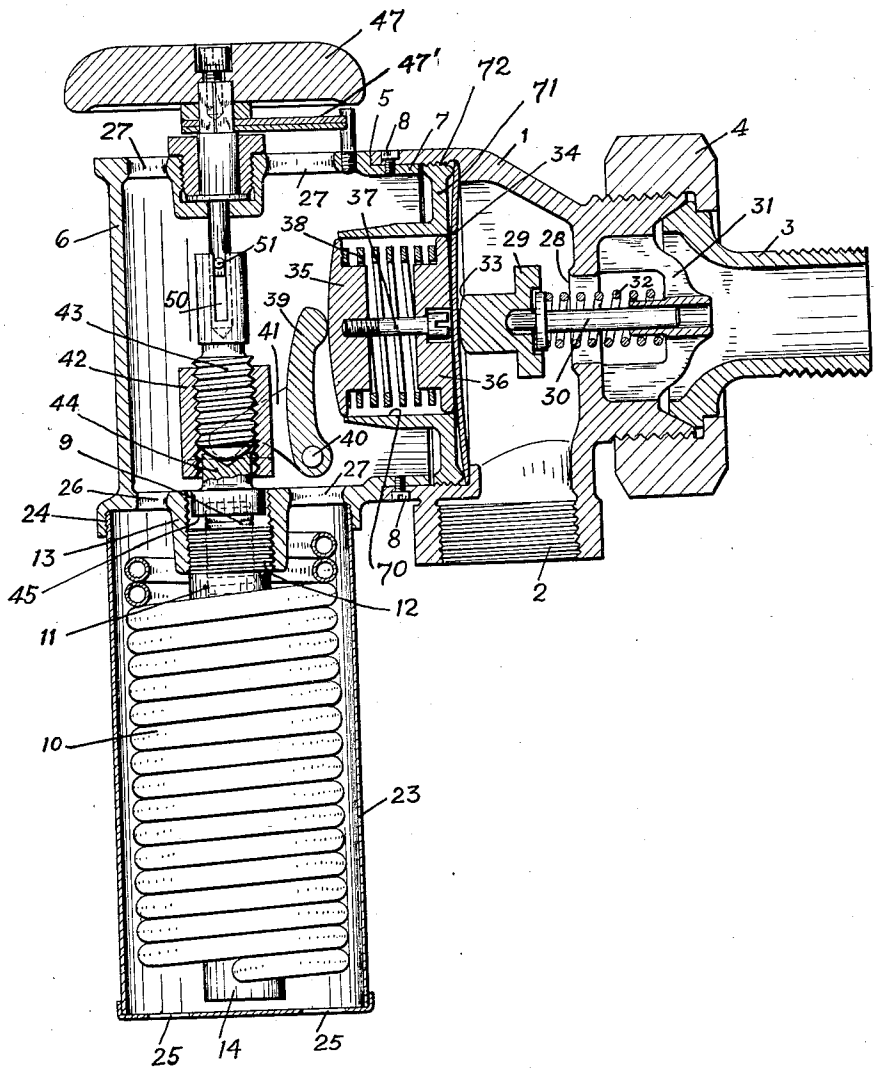
June 14, 1932. V. FINA 1,862,567

THERMOSTATIC CONTROL FOR VALVES

Filed Oct. 2, 1928 2 Sheets-Sheet 1

Fig. 1.



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Filed Oct. 2, 1928 2 Sheets-Sheet 2

Fig. 2.

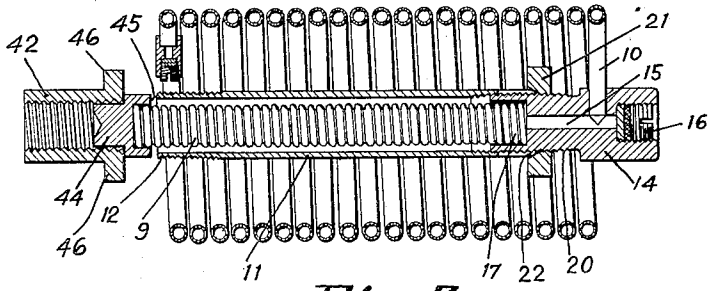


Fig. 3.

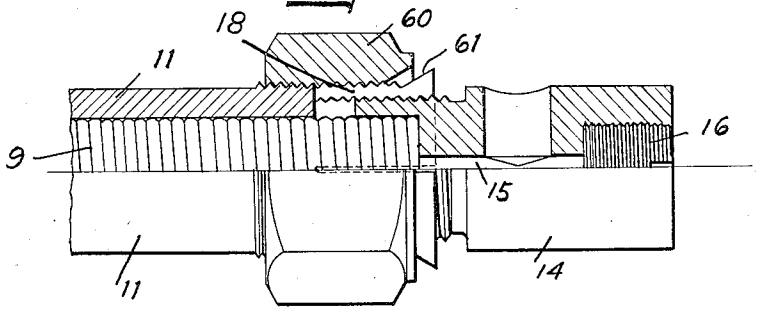


Fig. 4.

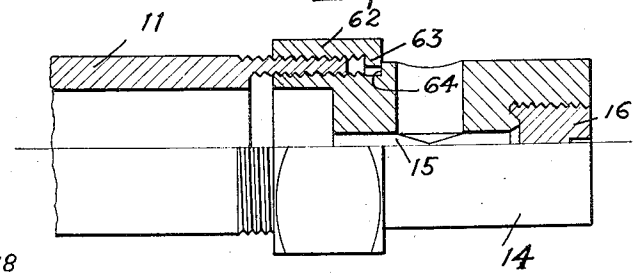
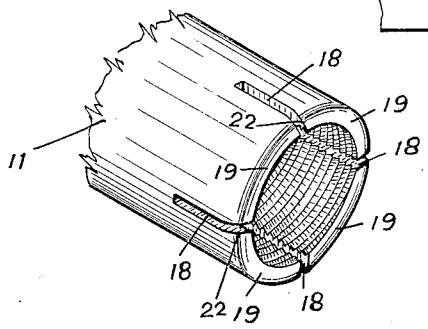


Fig. 5.



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1,862,567

UNITED STATES PATENT OFFICE

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THERMOSTATIC CONTROL FOR VALVES

Application filed October 2, 1928. Serial No. 309,817.

This invention relates to mechanism for thermostatically controlling and actuating valves and, with respect to its more specific features, to mechanism of the character referred to which is adapted to operate heat regulating valves as, for instance, the valves of steam or hot water radiators for heating rooms and the like.

Among the objects of the invention is the provision of a simple and practical device wherewith the adjustment of the thermostat to give its maximum efficiency under varying conditions of use may readily be made; to provide a simple, efficient and convenient construction for making the adjustment; to provide a practical and efficient operative connection between the thermostat and the valve to be operated; to avoid the necessity for filling expansible fluid thermostats with a high degree of accuracy before installing them in the valve control mechanism.

The invention accordingly comprises the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a vertical section taken centrally through controlling and actuating mechanism embodying this invention;

Fig. 2 is a sectional detail of a part of the mechanism illustrated in Fig. 1, and

Figs. 3, 4 and 5 illustrate respectively different modifications of detail.

Referring now more specifically to the drawings, it may be observed that the controlling mechanism is of the general type illustrated in Patent #1,640,243, patented August 23, 1927. The frame or casing of the controlling mechanism is indicated at 1. This frame is hollow and has a port 2 for introduction of heating medium, as steam or hot water, from the main supply of heating medium. The numeral 3 indicates a tubular coupling for leading the supply of heating medium to the radiator (not shown). The numeral 4 is a nut for retaining the coupling 3 in place. In the present embodiment the frame or casing 1 is divided into two sections along the line 5, the left hand section 6 having a flange 7 removably telescoping within the right hand section, and held in place by screws 8.

In the present embodiment the thermostatic element includes a longitudinally expansible and contractible tubular cell 9 made of metal. This cell is provided with circumferential corrugations as illustrated, to render it longitudinally flexible, so as to offer slight resistance to longitudinal expansion and contraction while preserving relative transverse rigidity. The corrugations are preferably co-extensive with the length of the cell. Communicating with the interior of the tubular cell 9 is a chamber which, in the embodiment illustrated, is a metal coil 10 which provides a thermo-sensitive surface substantially tubular in form and surrounding the cell 9. The cell 9 and the coil 10 are practically filled with a thermo-responsive expansible and contractible fluid as, for instance, liquid kerosene. When the thermostatic element is subjected to variations of temperature, the liquid therein expands or contracts and either causes an expansion of the cell 9 longitudinally of its long axis, or permits such cell to contract, the kerosene in the coil 10 providing a large volume of expansible and contractible liquid for effecting expansion and contraction of the cell 9.

Projecting or depending from the section 6 of the frame or casing is the support for the tubular cell 9. In the present embodiment this support consists of two members adjustably movable relative to each other for a purpose hereinafter described. One of these members is indicated at 11, being a sleeve or other rigid metal member laterally enclosing the greater part of the cell 9 and having threads 12 whereby it may be removably attached in stationary position to the frame or casing 1 as, for instance, to the interiorly threaded tubular bracket 13 which is an integral part of the left hand section 6 of the frame. Another of the cell supporting mem-

bers is indicated at 14, being a metal block having a liquid passage-way 15 closed by a suitable packing and a screw as indicated at 16. The block 14 directly carries the cell 9, this latter being soldered or otherwise firmly attached in a recess in one end of the block 14 as indicated at 17. At its end near the block 14 the sleeve 11 is provided with a circumferential series of resilient tongues 18 having bevelled ends 19, these tongues having interior screw threads for cooperation with external screw threads 20 on the carrier 14. The numeral 21 indicates an internally threaded nut engaging the external threads of the carrier or block 14. The sleeve or tubular member 11 is made of metal, and the tongues are integral parts of such sleeve and are resiliently flexible transversely of the longitudinal axis of the sleeve. The nut 21 has an interior, annular, bevelled, or cam face 22, so that when the nut is rotated on the carrier it will engage the bevelled ends of the tongues and compress them against the carrier so as to hold the sleeve 11 and the carrier 14 in any relative position of adjustment. By loosening the nut 21 the carrier 14 may be manually rotated relative to the sleeve 11 and thus longitudinally adjust the position of the tubular cell 9 in the sleeve 11. The tubular member 11 also serves to guide and laterally to brace the cell 9, being preferably closely adjacent the exterior face of the cell 9.

Referring to Figure 1, numeral 23 indicates a thin, hollow, metal, protector shell which encloses the thermostatic coil and cell 9, this shell being screw-threaded to the frame at 24 for ready detachment, and having a series of openings 25 in its bottom face for free circulation of air, the frame also having apertures 26, 27 for free circulation of air. The numeral 28 indicates the valve port for the passage of steam to the radiator through the coupling 3, from the steam supply port 2, and the numeral 29 indicates the valve to be controlled and which opens and closes the port 28. The valve 29 is loosely supported in a rockable manner on the end of a valve stem 30, which stem slides and is guided in a spider bracket 31, which latter may be cast integral with the right hand section of the casing 1. For opening the valve 29 there is a spring 32 disposed between the valve 29 and the bracket 31. The rounded end 33 of valve 29 presses against a thin, resilient, metal diaphragm 34, which latter is clamped in the casing. On the opposite side of the diaphragm is a plunger composed of the two metal heads 35, 36 connected by the screw bolt 37 and resiliently pressed apart by a strong spring 38. This plunger is slidable in a guide opening 70, of a ring 71, this ring being threaded to the frame at 72, and clamping diaphragm 34 in place in a steam-tight manner. The numeral 39 indicates a lever fulcrumed at 40 and having a forked arm 41 which is disposed on opposite sides of an exteriorly polygonal, force-transmitting member or sleeve 42 having interior screw threads engaged by the threads of a manually rotative, setting member 43.

On one end of the tubular cell 9 there is affixed a metal head 44 having a conical recess which is adapted to be engaged by the lower end of the member 43. The head 44 extends laterally of the tubular cell 9 to provide an abutment or flange 45 in alignment with that end of the sleeve 11 which is remote from the carrier 14. As will be seen from Figure 2, in the present embodiment the greater portion of the length of the tubular cell 9 lies in the sleeve 11, but the upper end thereof extends outside the sleeve 11 and freely into the sleeve member 42. Laterally projecting at opposite sides of the member 42 are the shoulders 46, against which the cam faces on the tines of the fork 41 are adapted to bear to depress the member 42 and the parts connected to the latter. For turning the setting member 43 a handle or knob 47 may be used.

In operation, when the cell 9 expands, it urges the member 42 upwardly (Figure 1), causing movement of the lever 39 to the right, and in consequence causing closing movement of the valve 29. When the cell 9 contracts the spring 32 imparts opening movement to the valve 29, this movement being permitted by reason of the contraction of the cell permitting the intermediate elements to move in counter direction to that in which they move to close the valve. When the controlling mechanism is in use on a radiator system the operation is substantially as follows: The heating medium, as steam, enters the port 2 and passes to the radiator through the valve port 28 when the valve 29 is open. The valve 29 is moved to close port 28 by expansion of the tubular cell 9. Closing movement of valve 29 is effected through the lever 39 which latter is actuated by the shoulders 46 on member 42 contacting with lever arm 41. Lever 39 moves plunger head 35 to the right (Fig. 1) and, through spring 38, also moves plunger head 36 to the right, thereby flexing diaphragm 34 and closing valve 29 against the resistance of the valve opening spring 32. When cell 9 contracts the spring 32 opens valve 29, flexes diaphragm 34 in the opposite direction, and also moves lever 39 contrary to its opening movement. By rotating handle 47 in one or the other direction actuation of lever 39 by the cell 9 to close the valve 29 may be controlled and adjusted at will, so as to set the connections to effect such actuation at any selected temperature within the range of operation of the cell 9. The member 47′ operatively connected for rotation with the handle 47 as shown in Fig. 1 may serve as the pointer of an indicator for indicating the selected temperature for which the automatic temperature regulation is set.

In case the expansible fluid in the cell 9 does not completely fill such cell, thus requiring some little expansion of the liquid before operating with full force to expand the cell, the full force of the thermostatic element might not act on the lever 39 even though the arms 41 were in contact with shoulders 46 and the setting member 43 in contact with the head 44 of cell 9. Under such conditions, though the handle 47 were set for closing the valve at a predetermined temperature of the room, some small interval might be required before the liquid in the cell 9 expanded sufficiently to exert its full force to expand the cell. Thus the valve might not close until a slightly higher temperature than that for which it had been set is reached. But by loosening nut 21 and adjusting tubular sleeve 11 longitudinally, or axially, relative to carrier 14, the cell 9 may either be adjustably expanded or contracted in length, independent of expansion or contraction due to variation of temperature alone thereby varying the relation of the longitudinal dimension of cell 9 to that of the expansible and contractible liquid contained therein. In other words, this arrangement provides a volumetric adjustment of the sensitive thermostatic element whereby the internal volume may be either increased or decreased at will. It will be understood that other means for effecting this volumetric adjustment of the thermostatic element may be substituted for that shown. Should the fluid in the cell be sealed therein under too great pressure, or be too great in amount, rotation of carrier 14 in one direction will cause the abutment 45 of the head 44 to contact with the sleeve 11 and lengthen the cell 9. Or if the fluid in cell 9 is too little in amount, rotation of carrier 14 in the opposite direction will cause the abutment 45 to separate from the end of sleeve 11, thus permitting the cell 9 to be adjustably contracted in length until the liquid completely fills the cell or fills it to the desired degree. This contraction might be effected by rotating handle 47 so as to cause stem 43 to forcibly contact the cell. As this would disturb the temperature adjustment for which the handle is set and require resetting of the handle for temperature adjustment, provision is made for effecting such adjustable contraction of cell 9 by means independent of the adjustable position of the handle 47. In the embodiment illustrated the stem 43 is connected to handle 47 by a slot 50 in the stem engaging a pin 51 on the handle, thus maintaining the stem and handle in constant rotative position relative to each other, while permitting rise and fall of the stem in any position of rotative adjustment. In this wise and by using a sufficiently strong valve opening spring 32, such spring may be relied upon to contract cell 9 to the desired degree. Also, in case contraction is not needed, the valve opening spring 32 will keep arms 41 in effective operable position relative to shoulders 46 and take up all lost motion between lever 39 and such spring, thereby tending to accuracy of time of operation of the valve by the cell.

Various different devices may be employed for securing the carrier 14 in position of adjustment relative to sleeve 11. In Fig. 3 the holding nut, instead of being threaded on the carrier is threaded on the sleeve 11, the nut being indicated at 60. In this form the bevels 61 on the resilient tongues 18 flare outwardly instead of inwardly as in Fig. 2.

In Figure 4 the carrier 14 engages the interior of sleeve 11 and a stop nut 62 threaded on the sleeve has a flange 63 which abuts a shoulder 64 in the carrier to lock the sleeve and carrier in adjusted relation. In this form the resilient tongues need not be used.

Many practical advantages pertain to the present invention. In practice hundreds of thermostats are filled and sealed apart from the conditions under which they are to be used. With the utmost care in filling it is difficult to attain such accuracy of filling as to eliminate all gas in the filled thermostatic cells. It will be perceived that any such gas in the cell may require compression before the full expansive force of the thermostatic liquid becomes effective to expand the cell 9. By the invention herein described contained gas is rendered relatively negligible as the length of the cell may be readily adjusted as it is installed to counteract for the pressure of contained gas. Furthermore, by the present embodiment this may be accomplished while retaining the adjustment of the setting handle 47 or for any adjustment of such handle. Thus, by the above described construction are accomplished, among others, the objects hereinbefore referred to.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In combination in thermostatically controlled means for actuating a valve, a longitudinally expansible and contractile tubular cell containing thermo-responsive expansible and contractile liquid, and means adjustable for increasing the length of said cell inde-

pendently of expansion thereof due to rise of temperature, said means including a cell supporting sleeve laterally surrounding the cell, an abutment on one end of said cell in longitudinal cooperative alinement with said sleeve, and a cell-supporting block to which the opposite end of said cell is attached, said block and sleeve being longitudinally adjustable, at will, relative to each other.

2. In combination in thermostatically controlled means for actuating a valve, a longitudinally expansible and contractile tubular cell containing thermo-responsive expansible and contractile liquid, means adjustable for increasing the length of said cell independently of expansion thereof due to rise of temperature, said means including a cell-supporting sleeve laterally surrounding the cell, an abutment on one end of said cell in longitudinal cooperative alinement with said sleeve, and a cell-supporting block to which the opposite end of said cell is attached, said block and sleeve being longitudinally adjustable, at will, relative to each other, and a nut movable on a cell-supporting member to either hold said sleeve and block in adjusted position or to relieve said hold.

3. In combination in thermostatically controlled means for actuating a valve, a longitudinally expansible and contractile tubular cell containing thermo-responsive expansible and contractile liquid, means adjustable for increasing the length of said cell independently of expansion thereof due to rise of temperature, said means including a cell-supporting sleeve having resilient tongues, an abutment on one end of said cell adapted to be engaged by said sleeve, a cell-supporting block threaded on said sleeve and to which the opposite end of said cell is attached, said sleeve and block being longitudinally adjustable, at will, relative to each other, and a nut having a cam face for compressing said tongues against said block to hold said sleeve and block in adjusted position.

4. In combination in thermostatically controlled means for actuating a valve, a metal supporting sleeve, a longitudinally expansible and contractile tubular cell, containing thermo-responsive expansible and contractile liquid, disposed in said sleeve and having a head outside said sleeve in longitudinal alinement with the adjacent end of said sleeve, the opposite end of said sleeve having resilient tongues, a block threaded on said sleeve and lying opposite said tongues, said cell attached to said block for adjustable movement therewith longitudinally of said sleeve when said sleeve and block are rotated one relative to the other, and means adapted to secure said sleeve and block in relative adjusted position.

5. In a thermostatic valve actuating means in combination, a longitudinally expansible and contractile tubular cell containing thermo-responsive expansible and contractile fluid, a stationary cell-support including a sleeve attached to a supporting structure and a cell supporting block to which the cell is attached at one end thereof, said block being adjustably connected to said sleeve for adjustment longitudinally of the sleeve and cell, means including a head connected to said cell at the end thereof opposite to said block whereby said sleeve and block may be adjusted relative to each other to effect volumetric adjustment of said cell, and a cell contracting locking nut engaging said cell to contract it in locked position upon said supporting block.

6. In a thermostatic valve actuating means in combination, a longitudinally expansible and contractile tubular cell containing thermo-responsive expansible and contractile fluid, a stationary cell-support including a sleeve attached to a supporting structure and a cell supporting block to which the cell is attached at one end thereof, said block being adjustably connected to said sleeve for adjustment longitudinally of the sleeve and cell, means including a head connected to said cell at the end thereof opposite to said block whereby said sleeve and block may be adjusted relative to each other to effect volumetric adjustment of said cell, said sleeve having resilient tongues embodied in the connection with said block whereby the sleeve may be contracted for locking it in adjusted position, said tongues having cam faces, and a locking nut having cam faces engaging said first mentioned cam faces for contracting said tongues into locking position upon said supporting block.

In testimony whereof I affix my signature.

VALENTINE FINA.