

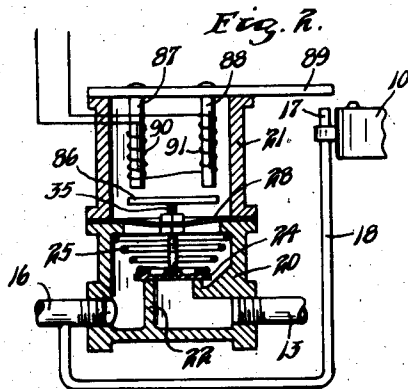
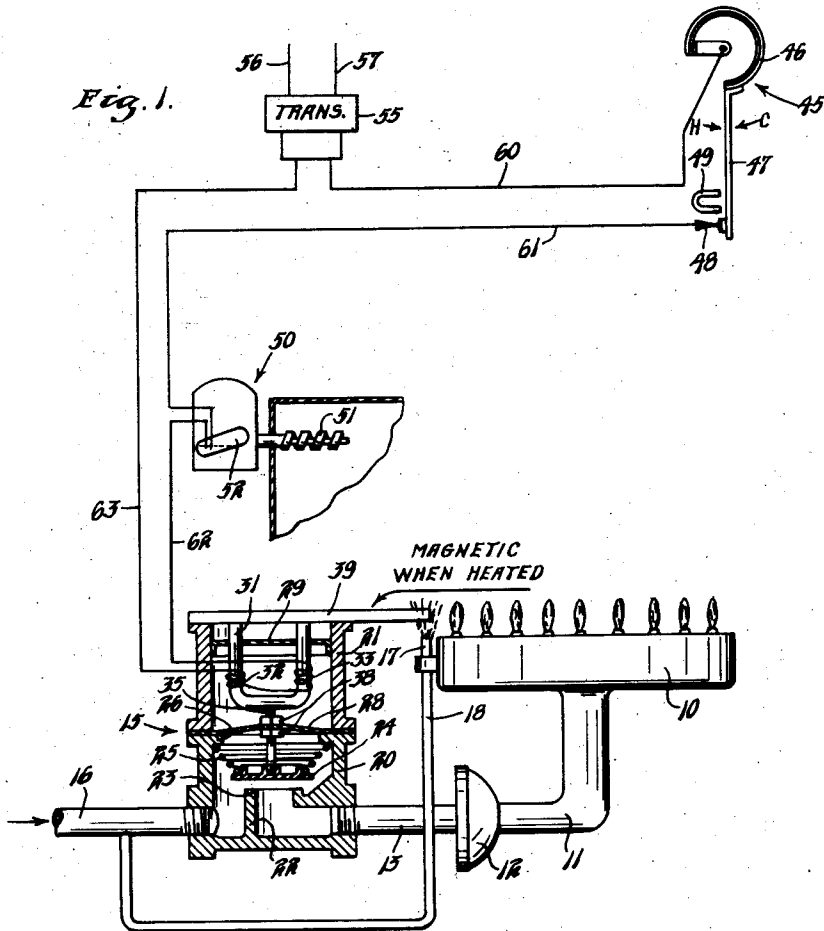
Dec. 18, 1945.

J. B. BOYER

2,390,985

BURNER CONTROL SYSTEM

Filed Dec. 2, 1942



INVENTOR.
JAMES B. BOYER.

BY

George H. Fisher
ATTORNEY

UNITED STATES PATENT OFFICE

2,390,985

BURNER CONTROL SYSTEM

James B. Boyer, Washington, D. C., assignor to
Minneapolis-Honeywell Regulator Company,
Minneapolis, Minn., a corporation of Delaware

Application December 2, 1942, Serial No. 467,596

16 Claims. (Cl. 158—117.1)

The present invention is concerned with a burner control system and more particularly with one employing an element whose magnetic properties vary with temperature.

It is conventional practice in the fuel burner art to provide some means for shutting off the flow of fuel if the ignition means is not properly operating. Where a pilot burner is employed as an ignition means, some means responsive to the temperature of the pilot burner flame is usually employed for this purpose. It has been proposed to employ as a pilot burner flame responsive means a control device in which the position of the control device is determined by the temperature to which an element of Curie point metal is subjected. It is well known that certain metals, known as Curie point metals, possess the property of changing their magnetic characteristics at different predetermined temperatures. In almost all cases, such metals become non-magnetic when heated above the Curie point temperature. These arrangements of the prior art employing a Curie point metal for controlling the flow of fuel to a burner have all employed this type of Curie point metal. Because of the fact that the Curie point metals which have been employed have become non-magnetic above a predetermined temperature rather than below a predetermined temperature, it has been necessary to devise various means to insure that these devices move to a safe position upon a failure of the controlling mechanism. Such a safe position is a position in which the operation of the burner is prevented. I have discovered that certain Curie point metals possess the property of becoming magnetic when heated above a predetermined critical temperature and when used make it possible to simplify the control device and yet insure safe operation.

It is an object of the present invention to provide an improved burner control device employing a positive Curie point metal; that is, a metal which is normally substantially non-magnetic but which becomes magnetic when heated above a predetermined temperature.

A further object of the present invention is to provide a burner control device which because of the employment of a positive Curie point material is extremely simple in construction and has a minimum number of parts.

A still further object of the invention is to provide a burner control device employing an element of Curie point material in which an electromagnetic winding is associated with one of the elements.

A further object of the present invention is to

provide a control device having a magnetic holding means for holding a controlling element against its bias, this magnetic holding means comprising an element of Curie point material and being provided with an electromagnetic winding for controlling the operation of the holding means when the Curie point material is magnetic.

A still further object of the present invention is to provide such a burner control device in which the controlling element is a valve normally biased to a position preventing flow of fuel to the burner and which is held against its bias by the magnetic holding means in a position permitting such flow.

A still further object of the present invention is to provide an improved burner control system in which it is possible to control the flow of fuel to a main burner both in accordance with the value of a condition indicative of the demand for burner operation and also in accordance with a condition indicative of the proper operation of an ignition means for the burner.

Other objects of the invention will be apparent from a consideration of the accompanying specification, claims, and drawing, of which:

Figure 1 is a schematic view of my improved burner control system employing the novel burner control device of the present invention, and

Figure 2 is a modified form of burner control device.

Referring to the drawing for a more detailed understanding of the invention, a main gas burner is indicated by the reference numeral 10. This gas burner is supplied with gas by a gas pipe 11 which connects with a conventional mixing chamber 12. Leading into the mixing chamber 12 is a gas pipe 13 which communicates with the outlet side of my burner control device generally indicated by the reference numeral 15. Connected with the inlet side of the burner control device 15 is a gas supply pipe 16 leading from any suitable source of gas supply (not shown). Located adjacent to the main burner 10 is a pilot burner 17. This pilot burner is supplied with gas by a pipe 18 connected to pipe 16. It will be obvious that pilot burner 17 is normally supplied constantly with gas from pipe 16.

The control device 15 comprises a lower valve housing 20 and an upper housing 21. The valve housing 20 is provided with the usual partition wall 22 which is apertured to provide a valve seat 23. Cooperating with valve seat 23 is a valve disk 24 of conventional construction. A spring 25 is interposed between the valve disk and an

internally extending flange 20. The spring 25 serves to bias valve disk 24 towards valve seat 23. A diaphragm 28 is interposed between valve housings 20 and 21. Any suitable means (not shown) is employed for holding housings 20 and 21 and diaphragm 28 in assembled relation. The housing 21 is provided for enclosing the holding mechanism for holding valve disk 24 in open position. Extending across the housing 21 is a guide plate 29. This guide plate 29 serves to guide the vertical movement of an electromagnet which consists of a U shaped core 31 on which is located series connected electromagnetic windings 32 and 33. The base of the U shaped core 31 is secured to a valve stem 35 which extends through the diaphragm 28 and is secured to valve disk 24. The valve stem is threaded and is clamped to the diaphragm 28 by nuts 36 or other suitable fastening means. The diaphragm 28 serves as a gas tight seal between the housings 20 and 21.

Cooperating with the electromagnet core 31 is a plate 39 of Curie point material. This plate 39 forms the upper closure for housing 21. The plate 39 projects substantially beyond the housing 21 so as to project into the path of the flame of pilot burner 17. If desired, the plate 39 can terminate adjacent the housing 21 and suitable means can be provided for conducting the heat from the pilot flame to the plate. The plate 39 is of that form of Curie point material which becomes magnetic when heated above a certain temperature. One type of material which has this property is cobalt and certain cobalt steels likewise have this property, the Curie point depending upon the amount of cobalt present in the alloy. In my device, a cobalt steel which has a Curie point substantially above a normal burner chamber temperature but less than the pilot burner flame temperature is employed.

The energization of the electromagnetic windings 32 and 33 is controlled by a room thermostat or by a switch responsive to a condition indicative of the demand for heat. For example, this switch may be a conventional room thermostat indicated in the drawing by the reference numeral 45. This thermostat comprises a bimetallic element 46 to which is secured a contact arm 47. The contact arm 47 is movable into and out of engagement with a fixed contact 48. As indicated by the legends C and H, the contact arm 47 is moved by the bimetallic element towards the left into engagement with contact 48 upon a drop in temperature and towards the right out of engagement with contact 48 upon a rise in temperature. A magnet 49 is associated with the contact blade 47 and serves to impart a snap action to the contact blade.

The energization of windings 32 and 33 is also controlled by a limit switch 50. This limit switch is of conventional construction comprising a bimetallic element 51 which is operatively connected to a mercury switch 52. The bimetallic element is located so as to be responsive to the furnace temperature. For example, the bimetallic element may be located within the bonnet of a furnace. The switch 52 is normally closed. Upon the temperature to which bimetallic element 51 is subjected rising above a predetermined high limit value, the switch 52 is opened.

A transformer 55 is employed to supply power for energization of the electromagnetic winding 32 under the control of thermostat 45 and limit switch 50. This transformer is a step down

transformer and has a line voltage primary which is connected to line wires 56 and 57 leading to any suitable source of power (not shown).

Operation of Figure 1 species

The elements of the system are shown in the position which they occupy when the thermostat 45 is calling for heat and when the pilot burner 17 is properly ignited. Under these conditions, the plate 39 of Curie point material is heated by the flame of pilot burner 17 above its Curie point and is consequently magnetic. The electromagnetic windings 32 and 33 are also energized through the following circuit: from the right hand terminal of transformer 55 through conductor 60, bimetallic element 46, contact blade 47, contact 48, conductor 61, switch 52, conductor 62, windings 33 and 32, and conductor 63 to the left hand terminal of transformer 55. Since the windings 32 and 33 are energized, flux flows through the magnetic circuit consisting of core 31 and armature 39 so that the core 31 of the electromagnet is held in engagement with the plate 39 and thus serves to hold valve disk 24 in open position against the biasing action of spring 25. Gas is thus able to flow through the valve casing to burner 10 where it is burned.

Under normal circumstances, the burner will continue in operation until the thermostat 45 becomes satisfied or the temperature adjacent the bimetallic element 51 of limit switch 50 reaches the setting of the limit switch. In either case, the circuit traced to electromagnetic windings 32 and 33 is interrupted with the result that the windings 32 and 33 are deenergized. Consequently, no flux is produced and there ceases to be any attraction between core 31 and plate 39. The biasing spring 25 is able to move valve disk 24 into engagement with the valve seat 23, this movement being aided by the effect of gravity. Movement of valve disk 24 into engagement with valve seat 23 interrupts the flow of gas to main burner 10 and causes the extinguishment of the main burner. Upon both thermostat 45 and limit switch 50 again being reclosed, the circuit to windings 32 and 33 is reestablished so that core 31 is again moved upwardly to reopen the valve. It will thus be seen that during normal operation, the valve disk is moved away from its seat by the cooperating action of the core 31, the windings 32 and 33, and the plate 39.

If at any time the pilot burner 17 is extinguished, it is desirable that the flow of gas to the main burner be interrupted. Whenever such an extinguishment of the flame of pilot burner 17 occurs, plate 39 is no longer heated. As a result, the plate 39 cools below its critical temperature with the result that it becomes substantially non-magnetic. The effect of this is that there is no longer an attraction between core 31 and plate 29 with the result that despite the energization of windings 32 and 33, the spring 25 is capable of moving the valve disk to closed position. The valve will remain in this position until such time as pilot burner 17 is relighted and the pilot burner is effective to reheat plate 39.

It will be seen that by the use of a Curie point material which becomes magnetic when heated above a certain temperature rather than one which becomes magnetic when its temperature is below a certain value, it is possible to have a much simpler and more direct acting device. With the arrangement of my control device, the valve is biased to closed position which is the safe position. If anything at all goes wrong with

the operating mechanism, the biasing means is effective to move the valve to the safe position. This is accomplished, moreover, without the use of any shunting members whatsoever.

The use of a positive Curie point material, moreover, has the further advantage that it makes possible the use of an electromagnet which is controlled in the normal manner by switches which close upon a demand for heat. In this way it is possible to dispense with a separate electromagnetically positioned shut-off valve. It will be noted that my control device functions both as a thermostatically controlled shut-off valve and also as a means for interrupting gas flow upon pilot extinguishment.

Species of Figure 2

In Figure 2, I have shown a modification of my burner control device. In this species, the electromagnet is stationary and the only element that is movable is an armature member. In order to facilitate a comparison of the two figures, identical reference numerals have been applied to elements of Figure 2 which correspond identically with elements of Figure 1. It will be noted that as in Figure 1, the control device comprises a lower valve housing 20 and a valve disk 24 biased to closed position by a spring 25. There is also an upper valve housing 21 and a diaphragm 28 disposed between the two housings. In this species, the stem 35 is connected to an armature member 86 which cooperates with a pair of magnetic core members 87 and 88 which are secured to a plate 89 of Curie point material corresponding to plate 39. Disposed on the core members 87 and 88 are a pair of windings 90 and 91 corresponding to windings 32 and 33 of the species of Figure 1. The plate 89 is adapted to be exposed to the flame of pilot burner 17 in the same manner as is plate 39. Like plate 39, it becomes magnetic when heated above a predetermined critical temperature.

In this form, the magnetic circuit of the holding means consists of core member 87, plate 89, core member 88, and armature 86. Flux flows through this magnetic circuit whenever plate 89 is heated and windings 90 and 91 are energized. Upon either plate 89 being unheated so as to be substantially non-magnetic or upon windings 90 and 91 being deenergized, the armature 86 separates from core members 87 and 88 and spring 25 is effective to move valve 24 to closed position.

It will be readily apparent that the various advantages outlined for the device of Figure 1 apply equally well to the species of Figure 2. The species of Figure 2 has the advantage that the only element which is movable is the armature 86 which can be made relatively light, if necessary.

With either species, control in accordance with both the demand for burner operation and the condition of the pilot flame is obtained with a minimum of apparatus.

While I have shown certain specific embodiments of my invention, it is to be understood that this is for purposes of illustration only and that my invention is to be limited solely by the scope of the appended claims.

I claim as my invention:

1. A safety mechanism for a fuel burner comprising a control device biased to a fuel feed preventing position, and holding means for retaining the control device in a fuel feed permitting position against its bias, said holding means comprising a plurality of elements of magnetic ma-

terial cooperating to form a magnetic circuit, one of said elements being adapted to be heated by a burner flame and being of a material which is normally substantially non-magnetic but which becomes magnetic when heated by said flame above a predetermined temperature.

2. A valve mechanism comprising a valve biased to a first position, and holding means for retaining the valve in a second position against its bias, said holding means comprising a plurality of elements of magnetic material cooperating to form a magnetic circuit, one of said elements being adapted to be heated by a burner flame and being of a material which is normally substantially non-magnetic but which becomes magnetic when heated by said flame above a predetermined temperature.

3. A safety mechanism for a fuel burner comprising a control device biased to a fuel feed preventing position, holding means for retaining the control device in a fuel feed permitting position against its bias, said holding means comprising a magnet and an armature cooperating to form a magnetic circuit, and a connection between said armature and said control device, a portion of said magnet being adapted to be heated by a burner flame and being of a material which is normally substantially non-magnetic but which becomes magnetic when heated by said flame above a predetermined temperature.

4. A safety mechanism for a fuel burner comprising a control device biased to a fuel feed preventing position, holding means for retaining the control device in a fuel feed permitting position against its bias, said holding means comprising a plurality of elements of magnetic material cooperating to form a magnetic circuit, one of said elements being adapted to be heated by a burner flame and being of a material which is normally substantially non-magnetic but which becomes magnetic when heated by said flame above a predetermined temperature, and an electromagnetic winding on another of said elements.

5. A safety mechanism for a fuel burner comprising a control device biased to a fuel feed preventing position, holding means for retaining the control device in a fuel feed permitting position against its bias, said holding means comprising a plurality of elements of magnetic material cooperating to form a magnetic circuit, one of said elements being adapted to be heated by a burner flame and being of a material which is normally substantially non-magnetic but which becomes magnetic when heated by said flame above a predetermined temperature, an electromagnetic winding on another of said elements, and thermostatically controlled means for controlling the energization of said winding.

6. A valve mechanism comprising a valve biased to a flow preventing position, a housing for said valve, holding means for retaining the control device in a flow permitting position against its bias, said holding means comprising a plurality of elements of magnetic material cooperating to form a magnetic circuit, and a second housing for said holding means, a flexible wall between said first and second housings, one of said elements of said magnetic circuit being movable and secured to said valve through said flexible wall, and another of said elements being of a material which is normally substantially non-magnetic but which becomes magnetic when heated above a predetermined temperature.

7. A control mechanism comprising a control device biased to a first safe position, magnetic

holding means for retaining the device in a second active position, said holding means comprising a plurality of elements of magnetic material cooperating to form a magnetic circuit, and a housing for said control device and holding means, one of the elements of said magnetic circuit extending beyond said housing so as to be adapted to be heated by a flame, said element being of a material which is normally substantially non-magnetic but which becomes magnetic when heated by said flame above a predetermined temperature.

8. A control mechanism comprising a control device biased to a first position, magnetic holding means for retaining the device in a second position, said holding means comprising a plurality of elements of magnetic material cooperating to form a magnetic circuit, a housing for said control device and holding means, one of the elements of said magnetic circuit extending beyond said housing so as to be adapted to be heated by a flame, said element being of a material which is normally substantially non-magnetic but which becomes magnetic when heated above a predetermined temperature, and an electromagnetic winding on another of said elements.

9. A control mechanism comprising a valve device biased to a closed position, magnetic holding means for retaining said valve in open position, said holding means comprising a plurality of elements of magnetic material cooperating to form a magnetic circuit, and a housing for said control device and holding means, one of the elements of said magnetic circuit extending beyond said housing so as to be adapted to be heated by a flame, said element being of a material which is normally substantially non-magnetic but which becomes magnetic when heated by said flame above a predetermined temperature.

10. A control mechanism comprising a control device biased to a first safe position, magnetic holding means for retaining the device in a second active position, said holding means comprising an electromagnet and a stationary magnetic element cooperating therewith to form a magnetic circuit, a housing for said control device and holding means, said electromagnet being movably mounted within said housing and connected to said control device, and said stationary element extending beyond said housing so as to be adapted to be heated by a flame, said stationary element being of a material which is normally substantially non-magnetic but which becomes magnetic when heated above a predetermined temperature.

11. In a burner system, a burner, ignition means therefor, a control device for said burner biased to a position preventing burner operation, and holding means for retaining said control device in a second position permitting burner operation, said holding means comprising a plurality of elements of magnetic material cooperating to form a magnetic circuit, one of said elements being of a material which is normally substantially non-magnetic but which becomes magnetic when heated above a predetermined temperature, said element being exposed to the heat of the ignition means.

12. In a fuel burner system, a main burner, a pilot burner therefor, a control device for said main burner biased to a position preventing burner operation, and holding means for retaining said control device in a second position permitting burner operation, said holding means comprising a plurality of elements of magnetic

material cooperating to form a magnetic circuit, one of said elements being of a material which is normally substantially non-magnetic but which becomes magnetic when heated above a predetermined temperature, said element being exposed to the heat of the pilot burner flame.

13. In a burner system, a burner, ignition means therefor, a control device for said burner biased to a position preventing burner operation, holding means for retaining said control device in a second position permitting burner operation, said holding means comprising a plurality of elements of magnetic material cooperating to form a magnetic circuit, one of said elements being of a material which is normally substantially non-magnetic but which becomes magnetic when heated above a predetermined temperature, said element being exposed to the heat of the ignition means, an electromagnetic winding on another of said elements, and means responsive to a condition indicative of the demand for heat for controlling the energization of said winding.

14. In a fluid fuel burner system, a burner, ignition means therefor, a valve controlling the flow of fuel to said burner and biased to a position preventing the flow of fuel to said burner, holding means for retaining said valve in a second position permitting a flow of fuel to said burner, said holding means comprising a plurality of elements of magnetic material cooperating to form a magnetic circuit, one of said elements being of a material which is normally substantially non-magnetic but which becomes magnetic when heated above a predetermined temperature, said element being exposed to the heat of the ignition means, an electromagnetic winding on another of said elements, and means responsive to a condition indicative of the demand for heat for controlling the energization of said winding.

15. In a fluid fuel burner system, a main burner, a pilot burner therefor, a valve controlling the flow of fuel to said main burner and biased to a position preventing the flow of fuel to said main burner, holding means for retaining said valve in a second position permitting a flow of fuel to said burner, said holding means comprising a plurality of elements of magnetic material cooperating to form a magnetic circuit, one of said elements being of a material which is normally substantially non-magnetic but which becomes magnetic when heated above a predetermined temperature, said element being exposed to the heat of said pilot burner, an electromagnetic winding on another of said elements, and means responsive to a condition indicative of the demand for heat for controlling the energization of said winding.

16. In a burner control system, burner means, a control device for said burner means biased to a position limiting burner operation, holding means for retaining said control device in a second position permitting full burner operation, said holding means comprising a plurality of elements of magnetic material cooperating to form a magnetic circuit, one of said elements being of a Curie point material which is appreciably magnetic only within a predetermined temperature range, means for controlling the temperature of said one element in accordance with a first normal operative condition of said burner means, an electromagnetic winding on another of said elements, and means responsive to a second condition indicative of the demand for heat for controlling the energization of said winding.

JAMES B. BOYER.