Jan. 6, 1931. G. C. CARNAHAN 1,788,048

RADIATOR FUEL CONTROL

Filed Dec. 13, 1929 2 Sheets-Sheet 1

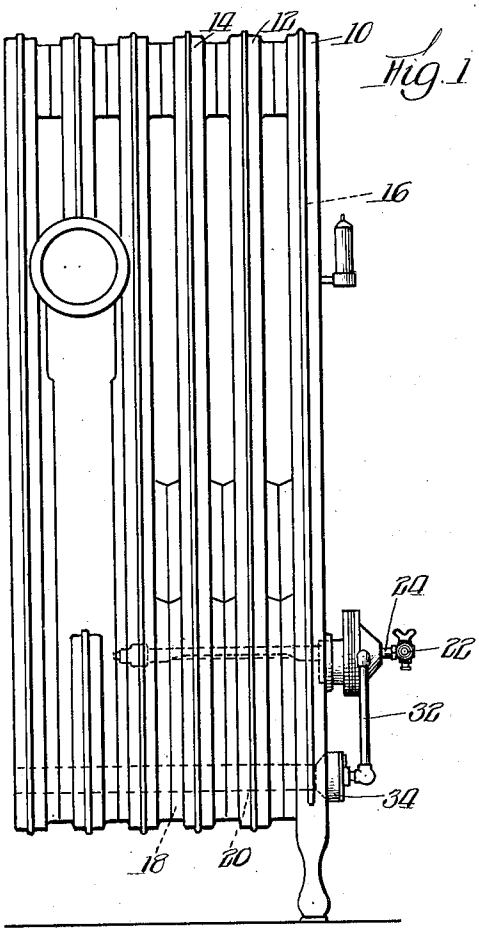


Fig. 1

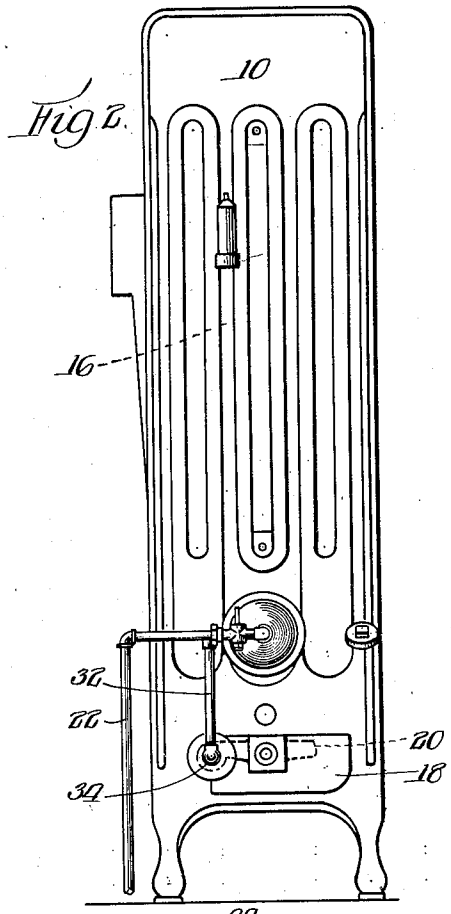


Fig. 2.

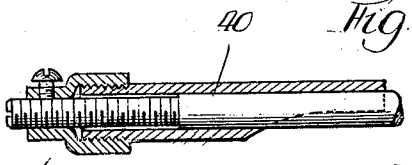
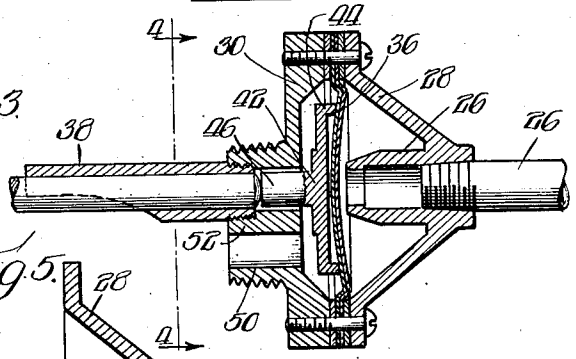


Fig. 3.



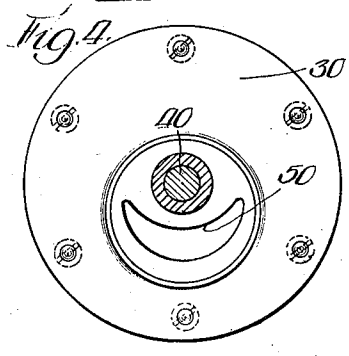


Fig. 4.

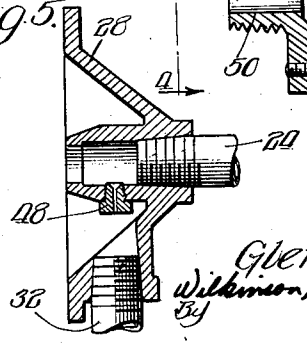


Fig. 5.

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Filed Dec. 13, 1929 2 Sheets-Sheet 2

Fig. 6.

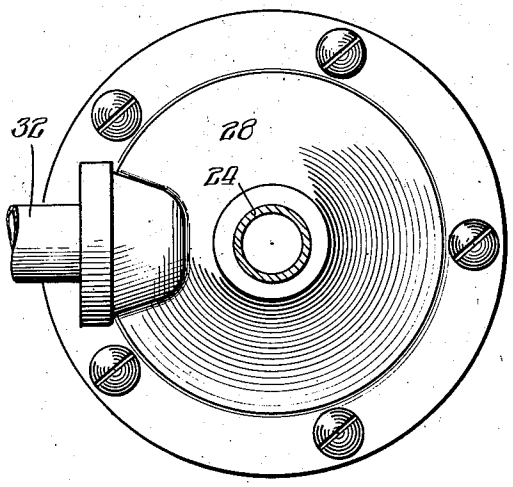


Fig. 7.

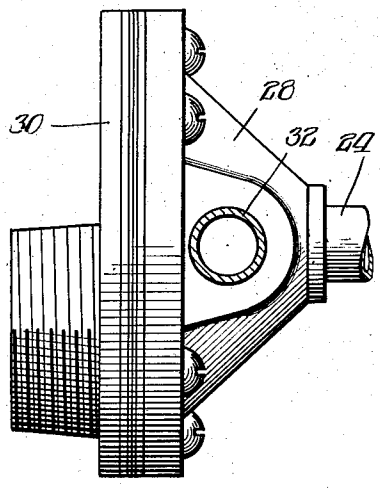
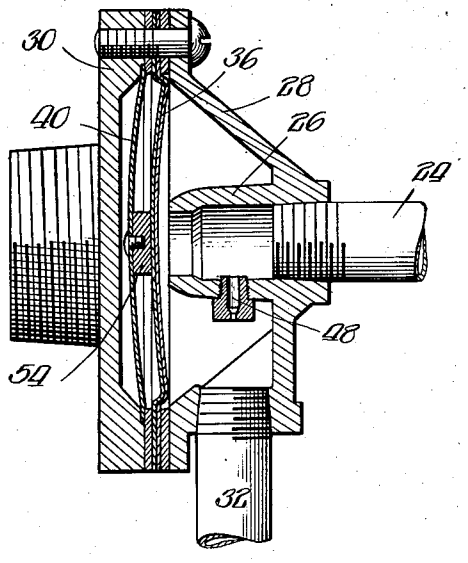


Fig. 8.



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Patented Jan. 6, 1931 1,788,048

UNITED STATES PATENT OFFICE

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RADIATOR FUEL CONTROL

Application filed December 13, 1929. Serial No. 413,806.

This invention relates to heaters of the type that generally employ a fluid fuel, such as a liquid or gas, as contrasted with a solid fuel, and is illustrated herein as embodied in a gas-fired steam radiator.

Radiators of this class comprise generally a hollow shell having a water space in the upper portion thereof and a burner space in the lower portion thereof. Upon ignition of the fuel at the burner, heat is imparted to the portion of the radiator containing water thereby transforming the latter into steam and imparting heat to the space surrounding the radiator. It sometimes happens that the steam pressure in the radiator would become unduly high if it were not equipped with a device to regulate the flow of fuel to an amount that will just maintain a desirable steam pressure once it is attained. With this in view radiators long in use have been equipped with a valve for controlling the admission of fuel to the burner and the action of the valve has been governed by variations occurring in the steam pressure within the radiator. Fuel controls of this character are in successful use today, but like all other devices of their kind they are subject to beneficial improvement.

To illustrate the demand for an improved control, it is necessary only to recite a certain condition that may arise in the use of a gas-fired steam radiator and which may operate harmfully in spite of the pressure controlled valve, now in use. If the fuel at the burner of a cold radiator containing no water is ignited, the flame will in time cause the metallic shell of the radiator to become highly over-heated in the absence of water, as no steam pressure can be generated which normally would regulate the supply of fuel. Therefore the dry radiator will become hotter and hotter until harmful and sometimes disastrous results take place.

With the foregoing in view it is an object of the present invention to provide a radiator of the class described with means responsive to variations in temperature conditions within the radiator, both in the presence as well as in the absence of steam, for governing the supply of fuel thereto. In the illustrated embodiment of the invention the radiator is provided with a fuel supply line and a valve is interposed in the line for controlling the passage of fuel therethrough. In accordance with the present invention a thermostatic element is extended into the radiator and is operatively connected with the valve in such a manner that upon the temperature in the radiator rising to a certain point, in the absence of water and steam pressure the thermostatic element will expand sufficiently to partially close the valve and thereby regulate the fuel supply to the radiator and prevent the radiator from overheating in the absence of water for steam generating purposes.

Another equally important feature of the present invention consists in combining efficiently and simply, in a single structure, a means responsive both to variations in temperature and pressure within the radiator for controlling the admission of fuel thereto. By means of such a provision the fuel controlling valve operates when either the temperature or the pressure within the radiator reaches the desired point, and thereby guards against the outstanding disadvantageous tendencies of the present day radiator to overheat when no water is contained therein, which can be generated into steam pressure and which will operate the valve controlling the fuel.

Other important objects and features of the invention will become apparent from a reading of the following specification in the light of accompanying drawings in which,

Fig. 1 is a rear elevational view of the end portion of a gas-fired steam radiator equipped in accordance with the present invention,

Fig. 2 is a right end view of the radiator illustrated in Fig. 1,

Fig. 3 is a detailed view of the fuel control device,

Fig. 4 is a sectional view taken along the line 4—4 of Fig. 3,

Fig. 5 is a detailed view of a portion of the device illustrated in Fig. 3,

Fig. 6 is a detailed view of the outside casing of the control device,

Fig. 7 is an outside view of a portion of the control device, and

Fig. 8 is a modified form of the apparatus shown in the earlier figures.

As shown in the drawings, the radiator is composed of a number of sections, 10, 12, 14, etc., which are suitably joined together and when so joined form a hollow upper water chamber 16, and a lower burner chamber 18. In operation the fuel at a burner 20, located in the burner chamber, is ignited and the heat therefrom converts into steam the water that is located in the upper portion of the radiator. As heretofore pointed out, it occasionally happens that the water becomes too low and the metallic shell of the radiator may be unduly heated. To overcome this disadvantage the present invention contemplates equipping the radiator with a fuel control device which will now be described.

Fuel flowing to the radiator passes through a supply or entrance conduit composed of the pipe sections 22 and 24. As shown in Fig. 3, the fuel leaves the open end of the entrance passageway 24 (the latter terminates in a nozzle portion 26), and enters a chamber formed by a hollow cup-shaped shell 28 and a base 30. Leading from the shell 28 is an exit passageway or conduit 32 which communicates through an air-mixing valve 34 with the burner 20. Under ordinary conditions fuel flowing through the supply conduit 24 enters the chamber defined by the shell 28 and base 30 and thence flows to the burner directly, through the exit passageway 32. The chamber defined by the members 28 and 30, is provided with a central partition or valve 36, consisting of a plurality of thin and flexible concave-convex disks. Normally the disks occupy the position illustrated in Fig. 3 in which the open end of the supply passageway 24 and nozzle 26 is disposed in spaced relationship to the valve, thereby permitting the incoming fuel to flow from the nozzle 26 through the exit passageway 32. The valve is arranged, however, to be actuated upon by fluctuations in steam pressure of predetermined magnitude, occurring in the water chamber of the radiator. To provide for regulation in the absence of water and steam pressure a hollow sleeve 38 extends rearwardly from the base member 30 and contains a thermostatic element 40. The member 40 has a coefficient of expansion greater than the casing 38 in which it is enclosed, in order that upon heat being applied to the casing 38 and the element 40, the latter will expand more rapidly than the casing, causing the inner end of the thermostatic element 40 to move in the direction of the valve 36. It will be appreciated that if the thermostatic element bore directly upon the rear surface of the valve a considerable amount of movement would be required to move the valve from an open to a closed position. In order to decrease the amount of movement necessary to perform this operation there is interposed between the valve and the inner end of the thermostatic element 40, a cup-shaped plunger 42 having an outer circular rim portion 44 adapted to engage the marginal portion of the plurality of thin and flexible concave-convex valve disks 36 and a seat 46 arranged to be engaged by the inner end of the thermostatic element. The amount of movement required to close the valve through the arrangement just described is far less than that which would otherwise be required and thus the efficiency of the device is enhanced and assured.

From so much of the description as has already been given it will be understood that in the operation of the radiator the control device being disposed in the water or steam chamber of the radiator will be exposed to variations in temperature occurring therein in the absence of water in the radiator with the result that when a predetermined degree of temperature is reached the thermostatic element 40 will expand sufficiently to move the plunger 42 in the direction of the valves 36, to close the latter. It would be undesirable if the movement of the valve 36 to a closed position completely cut off the fuel supply and extinguished the flame, because later, upon cooling, the thermostat would once more contract and allow the concavo-convex valve 36 again to assume its normal position and raw unburned fuel would then flow into the radiator and be liberated from the burner. Accordingly the device is provided with means for by-passing a small quantity of fuel when the valve is closed.

The by-pass permits the fuel to burn with a low flame and in such quantity that will not bring the temperature of the radiator to an undesirable degree. Thus, as shown in Fig. 5, the nozzle 26 of the incoming passageway 24 is provided with a plug 48 having a small central passageway therethrough. From an inspection of this figure in connection with Fig. 3 it will be seen that when the valve occupies a closed position, enough of the fuel may flow from the entrance passageway 24 through the plug 48 to the exit passageway 32 to insure against the burner being extinguished.

It has heretofore been stated that the present invention aims to combine with the means for controlling, through variations occurring in steam pressure within the radiator, the entrance of fuel to the radiator, an additional means for governing thermostatically the admission of fuel.

To permit steam pressure to actuate the valve, the base section 30 of the valve chamber is provided with a passageway 50 (Fig. 4) leading into the interior of the radiator. This passageway is formed in a screw-threaded plug 52 which serves to hold the control de-

vice in assembled position within the radiator.

In the operation of this latter feature of the invention, pressure variations of a predetermined magnitude pass through the passageway 50 and engage the rear of the flexible valve 36, moving the latter into engagement with the open end of the entrance passageway 24. It will be appreciated that the size of the opening 50, the linear coefficient of expansion of the thermostatic element 40, and the degree of flexibility of the valve 36 are all factors in determining the predetermined magnitudes of pressure and temperature which will cause the valve 36 to seat itself and the supply of fuel to be diminished.

Turning now to Fig. 8, there is shown a somewhat modified type of structure in which the thermostatic element 40 takes the form of a bi-metallic disk which, upon being heated, flattens out and presses, by means of a button 54, the valve 36 into engagement with the open end of the entrance passageway 24, in exactly the same manner that has hereinbefore been described with reference to the earlier figures.

It is to be understood that, although this invention has been illustrated and described in connection with a gas-fired steam radiator (shown in the drawings as a vented radiator) the invention may be employed with equal feasibility and success in connection with heaters of different kinds and types, and is not to be limited to the style of heater illustrated. Furthermore it is to be understood that changes and modifications in design and construction may from time to time be made by those skilled in the arts without departing in the slightest from the true scope of the invention as set forth in the appended claims. As an example of such a modification, the range of movement of the valve 36 may be so increased that it will vary the incoming supply of fuel upon any desired degree of change of temperature pressure conditions within the radiator, thereby providing a precise and delicate control.

Having described the invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A radiator of the class described, having, in combination, a burner, a conduit for supplying fuel to the burner, a valve in the conduit for governing the amount of fuel supplied, a thermostatic element associated with the valve and adapted to be acted upon by heat variations within the radiator to control the operation of a valve, and a passageway leading from the valve chamber into the interior of the radiator whereby pressure variations within the radiator are transmitted to the valve.

2. A heater of the class described, comprising, in combination, a burner, a conduit for supplying fuel to the burner, a valve for governing the passage of fuel through the conduit, a thermostatic element associated with the radiator and adapted to close the valve when a predetermined degree of heat is generated within the radiator, a passageway leading into the valve chamber for communicating to the valve pressure variations occurring in the radiator, and means for by-passing a small amount of fuel around the valve when the latter is closed whereby extinguishment of the burner is prevented.

3. A device for controlling the fuel supply in radiators and the like comprising, in combination, a fuel entrance passageway, a fuel exit passageway, a flexible diaphragm member normally disposed in spaced relationship to the open end of one of the passageways and responsive to variations in temperature and pressure in the radiator to close the open end of said passageway.

4. A device for controlling the fuel supply in radiators and the like comprising, in combination, a fuel entrance passageway, a fuel exit passageway, a concavo-convex flexible diaphragm member normally disposed in spaced relationship to the open end of one of said passageways, and means for contracting the diaphragm into a position closing the open end of said passageway, said means comprising an expansible bar and a cup-shaped member adapted to be moved upon expansion of the bar; the cup-shaped member having a rim for engaging the marginal portion of the diaphragm, and a seat to be engaged by the expansible bar.

5. A radiator of the class described, having, in combination, a burner, a conduit for supplying fuel to the burner, and a valve interposed within the conduit for governing the amount of fuel delivered to the radiator, said valve comprising, a casing, and control means within the casing responsive to changes in temperature and pressure within the radiator.

6. A radiator of the class described, comprising, in combination, a burner, a conduit for supplying fuel to the burner, and control means for governing the amount of fuel delivered to the burner through the supply conduit, said control means being responsive to variations in both temperature and pressure occurring within the radiator and comprising a heat responsive device located interiorly of the radiator.

Signed at Chicago, Illinois, this 2nd day of December, 1929.

GLEN C. CARNAHAN.