N. WISE.

THERMOSTATIC VALVE CONTROLLING MECHANISM.

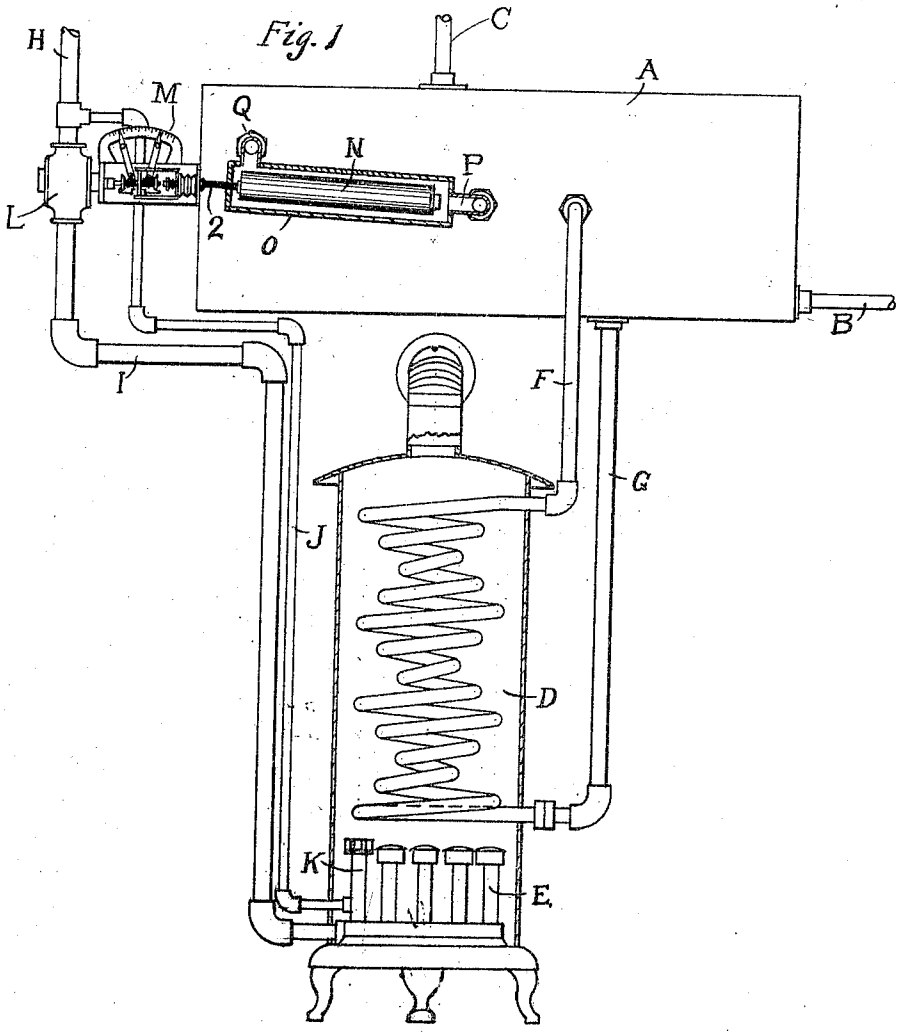
APPLICATION FILED FEB. 9, 1911.

1,030,367.

Patented June 25, 1912

3 SHEETS-SHEET 1

Fig. 1



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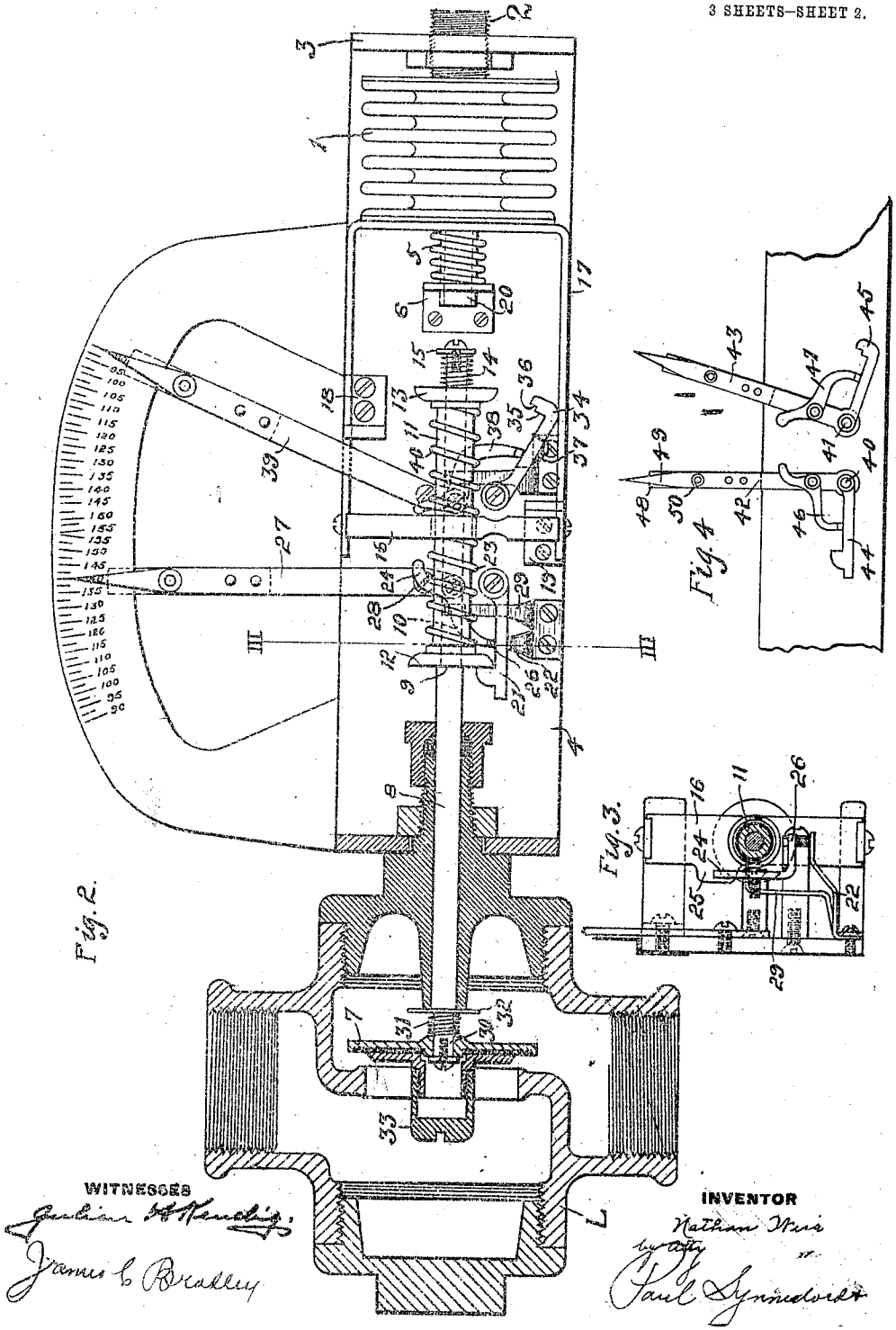

Fig. 2.

Fig. 4

Fig. 3.

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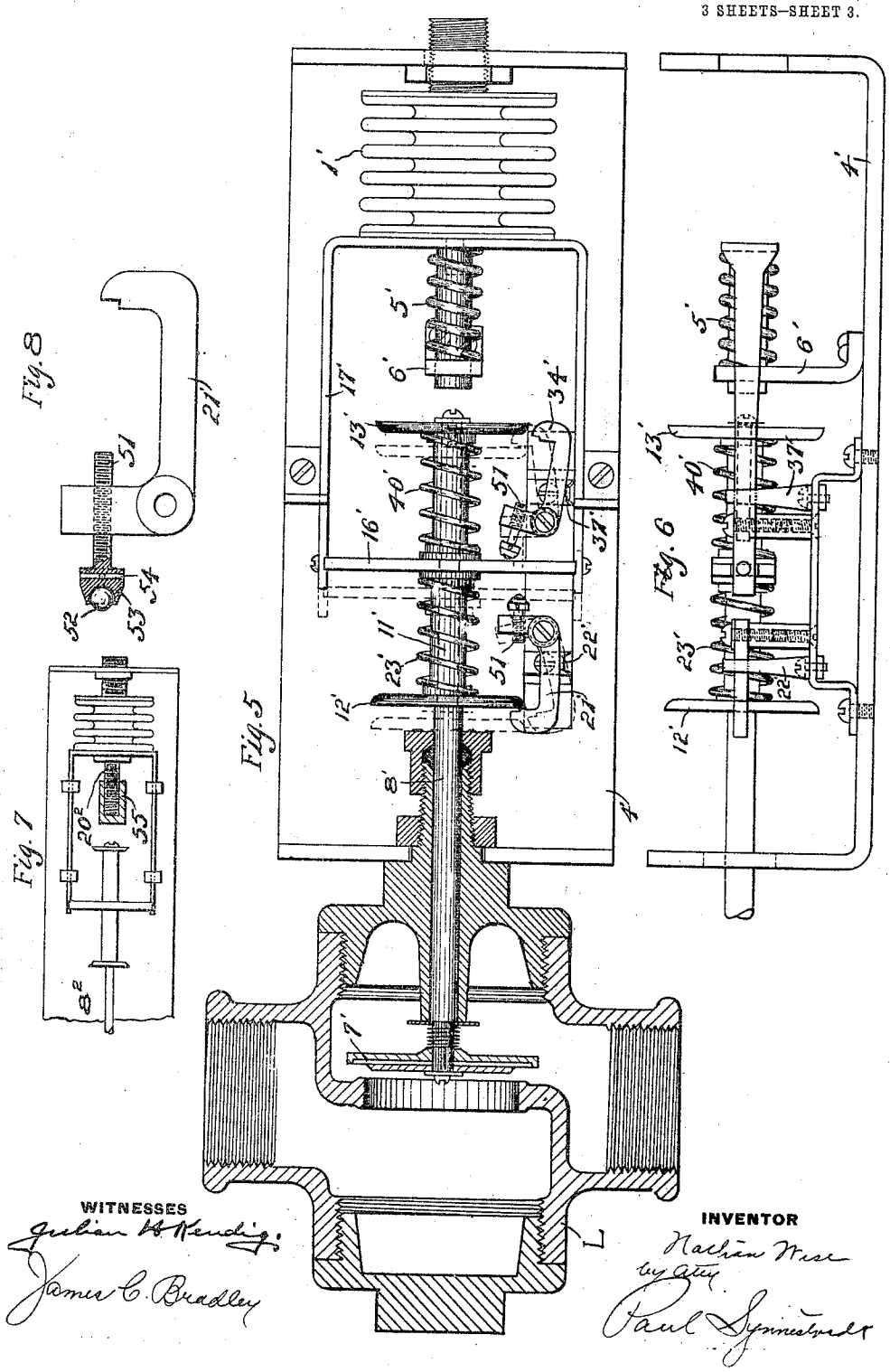

UNITED STATES PATENT OFFICE.

NATHAN WISE, OF NEW YORK, N. Y.

THERMOSTATIC VALVE-CONTROLLING MECHANISM.

1,030,367. Specification of Letters Patent. Patented June 25, 1912.

Application filed February 9, 1911. Serial No. 607,668.

To all whom it may concern:

Be it known that I, NATHAN WISE, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Thermostatic Valve-Controlling Mechanism, of which the following is a specification.

The invention relates to thermostatic valve controlling mechanism and more particulary to mechanism of this character for use in connection with what are known as storage water heaters. The primary objects of the invention are; the provision of an improved quick acting mechanism thermostatically controlled, of very direct, positive and reliable action; the provision of a mechanism of the character specified having means whereby the violence of the ignition explosion is reduced to a minimum; the provision of improved safety means for securing the closing of the valve in case the quick acting mechanism for controlling the valve is accidentally prevented from operating; and the provision of means whereby the range of operation of the valve may be readily and accurately adjusted. Certain embodiments of the invention are illustrated in the accompanying drawings, wherein:—

Figure 1 is a general view showing the application of the apparatus to a storage water heater, Fig. 2 is a side elevation of the valve operating mechanism, with the gas valve in section, Fig. 3 is a section on the line III—III of Fig. 2, Fig. 4 is a plan view of a modified form of adjusting means, Fig. 5 is a side elevation of a modified form of valve operating mechanism with the gas valve in section, Fig. 6 is a side elevation of a part of the apparatus of Fig. 5, Fig. 7 illustrates in plan view a modified detail of construction, and Fig. 8 is an enlarged detail view of one of the catches or detents employed in the device as shown in Fig. 5.

Referring to the general arrangement as shown in Fig. 1, A is the reservoir or tank of a storage system, which tank is provided with the cold water inlet pipe B connected to the main, and the outlet pipe C for hot water; D is a coil heater provided with the battery of burners E, and connected with the reservoir A by means of the pipes F and G; H is the gas pipe provided with the main branch I, leading to the battery of burners E and with the branch J leading to the pilot light K; L is the gas valve for controlling the flow of fuel through the pipe I; and M is a quick acting mechanism for controlling the gas valve L, such quick acting mechanism being operated by the thermostat N lying in the casing O outside of the reservoir A, but connected to such reservoir by means of the circulation pipes P and Q.

The character of the thermostatic controlling means will be seen by reference to Figs. 1 and 2. The casing N is filled with a liquid such as ether having a high coefficience of expansion, and this casing is connected with the corrugated expansion member 1 by means of a pipe 2. A rise of temperature in the casing N causes the liquid therein to expand, and the forcing of this liquid into the corrugated member 1 tends to carry the front end of such member forward, the rear end of the member 1 being supported upon the flange 3 of the suporting framework 4. On a lowering of the temperature in the casing N a reversed movement of the front end of the member 1 occurs, such movement being assisted by the spring 5, which bears upon the bracket 6 carried by the frame 4.

The valve casing L is provided with the controlling valve 7 mounted upon a stem 8, which stem has a shoulder 9, and a portion 10 of reduced diameter extending from the shoulder 9 to the rear end of the stem. Mounted slidably upon this reduced portion 10 of the stem is a sleeve 11, which sleeve is provided with the disks 12 and 13 integral with the sleeve, the said sleeve being held in the position shown with the disk 12 against the shoulder 9 by means of the relatively light spring 14 interposed between the disk 13 and the washer 15 carried by the reduced portion 10 of the valve stem. Mounted loosely and slidably upon the sleeve 11 is the cross head 16, which cross head is secured at its ends to the guide-frame 17, such frame being slidably supported for longitudinal movement upon a pair of upstanding brackets 18 and 19 carried by the frame 4. The rear end of this frame 17 is provided with the forwardly projecting member 20 which passes freely through the upstanding flange of the bracket 6. The rear end of this frame 17 is engaged by the front face of the corrugated member 1, and from the foregoing description it will be seen that this frame with its cross head 16 follows the movement of the front end of the member 1, so that the move-

ment of the cross head 17 is governed by the temperature of the liquid in the thermostat casing N.

Mounted adjacent the sleeve 11 is the pivoted detent or catch 21 normally held in the position shown in Fig. 2 by means of the leaf spring 22 bearing against the back of the detent. Intermediate the cross head 16 and the disk 12 is a spring 23, which spring 23 is placed under compression as the cross head 16 moves to the left by reason of the fact that the disk 12 which supports the left hand end of the spring is held against movement to the left by the detent 21. Until the detent 21 is released therefore there will be no movement of the gas valve 7, and after the detent 21 is released, the spring 23 will expand and snap the valve shut suddenly. The release of the detent 21 at the proper time is secured by means of the dog 24 lying beneath the sleeve 11 and having one end lying in the path of movement of a lug 25 (see Fig. 3) upon the cross head 16, and the other end 26 upturned and adapted to bear against the front side of the detent 21. When the cross head 16 moves sufficiently to the left therefore to engage the end of the dog 24, the other end of the dog will press the detent 21 outward and release the disk 12, permitting the valve 7 to snap shut. The dog 24 is pivotally mounted upon the end of the indicator arm 27 as indicated in dotted lines in Fig. 2, and such arm 27 is in turn pivotally mounted upon the frame 4 by means of the screw 28. It will be seen that the position of the dog 24 may be shifted bodily by the movement of the indicator arm 27, and that the time at which the release of the detent 21 occurs will be dependent upon the position of the indicator arm. The dog 24 is normally held in the position indicated by means of the leaf spring 29. In case the stem 8 should stick in its stuffing box after the release of the detent 21, or in case the mechanism should fail to operate to release the detent 21 at the proper time, the valve 7 will still be closed, and an over heating of the water in the reservoir avoided. This is accomplished by the engagement of the member 20 with the washer 15 carried by the rear end of the stem 8, the distance between the member 20 and the washer 15 being such that these parts will not come into engagement unless the quick acting portion of the mechanism fails to work and the temperature of the water rises above the point for which the quick actuating mechanism is set. In order to prevent injury to the valve 7 due to too great a movement of the member 20 under the conditions as just described, the front end 30 of the valve stem 8 is mounted to slide freely through the valve disk the spring 31 being interposed between the disk and the washer 32 carried by the valve stem, and the opening through the valve being closed by means of the screw cap 33.

The means whereby the quick snap opening of the valve is secured when the temperature of the water in the reservoir drops below a predetermined point is substantially the same as that just described for securing the quick closing of the valve, the primary difference being that the detent 34 is provided with two holding faces 35 and 36 instead of a single holding face as is the case with the detent 21, such holding surfaces being provided upon this detent 34 in order to secure a two stage opening of the valve 7 in the manner and for the purpose to be hereinafter described. The detent 34 is normally held forward by means of a leaf spring 37, and is actuated by a dog 38 corresponding to the dog 24 heretofore described, such dog 38 being pivotally mounted upon the end of an indicator arm 39. A spring 40 is provided upon the sleeve 11, such spring being interposed between the cross head 16 and the disk 13 and corresponding to the spring 23 upon the other side of such cross head. With the parts as indicated in Fig. 2 the temperature of the water in the casing O has just dropped to 90 degrees, and the cross head 16 has moved sufficiently to the right to engage the end of the dog 38 with the result that the other end of the dog 38 has engaged the detent 34 and moved it to the position shown, thus permitting the valve stem 8 to move suddenly to the position indicated, and permitting a full flow of gas past the valve 7. The two faces 35 and 36 upon the detent 34 are provided in order that the valve 7 may not arrive at its complete full open position at one movement. It has been found that where the gas valve is moved in one movement to full open position too great a quantity of gas accumulates in and about the burners E before ignition from the pilot K occurs, so that upon such ignition there is an explosion of more or less violence, which explosion is not only detrimental to the apparatus but is undesirable, because of the noise incident to the repeated and periodic explosions, and the fact that users of the apparatus become apprehensive as to its safety. It has been found that these explosions may be largely eliminated by first permitting the valve to open slightly and then after momentarily holding the valve in this position of partial opening, giving it its final movement to full open position. When the valve 7 is in full closed position, the surface 35 on the detent 34 engages the face of the disk. The preliminary movement of the detent by the dog 38 causes the detent to move to the rear sufficiently to allow the disk 13 to move so that it engages the surface 36 giving a partial opening of the valve 7. A

further movement of the dog 38 completely disengages the detent from the disk, permitting a full opening of the valve.

Starting with the parts at the position indicated in Fig. 2, and with the water in the reservoir at a temperature of about 90 degrees, the operation is as follows. The valve 7 is in full open position so that there is a free flow of gas to the battery of burners, E, and the water in the reservoir is rapidly heated. As such heating continues, the liquid in the casing N expands, causing the member 1 to expand and carry the frame 17 and cross head 16 to the left. This movement of the cross head 16 permits the dog 38 to move back to its normal position, the detent 34 moving forward to a position in which it is ready to engage the disk 13. The movement of the cross head 16 to the left upon the sleeve 11, also produces a compression of the spring 23, which compression continues until the cross head engages the end of the dog 24, at which time the water in the reservoir has reached a temperature of nearly 140 degrees. A further movement of the cross head to the left causes the dog 24 to disengage the detent 21 from the disk 12, so that the expansion of the spring 23 causes the valve 7 to snap shut entirely cutting off the supply of gas. As the water in the reservoir cools or as the hot water in the reservoir is withdrawn therefrom the reverse action occurs, and the front end of the corrugated member 1 moves to the right, the frame 17 and the cross head 16 being carried therewith by the spring 5. The detent 34 engages the face of the disk 13 and prevents its movement to the right, after which the spring 40 is gradually compressed until the water in the reservoir reaches the temperature for which the thermostat is set, at which time the engagement of the cross head 16 with the dog 38 first partially disengages the detent 34 from the disk 13, and then fully disengages it, permitting the valve to move to open position, which movement completes the cycle of operation.

In Fig. 4 a modified arrangement of indicator arms, dogs and detents is shown. In this arrangement the pivot points 40 and 41 of the indicator arms 42 and 43 are coincident with that of the detents 44 and 45, and the dogs 46 and 47 are carried intermediate the pivot points 40 and 41, and the ends of the indicator arms 42 and 43. In this arrangement as in the arrangement of Fig. 2, the movement of the indicator arms shifts the dogs bodily, so that the points at which the valve is operated may be varied to suit conditions. In this construction as in the construction of Fig. 2, the ends of each of the indicator arms are in two parts, the parts 48 lying behind the indicator segment and the pointers 49 to the front of such indicator, a screw 50 being provided for clamping the parts 48 and 49 tightly against the indicator segment to prevent accidental movement of the arm. In this connection it will be seen that any movement which is given to the dogs is greatly magnified at the upper ends of the indicating arms, so that a very accurate adjustment can without difficulty be made by anyone.

In Figs. 5 and 6 a modified form of apparatus is shown, the principle of such apparatus and its general method of operation being precisely the same however, as that of the apparatus shown in Fig. 2. The principal distinction in the apparatus over that of Fig. 2 resides in the fact that the dogs 24 and 38 of the apparatus of Fig. 2 are done away with, and the detents are actuated directly from the cross heads. Briefly stated, the principal parts as shown in Figs. 5 and 6 are as follows. L′ is the gas valve, 4′ is the frame upon which the apparatus is mounted, 7′ is the gas valve provided with the stem 8′ to which is secured the sleeve 11′ provided with the disks 12′ and 13′, 1′ is the corrugated member, 17′ is the frame carrying at its front end the cross head 16′ and normally held to the rear by means of the spring 5′ bearing at its front end against the bracket 6′, 23′ and 40′ are the compression springs mounted upon the sleeve 11′, and 21′ and 34′ are the detents for coöperating with the disks 12′ and 13′. The dogs 21′ and 34′ are held normally forward by means of the leaf springs 22′ and 37′, and are provided at their rear ends with the adjusting screws 51. These screws are provided at their ends with the balls 52 held in position in the ends of the members 51 by turning in slightly the edges 53 of the sockets in which they are mounted. Slots 54 are provided through the heads of the screws for engagement with a tool when it is desired to adjust the screws. The actuation of the detents is secured directly by the engagement of the cross heads 16′ with the ends of the screws 51.

Fig. 7 illustrates the application of a means to the member 22′ whereby a variable actuation of valve stem 8′ from such member may be secured. This is secured by means of the cap 55 which is threaded upon the end of the member 22′.

Many other embodiments of the broad invention involved obviously might be made. The primary feature of the invention is the provision of the means whereby the valve is held against movement until the yielding means employed is energized by the thermostatic element, which operates to release the valve at a predetermined time. While I prefer to use as the yielding means coil springs which are placed under compression, it is obvious that other styles of springs placed under stress in other ways than com-

pression might be employed, or some other elastic medium other than springs might be utilized without departing from the invention as defined in the claims. It will also be clear that the invention is not limited to the character of thermostat shown, or to the particular use shown.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is the following:—

1. In combination, a thermostatic element, a valve, a detent for holding the valve in open position, yielding means operated by the thermostatic element and tending to close the valve, means operated by the movement of the thermostatic element whereby the detent is moved to release the valve after the yielding means has been energized by the thermostatic element, a second detent for holding the valve in closed position, yielding means operated by the thermostatic element and tending to open the valve, and means operated by the movement of the thermostatic element whereby such second detent is moved to release the valve, after the last-mentioned yielding means has been energized by the thermostatic element.

2. In combination, a thermostatic element, a valve, a detent for holding the valve in open position, yielding means operated by the thermostatic element and tending to close the valve, means operated by the movement of the thermostatic element whereby the detent is moved to release the valve after the yielding means has been energized by the thermostatic element, a second detent for holding the valve in closed position, yielding means operated by the thermostatic element and tending to open the valve, means operated by the movement of the thermostatic element whereby such second detent is moved to release the valve, after the last mentioned yielding means has been energized by the thermostatic element, and yielding means for normally moving the detents to position to engage the valve when it reaches its extreme positions.

3. In combination, a valve, a thermostatic element, and quick operating mechanism intermediate the valve and thermostatic element comprising means for holding the valve in closed position during a predetermined movement of the thermostatic element, and opening means acting in conjunction with the holding means whereby the valve is first moved suddenly to partially open position, stopped, and then moved suddely again to fuller open position.

4. In combination, a valve, a thermostatic element, and quick operating mechanism intermediate the valve and thermostatic element comprising yielding opening means for the valve means for holding the valve in closed position during a predetermined movement of the thermostatic element, during which movement the yielding opening means is energized, and means operated by the thermostatic means whereby the means for holding the valve in closed position is actuated to permit a two stage quick opening of the valve.

5. In combination, a thermostatic element, a valve, a detent provided with two holding surfaces for maintaining the valve in closed position, yielding means operated by the thermostatic element and tending to open the valve, and means operated by the thermostatic element whereby the detent is moved to release the valve after yielding means has been energized by the thermostatic element, the said detent being first moved to release the valve from one holding surface permitting a partial opening of the valve and then being moved to release the valve from the second holding surface to permit a fuller opening of the valve.

6. In combination, a thermostatic element, a valve, a detent for holding the valve in open position, yielding means operated by the thermostatic element and tending to close the valve, a member operated by the movement of the thermostatic element whereby the detent is moved to release the valve after the yielding means has been energized by the thermostatic element, and means whereby the position of the said member may be adjusted to vary the time at which the said release occurs.

7. In combination, a thermostatic element, a valve, a detent for holding the valve in open position, yielding means operated by the thermostatic element and tending to close the valve, a member operated by the movement of the thermostatic element whereby the detent is moved to release the valve after the yielding means has been energized by the thermostatic element, and an indicator movably supporting the said member whereby the position of the said member may be adjusted to vary the time at which the said release occurs.

8. In combination, a thermostatic element, a valve, a detent for holding the valve in closed position, yielding means operated by the thermostatic element and tending to open the valve, a member operated by the movement of the thermostatic element whereby the detent is moved to release the valve after the yielding means has been energized by the thermostatic element, and means whereby the position of the said member may be adjusted to vary the time at which the said release occurs.

9. In combination, a thermostatic element, a valve, a detent for holding the valve in closed position, yielding means operated by the thermostatic element and tending to open the valve, a member operated by the movement of the thermostatic element

whereby the detent is moved to release the valve after the yielding means has been energized by the thermostatic element, and an indicator whereby the position of the said member may be adjusted to vary the time at which the said release occurs.

10. In combination, a thermostatic element, a valve, a detent for holding the valve in open position, yielding means operated by the thermostatic element and tending to close the valve, means operated by the movement of the thermostatic element whereby the detent is moved to release the valve after the yielding means has been energized by the thermostatic element, and safety means actuated by the thermostatic element for directly moving the valve to closed position in case of failure of the yielding means to close the valve.

In testimony whereof I have hereunto signed my name in the presence of the two subscribing witnesses.

NATHAN WISE.

Witnesses:
N. GORDON,
JOHN W. WALLER.