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FLAME RESPONSIVE CONTROLLER

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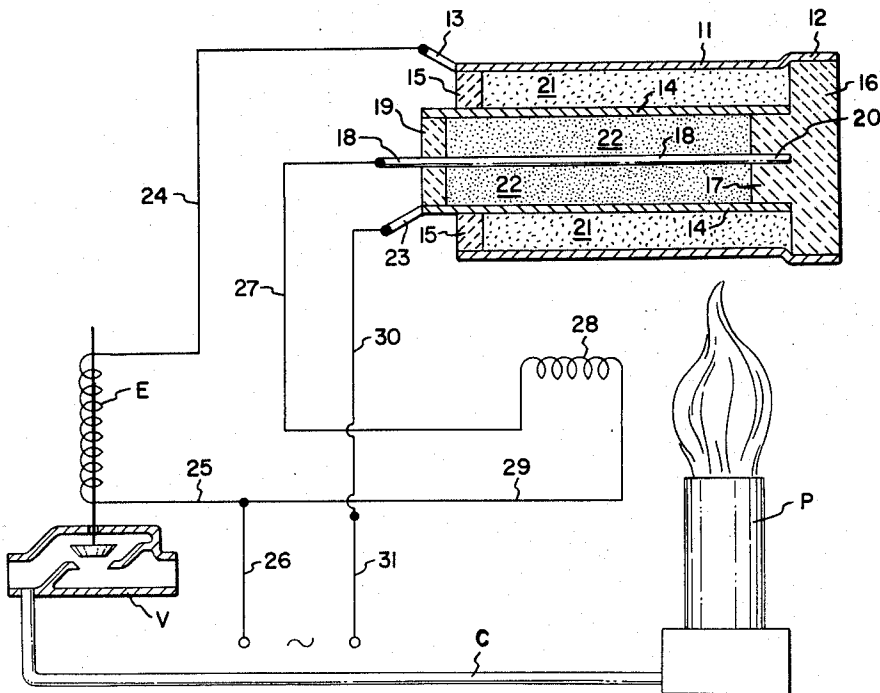


Fig. 1

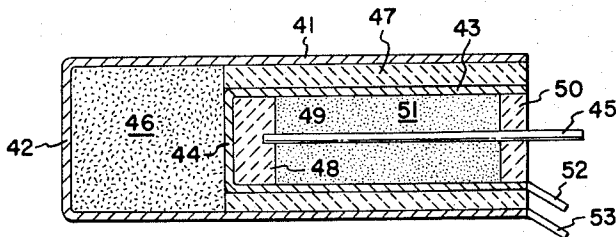


Fig. 2

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1

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FLAME RESPONSIVE CONTROLLER

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6 Claims. (Cl. 338-9)

This invention relates to control apparatus for fuel burning apparatus, and more particularly, to a pilot flame responsive device for controlling the energization of an igniter for a pilot burner and energization of an electrically operated valve for controlling the flow of gas to a main burner usually associated with and adapted to be ignited by the pilot burner.

While it is well known in the fuel burning art to provide an igniter for igniting a pilot burner and to provide a pilot flame sensing unit for controlling the energization of a main gas valve, these prior art devices and arrangements have required separate means for providing the separate functions and have, consequently, made the mounting thereof with respect to a pilot burner somewhat awkward, expensive, and bulky.

One of the objects of this invention is to provide a single unit which will be compact and easy to install with respect to a pilot burner and yet provide both of the above mentioned control functions.

Another object of the invention is to provide a combined flame sensing control unit in which one of the elements of the unit has a positive temperature co-efficient of resistance for connection in series with an electric igniter for a pilot flame and another element of the unit has a negative temperature co-efficient of resistance for connection in series with an electrically operated main burner fuel valve.

A still further object of the invention is to provide a flame sensing unit having two concentrically arranged flame sensing units, one with a positive temperature co-efficient of resistance and the other with a negative temperature co-efficient of resistance.

A further object of the invention is to provide a combination flame sensing unit wherein the unit for controlling the energization of an igniter is co-axial with the unit for controlling the energization of the main burner.

Another object of the invention is to provide co-axially arranged flame sensing units in a single assembly, with an electrode common to each of the units so as to require only a three wire connection to the unit assembly.

Still further objects of the invention will become apparent upon reading the following detailed description of the invention in conjunction with the accompanying drawing wherein:

Figure 1 is a schematic view of a heating system with the flame sensing unit shown in cross section; and

Figure 2 is a modification of the flame sensing unit, also shown in cross section.

Referring to Figure 1 of the drawing, the flame sensing unit comprises a tube 11 having an enlarged diameter portion 12 at one end thereof and a lead wire connector tab 13 projecting from the other end thereof. Positioned concentrically within the tube 11 is a second smaller tube 14 that is held in concentrically spaced relationship with respect to the tube 11 by means of a washer-shaped electrically insulating washer 15 and an insulation plug 16 having a reduced diameter portion 17 projecting inwardly from the end 12 of tube 11 and into the tube 14. The

2

space between the tubes 11 and 14 is filled with an electrically conductive material having a negative temperature co-efficient of resistance, that is, a material that decreases in resistance as its temperature rises, such as a mixture of lithium nitrate, sodium nitrate and potassium nitrate.

Positioned along the longitudinal axis of the tube 14, is a metallic rod 18 that is held in this position by means of an insulation washer 19 at its left hand end and is held in said position at its right hand end by the rod extending into an axial bore 20 in the portion 17 of the plug 16. A lead wire connecting tab 23 projects from the left hand end of the tube 14 while the left hand end of the rod 18 projects beyond the outer surface of the washer 19 to serve as a lead wire connector. The space between the tube 14 and the rod 18 is filled with a material having a positive temperature co-efficient of resistance, one which increases in resistance as its temperature rises, such as a mixture of copper and/or iron particles and alumina.

The unit is illustrated as being heated by a flame at the pilot burner P which, in turn, is connected through a conduit C to the inlet end of a main gas valve V. One end of the valve's energizing coil E is connected through a lead wire 24 to the connector 13 while the other end of the coil is connected through a lead wire 25 to an electric power line 26. The rod 18 is connected through a lead wire 27 to one end of an electric igniter 28, while the other end of the electric igniter 28 is connected through a lead wire 29 to the power line 26. The tube 14 is connected through its connector 23 and a lead wire 30 to a second power line 31.

A conventional main burner (not illustrated) for a fuel heated appliance (not illustrated) is adapted to be connected to the outlet of the valve V so as to be ignitable by the pilot burner P when the main valve is opened.

Operation

The valve is illustrated as being in its open position and the flame sensing unit is illustrated as being heated by a flame present at the tip of the pilot burner P. Under these conditions, the materials 21 and 22 are in their heated condition with the result that the resistance of the material 22 is extremely high so as to substantially cut off the flow of electrical current through the igniter 28. However, the resistance of the material 21 is very much lower than normal so that sufficient current passes through it, for the energization of the coil E of the valve V, to cause the valve to open.

Should the pilot burner flame become extinguished, the materials 21 and 22 would reduce in temperature with the result that the resistance of the material 21 would greatly increase cutting off the flow of sufficient electrical current to the coil E to cause the valve to close. Simultaneously, the resistance of material 22 decreases sufficiently as to enable enough current to flow through the igniter 28 to cause or attempt to cause re-ignition of the pilot burner.

Modification

The modification of the invention, illustrated in Figure 2 of the drawing, consists of a tube 41 having a closed end 42, a concentrically arranged tube 43 having a closed end 44, and a rod 45 concentrically positioned in the tube 43. The space between the closed ends of the tubes 42 and 44 is filled with a material 46 having a negative temperature co-efficient of resistance. The material is sealed in this space by means of a sleeve-like insulating member 47 positioned between the tube 43 and the surrounding portion of the tube 41.

A plug 48 positioned in the inner end of the tube 43 has an axial bore 49 therein into which the inner end of the rod 45 extends. The outer end of the tube 43 is sealed by means of an insulation washer 50. A mate-

3

rial having a positive temperature co-efficient of resistance is confined within the tube 43 and around the rod 45 by the insulation plugs 48 and washer 50.

As in Figure 1 of the drawing, the outwardly projecting end of the rod 45, a tab extension 52 on the tube 43 and a tab extension 53 on the tube 41 are adapted to be electrically connected into the same system as illustrated in Figure 1 and in the same way.

While the preferred and an alternate embodiment of the invention has been illustrated in the drawing and described in the specification, it is deemed to be obvious that modifications may be made therein without departing from the spirit of the invention. Therefore, the scope of the invention should be determined from the appended claims.

I claim as my invention:

1. The combination comprising a first metallic tube, a second metallic tube within said first tube and spaced therefrom, a first electrically conductive material between said tubes, an electrode within said second tube and spaced therefrom, a second electrically conductive material between said second tube and said electrode, one of said materials having a positive temperature co-efficient of resistance, the other of said materials having a negative temperature co-efficient of resistance and means for closing the ends of said tubes to confine said materials in said tubes.

2. The combination comprising a first metallic tube, a second metallic tube of substantially the same length of said first tube and within said first tube and spaced therefrom, a first electrically conductive material between said tubes, an electrode within said second tube and spaced therefrom, a second electrically conductive material between said second tube and said electrode, a plug closing the opening between said tubes and electrode at one end thereof, one of said materials having a positive temperature co-efficient of resistance, the other of said materials having a negative temperature co-efficient of resistance and means for closing the other ends of said tubes to confine said materials in said tubes.

3. The combination comprising a first metallic tube having a closed end, a second shorter metallic tube having a closed end and positioned within said first tube and spaced therefrom radially and with the closed end positioned intermediate the ends of the first tube, a first electrically conductive material between the closed ends of said tubes, an electrode within said second tube and spaced therefrom, a second electrically conductive material between said second tube and said electrode, one

4

of said materials having a positive temperature co-efficient of resistance, the other of said materials having a negative temperature co-efficient of resistance and means for closing the ends of said tubes to confine said materials in said tubes.

4. A flame responsive controller comprising a first metallic tube, a second metallic tube of smaller diameter and concentrically spaced within said first tube, a first electrically conductive material between said tubes, an electrode concentrically spaced within said second tube, a second electrically conductive material between said second tube and said electrode, one of said materials having a positive temperature co-efficient of resistance, the other of said materials having a negative temperature co-efficient of resistance and means for closing the ends of said tubes to confine said materials in said tubes.

5. A flame responsive controller comprising a first metallic tube, a second metallic tube within said first tube and spaced therefrom and substantially co-extensive therewith, a first electrically conductive material between said tubes, an electrode within said second tube and substantially co-extensive therewith and spaced therefrom, a second electrically conductive material between said second tube and said electrode, one of said materials having a positive temperature co-efficient of resistance, the other of said materials having a negative temperature co-efficient of resistance and means for closing the ends of said tubes to confine said materials in said tubes.

6. A flame responsive controller comprising a first metallic tube having a closed end, a second metallic tube having a closed end and positioned within said first tube and spaced therefrom radially and with the closed end of said second tube positioned substantially inwardly from each end of said first tube, a first electrically conductive material between said tubes, an electrode within said second tube and spaced radially therefrom, a second electrically conductive material between said second tube and said electrode, one of said materials having a positive temperature co-efficient of resistance, the other of said materials having a negative temperature co-efficient of resistance and means for closing the other ends of said tubes to confine said materials in said tubes.

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