(No Model.) 2 Sheets—Sheet 1.

G. WESTINGHOUSE, Jr., & F. MOORE.

THERMOSTAT.

No. 353,186. Patented Nov. 23, 1886.

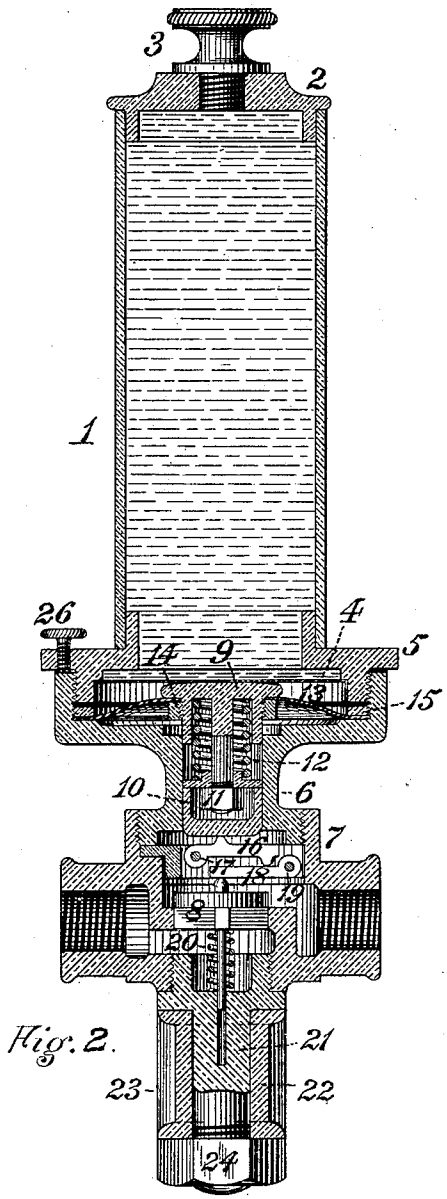


Fig. 2.

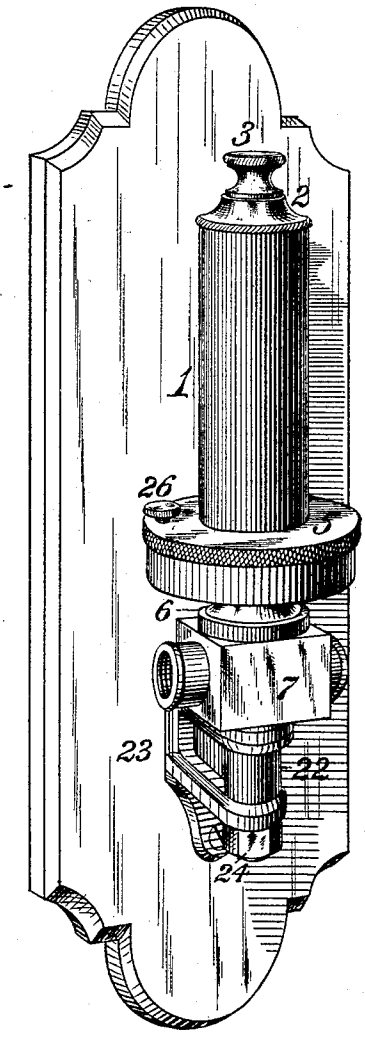


Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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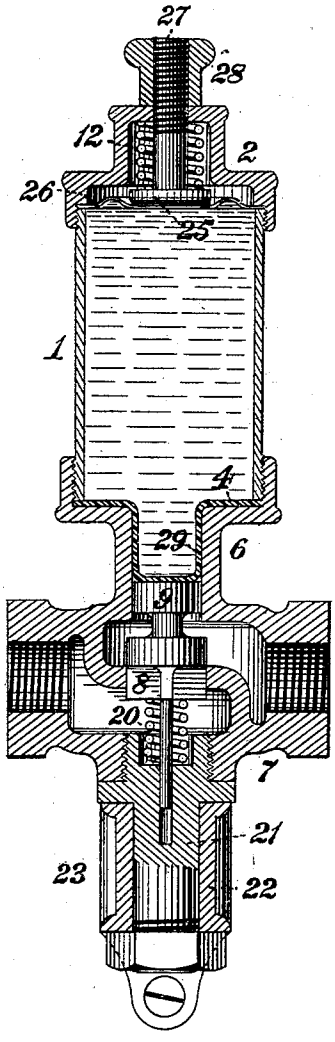


Fig. 3.

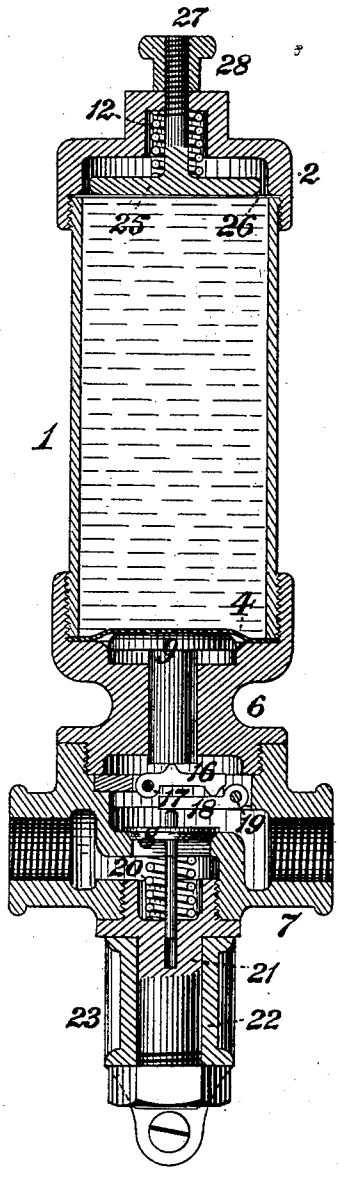


Fig. 4.

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UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, JR., AND FRANK MOORE, OF PITTSBURG, PA.

THERMOSTAT.

SPECIFICATION forming part of Letters Patent No. 353,186, dated November 23, 1886.

Application filed May 15, 1886. Serial No. 202,227. (No model.)

To all whom it may concern:

Be it known that we, GEORGE WESTINGHOUSE, Jr., and FRANK MOORE, both residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, and both citizens of the United States, have invented or discovered a certain new and useful Improvement in Thermostats, of which improvement the following is a specification.

In the accompanying drawings, which make part of this specification, Figure 1 is a view in perspective of a thermostat embodying our invention; Fig. 2, a vertical central section on an enlarged scale through the same, and Figs. 3 and 4 similar sections illustrating modifications of certain details.

The object of our invention is to provide an apparatus of small compass and simple and inexpensive construction, whereby the temperature of an apartment may be maintained at a substantially uniform determined temperature by the automatic regulation of the supply of heating medium coincidently with and proportionately to variations of temperature above or below the desired and determined degree.

To this end our invention, generally stated, consists in the combination of a closed case or chamber for the reception of a readily expansible liquid, said chamber being connected to the chest or body of a regulating-valve, a movable abutment closing one end of said chamber and a follower adapted to bear against the movable abutment, and to transmit pressure therefrom to the regulating-valve.

The improvement claimed is hereinafter fully set forth.

In the practice of our invention we provide a thin metallic chamber or receptacle, 1, designed to be filled with any suitable liquid having a high degree of expansibility—as, for example, alcohol, benzine, or other liquid which vaporizes at a low temperature—which chamber is most conveniently made, as shown, of cylindrical form, and is closed at one end by a cap, 2, having an opening fitted with a suitable plug, 3, through which the liquid may be introduced. The opposite end of the chamber 1 is fitted with a movable abutment adapted to be moved outwardly by the pressure of the contained liquid when expanded, and to be returned to position upon the contraction of the liquid, a desirable form of such abutment being a flexible diaphragm, 4, soldered at its edges to the end piece, 5, of the chamber 1. The end piece, 5, is connected to a follower-chamber, 6, which is formed integral with or connected to the body or casing 7 of a regulating-valve, 8, controlling the passage of a heating medium—as gas—to the apparatus, by which heat is imparted to the apartment in which the apparatus is located. The end piece, 5, of the liquid-chamber may be connected adjustably to the follower-chamber, as by a screw-thread on the periphery of the former engaging an internal thread in the latter, in order to enable the distance between the flexible diaphragm and regulating-valve to be increased or diminished, as desired. The movable abutment 4 bears against a follower, which moves freely in the chamber 6, and which, as shown in Fig. 2, is composed of a section, 9, having one of its ends abutting against the movable abutment 4, and a section, 10, which is connected to the section 9 by a nut, 11, engaging a thread on a central stem on the section 9, which passes freely through the adjacent end of the section 10. A helical relieving-spring, 12, interposed between the sections 9 and 10, and of sufficient tension to resist compression under the pressure of the movable abutment during such period as the regulating-valve is raised from its seat, maintains the outer faces of the sections 9 and 10 at the maximum distance apart permitted by the adjustment of the nut 11. To prevent leakage of fluid from the valve-casing 7 past the follower, a flexible diaphragm, 13, may be interposed between the central opening of the follower-chamber 6 and the movable abutment 4, said diaphragm being secured centrally by a nut, 14, to the follower-section 9, and at its periphery by a nut, 15, to the chamber 6.

In the modifications shown in Figs. 3 and 4, in which the liquid-chamber is fixed without adjustment to the follower-chamber, the follower 9 is formed in a single piece having a broad head or upper face bearing against the movable abutment, and the relieving-spring 12 is located at the opposite end of the liquid-chamber and bears against a seat on the inside of the cap 2, and against a supplemental fol-

lower, 25, abutting against a flexible diaphragm, 26, closing the upper end of the liquid-chamber, and confined at its periphery between the same and the cap 2. The stem 27 of the follower 25, which passes freely through the cap, is threaded at and adjacent to its outer end, and is engaged by an adjusting-nut, 28, bearing against the outer face of the cap. By this construction provision is made for the adjustment of the apparatus to effect the maintenance of different degrees of temperature by permitting the preliminary expansion of the liquid in the chamber 1 to take place for a longer or shorter period without acting upon the movable abutment 4, and through the same upon the regulating-valve, the duration of the inactive preliminary expansion depending upon the adjusted position of the follower 25 by the nut 28. Provision is also made for such further expansion, if any, of the liquid as may be occasioned subsequently to the seating of the regulating-valve, pressure being exerted in such case against the diaphragm 26, supplemental follower 25, and relieving-spring 12, said spring serving the same function of permitting such subsequent expansion as when interposed between the two sections of a divided or composite follower, as in Fig. 2.

The pressure of the movable abutment 4 when moved outwardly by the expansion of the liquid contained in the chamber 1 is transmitted by the follower 9 10 to the regulating-valve 8, to wholly or partially close the same, as may be required to maintain the desired temperature, and for the purpose of increasing the sensitiveness of the apparatus an increased degree of movement is imparted to the regulating-valve relatively to any given movement of the movable abutment. In the instance illustrated in Figs. 2 and 4 such increased traverse is imparted to the valve through the intermediation of a lever system, the lower section, 10, or lower end of the follower, bearing upon a lever, 16, of the third order, pivoted by a pin, 17, in the valve-body, the outer end of said lever bearing in turn upon a similar lever, 18, working on a pivot, 19, and the outer end of the lever 18 bearing upon a central projection on the top of the regulating-valve 8. It will be seen that by the employment of a system of levers, as above, a slight degree of movement of the abutment and follower will induce a materially increased movement of the valve, and consequently that comparatively slight variations of temperature will act effectively to regulate to the required degree the passage of fluid through the opening controlled by the valve. It will be further obvious that a lever system of different construction, or a single lever of unequal arms, may, if preferred, be employed to similarly effect the result of giving greater traverse to the valve than that of the movable abutment.

In the modification shown in Fig. 3 the follower 9 is made integral with the regulating-valve 8 as an axial prolongation thereof, and bears at its upper end against a flexible cylindrical extension, 29, of a diaphragm, 4, fixed between the lower end of the liquid-chamber 1 and the top of the follower-chamber 6, said extension being of materially reduced transverse area relatively to that of the liquid-chamber—as, say, one-eighth. The traverse of its lower face and of the follower and regulating-valve against which it abuts will consequently be increased in corresponding ratio above that which would be due to the pressure of a movable abutment substantially equal in transverse area to that of the liquid chamber.

Upon the contraction of the fluid in the chamber 1, as induced by decrease of temperature in the apartment, the regulating-valve 8 is opened to correspondingly increase the supply of heating medium by a helical supply-spring, 20, the tension of which is less than that of the relieving-spring 12, said supply-spring bearing against the supply side of the valve 8 and against the end of a central recess in a stem, 21, fixed in the valve-casing 7 in line with the regulating-valve, said stem fitting a socket, 22, on a bracket, 23, which serves to secure the apparatus to any suitable support, it being held in position with the capacity of ready removal, when desired, by a nut, 24, engaging a screw-thread on the end of the stem 21.

In operation, where a divided follower and an adjustable liquid-chamber are employed, the sections 9 and 10 of the follower are adjusted by the nut 11, as may be required to make the follower of proper length to transmit pressure to the levers and regulating-valve, and the base-piece 5 of the liquid-chamber 1 is connected to the top of the follower-chamber 6, and fixed in position thereon by a set-screw, 26, or other suitable locking device. The adjustability of the liquid-chamber to a greater or less distance from the regulating-valve admits of the ready adjustment of the apparatus to effect the maintenance of different desired degrees of temperature by increasing or diminishing, as may be required, a portion of the traverse of the movable abutment during which its action is not exerted upon the regulating-valve. Expansion of the liquid in the chamber by increase of temperature of the apartment will correspondingly diminish the supply of heating medium from the supply to the delivery side of the regulating-valve, and upon the contraction of the liquid induced by decrease of temperature the supply-spring 22, being relieved from the pressure of the movable abutment, will correspondingly raise the valve from its seat and admit an increased supply of heating medium to the apparatus by which the apartment is heated. The relieving-spring 12, acting in connection with the sectional follower, admits of such further traverse of the movable abutment 4 as may be induced by expansion of the liquid in the chamber 1 subsequent to the seating or

complete closure of the regulating-valve, the compression of the relieving-spring in such case permitting the section 9 to move toward the section 10 for such distance as may be required. Corresponding facilities for adjustment for different temperatures and normal exertion of pressure after the seating of the regulating-valve are afforded, as before explained, where the relieving-spring is employed in connection with a supplemental follower and flexible diaphragm at the upper end of a non-adjustable liquid-chamber.

We claim herein as our invention—

1. The combination of a closed liquid chamber or receptacle, a casing or chest connected to said chamber, a regulating-valve working in the casing, a movable abutment closing one end of the chamber, and a follower bearing against said abutment and transmitting pressure therefrom to the regulating-valve, substantially as set forth.

2. The combination of a closed liquid chamber or receptacle, a casing or chest connected to said chamber, a regulating-valve working in the casing, and a device interposed between the liquid-chamber and valve for increasing the degree of traverse of the latter under the action of pressure resultant upon the expansion of liquid contained in the chamber, substantially as set forth.

3. The combination of a closed liquid chamber or receptacle, a casing or chest connected to said chamber, a regulating-valve working in the casing, a movable abutment closing one end of the chamber, a follower bearing against said abutment, and one or more levers adapted to transmit pressure from the follower to the regulating-valve, substantially as set forth.

4. The combination of a closed liquid chamber or receptacle, a casing or chest connected to said chamber, a regulating-valve working in the casing, a movable abutment closing one end of the chamber, a follower bearing against said abutment and transmitting pressure therefrom to the regulating-valve, a movable abutment closing the opposite end of the liquid-chamber, a supplemental follower bearing against said abutment, and having a stem provided with an adjusting-nut for regulating its traverse, and a spring bearing against the supplemental follower and against a fixed abutment, substantially as set forth.

5. The combination of a casing or chest, a regulating-valve working therein and adapted to control the passage of a heating medium from the supply to the delivery side thereof, a closed liquid-chamber connected adjustably to the valve-casing, so as to be fixed at a greater or less distance therefrom, a movable abutment closing one end of said chamber, and a follower bearing against said abutment and transmitting pressure therefrom to the regulating-valve, substantially as set forth.

6. The combination of a closed liquid chamber or receptacle, a casing or chest connected to said chamber, a regulating-valve working in the casing, a movable abutment closing one end of the chamber, a follower composed of two sections connected with the capacity of relative longitudinal movement, one of said sections adjoining the movable abutment and the other bearing against the regulating-valve, and a relieving-spring interposed between the follower-sections, substantially as set forth.

7. The combination of a casing or chest, a regulating-valve working therein and adapted to control the passage of a heating medium from the supply to the delivery side thereof, a closed liquid-chamber connected to the valve-casing, a movable abutment closing one end of said chamber, a follower working in a passage leading from the valve-casing to the movable abutment and transmitting pressure from said abutment to the regulating-valve, and a flexible diaphragm connected at its center to the follower and at its periphery to the casing within which the same is inclosed, substantially as set forth.

8. The combination of a closed liquid chamber or receptacle, a movable abutment closing one end of said chamber, a valve-casing connected to the abutment end of said chamber, a regulating-valve working in said casing, a follower bearing against the movable abutment and transmitting pressure therefrom to the regulating-valve, a removable plug or stem closing an opening in the valve-casing in line with the regulating-valve, and a bracket for supporting the apparatus, having a socket to receive said plug or stem, substantially as set forth.

In testimony whereof we have hereunto set our hands.

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FRANK MOORE.

Witnesses:
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