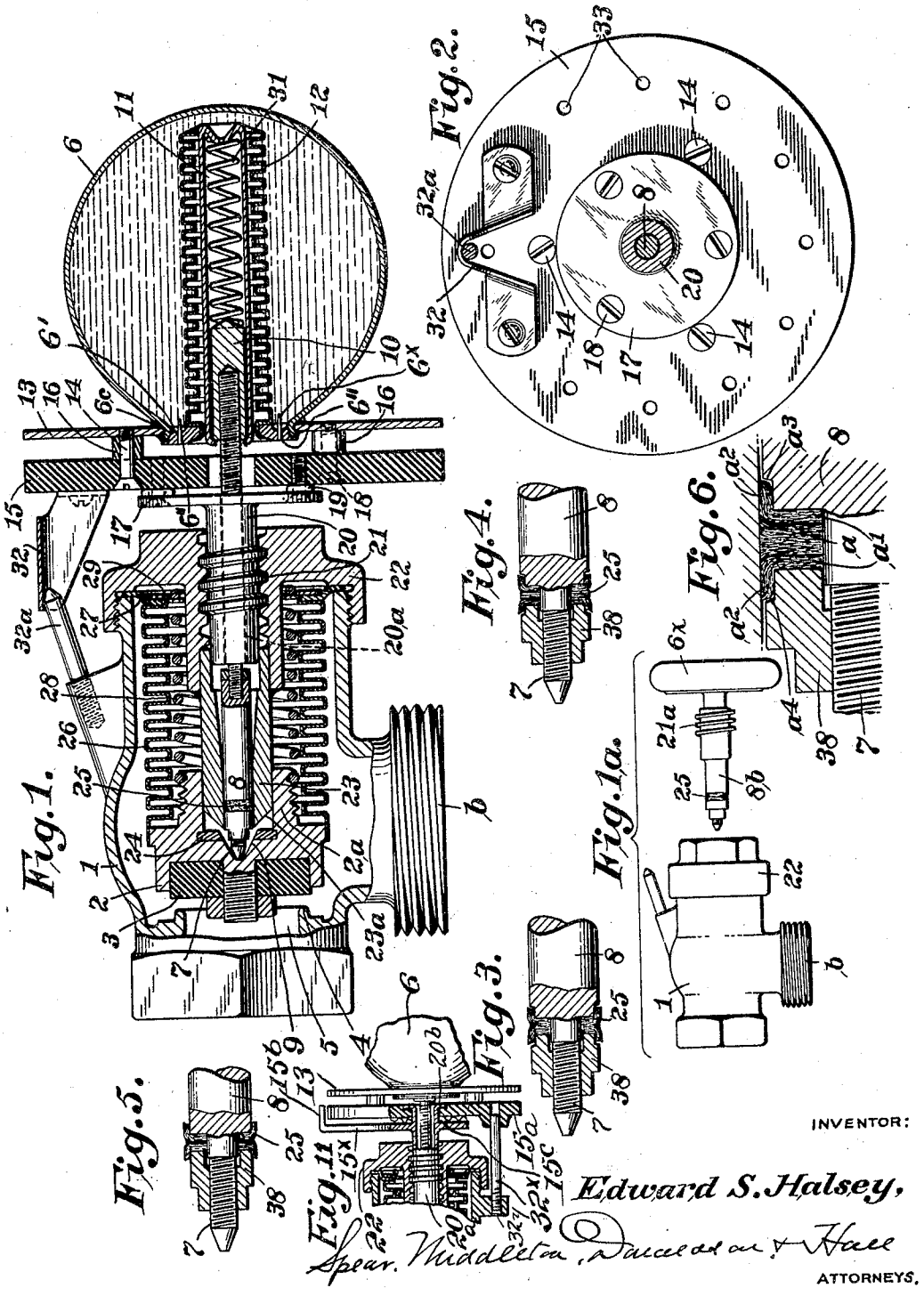
March 3, 1931. E. S. HALSEY 1,794,612

THERMOSTATIC CONTROL VALVE FOR STEAM RADIATORS

Filed July 6, 1929 2 Sheets-Sheet 1



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THERMOSTATIC CONTROL VALVE FOR STEAM RADIATORS

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Fig. 7.

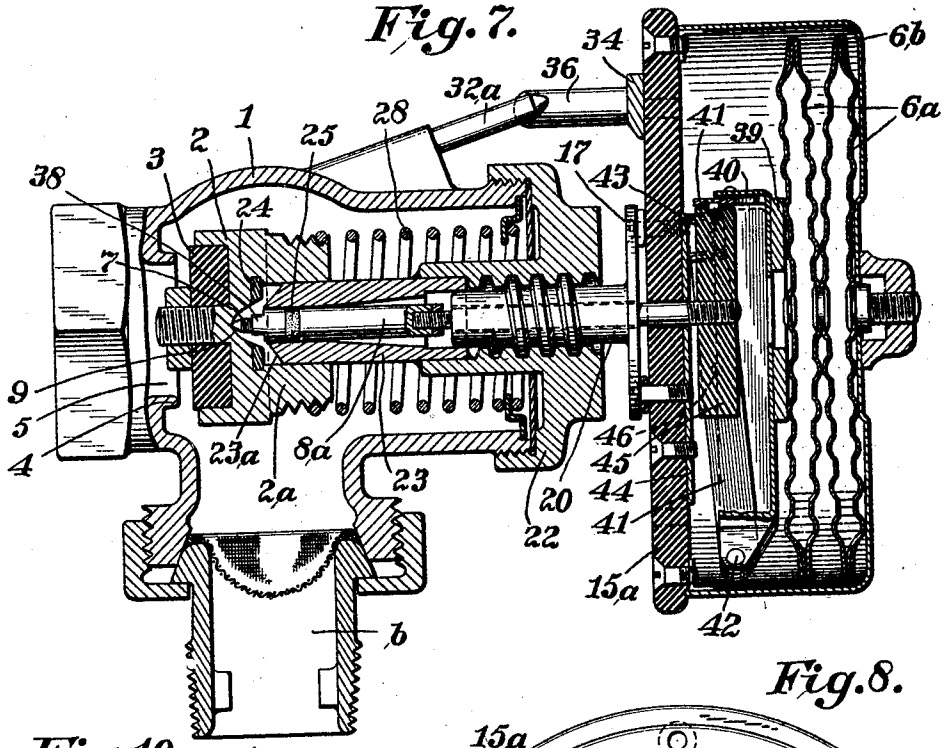


Fig. 8.

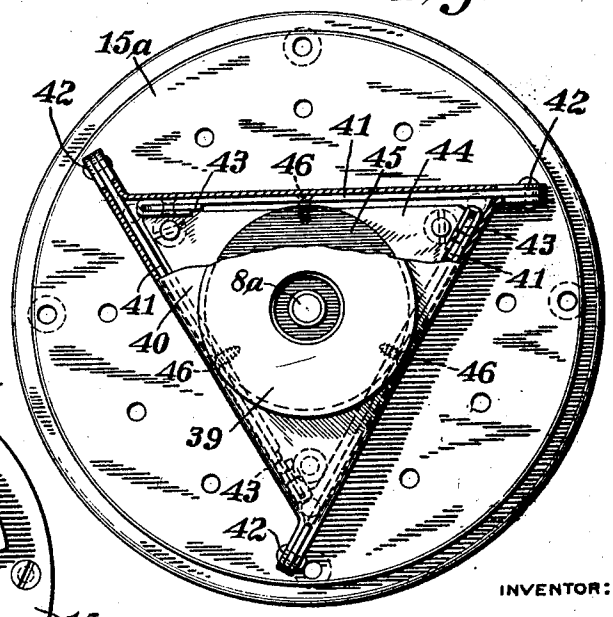


Fig. 10.

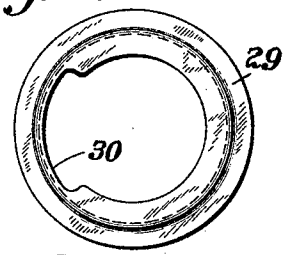
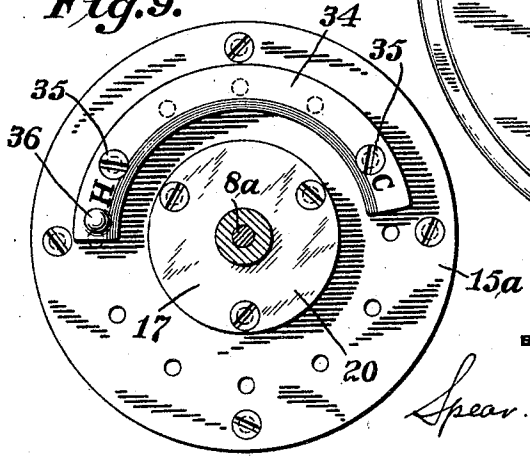


Fig. 9.



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UNITED STATES PATENT OFFICE

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THERMOSTATIC-CONTROL VALVE FOR STEAM RADIATORS

Application filed July 6, 1929. Serial No. 376,398.

My invention relates to thermostatic modulating steam inlet valves for radiators of the general type which are usually or preferably connected to the upper part of the radiator.

The invention consists in the features and combination and arrangement of parts hereinafter described and particularly pointed out in the claims.

In the drawings:

Figure 1 is a view of the valve organization in vertical section.

Fig. 1*a* is a view of the valve body and a hand operated screw stem for operating the valve without the thermostat.

Fig. 2 is a face view of the heat insulating disc or shield with parts in section.

Figs. 3, 4 and 5 are views of a portion of an operating rod with packing washers carried thereby to prevent leakage of steam, these views being partly in section.

Fig. 6 is an enlarged view of part of Fig. 4.

Fig. 7 is a view similar to Fig. 1 of a modified form of cell.

Fig. 8 is a rear view of part of Fig. 7.

Fig. 9 is a face view of a heat insulating disc.

Fig. 10 is a view of a spring holding ring.

Fig. 11 shows another form of the appliance.

In these drawings, 1 is the valve body or casing, *b* the steam supply connection. 2 is the valve disc having a Jenkins or like seating disc 3 to engage the seat 4 for closing the inlet port 5 for the steam.

This valve is automatically controlled by thermostatic means which includes a globular container or pressure cell 6 for a liquid expansible by heat. The valve may also be controlled by a hand operation of the parts to shut off steam from or supply steam to the radiator, certain of the parts belonging to the thermostatic means entering into the manual operation. This manual operation may be performed by using the cell member 6 as a handle.

The valve 2, 3 is borne upon by the reduced screw threaded end 7 of a comparatively slender rod 8 which seats in a conical recess 9 in the rear face of the valve member 2. The slender rod 8 is united at its rear end by a screw thread or other conducting means to a plunger member 10 of brass or other metal sliding in a tubular shell 11 extending diametrically of the globular shell or cell 6 and united at its closed rear end with a bellows 12 which is arranged coaxially of said shell 11. The forward end of the bellows is attached liquid-tight to the outer wall of the cell by spinning and sweating into a ring stopper member 6′ prior to the insertion and sweating of said stopper into the neck of cell 6.

The tubular shell 11 which is within the bellows is spun over at its front end so that its edge embraces and constitutes a retaining stop for the forward end of the member 10. The cell 6 is supported by a plate 13, which also increases its radiating surface, attached to its shell by spinning or expanding the shell at 6*c* out over the inner edge of the disc 13. This plate 13 receives screws 14 from a heat insulating disc or shield 15, washers 16 being interposed between the insulating disc and the plate 13, to space them apart for the free circulation of air between them. The heat insulating disc, which is intended to shield the thermostatic cell from the heat radiated from the valve casing, is supported by a plate or flange 17 attached thereto by screws 18 passing through spacing washers 19 to provide an air space between flange and insulating disc. The flange 17 forms a part of a sleeve or hollow stem 20, which has a coarse screw thread 21 fitting a corresponding screw thread in the bonnet 22 which is screw threaded onto the end of the valve casing. The slender rod 8 passes through the said sleeve or hollow stem 20, with clearance as indicated by the double dotted lines at 20*a* and it also extends through the insulating disc 15 and the forward end of the brass shell 11 with clearance. This rod is so proportioned as to raise the temperature of the cell up to about 100° F. and it will be noted that the heat transmitted or conducted by this slender rod is conveyed to the center of the cell and is dissipated through the wall of this cell. Rapid circulating currents of the liquid are set up by convection and the heat is transmitted from the center of the cell to its enclosing walls by these currents.

The globular cell 6 is completely filled with the expansive liquid through the small holes 6'' and 6'' in stopper ring 6', while upright to allow the escape of all traces of air, after which said holes may be sealed by taper plugs 6a, or solder.

The liquid which I select is of mobile character and as an example, I use benzol (C_6H_6) within the cell, which is highly expansible and of low specific heat. Liquids generally are poor heat conductors, but if provision is made to induce or stimulate rapid circulation the rapidity of the temperature change throughout the liquid body by the dissipation of heat at the outer shell, resulting from changes of room temperature, is more pronounced than otherwise would be the case, hence I transmit the heat to the center of the cell in a definite degree by means of the slender rod 8.

It will be noted that the slender rod 8, which conducts the heat to the interior of the cell, is supported at its front end in a fixed sleeve or member 23, having a bore which is cylindrical at its forward end and is flaring at its rear end. The slender rod is fitted to slide in and be supported by the cylindrical portion of the fixed sleeve; and at its rear end, this slender rod is supported in the member or block 10 which in turn is supported by the centrally disposed shell or tube 11. The intermediate part of the slender rod, which is the major portion thereof, is free from contact with any adjacent part and receives no heat by contact except at its forward end, this effect being due to the clearance about the intermediate major portion of the rod. By reason of this clearance throughout the major portion of the rod and by reason of the slender character of this rod, the conduction of heat by it to the center of the cell from the steam heated parts; i.e., the valve member 2 and fixed sleeve 23, can be made approximately definite and therefore the cell at its center will receive a substantially fixed degree of heat for its proper operation in respect to the room temperature.

The fixed sleeve member 23 is secured to the inner extension of the bonnet 22 by fillets of solder or in any other suitable way. The valve disc has a rear extension 2^a which is guided on the outside of the fixed sleeve or member 23, so that this member performs the two-fold purpose of guiding the slender operating rod 8 and the valve member 2.

The forward end of this fixed member 23 is conical at 23^a and receives contact from the packing or washer 24 when the valve is retracted to its full limit so as to seal the joint at this point, should the thermostatic cell, together with the slender rod be removed for replacement or repair. Said slender rod has packing at 25, as will be described later, and which packing, when the rod is in place, prevents the escape of steam along it.

The valve 2 is connected to a bellows 26 attached thereto. The rear end of this bellows has attached thereto a ring 27, which is clamped between the bonnet 22 and the valve casing to which it is screw threaded as shown. A retrieving spring 28 engages, at its front end, the coarse screw threads of the valve extension 2^a and at its rear end this spring is held by a ring or plate 29 which surrounds the inward extension of the bonnet and bears upon the ring or plate 27. The ring 29, as shown in Fig. 10, is provided with a recess 30 to allow the end of the helical spring 28 to be threaded through it. This spring, together with the bellows, provides the means whereby the valve is retracted from its seat, and should the bellows become fatigued or break down, the spring will act alone to accomplish the result.

A safety spring 31 is arranged in the tubular shell 11, between the back end thereof and the block or plunger 10 to which the slender operating rod 8 is connected. This relief spring is compressed initially or normally to say 15 or 20 pounds. It is held under this pressure by the brass shell 11 which contains it, and only yields in case the liquid should continue to expand to some extent after the valve had fully seated.

As before stated, heat is dissipated from the center of the shell outwardly and the right amount of heat is conveyed to this center by the slender operating rod 8, to set up the convection currents. The cell being exposed to the temperature of the room, will have its contained liquid influenced thereby to expand or contract, thus affecting the bellows 12 so that this will be compressed or reduced in length under an expansion of the liquid in the cell due to a rise of room temperature. Under this condition, the shell or sleeve 11 will be moved leftward and will transmit its movement through the unyielding spring 31 to the block 10 and therefore to the operating rod 8 to close the valve 2 toward or upon its seat 4 for cutting down or cutting off the steam supply to the radiator against the retrieving or retracting action of the spring 28 and bellows 26. When the room temperature falls, the liquid in the cell contracts, allowing the bellows 11 to expand, and the shell 11 recedes toward the right, and rod 8 is moved rightward with the bellows 26 and retrieving spring 28, retracting the valve 2 from its seat for the admission of steam to the radiator.

If it is desired to operate the valve by hand, the cell or globe 6 is used as a handle or the insulating disc 15 may be so used to turn the screw threaded sleeve or stem 20 after releasing stop 32, which will therefore move leftward and cause its end to bear on the shoulder 8a of or lock nut of the slender rod

8, thus moving this rod leftward and closing the valve. The slender rod has packing at 25 to prevent the escape of steam along it should the bellows 26 fail through rupture.

The cell or thermostatic unit may be removed by turning the cell to unscrew the sleeve or stem from the bonnet 22. The rod 8 goes with the thermostatic unit and the valve retracts from its seat, and causes its packing 24 to engage the end of the fixed sleeve 23, so that in case of leakage of the bellows 26, the steam will be unable, because of the seal formed by said packing, to reach the central bore from which the operating rod 8 has been removed, and thus escape of steam is prevented.

It will be noticed that all of the major parts of the device are coaxially arranged.

Means are provided by which the parts are locked in prescribed relation to each other. This locking means consists of a bracket 32 to be fixed to the insulating disc 15 so as to embrace a pin 32*a* on the valve casing. This bracket is secured by screws in the desired ones of an annular row of holes 33 Fig. 2, in the disc. These holes primarily are intended to hold a segmental member 34, Fig. 9 by means of screws 35. The segment has a projection 36 to come against the stop pin 32*a* to limit the open position of the valve and its upper temperature limit. The segment may be set in various positions about the disc so that various degrees of opening of the valve initially can be provided for.

This arrangement allows the valve to be adjusted by hand, but at the same time, it provides a stop for arresting the rotation of the thermostatic unit according to various adjustments desired of the valve. In other words, the prescribed adjustment of the segment having been made to get a certain temperature, the parts may be turned to get another temperature, but when it is desired to attain again the highest prescribed temperature, it is simply necessary to turn the parts to bring stud 36 to the pin 32*a*.

The packing 25 for the operating rod is shown in detail in Figs. 3, 4, 5, and 6. The preferred form is shown in Fig. 4 and enlarged view Fig. 6. This is made of three washers consisting of a comparatively thick central washer *a* and two thinner washers a^1, one at each side of the central washer, and in the form of cups. The central thicker washer is of a diameter to fit the bore of the seat in which the packing lies with its raw fibrous edge bearing upon the wall of said bore, whereas the thinner washers a^1 are of such diameter as to provide a flange a^2 to lie along the surface of the rod and between it and the wall of the bore. These washers are formed of laminated, fibrous material, such as Vellumoid or asbestos steam packing, which have a binder to prevent the fibres from detaching from the washer.

The ends of the fibres or the edges of the laminations provide a more or less plastic edge which conforms readily, especially when wet by the steam to the surface upon which they bear. The cup-shaped or bent over walls of the outer thin washers lie in a shallow groove defined by the shoulders or walls a^3, a^4, the former being on the rod and the latter on the nut 38 screw threaded onto the end of the rod. In the form now being described, the walls or shoulders a^3, a^4 form the retaining walls for the ends of the cup-shaped washers which at their edges are more or less plastic.

Instead of using three washers as in Fig. 4 and Fig. 6, I may use but one washer, as shown in Fig. 3. In this form, the washer at or near its periphery is parted and crushed or laid open in such a way as to provide two cup formations, which fill the channel and have the same effect in material degree to the form shown in Fig. 6.

In Fig. 5, the washer is made of two sheets of laminated material, each sheet being of cup form. In this Fig. also, the flanges of the washer overlie the outer surface of the rod and clamping nut which are smooth and have no channel forming shoulders as in Fig. 6.

The laminated material when unrestrained, will expand under the action of the steam which gives it a wet condition, therefore by proportioning the washers to the size of the space defined by the confining or restraining walls, we will get a good packing contact, with a very low friction element.

It will be noticed that the fixed tubular member or sleeve 23 in which the steam packing 25 is located has its taper bore so disposed that the rod 8 when being inserted into place will enter the larger diameter end of this bore and the packing 25 will be acted on gradually, owing to the long low incline of the wall of the bore and therefore, the advancing edge of the formed cup packing will not be distorted or turned back, but will reach its seat at the cylindrical bore in its prescribed position.

The above effect is aided by giving the rod a slight rotary motion as it advances along the bore of the sleeve, as though screwing it into place.

I show in Figs. 7 and 8 a modified form of the thermostatic elements and associated mechanism in which the cell proper containing volatile liquid is made up of, say as an example, two members 6*a* containing a volatile liquid, such as common ether. These members are inclosed in a housing or casing 6*b*, one of these members bearing upon a ring 39 attached to a shell or tray shaped member 40 of sheet metal having the triangular shape shown in Fig. 8.

This sheet metal member has links 41 pivoted thereto at 42, said links at their other

ends being pivoted to ears 43 extending from a plate 44, which is attached to the heat insulating shield 15*a* which forms the base of the enclosure 6*b*. At their intermediate points 46, the links or levers are pivotally connected to the disc 45, which is connected to the slender operating rod 8*a*.

When the cell members expand, they force the ring 39 with its shell 41 leftward and thus through the leverage links, this movement is transmitted to the disc 45, with a multiplied force of about three to one, so that the steam inlet valve is moved leftward towards closed position in opposition to the action of the retrieving spring before described.

In this modification, no sealing bellows like 26 of the first described form is used, but I depend upon the steam packing at 25 to make the seal. Before this packing passes out of its working bore in removing the cell unit, the retrieving spring will draw the packing washer 24 up against the conical seat at the end of the fixed member 23 so that the appliance is sealed for changing the cell.

As shown in Fig. 1*a*, I show a rod, such as 8*b*, provided with the packing 25 described above, but having a screw threaded portion 21*a* and a handle 6*x* which can be used as means to operate the steam valve 2 by hand. This appliance can be used in substitution for the thermostatic cell and associated parts. It fits in the same bonnet and the rod extends through the sleeve 23 in the same manner as does the slender rod 8. It may be used when the thermostatic unit is removed for repairs.

In the foregoing disclosure, it will be understood that where features are shown and described in connection with one form, and are susceptible of use in another form illustrated, they are to be regarded as belonging to the said other form.

As shown in Fig. 7, I have provided a protective strainer basket *b'* for the seat of the valve, below the valve, detachably carried by the lower portion *b* of the union coupling which is fixed to the vertical steam supply pipe.

By this combination, the strainer is readily accessible for inspection or cleaning without disturbing the valve, i. e., by simply unscrewing the union and springing the pipe to one side, the strainer is brought out to view, where it is easily removed.

In Fig. 11 I show so much of the appliance as will illustrate a further improvement, it being understood that the general form of the appliance is like that above described.

In this form the screw threaded sleeve 20*a* is adapted to have rotary movement independent of the thermostatic cell and heat shield or disc 15*a*, and said disc is adapted to be rotatably fixed to the valve casing by a pin 32*x* held at one end in a socket 32*y* of the valve casing. The sleeve 20*a* has a hub or flange 20*b* expanded into a recess of the disc 15*a*, but to permit rotary motion of the sleeve relative to the disc. The sleeve is rotated by a suitable handle such for instance as an arm or disc member 15*x* attached to the sleeve. This handle may have a pointer 15*b* to register with scale marks on the edge of the disc 15*a*. There is a friction washer at 15*c* of any ordinary construction arranged between the disc 15*a* and the sleeve so as to retain the sleeve in any position to which it may be turned. By this arrangement, hand adjustment can be effected by operating the sleeve without turning either the thermostatic cell or the disc 15*a*. These parts will of course move axially during the adjustment by the handle, but they will not turn during said adjustment. The handle may be turned to a point such as will cause the disc 15 to leave the pin 32*x* and then the cell with its associated parts may be removed by turning these parts as a body, as in the form first described.

It will be understood that the means of adjustment just described, and shown in Fig. 11, may be incorporated with the form shown in Fig. 1 and the details pertaining thereto. Where features are shown in one figure but are susceptible of transfer or incorporation in another figure, they are to be regarded as so incorporated.

I claim:

1. In combination in thermostatic steam inlet valves, a valve casing, an inlet valve therein, a cell containing expansible liquid, a bellows within the cell, a tubular member within the bellows attached thereto, a rod extending from the inlet valve into said tubular member, and a spring within the tubular member and interposed between the end of the tubular member and the rod, substantially as described.

2. Apparatus according to claim 1, in which a member slidable within the tubular member is attached to the rod and affords a bearing for the spring.

3. In combination with the inlet valve and its casing, a thermostatic cell, a bellows therein, a rod extending from the inlet valve into the bellows and a spring within the bellows and between it and the rod, said rod at its front end contacting the valve and serving as a conductor of a definite degree of heat to the cell, substantially as described.

4. In combination, an inlet valve for a steam radiator, a casing therefor, a thermostatic cell containing an expansible fluid, a bellows within the cell, a tubular member arranged within the bellows and attached thereto, a rod extending from the valve and having an enlargement slidable within said tubular member and a spring between said enlargement and the end of the tubular member.

5. In combination, a steam inlet valve, a

casing therefor, a thermostatic cell, a rod extending from the valve into the cell, a bellows within the cell for operating the rod, means connected to the valve for retrieving the same, said valve having an annular extension, a bearing within said annular extension and within the casing on which said annular extension is guided, a hood on the casing, said retrieving means being connected with the hood at its end distant from the valve, substantially as described.

6. Apparatus according to claim 5, in which said bearing is carried by a hood forming part of the casing, which hood has an internal screw thread receiving removably a sleeve connected with the cell so that the cell can be removed and replaced, said rod passing through said sleeve, substantially as described.

7. In combination, a valve casing, an inlet valve therein for steam radiators, a thermostatic cell removably mounted on the valve casing, a rod influenced by said thermostatic cell for closing the valve, means for retracting the valve, a bearing having a bore against the wall of which the rod works and by which it is guided at its front end, said rod carrying thereon a packing to seal the bore of the bearing, said packing having sliding contact with the wall of said bore, substantially as described.

8. In combination, a valve casing for attachment to a steam radiator, an inlet valve therein, a thermostatic member, a rod for operating the valve from said member, a packing on the rod, a bearing within the casing through which the rod moves and by which it is guided at front end, said bearing having a flaring bore leading thereto, substantially as described.

9. In combination, a valve casing for attachment to a steam radiator, an inlet valve therein, a thermostatic member, a rod for operating the valve from said member, a packing on the rod, a seat for the valve in rear thereof, packing for sealing said seat, said thermostatic means and rod being removably mounted while leaving the valve in place, and means for retracting the valve onto its rear seat when said removable parts are withdrawn, the seat packing then being effective to seal the space left by the removal of the rod, substantially as described.

10. In combination, a valve casing, a hood attached to the valve casing and having an extension within the same, an inlet valve guided on the exterior of said extension, means for retracting the valve surrounding said extension, a thermostat and a rod operated thereby for closing the inlet valve, said rod extending entirely through said extension and engaging the valve, substantially as described.

11. In combination, a valve casing, an inlet valve therein, a thermostat arranged coaxially with the valve and having a connection thereto for closing the same, a sleeve screw threaded into the valve casing and turnable independently of the thermostat for carrying and adjusting the said thermostat, together with its connection, towards and from the valve seat, said thermostat being held against turning movement during said adjustment and means for so holding the thermostat.

12. Apparatus according to claim 11, in which the sleeve has a range of axial adjustment to move the thermostat to a point released from its holding means so that then the thermostat can be turned and thereby removed.

13. In combination, a valve casing, an inlet valve therein, a thermostat, a rod for imparting the movement of the thermostat to the valve to close the same, a screw threaded sleeve revolubly connected with the thermostat, and working in a screw thread of the casing, a spline connection between the thermostat and the casing for permitting movement coaxially of the valve but preventing rotary movement, means for turning the sleeve to adjust the valve, or for removing the thermostat from the casing, substantially as described.

14. In combination, a valve casing for attachment to a steam radiator, an inlet valve therein, a thermostatic cell, a rod influenced by said cell to close the valve, a hood removably attached to the casing, and a sleeve through which the rod is guided carried by said hood, said sleeve carrying the cell, substantially as described.

15. Apparatus according to claim 14, in which said hood has a threaded portion and the sleeve has a screw threaded portion engaging the threads of the hood, substantially as described.

In testimony whereof, I affix my signature.

EDWARD S. HALSEY.