided intermediate of its ends below the top of the chamber with outlet openings whereby to provide a compressed air space above the level of the liquid of the expansion tank, an effluent tube arranged within the first-named tube and terminating short of the bottom thereof, and a body of mercury normally sealing the lower end of the effluent tube.

6. The combination with a closed expansion tank adapted for use in hot water heating systems, of a separating chamber carried thereby, an influent tube sealed at its terminals and arranged within the tank and provided intermediate its ends with outlet openings, an effluent tube arranged within the first-named tube and communicating at its upper end with the separating chamber and terminating at its lower end short of the like end of the influent tube, and, a safety valve, consisting of a body of mercury, for sealing the lower end of the effluent tube.

7. The combination with a closed expansion tank adapted for use in hot water heating systems, of a separating chamber carried thereby and including a perforated deflecting plate, an influent tube sealed at its terminals and arranged within the tank and provided intermediate of its ends with outlet openings, an effluent tube arranged within the first-named tube and communicating at its upper end with the separating chamber beneath the deflecting plate and terminating at its lower end short of the like end of the influent tube, and a safety valve, consisting of a column of mercury, for sealing the lower end of the effluent tube.

8. The combination with a closed expansion tank adapted for use in hot water heating systems, of a safety valve arranged therein and embodying an influent tube having its terminals sealed and provided intermediate of its ends with openings, an effluent tube arranged within the first-named tube and terminating short of the bottom thereof, a liquid dividing tube disposed within the effluent tube and having its terminals oppositely beveled, and a body of mercury normally sealing the lower end of the last-named tube.

9. The combination with a closed expansion tank adapted for use in hot water heating systems, of a safety valve arranged therein and comprising a terminally sealed tube depending from the top of the tank and provided intermediate of its ends with openings, that portion of the tank below the openings constituting a water chamber

and that portion above the openings constituting a compressed air chamber, a second tube arranged within the first-named tube and terminating short of the bottom of the latter, and a body of mercury for sealing the lower end of the second tube.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

JOHN RICHARD SHANKLIN.

Witnesses:
GEORGE D. HOFFMAN,
FRANK S. APPLEMAN.