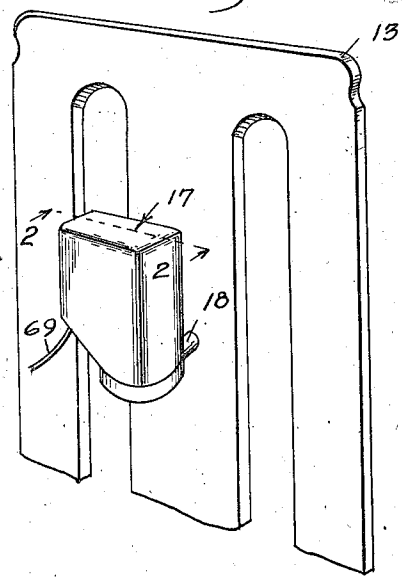
May 28, 1946. W. H. SMITH 2,401,025

RADIATOR CONTROL DEVICE

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Fig 1



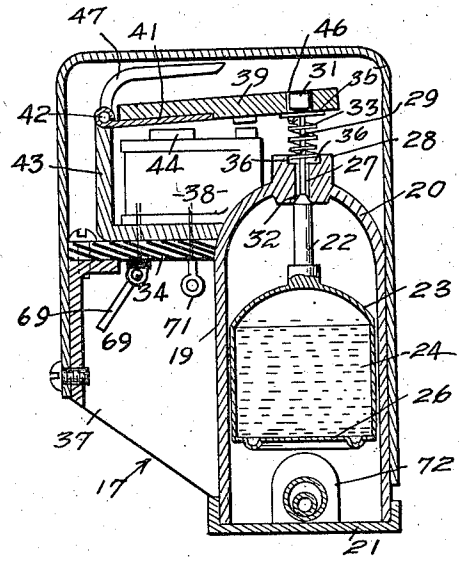




Fig. 2.

Fig. 3.

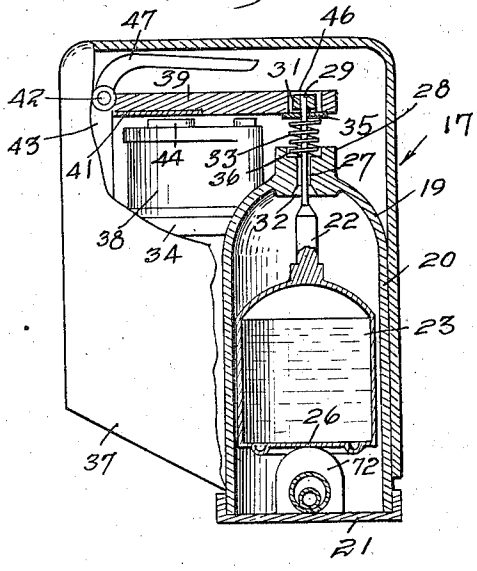
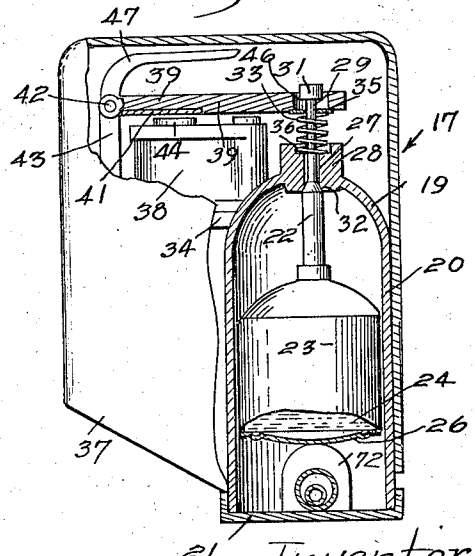



Fig. 4.




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Fig. 5.

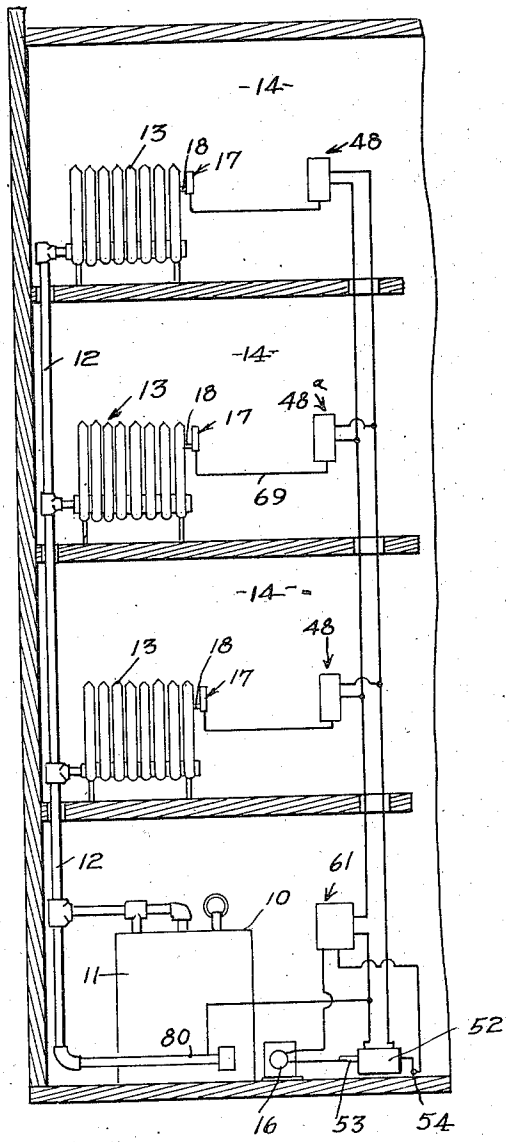
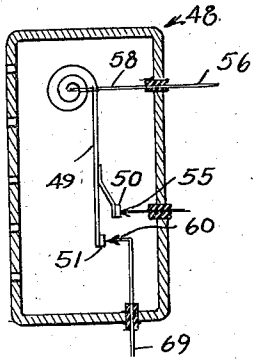



Fig. 6.



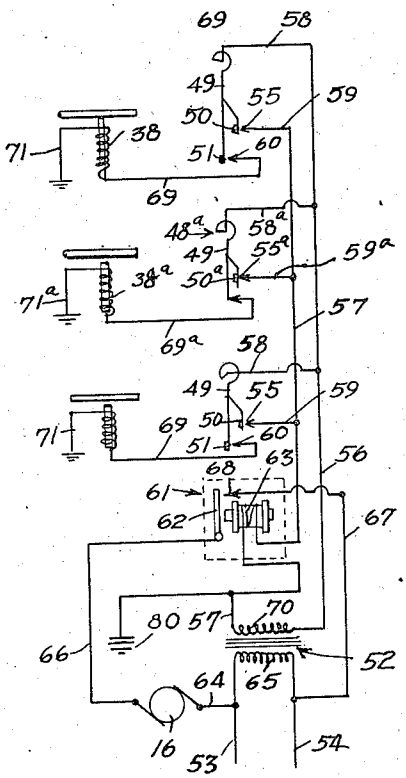




Fig. 7.

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# UNITED STATES PATENT OFFICE

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## RADIATOR CONTROL DEVICE

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Application April 30, 1945, Serial No. 591,181

4 Claims. (Cl. 236—37)

This invention relates generally to steam heating systems and in particular to a radiator control device adapted to provide for the individual control of radiators in a steam heating system. This application is a continuation in part of application Serial No. 538,837 filed June 5, 1944.

An object of this invention is to provide an improved radiator control device.

Another object of this invention is to provide a radiator control device having a heat responsive float valve which is freely movable at all times to a valve closing position.

A feature of this invention is found in the provision of a radiator control device including a casing having an air discharge passage in which a single valve for opening and closing the casing is selectively controlled by means responsive to the temperature in the casing, and by other means responsive to the room temperature.

A further feature of this invention is found in the provision of a radiator control device including a casing having an air discharge passage in which a single valve for the passage is conditioned for movement to an open position in response to the heat demand of a room thermostat unit, and movable to a closed position independently of the heat demand on the room thermostat unit.

Further objects, features and advantages of this invention will become apparent from the following description when taken in connection with the accompanying drawings in which:

Fig. 1 is a perspective view of the control device of this invention shown in assembly position on a radiator;

Fig. 2 is a transverse sectional view of the control device as seen along the line 2—2 in Fig. 1;

Fig. 3 is a view illustrated substantially similarly to Fig. 2 and showing parts thereof in a changed position;

Fig. 4 is illustrated similarly to Fig. 3 and shows the parts of the control device in another changed position;

Fig. 5 is a diagrammatic illustration of a steam heating system showing the assembly therein of the room thermostats associated with the radiator control devices and with the heating unit for the system;

Fig. 6 is a detail view of one type of thermostat adapted for use in the system shown in Fig. 5; and

Fig. 7 is a diagrammatic control circuit for the heating system shown in Fig. 5.

With reference to the drawings there is shown in Fig. 5 a steam heating system comprising a heating unit 10 having a boiler 11 connected through a water and steam pipe 12 with a plurality of radiators 13 located in rooms 14. The heating unit is illustrated as being of stoker type operated by an electrical motor 16. Each radiator 13 is provided with an individual control device 17 connected to a radiator in a usual manner by a pipe connection 18 (Figs. 1 and 5). Since all of the control devices 17 are of a like construction only one will be described in detail.

A control device 17 comprises a casing 20 including a hollow top member 19 having an open bottom which is closed by a bottom member 21 (Figs. 2, 3 and 4). Within the casing 20 is a valve member 22 carried on a hollow float 23 which is partially filled with a volatile fluid, indicated at 24, capable of being expanded when heated. The bottom 26 of the float 23 is of a corrugated construction to facilitate its distortion for movement outwardly when a pressure is produced within the float.

The valve 22 controls a passage 27 in the top of the casing member 19, which passage connects the casing with the atmosphere and is formed in boss member 28 on the casing member 19. Integrally formed with the valve member 22 is a valve stem 29 projected outwardly from the casing through the passage 27 and formed at its outer or top end with a head portion 31. In closing the passage 27 the valve 22 is adapted for mating engagement with a seat 32 formed at the lower end of the boss 28 and about the passage 27. A coil spring 33 mounted about the valve stem 29 is arranged in compression between the upper end of the boss 28, and a collar member 35 loose on the stem 29 and adapted to be held in a stop position against the under side of the head 31 by the spring 33. The spring 33 is maintained in a substantially centered position about the stem 29 by the location of its lower end in an annular recess 36 formed in the top of the boss 28 concentric with the passage 27.

Suitably secured to one side of the casing 20, as by welding or like means, is a bracket 37 having an electrically insulated top member 34 for supporting an electro-magnet 38 at a position adjacent to the top of the casing 20. The magnet 38 includes a pole 44 and an armature 39 having a magnetically attractable member 41. The armature 39 is pivoted at 42 to the magnet frame 43. A stop member 47 integrally formed with the frame 43 is engageable with the armature 39 to limit its movement in a direction away from the pole 44.

The free end of the armature 39 is formed with an opening 46 to loosely receive the head 31 on the valve stem 29. However, the collar

member 35 is of a size greater than the diameter of the opening 46 so as to be engageable with the underside of the armature 39 about the opening 46 for a purpose which will appear later.

Each magnet 38, and in turn each control device 17, is individually connected with a room thermostat 48 located in a room 14. As shown in Fig. 6 the thermostat 48 is of the so-called double contact type and includes a bi-metal conductor 49 having a pair of contacts 50 and 51 adjacent its free end, movable in response to temperature changes in the room, into and out of contact with terminals 55 and 60, respectively.

The control circuit for the heating system (Figs. 5 and 7) includes a transformer 52 having a primary coil 65 connected through lead lines or conductors 53 and 54 with a suitable source of electrical supply (not shown) such as the usual city power line.

The electrical circuit for the transformer secondary coil 70 comprises a conductor 56 and a conductor 57 grounded at 89. The conductor 56 is connected with the fixed end of the bi-metal elements 49 of the room thermostats 48 by conductors 58, and the conductor 57 is connected with the terminals 55 by conductors 59, whereby the closing of any one of the thermostats 48 will provide for the closing of the circuit of the secondary coil 70 of the transformer 52.

A circuit for the stoker motor 16 includes a relay switch 61 and a conductor armature 62 attractable by a magnet 63 connected in the conductor 57. The motor 16 is connected with the lead line 53 by a conductor 64, and with the lead line 54 through a conductor 66, armature 62, and a conductor 67, with the motor circuit being controlled by movement of the armature 62 into and out of contact engagement with a terminal 68 connected to the conductor 67.

The circuit for each magnet 38 in the control device 17 includes a conductor 69 connecting one side of the magnet coil to the terminal 60, and a conductor 71 connecting the opposite side of the magnet coil to the ground. As shown in Fig. 2 the ground connection 71 is a wire or bolt extended through the insulated member 34 and grounded to the bracket 37 which in turn is grounded through the casing 20, pipe connection 18 and a radiator 13 to the water and steam pipe 12.

In the operation of the heating system the valve member 22 in each control device 17 is normally held in a closing position for the discharge passage 27, as shown in Fig. 2, by the action of the spring 33 which also yieldably holds the armature 39 away from a closed position with the magnet pole 44. In other words, when the magnet is deenergized, the armature 39 is moved to an open position by the action of the spring 33 against the collar 35. Since the head 31 of the valve stem 29 is engaged by the collar 35 and free within the armature opening 46 the extent to which the spring 33 can extend itself is limited by the seating of the valve 22 within the valve seat 32. The valve 22 is thus movable to and held in a passage closing position by the spring 33. Each float 23 is normally in a contracted condition and held by the action of the spring 33 on the valve 22 in a position such that the bottom 26 of the float is spaced above an upright stop member 72 carried within the casing 20 on its bottom section 21.

Since the operation of thermostat 48 and associated control device 17 is the same in all rooms 14 assume that a call for heat is made by the thermostat indicated as 48*a* in Figs. 5 and 7. On closing of the thermostat 48*a* the circuit through the secondary coil 70 of the transformer 52 is closed through the conductor 56, conductor 58*a*, room thermostat 48*a*, conductor 59*a* and the conductor 57. The closing of this circuit for the transformer secondary in turn energizes the magnetic relay 61 to close the circuit for the motor 16 to provide for an operation of the stoker unit concurrently with the call for heat by the thermostat 48*a*. A closing of the thermostat 48*a* also closes the circuit for the magnet 38*a*, with this circuit from the conductor 56 comprising the conductor 58*a*, thermostat 48*a*, conductor 69*a*, the magnet 38*a* and the ground connection 71*a*.

On energization of the magnet 38*a* the magnet armature 39 is attracted to a closed position with the pole 44. In moving to an attracted position the armature 39 engages and moves the collar 35 downwardly against the pressure of the spring 33 to its position shown in Fig. 3. By virtue of the head member 31 being loosely received in the armature opening 46, the closing of the armature does not directly provide for any movement of the valve 22 and float 23. However, on contraction of the spring 33 the float drops, by the action of gravity, to a stop position defined by the engagement of its bottom side 26 with the stop 72 as also shown in Fig. 3. This dropping of the float 23 provides for the movement of the valve 22 downwardly out of seating engagement with the valve seat 32. The passage 27 is thus opened to permit the escape of fluid from the radiator.

If the call for heat by the thermostat 48*a* is satisfied before the temperature within the casing 20 reaches a value to operate the float 23, the magnet 38*a* will be deenergized and the control device 17 will assume its position shown in Fig. 2.

However, should the call for heat by the thermostat 48*a* continue after the temperature within the casing has reached a predetermined value, the volatile liquid 24 within the float 23 expands and distorts the float bottom 26, outwardly or downwardly from the float as shown in Fig. 4. The bottom 26, during distortion or expansion, presses against the stop member 72 and moves the float 23, and in turn the valve 22, upwardly to a position in which the valve 22 is in a closing position with the discharge passage 27. This action of the float 23 to close the valve 22 takes place independently of the room thermostat 48*a* and spring 33 by virtue of the fact that the head 31 is loose within the armature opening 46, and the valve stem 29 is freely movable axially relative to the collar 35. As a result, on heating of the casing 20 to a certain temperature, the valve stem 29 is moved axially through the spring 33 and the collar 35 to in turn lift the head 31 out of a supported position on the collar 35. It is seen, therefore, that the energization of a magnet 38, in response to a call for heat from an associated thermostat 48, provides for an opening of the passageway 27 in a control device 17 and that the passageway 27 is retained open by the action of gravity on the float 23 until such action is overcome by the heating of the float 23 to a certain temperature.

When a room 14 is heated to a temperature called for by a thermostat 48, the thermostat 48 opens to in turn deenergize the circuit for a magnet 38, the transformer secondary 70, and the motor 16, whereby the parts of a control device 17 assume their relative positions shown in Fig. 2.

It is thus seen that the valve 22 is normally closed by the expansion action of a float 23 and then, after a call for heat by an associated thermostat 48 is discontinued, is held in a closed position by the spring 33.

On cooling of a radiator, the steam pressure in such radiator falls below atmospheric pressure so as to produce a sub-atmospheric pressure or vacuum within the radiator. This vacuum retards the cooling of the radiator so that its heating efficiency is retained over a longer period of time than would take place if air was permtited to return through the passage 27 after the radiator has been heated. As a result a more uniform temperature of the radiator, and in turn of the room it is heating, is maintained.

On the opening of a valve 22 in any of the control devices 17, air initially enters the heating system through a corresponding passage 27 to break the vacuum in the system so that the vacuum pressure in the system is increased to atmospheric pressure. Air is then expelled through the passage 27, of the control device 17 which is being operated, by the incoming steam. It is seen, therefore, that any vacuum in the heating system is broken on the opening of a valve 22 in any of the control devices 17.

However, it has been found that air will tend to accumulate in a radiator, the control device of which is not operated so as to reduce the heating efficiency of such radiator. This condition is desirable because it reduces the supply of excess heat to a room which is easily heated, or requires a less amount of heat than another room. Thus where a room is capable of being easily heated the full operation of the radiator in such room, each time the heating system is operated, usually provides for the room temperature being raised to an uncomfortable degree. However, since the air from a radiator is released only when there is a call for heat by a thermostat individual to the radiator a more uniform heating of the room is accomplished. As for example, and referring to Fig. 5, on a call for heat only from the thermostat 48*a* the radiator 17 associated with the thermostat 48*a* will have air released therefrom so as to provide for the maximum heating efficiency of the radiator. The heating efficiency of the remaining radiators, however, will be reduced to an extent corresponding to the amount of air trapped in these radiators whereby to reduce the supply of excess heat to the rooms in which the thermostats are not calling for heat.

From a consideration of the above description it is seen that the invention provides a steam heating system in which a plurality of radiator units are controlled by individual control devices associated with corresponding individual room thermostats. Each thermostat is operative to control the operation of a corresponding control device, and concurrently with such control to also provide for the control of the operation of the heating unit which supplies steam to the radiators. The radiator control device is of a simple and rugged construction and employs but a single valve for selectively controlling the discharge of fluid from the radiators in response to the temperature within the control device, and to the temperature of a room in which a radiator is located.

Although the invention has been described with respect to a preferred embodiment thereof it is to be understood that it is not to be so limited since modifications can be made therein which are within the full intended scope of the invention as defined by the appended claims.

I claim:

1. A radiator control device for a room radiator comprising a casing having a fluid passage therein open to a room, means fluid connecting said casing with a radiator, valve means in said casing for opening and closing said passage, with said valve means being movable by gravity to an open position, yieldable means having a pressure adapted to normally hold said valve means closed against the action of gravity, control means responsive in operation to the room temperature to remove the application of said pressure on said valve means to provide for the opening of said valve means by gravity, and means responsive to the temperature in said casing for closing said valve means against the action of gravity.

2. A room radiator control device comprising a casing having a fluid passage therein open to a room, means fluid connecting said casing with a radiator, a valve means for said passage movable by gravity to a passage opening position, spring means normally acting on said valve means to yieldably hold said valve means in a passage closing position against the action of gravity, means outside of said casing operable, in response to room temperature, to engage and move said spring means out of a holding position for said valve means, and means within said casing responsive to the temperature in the casing for closing said valve means against the action of gravity.

3. A room radiator control device comprising a casing having a fluid passage therein open to a room, means fluid connecting said casing with a radiator a valve within said casing movable to a passage opening position by the action of gravity, an upright stem portion for said valve projected upwardly from said casing, spring means supported for movement relative to said stem member and engageable therewith to normally support said valve in a passage closing position against the action of gravity, means within said casing responsive to the temperature in the casing to move said valve to a passage closing position against the action of gravity, and means outside of said casing responsive in operation to room temperature and including an actuating portion engageable with said spring means, at a predetermined room temperature, to move said spring means downwardly relative to said stem portion to permit movement of said valve means by gravity to said passage opening position.

4. A room radiator control device comprising a casing having a fluid passage therein open to a room, means fluid connecting said casing with a radiator, valve means within said casing movable to a passage opening position by the action of gravity and including a stem member projected upwardly through said passage and outwardly of said casing, a head portion on said stem member, a coil spring mounted about said stem member and arranged in compression between said head portion and said casing to normally hold said valve means in a passage closing position against the action of gravity, means outside of said casing responsive in operation to the room temperature and including an actuating portion engageable with said spring to compress the same downwardly against said casing to provide for a gravity closing of said valve means, and means within said casing responsive to the temperature in the casing to move said valve to a passage closing position against the action of gravity.

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