May 6, 1930. R. R. ROOT 1,757,591

CONTROLLING DEVICE FOR GAS BURNERS

Filed Feb. 28, 1927

Fig. 1.

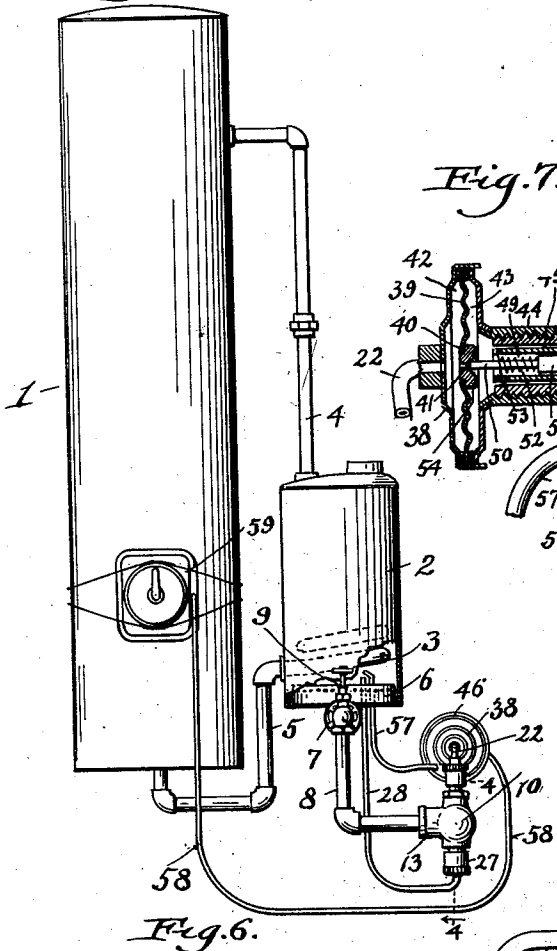


Fig. 7.

Fig. 2.

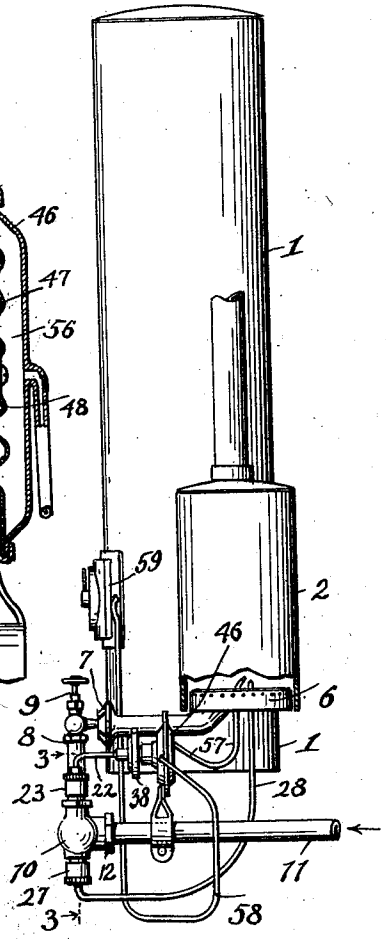


Fig. 6.

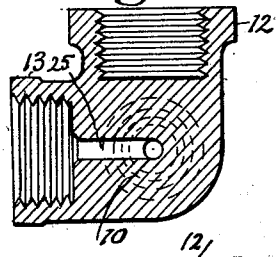


Fig. 5.

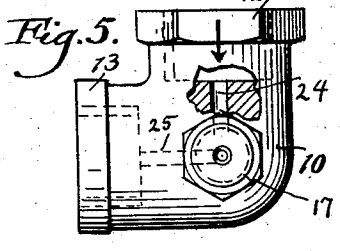


Fig. 3.

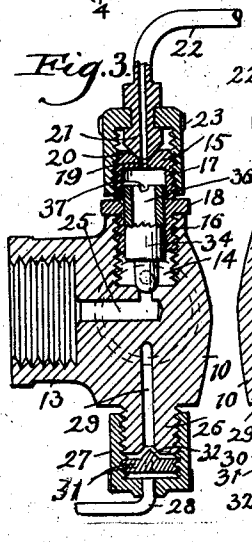
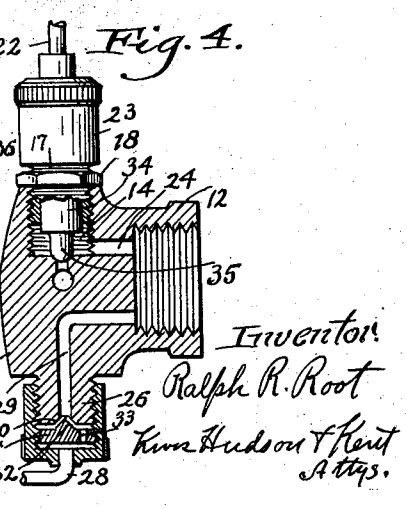


Fig. 4.



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UNITED STATES PATENT OFFICE

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CONTROLLING DEVICE FOR GAS BURNERS

Application filed February 28, 1927. Serial No. 171,525.

This invention relates to controlling devices for gas burners and has for an object the provision of a simple, inexpensive and efficient thermally controlled device for controlling the operation of the burner.

A further object of the invention is to provide a burner controlling device which is positive and reliable in its action and by which the valve controlling the flow of gas to the burner is opened and closed with a snap action so that danger of back-fire to the mixer is eliminated.

A further object of the invention is to provide a thermally controlled valve actuating device in which gas pressure is utilized for operating the valve, and further to provide a controlling device which is sensitive to small variations in temperature.

With the above and other objects in view, the invention may be said to comprise the device as illustrated in the accompanying drawings hereinafter described and particularly set forth in the appended claims, together with such variations and modifications thereof as will be apparent to one skilled in the art to which the invention appertains.

Reference should be had to the accompanying drawings forming a part of this specification, in which:

Fig. 1 is a side elevation of a water tank and a heater equipped with the burner controlling device of the present invention;

Fig. 2 is a side elevation of the tank and water heater as viewed in a direction at right angles to Fig. 1;

Fig. 3 is a section taken on the line indicated at 3—3 in Fig. 2;

Fig. 4 is a section taken on the line indicated at 4—4 in Fig. 1;

Fig. 5 is a top plan view, partially in section, of the fitting in the gas pipe line to which the controlling devices are connected;

Fig. 6 is a central horizontal section through the fitting shown in Fig. 5; and

Fig. 7 is a transverse section through the thermally actuated controlling valve and the diaphragm pressure chambers associated with said valve.

In the accompanying drawings, the invention is illustrated as applied to the burner of a common form of water heater employed in connection with a water tank, the tank being indicated by the numeral 1, the heater casing by the numeral 2, the coil in the heater casing by the numeral 3, and the pipes connecting the coil with the upper and lower portions of the tank by the numerals 4 and 5. The heater is provided with a gas burner 6 of the usual form provided with a mixer 7 and receiving gas through a pipe 8 which has a hand-operated valve 9 therein and which is connected to a fitting 10 in the gas pipe line 11.

The fitting 10 is provided with passages through which gas flows to pipe 8 and with connections to the pilot burner and to the controlling mechanism. This fitting is provided with a hexagonal internally threaded end portion 12 adapted to be screwed onto the pipe 11 and with an internally threaded portion 13 at its opposite end adapted to receive the pipe 8. The fitting 10 is also provided at the top thereof with an internally threaded recess 14 which receives a cup-shaped valve casing 15 which is provided with externally threaded end portions 16 and 17 and with a flange portion 18 intermediate the threaded portions. The threaded portion 16 at the open end of the casing member is screwed into the threaded recess 14 until the flange 18 engages the top of the fitting, and the closed top of the casing is provided with a central aperture 19 which leads to a conical recess 20 in the top of the casing. The conical recess 20 is adapted to receive the enlarged tapered end 21 of a small pipe 22, and attached to the enlarged end 21 of the pipe is an internally threaded cap 23 adapted to be screwed onto the threaded portion 17 of the casing member to clamp the end 21 of the tube in the conical seat of the casing member with the passageway of the tube in alignment with the opening 19.

A passage 24 is formed in the fitting 10 from the recessed end portion 12 into the recess 14, and a passage 25 extends from the bottom of the recess 14 to the recessed end 13 of the fitting to which pipe 8 is attached so that gas may pass from the pipe line 11 through the fitting 10 to the burner under the

control of a valve mounted in the casing member which will be presently described.

It is necessary that suitable means be provided for igniting the burner when gas is supplied thereto, and for this purpose a pilot burner is herein shown. This burner, however, does not per se form a part of the present invention, and it is to be understood that in so far as the present invention is concerned any suitable device may be employed for igniting the gas when it is fed to the burner.

As shown herein, the gas is supplied to the pilot burner from the fitting 10 which is provided at the bottom thereof with a downwardly projecting treaded nipple 26 which receives a cap 27 to which the pilot burner pipe 28 is attached. A passage 29 is formed in the fitting 10 leading from the inlet end 12 to the lower end of the nipple 26. A conical seat 30 is formed in the lower end of the nipple 26 at the end of the passageway 29, and within the cap 27 there is a threaded disk 31 which carries upon the upper side thereof a conical valve member 32 adapted to extend into the conical recess 30. The disk 32 is screwed to the desired depth within the cap 27 and is provided with an aperture 33 through which the gas flows to the space beneath the disk with which the pilot burner pipe 28 communicates. The space between the conical valve member 32 and the seat 30 may be regulated by turning the cap 27 on the threaded nipple 26 to feed the desired amount of gas to the pilot burner.

In the casing member 15 there is a vertically movable valve member 34 which has a reduced lower end 35 which is adapted to close the passageway 25 leading to the outlet end 13 of the fitting. The valve 34 has a hollow cylindrical upper portion which slides in the casing member 15 and which is of a diameter slightly less than the internal diameter of the casing to provide a small clearance for leakage of gas to the upper portion of the valve chamber. The upper end of the cylindrical portion 36 of the valve member is provided with a notch 37 which permits leakage of gas to the outlet pipe 22 when the valve is in its uppermost position.

If the outlet passage 22 is closed, the gas leaking past the valve member 34 will equalize the pressure upon the upper and lower sides of the valve member so that the valve member will drop by gravity to a position closing the passage 25 leading to the burner. If the passage through the tube 22 is opened, gas will escape from the upper end of the casing faster than it leaks past the valve member, and the pressure in the lower end of the chamber, which is the same as in the gas pipe line 11, will be sufficient to lift the valve and open the passage 25 so that gas can flow to the burner, and as long as the passage through the tube 22 remains open, the valve member 34 will be held in raised position by the line pressure.

The pipe 22 is connected to a casing 38 which has a partition member in the form of a flexible diaphragm 39. The diaphragm 39 has attached to the center thereof a valve member 40 which is provided with an aperture 41 which is adapted to establish communication between the chamber 42 on the side of the diaphragm to which the pipe 22 is connected and the chamber 43 upon the opposite side of the diaphragm. The casing 38 is provided on the side opposite that to which the pipe 22 is connected with a tubular internally threaded extension 44 which is adapted to be screwed onto a tubular extension 45 of a second diaphragm casing 46 which is provided with a central partition member in the form of a flexible diaphragm 47. A cylindrical member 48 is rigidly secured to the diaphragm 47 at the center thereof and projects centrally through the tubular extension 45 of the casing, the diameter of the member 48 being slightly less than the internal diameter of the extension to permit passage of gas from the chamber 43 of the casing 38 to the casing 46. The member 48 has an axial bore 49 extending from the outer end thereof and within this bore there is mounted a valve pin 50 which is provided with an enlarged head 51 which has a rounded end bearing against the inner end of the bore 49. The valve pin 50 is held in place by means of a coil spring 52 which bears at its inner end against the head 51 of the valve pin and engages at its outer end in an internal groove 53 in the wall of the bore 49. The spring 52 serves to yieldably hold the valve pin within the bore 49 and also permits lateral movement of the pin with respect to its supporting member 48. The valve pin 50 is normally held in axial alignment with the aperture 41 of the valve member 40 and this valve member is provided on the side toward the valve pin with a conical recess 54 around the aperture 41. The yieldable mounting of the valve pin 50 compensates for any misalignment of the valve pin due to distortion of one or both diaphragms since when the valve pin is forced against the conical recess it will be guided to a position closing the aperture 41. The casing 46 is provided with chambers 55 and 56 on opposite sides of the diaphragm 47 and the chamber 55 is at all times in communication with the chamber 43 of the casing 38 through the annular passage surrounding the valve supporting member 48. When the aperture 41 is open, gas is permitted to escape through the pipe 22 from the valve chamber into the chamber 43 and from the chamber 43 into the chamber 55 which has connected thereto an open outlet pipe 57 which preferably extends to

a point adjacent the pilot burner so that the waste gas will be consumed.

The chamber 56 of the diaphragm casing 46 is in communication through a pipe 58 with a closed sheet metal casing 59 which is adapted to be secured against the side of the water tank 1 at a convenient point between the upper and lower ends thereof. The chamber 56, the casing 59 and the pipe 58 contain a body of air which expands when the water in the tank 1 is heated and forces the flexible diaphragm 47 toward the diaphragm 39, moving the valve member 40 toward closing position. When the aperture 41 is closed, the flow of gas through the waste outlet 22 is prevented, causing pressure to be built up in the upper end of the valve chamber and allowing the valve member to move to closed position to cut off the supply of gas to the burner 6. When the water in the tank has cooled sufficiently to allow the air in the casing 59 to contract sufficiently to return the diaphragm 47 to its normal position, the valve controlling the flow of gas from the chamber 42 is opened, whereupon the reduction of pressure in the upper end of the valve chamber will permit the actuation of the valve by the gas pressure in the lower end of the chamber, opening the valve, and permitting the flow of gas to the burner.

An important feature of the present invention is the means employed for relieving the pressure in the waste gas line suddenly so that the valve member 34 will be moved toward and from its closed position with a snap action so that when the gas burner is turned on the gas flows immediately to the burner under full pressure and when the gas is turned off the burner is quickly extinguished so that danger of back-firing to the mixer when the burner is turned on or off is eliminated. This sudden relief of pressure in the waste gas line is accomplished by means of the double diaphragm valve above described. Let us assume that the main gas valve and the waste gas controlling valve are in the positions shown in Figs. 3 and 7, i. e., in closed positions, the water in the tank 1 having been heated sufficiently to produce the necessary expansion in the air within the chambers 59 and 56 to hold the valve member 50 in closed position. As the water in the tank 1 cools, the air in the chamber 56 will gradually contract thus reducing the pressure on the diaphragm 47 and allowing the valve 50 to move slowly toward the casing 46. While the valve 50 is moved in a direction away from the diaphragm 39, the waste gas in the chamber 42 will be at substantially line pressure and will force the diaphragm 39 toward the valve. This action will continue until the resiliency of the diaphragm 39 resists further movement of the diaphragm, whereupon the continued movement of the valve pin 50 will permit a slight escape of gas from the chamber 42. This will relieve some of the pressure in the chamber 42, and the diaphragm 39, by reason of its resiliency, will snap the valve member 40 away from the valve pin 50 completely opening the opening 41 and exhausting the pressure from the pipe 22 and the upper end of the main valve chamber. The opening of the relief opening 41 is substantially instantaneous, which results in a very rapid reduction of pressure above the valve member 34 so that the line pressure acting upon the lower end of the valve member will rapidly move the valve member to the upper end of the casing completely opening the passage 25 so that the gas will flow freely to the burner.

After the water in the tank is again heated to the desired temperature, the valve pin 50 is moved slowly toward the valve member 40, and when the valve pin begins to impede the flow of gas through the aperture 41, pressure will build up in the chamber 42 to press the valve member 40 against the pin 50 and tightly seal the opening 41 so that the pressure in the upper and lower ends of the valve chamber will be quickly equalized so that the valve member can drop to closed position.

Having thus described my invention, I claim:

1. In combination with a burner having means for igniting gas supplied thereto, a pipe line for gas under pressure having an outlet passage leading to said burner and a waste outlet passage, a valve controlled by the pressure in the waste outlet passage for opening and closing the passage to the burner, and a thermally controlled device for varying the pressure in the waste outlet passage comprising a pair of diaphragms, one having an aperture and a valve seat surrounding the aperture and the other a valve member adapted to engage said seat and close said aperture, and pressure chambers on the sides of the diaphragms opposite the valve seat and valve, one communicating with the waste gas outlet and the other containing an expansible fluid medium responsive to changes in temperature.

2. In combination with a burner having means for igniting gas supplied thereto, a pipe line for gas under pressure having an outlet passage leading to said burner and a waste outlet passage, a valve controlled by the pressure in the waste outlet passage for opening and closing the passage to the burner, and a thermally controlled device for varying the pressure in the waste outlet passage comprising a pair of diaphragms, one having an aperture and a valve seat surrounding the aperture and the other a valve member adapted to engage said seat and close said aperture, said valve member being yieldably connected to the diaphragm, and pressure chambers on the sides of the diaphragms opposite the valve seat and valve, one communicating with the waste gas out-

let and the other containing an expansible fluid medium responsive to changes in temperature.

3. In a thermally operated controlling device for gas burners, a pair of pressure chambers having diaphragm walls, one having an aperture and the other having a valve member adapted to close said aperture, the first chamber being in communication with the gas supply line and the other containing an expansible fluid responsive to variations in temperature.

4. In a thermally operated controlling device for gas burners, a pair of pressure chambers having diaphragm walls, one having an aperture and the other having a valve member adapted to close said aperture, the first chamber being in communication with the gas supply line and the other containing an expansible fluid responsive to variations in temperature, said aperture having a conical seat and said valve member being yieldably connected to its diaphragm and laterally movable to accommodate itself to said seat.

5. The combination with a gas burner having a gas supply line communicating therewith, of a plunger valve for controlling the flow of gas to said burner, said plunger valve being subjected on one side to the pressure of said line, means for maintaining a pressure upon the opposite side of said plunger valve including a valve which when open permits exhaust of pressure, and thermally controlled means for operating said last mentioned valve with a snap action to cause rapid operation of the plunger valve.

6. In a device of the character described, a gas burner, a gas supply line, a vertically disposed cylinder having a lateral passage from the lower end thereof to the gas supply line and a passage leading from the bottom thereof to said burner, a piston in said cylinder having a loose fit therein whereby gas may escape past the piston to the upper end of the cylinder, said piston having a projection forming a valve adapted to close the passage leading to the burner when the piston is in its lowermost position, a chamber having a diaphragm wall communicating with the upper end of said cylinder, said diaphragm wall having a central opening, a second chamber having a diaphragm wall opposite the first and containing a body of fluid which expands and contracts as its temperature varies, and a valve carried by said second diaphragm wall adapted to open and close said opening in the first diaphragm wall, to permit pressure to exhaust from the upper end of said cylinder, to permit the line pressure to raise the piston to open the passage to the burner or to cause the pressure on opposite sides of the piston to be balanced so that the piston will drop.

In testimony whereof, I hereunto affix my signature.

RALPH R. ROOT.