T. G. MOUAT.

VAPOR HEATING SYSTEM.

APPLICATION FILED SEPT. 28, 1918.

1,404,995. Patented Jan. 31, 1922.

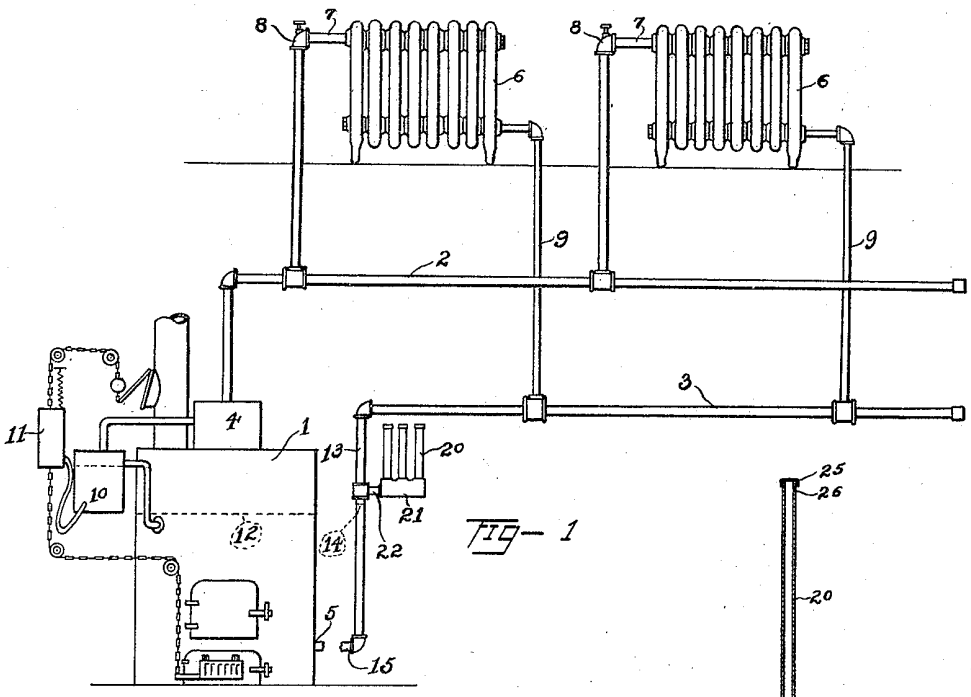

Fig- 1

Fig-4

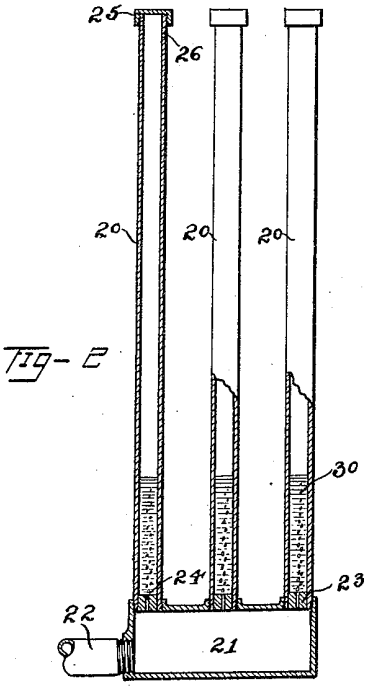

Fig- 2

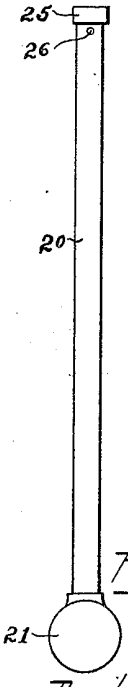

Fig-3

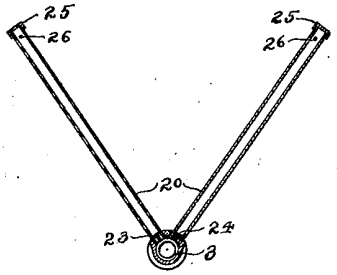

Fig-5

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VAPOR HEATING SYSTEM.

1,404,995. Specification of Letters Patent. Patented Jan. 31, 1922.

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To all whom it may concern:

Be it known that I, THOMAS G. MOUAT, a citizen of the United States, residing at Bratenahl, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Vapor Heating Systems, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to steam heating systems and has special reference to systems of the low-pressure or so-called "vapor" type, and the objects of the invention are the provision of means for discharging automatically the air contained in the radiators or other parts of the system, while safeguarding against the escape of water from the system, either in the shape of vapor or liquid, so as both to dispense with the necessity of frequently filling the boiler and to avoid the danger of injury to things surrounding.

In the drawings accompanying and forming a part of this application, I have illustrated my improved air-escape fitting, both by itself and in conjunction with a complete vapor-heating system; although it will be understood that the particular constructions and designs which are here illustrated are only a few of a large number wherein my invention my be embodied. In these drawings Fig. 1 illustrates a complete heating system embodying my improvement; Fig. 2 represents a vertical sectional view through my improved air escape fitting; Fig. 3 is a right hand elevation of the fitting shown in Fig. 2; and Figs. 4 and 5 illustrate modified constructions and arrangements.

Describing the parts by reference characters, 1 represents the boiler which may be of any suitable type, 2 represents the steam-main, and 3 represents the return main. The steam-main 2 leads from a riser, dome, header, or other steam-space represented at 4, as is customary in devices of this character, and the return main 3 is depressed so as to reenter the boiler at some point 5 well below the water line. The radiating devices, here represented by the radiators 6—6, are connected in parallel between the mains 2 and 3. These may extend to any number within the capacity of the boiler, and will seldom be so few as two, although I have chosen this number for illustration believing that the same is sufficient for purposes of disclosure. These radiators may be of any suitable or desired type, and my invention is largely independent of the mode of connecting these radiators to the mains, although it is decidedly preferable to connect the steam-main 2 to the upper part of the radiators as shown at 7—7, and to provide each radiator at that point with an adjustable valve 8. The return pipes 9 lead from the lower part of the radiators to the return main 3.

It is very desirable that the boiler be provided with a delicate pressure-control apparatus of the type adapted to maintain at all times a small positive pressure. I prefer that type which is illustrated and described in my prior patent issued October 9, 1909, No. 937,686, which operates by the expulsion of water from a closed, fixed-level receptacle 10 into a movable receptacle 11, but any suitable type of regulator can be employed within the scope of my invention or the boiler can be tended manually. I have shown the water level in the boiler at 12; owing to the condensing effect of the radiators the pressure in the return main 3 will ordinarily be less than that inside the boiler and the water line in the leg 13 will be slightly above that in the boiler as shown at 14. It will be understood that the horizontal connection 15 between the leg 13 and the boiler can be either short or long.

In order to permit the escape of air from the apparatus, I attach to some part of the system beyond the radiating means a device consisting essentially of one or more upright tubes connected at their lower end by a restricted passage to the return main, and open at their upper ends by a correspondingly restricted passage to the atmosphere. One of these can, if desired, be connected to or near each radiator, but in the preferred embodiment of my invention a single device is used for the whole system, being connected to some part of the return main 3. The only requirement is that it be located above the water level 14 and be outside of the direct heat influence of the boiler. In the embodiment here illustrated, the air escape device consists of tubes 20—20—20 having their lower ends connected to a header or manifold 21, which is connected by means of a nipple 22 to some portion of the return main 3. The lower end of each tube is closed by plug 23 through which is drilled a small

hole 24 preferably about ⅛ inch in diameter, or slightly smaller. The upper end of each tube is suitably closed as by a cap 25 and is also formed with a small escape opening 26 of about the same size as the hole 24.

The number of these tubes will be greater or smaller depending upon the size of the system. I preferably employ one tube for approximately each three hundred square feet of radiator surface, but do not desire to restrict myself thereto. The tubes 20 may vary widely in dimensions, but should be of such a nature as to conduct and radiate heat readily. Common iron pipes are found to be perfectly satisfactory. They must be of sufficient size so as to be non-capillary and their length must be greater than the height of a column of water equal to the maximum pressure which exists in the return main 3 under any conditions, which in turn is a function of the pressure for which the pressure-regulator is set. I ordinarly employ tubes of an interior diameter of from ⅝ to ¾ inch and a length of from 20 to 30 inches; but any one of these dimensions can be halved or doubled without changing the operation, provided only that the height of the tube be always greater than that of the water column corresponding to the maximum pressure.

The size of the bores 24 must be sufficiently small to prevent the occurrence of a downward flow of liquid simultaneously with an upward flow of gas or vapor; I have expressed this requirement by the term "capillary."

The operation of the device is as follows: Vapor being admitted into any radiator, the same because of its low pressure enters the same in a gentle manner and mixes very little with the air already therein. The water vapor being lighter than the air, (both because of its higher temperature and its well known specific gravity at equal temperatures), occupies the top of the radiator and expels the air before it into the main 3 whence it travels towards the boiler being impelled both by gravity and by the general drift of the heating fluid. Arriving at the header 21 it escapes through the bores 24 and aperatures 26, the cold walls of the tubes 20—20 serving to condense any moisture dissolved in or entrained by the escaping air. This may even continue until the lower parts of the tubes 20 become filled with condensation as shown, through which the escaping air bubbles freely until the head of the liquid therein becomes equal to the boiler pressure, whereupon escape ceases temporarily.

However minor variations in the boiler pressure are always occuring, and at the next decrease in such pressure, some or all of the condensed liquid will gravitate into the header 21 and so be returned to the boiler. I have shown the nipple 22 as eccentrically inserted in the header so as to permit the same to be self clearing.

In case the return main 3 becomes filled with live steam or hot vapor, the condensation effect of the tubes prevents the loss of any material amount of water vapor unless the pressure of the fluid becomes so abnormally high as to necessitate a safety release, which my improved device provides; in addition to which the noise of the live steam condensing in the tubes 20 would sound an alarm.

The device operates with equal facility whether the radiators be turned on all together, or only one at a time. Upon a cooling of the system air will enter the same through the bores 24, thus preventing the formation of any vacuum in the mains which would tend to modify the operation of the boiler. The device can be located anywhere in the entire system whence it is desired to remove the air, provided only that it be not so close to the boiler, smoke flue, or to some radiator as to prevent the condensation action here described; and several devices can be employed at different points in a single system, although the particular arrangement herein shown is the preferable one.

The header can in some cases be dispensed with, the tubes being located directly upon the return main as shown in Figs. 4 and 5. And the tubes need not be vertical but may be inclined as shown in Fig. 5, provided only that they possess sufficient rise to afford the requisite "head" of liquid to balance the working pressure. Also my invention is not restricted to the use of a pressure regulating device of the type shown herein but any suitable expedient can be employed, while many other modifications will occur to those skilled in the art and are to be esteemed as covered in and by the claims hereto annexed.

Having thus described my invention, what I claim is:—

1. An air escape device for heating systems employing the vapor of water and having steam and return mains, comprising an elongated tube of conducting material supported with one end higher than the other, the lower end of said tube communicating with said return main, said tube being located therein above the water level therein such communication being effected by means of a capillary passage and the other end communicating with the outer air by means of a restricted passage, the difference in level between said passages being not less than the height of a column of water equivalent to the maximum pressure in the system adjacent thereto.

2. The combination with a heating system employing the vapor of water and hav-

ing steam and return mains, of an elongated tube of conducting material supported in a generally upright position outside of the direct influence of said system, the upper end of said tube being in communication with the atmosphere and the lower end communicating with the return main of the system above the water level therein by means of a capillary bore, the difference in level between the ends of said tube being at least as great as the height of a column of water equivalent to the maximum pressure in the system adjacent thereto, said tube being located entirely above the water level and adapted to discharge water by gravity into said return main.

3. An air escape device for heating systems employing the vapor of water and having steam and return mains, comprising a tube of heat-conducting material having at one end a capillary bore and at the other end a restricted outlet, the body of said tube being sufficiently larger than said bore so as to be non-capillary, and means for attaching said tube to the system in substantially upright position with said capillary bore at its lower end and above the water level in the system, the length of said tube being not less than the height of a column of water equivalent to the maximum pressure in said system at the point to which said device is attached.

4. An air escape device for heating systems employing the vapor of water, comprising a condensing chamber located wholly above the water level and having its lower part communicating with the interior of said system by a capillary bore and having its upper part communicating with the atmosphere at a point at least as high above said bore as the height of a column of water equivalent to the maximum pressure in the system at the point to which said device is attached.

5. An air escape device for heating systems comprising a header, means for attaching said header to a return main and a plurality of upright metal pipes carried by said header, each pipe communicating with said header by a capillary bore.

6. In a device of the character described, the combination with a return pipe of a steam heating system, of an upright metal tube connected at its lower end to said return pipe above the water level of the system and communicating therewith by way of a narrow bore, the diameter of said bore being materially less than that of said tube and also less than the length of the bore, said tube being located entirely above the water level of the system and adapted to discharge its water of condensation therein by gravity.

7. An air escape fitting for steam heating systems comprising, in combination, a chambered part adapted to communicate freely with the interior of the system, and one or more upright tubes carried by said part and communicating with the atmosphere at their upper ends, the length of a tube being not less than the height of a column of water equivalent to the maximum pressure in the system, and each tube communicating with the chamber by means of a narrow bore whose diameter is less than its length and also less than the diameter of the tube into which it opens.

In testimony whereof, I hereunto affix my signature.

THOMAS G. MOUAT.