Sept. 27, 1932. R. H. CARSON 1,879,791

TRAP

Filed Nov. 2, 1929

Fig. 1.

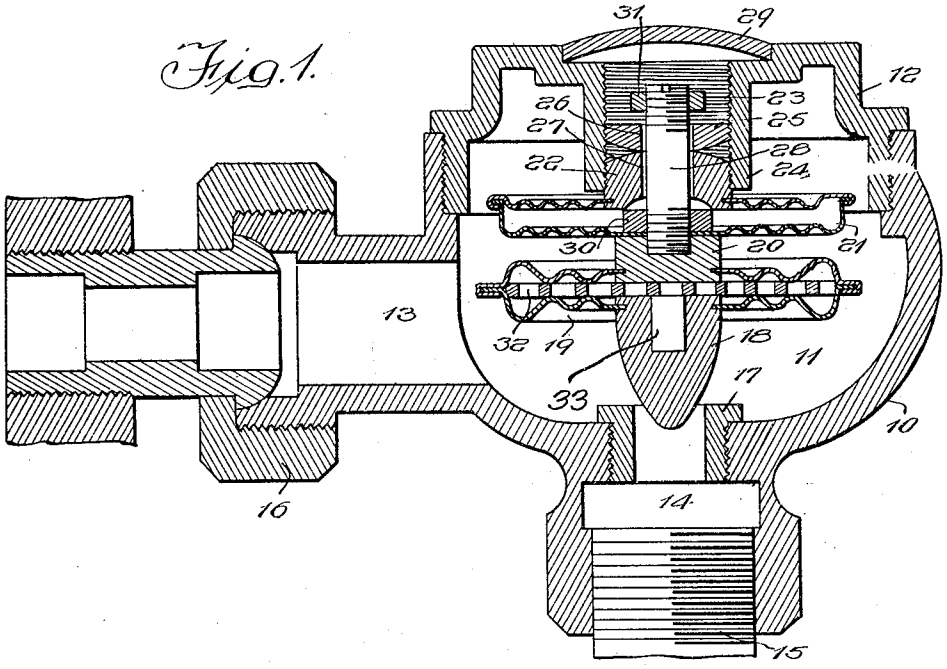


Fig. 2.

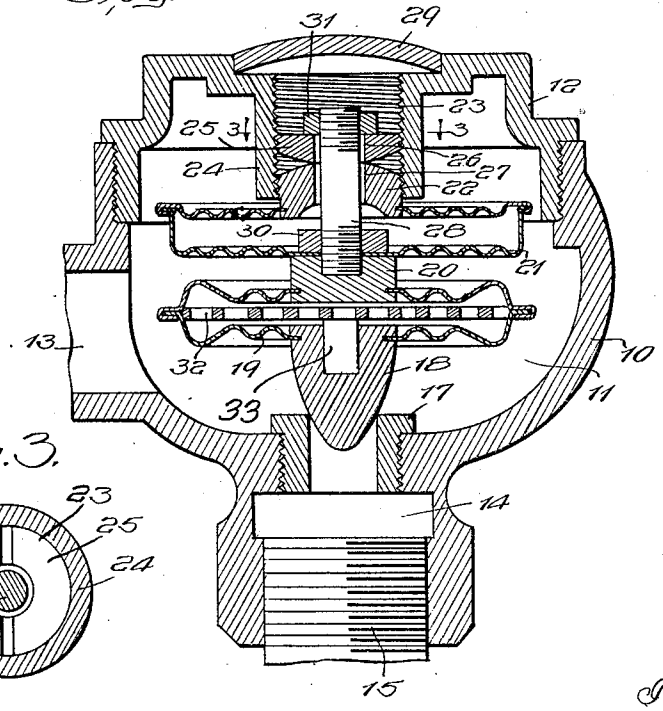


Fig. 3.

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1,879,791

UNITED STATES PATENT OFFICE

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TRAP

Application filed November 2, 1929. Serial No. 404,424.

The invention has among its particular objects the production of a construction which is capable of being incorporated in a heating system to automatically control the flow of heating fluid by the temperature of the heating fluid and the difference between atmospheric pressure and the pressure of the fluid.

Another object of the invention is the provision of a construction such as that just referred to which includes pressure responsive and thermally operable means for controlling the valve and to associate with said structure a means for limiting opposed directional movements of the pressure responsive and thermally operable means to thereby control operation of a valve associated with said elements.

A still further object of the invention is to combine pressure responsive and thermally operable means with each other to provide a unitary structure comprised of elements such as these and to provide for unitary adjustment thereof relatively to the seat of the valve, the structure being capable of further adjustments to regulate the pressure and temperature at which the device will function to effect operation of the valve.

The invention has these and other objects, all of which will be described and more clearly understood when read in conjunction with the accompanying drawing which illustrates one embodiment of which the invention is susceptible, it being obvious that changes and modifications may be resorted to without departing from the spirit of the appended claims forming a part hereof.

In the drawing,

Fig. 1 is a central sectional view of a device constructed according to the invention;

Fig. 2 is a view similar to Fig. 1 showing the elements of the structure in a changed relation; and

Fig. 3 is a plan view of one of the elements shown in Figs. 1 and 2.

The structure disclosed in the drawing contemplates a trap comprised of a housing 10 forming a valve chamber 11 which is closed at its upper end by a cap 12, the cap being screw-threaded into the housing 10. The housing 10 is formed to provide passages 13 and 14 whereby the trap may be operatively connected to a radiator (not shown) and a return line through the medium of a riser 15. The passage 13 is adapted to be connected through a suitable nipple or coupling device 16 with the radiator and the passage 14 preferably provided with internal screw threads which are adapted to engage the screw-threads provided upon the riser providing a connection between the device and the return pipe of the system. The housing 10 is provided with a screw-threaded aperture to receive a bushing 17 which forms a valve seat for the valve 18, the latter of which is rigidly secured to one wall of a diaphragm generally designated 19. This diaphragm 19 has another wall secured to a post 20. The post 20 is in turn rigidly secured to one wall of a diaphragm generally designated 21, another wall of the diaphragm 21 being secured to an apertured screw-threaded element 22. This element 22 is screw-threaded into the bore 23 provided in a boss 24 which projects from the cap 12 into the interior of the housing 10. The screw-threaded element 22 may be brought into a plurality of adjusted positions with respect to the valve seat 17, it being obvious that said element may be screwed up or down in the bore of the boss 24, it being understood that the screw-threaded element 22 is provided with a slot or some other construction to receive a suitable tool whereby this element may be rotated with respect to the boss 24. A nut 25, also screw-threaded in the bore 23 of the boss, may be brought into a position wherein it abuts the screw-threaded element 22 to lock the latter against accidental displacement. It will be noted that the nut and the screw-threaded element are each provided with centrally disposed apertures respectively designated 26 and 27, the openings of which align with each other. A screw-threaded post 28 has one end thereof threaded into the member 20, the post being adapted to project through the apertures provided in the nut and screw-threaded element. In practice, the diameter of these apertures is greater than the diameter of the post 28 which will thus provide a proper amount of clearance between the post and

the apertures which will thus allow air to flow into the diaphragm 21. The upper end of the bore 23 is preferably closed by a disc 29, it being understood that this disc does not hermetically seal the bore and, therefore, atmospheric pressure will, at all times, obtain in the diaphragm 21. It will be noted that the post 28 has screw-threads provided upon the lower end thereof and that a nut 30 is screw-threaded upon the post and clamps one wall of the diaphragm 21 against the post 20. A nut 31 is screw-threaded upon the upper end of the post 28. This last mentioned nut is provided and designed to be brought into adjusted positions upon the post and to cooperate with the nut 25 to limit downward movement of the post and also limit movement in this direction of the other elements connected with the post. Thus, it will be noted that if the diaphragm 21 expands, the post 28 is displaced in a downward direction and should this displacement be sufficient, the nut 31 will engage the screw-threaded element 25 and prevent further displacement of the post and the elements connected therewith. It will also be noted that the nut 30 engages the screw threaded element 22 and limits movement of the elements connected to the post in an upward direction. The diaphragm 19 constitutes a thermostatic element and preferably contains some substance which is responsive to changes in temperature. In other words, the diaphragm will expand when subjected to a rise in temperature and will contract when the temperature falls. In practice, the nut 31 is preferably so adjusted that the diaphragm 19 will control the flow of fluid through the trap. When relatively cool liquid and non-condensible gases accumulate in the lower portion of the device, the diaphragm will contract sufficiently so that the liquid and gases may be discharged into the riser 15 and thence into the return pipe and then after the liquid has been discharged from the radiator and the diaphragm is again subjected to heated vapor, it will expand and cause the valve 18 to engage the valve seat 17. It being one of the prime objects of a trap of this character to prevent the escape of vapor from the radiator and permit condensate and non-condensible gases to be discharged from the radiator in a system adapted to be operated with a partial vacuum obtaining in the boiler of the system and with a still larger vacuum obtaining in the return main, it is readily understood that when a sufficiently high vacuum obtains in the radiator and the return main, the temperature of the vapor therein would not be sufficiently high to cause the diaphragm 19 to function properly, the temperature to which this diaphragm is then subjected being so low that the valve 18 will not engage the seat thereof to prevent the vapor from escaping into the return main.

To cause the structure to function to close the valve 18 when a condition such as this prevails, the diaphragm 21 is provided which will, when a partial vacuum is built up in the chamber of the housing 10, expand and displace the valve 18 toward the valve seat 17 so that the diaphragm 19 need only expand relatively small amounts to bring the valve into engagement with its seat. The nut 31 is preferably so adjusted upon the post 28 so that when a relatively high vacuum obtains within the chamber, the diaphragm 21 will not expand to such an extent that the valve 18 would engage the seat thereof unless the diaphragm 19 is subjected to vapor of a temperature corresponding to the vacuums obtained within the chamber 11. Obviously, the diaphragm 19 will then function properly and will contract to unseat the valve 18 whenever condensate and non-condensible gases accumulate in the chamber 11 but after this condensate and all or some of the gases have been discharged from the chambers and the diaphragm 19 is again subjected to the vapor, it will expand and seat the valve 18. If the system is designed so that it may be operated on a maximum vacuum of twenty inches of mercury in the return main, the nut 31 will be positioned upon the post so that it will engage the associated nut 25 whenever a vacuum of twenty inches obtains within the chamber 11. Then when the diaphragm 19 is subjected to vapor of a corresponding temperature, it will expand and seat the valve 18 so that vapor will not be drawn into the return main. It will be noted that the valve 18 is of a tapered formation so that the effective cross sectional area of the passage provided in the element providing the valve seat 17 is gradually reduced as the valve is moved toward its seat.

As mentioned above, when partial vacuums obtain in the valve chamber 11, the diaphragm 21 is expanded and the accumulation of liquid and non-condensible gases in the chamber 11 and in the lower portion of the associated radiators causes the diaphragm 19 to unseat the valve 18 so that liquid and non-condensible gases may be drawn into the return main through the riser 15. In practice, I preferably construct the traps so that when liquid continues to accumulate while the diaphragm 19 is expanded, the valve 18 is displaced a relatively small distance from its seat 17 permitting the liquid to flow out substantially continuously at times and intermittently at other times, but the liquid flows out so slowly that for all practical purposes, water seals are provided. This prevents a portion of the non-condensible gases from escaping from the radiators, and of course, reduces the amount of steam used by the radiators per unit time. As this feature of my invention is mainly or entirely apparent when the system is operating throughout under a relative-

ly high vacuum and it is then desirable to have a relatively small exchange of heat between the radiators and the surrounding air, the advantages of my improved construction are readily apparent.

An apertured disc 32 is located within the diaphragm 19 and is provided to serve as a filler to prevent complete contraction of the diaphragm when subject to a reduced air pressure. This disc 32 is in the present showing connected to the valve 18 by means of a post 33 so that said disc is movable with this portion of the thermally controlled means 19.

From the foregoing description of the construction, it is manifest that an arrangement is disclosed which permits the thermally controlled and pressure responsive means to be adjusted as a unit relatively to the valve seat 17 and that the structure is capable of adjustment and limited movement of the elements in opposite directions.

Having thus described the invention, what I claim as new and desire to cover by Letters Patent is:

1. A device of the kind described comprising a housing, a valve, pressure responsive means operable by pressure below atmospheric pressure, and thermally operable means located in the housing for controlling actuation of the valve, means movable with the pressure responsive means for limiting the expansion of the pressure responsive means to thereby control the temperature required to actuate said valve by said thermally operable means.

2. A device of the kind described comprising a housing, a valve, pressure responsive means and thermally operable means located in the housing for controlling the operation of said valve, said pressure responsive and thermally operable means being adjustable as a unit relatively to the seat of said valve, and means movable with said pressure responsive and thermally operable means upon adjustment for limiting movement of the pressure responsive means, said limiting means providing means for controlling the temperature required to effect operation of said valve.

3. A device of the kind described comprising a housing, a valve, pressure responsive means operable by pressure below atmospheric pressure and thermally operable means located in the housing for controlling the valve, said casing and pressure responsive means having means which cooperate with each other limiting the expansion of the pressure responsive means to thereby control the temperature required to actuate said valve by said thermally operable means said element of said pressure responsive means being movable therewith into cooperative relation with said element of said casing upon expansion of said pressure responsive means.

4. A device of the kind described comprising a housing, a valve, pressure responsive means and thermally operable means located in the housing for controlling said valve, said pressure responsive, said thermally operable means and an element of said valve being connected together and being movable as a unit relatively to the seat of the valve, and means for limiting opposed directional movements of said pressure responsive means.

5. A device of the kind described comprising a housing, a valve, pressure responsive means and thermally operable means located in the housing for controlling said valve, said pressure responsive, said thermally operable means and an element of said valve being connected together and being movable as a unit relatively to the seat of the valve, and means respectively provided upon said housing and an element of said pressure responsive means for limiting opposed directional movements of said pressure responsive means.

6. A device of the kind described comprising a housing having a cap, a valve, pressure responsive means and thermally operable means located in the housing and carried by said cap, said pressure responsive and thermally operable means being adjustably mounted in said cap, and means for controlling the thermally operable means to thereby regulate temperature required for actuating said valve.

7. A device of the kind described comprising a housing, a valve, a diaphragm providing pressure responsive means and a diaphragm providing thermally responsive means located in the housing for controlling the operation of said valve, adjacent walls of said diaphragms being connected with each other, a support for said diaphragms, said support being connected with one of the walls of the pressure responsive diaphragm, and means for limiting expansion of said pressure responsive means, said means including means engageable with said support and extending from another wall of said diaphragm providing said pressure responsive means.

8. A device of the kind described comprising a housing having an opening and a valve seat, a cap removably mounted in said opening, said cap having a threaded opening, pressure responsive means having a valve associated therewith, means in said threaded opening providing means for varying the relative position of said pressure responsive means and valve relatively to the seat of said valve, thermally responsive means carried by said pressure responsive means, means associated with said pressure and thermally responsive means cooperating with said means in said threaded opening for limiting movement of said pressure and thermally responsive means.

In witness whereof, I hereunto subscribe my name this 30th day of October, A. D., 1929.

ROBERT H. CARSON.

CERTIFICATE OF CORRECTION.

Patent No. 1,879,791. September 27, 1932.

ROBERT H. CARSON.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, before line 1, insert the following paragraph:

> The invention relates to valve devices and particularly to thermostatically controlled valve devices such as shown and described by me in my application, filed June 21, 1928 - Serial No. 287,172.;

and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22nd day of November, A. D. 1932.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.