

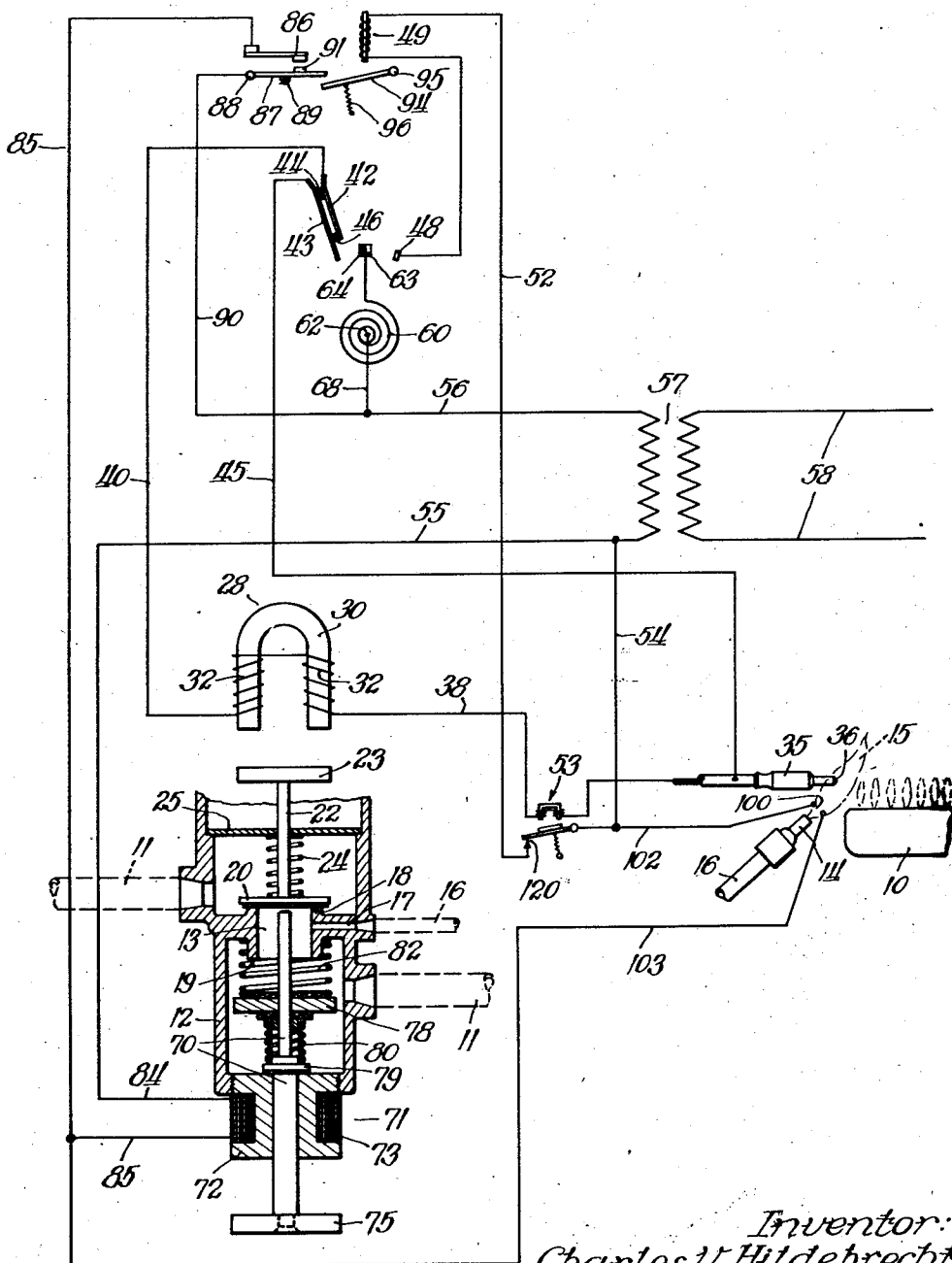
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2,290,048

SAFETY DEVICE FOR HEATING AND OTHER APPARATUS

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SAFETY DEVICE FOR HEATING AND
OTHER APPARATUS

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This invention relates to safety devices for heating and other apparatus and may be characterized as an improvement upon the invention disclosed and claimed in my copending application, Serial No. 239,799, filed November 10, 1938.

More particularly, the invention relates to safety devices of the general character in which an electromagnet connected in circuit with a thermocouple is adapted to be energized by the thermo-electric current set up by the thermocouple as long as the burner, to the heat of which the thermocouple is subjected, such as a pilot burner, is lighted, and when so energized, maintains a valve or other controlling member for controlling the supply of fuel or operative energy to the apparatus in open or operating position; cessation of the holding action of the electromagnet, upon extinguishment of the burner or upon opening of the thermo-electric circuit, releasing the valve or controlling member for movement to closed or safety position shutting off the supply of fuel or operative energy to the apparatus.

One of the main objects of the present invention is to provide a tripping and resetting combination generally such as disclosed in my above identified copending application and of a character not only automatically to maintain the supply of fuel to the burner as long as it is desired to supply heat therefrom and automatically to shut off the fuel supply when heat from the burner is not desired and to set up the supply of fuel when heat from the burner is again desired, but, further, automatically to shut off the supply of fuel to the pilot burner with the shutting off of the supply of fuel to the main burner and to re-establish the supply of fuel to the pilot burner and automatically ignite the same in the resetting operation which reestablishes the supply of fuel to the main burner.

It is also an object of the present invention to prevent overheating in the event of failure of the circuit other than the thermo-electric circuit, and, more particularly, to avoid failure to trip the electromagnet to release the valve or controlling member for movement to closed or safety position when, for example, the other circuit fails and a desired temperature is exceeded or other abnormal defective or insufficient functioning or non-functioning of the apparatus occurs.

Further objects and advantages of the invention will appear from the following detailed description, taken in connection with the accompanying drawing in which the single figure is a diagrammatic view, partly in section, of an illustrative embodiment of the present invention.

Referring to the drawing, the burner 10 is any suitable or preferred main burner—by way of example, the main burner for a water heater or for a space or room heater, or it may be the main burner for certain types of ovens or other heating apparatus, or any other burner.

A pipe, indicated diagrammatically at 11, supplies gaseous or any other suitable fuel to the burner 10. A valve body shown fragmentarily at 12 is connected into the fuel supply pipe 11. The valve body 12 has a valve opening or port 13. Disposed in juxtaposition to the burner 10 is a pilot burner 14 which maintains a pilot flame 15 for igniting the main burner. The pilot burner 14 is supplied with fuel by a tube 16 which is preferably connected through a port 17 with the valve opening 13 between the valve seats 18 and 19 at opposite ends thereof.

A valve 20 is adapted to seat upon the seat 18 at the outer end of the valve opening 13 to shut off the fuel supply to the main burner 10 and also the fuel supply to the pilot burner 14. The valve 20 is connected by a valve stem 22 to an armature 23, and a helical spring 24 surrounds the valve stem with one end engaging the valve 20 and the other end engaging a fixed part 25 of the control device. The spring 24 is normally under compression when the armature is in attracted position, but when the electromagnet, indicated generally at 28, is energized and the armature 23 is held in attracted position thereby, the spring 24 is prevented from moving the valve 20 to closed position engaging the valve seat 18 to shut off the supply of fuel to the main burner and the pilot burner.

Upon cessation of the holding action of the electromagnet 28 as, for example, upon extinguishment of the pilot flame at the pilot burner 14 or upon tripping of the electromagnet as will hereinafter appear, the armature 23 and connected valve 20 are released, whereupon the valve 20 is moved by the spring 24 into engagement with the valve seat 18 to shut off the supply of fuel to the main burner and also to the pilot burner.

The electromagnet 28 comprises a magnet frame 30 having energizing coil means 32. In the illustrated embodiment of the invention, the magnet frame 30 is of generally U-shaped form, and the coil means 32 surrounds each of the legs of the magnet frame. It is to be understood that the electromagnet may be of any other suitable or preferred form. The coil means 32, instead of surrounding each of the legs of the magnet

frame, may surround only one leg, and a trip coil may be provided around the other leg as disclosed and for the purposes set forth in my copending application Serial No. 239,799, filed November 10, 1938, and in the copending application of John H. Thornbery and Theodore A. Wetzels, Serial No. 283,572, filed July 10, 1939. The coil means 32 is connected in circuit with the thermocouple 35 as will presently be described.

The thermocouple 35 is placed in position so that its hot junction 36 will be heated by the pilot flame 14 as long as the pilot flame is burning. Its construction may be similar to that more fully disclosed in Oscar J. Leins Patent No. 2,126,564, granted August 9, 1938, or it may be in the form of any of the thermocouples or multiple thermocouple devices disclosed in the copending application of Guido Wunsch and Josef Schuppert, Serial No. 738,370, filed August 3, 1934, or of any other suitable or preferred form.

One terminal of the coil means 32 is connected through a conductor 38 to the internal thermocouple element of the thermocouple 35, and the other terminal of the coil means 32 is connected by a conductor 40 in circuit with a fixed contact 42. A spring contact 43 is fixedly supported adjacent the contact 42 and insulated therefrom as indicated at 44. The contact 43 is connected in circuit with the external metallic tubular thermocouple element of the thermocouple 35 by a conductor 45. The spring contact 43 is preferably tensioned normally to engage the contact 43 with the contact 42 at 46.

A second fixed contact 48, positioned in spaced relation with respect to the contact 42, is connected, for example, through the winding of an electromagnet 49, a conductor 52, relay 53, and conductor 54, to the conductor 55 of a circuit 55, 56. The circuit comprising the conductors 55, 56 is connected to a suitable source of current, for example through a transformer 57 to an alternating current circuit 58. The circuit 58 may, for example, be an alternating current lighting circuit or any other alternating current circuit supplied by a suitable source of alternating current (not shown), although of course a direct current resetting circuit, as well as other resetting arrangements, may be employed within the scope of the broader aspects of the present invention.

A thermally sensitive member or thermostat 60 is fixedly supported at one end at 62 and carries, at its opposite end, a contact 63 backed by an insulating piece 64, the contact 63 and insulating piece 64 being moved by the action of different temperatures upon the thermostat 60. For example, upon a predetermined maximum temperature adjacent the thermostat, the insulating piece 64 engages the projecting end of the contact spring 43 and separates the same from the contact 42 to open the thermo-electric circuit at 46. Upon a predetermined minimum temperature adjacent the thermostat the contact 63 engages the contact 48.

The thermostat 60 shown in the drawing comprises a pair of strips formed of dissimilar metal and secured together, the strips having different coefficients of expansion, and the thermostat has a bimetal spiral or coiled portion as shown. The fixedly supported end of the bimetal spiral is connected by a conductor 68 to the conductor 56 of the circuit 55, 56. In the embodiment of the invention shown in the drawing which is illustrative and not limiting, the bimetal thermally sensitive element forms a part of the electric

circuit for conducting current from the circuit 55, 56 to the contact 63. This may be varied so that the bimetal thermally sensitive element is removed from the electric circuit. Moreover, the thermostat may be of any other suitable or preferred type, and I contemplate other devices such as a pressure responsive device or a humidity responsive device, or a device responsive to some other conditions for actuating the contact 63 and insulating piece 64.

The reset means for resetting the armature 23 into attracted position and the valve 20 to open position comprises a reset stem 70. The resetting electromagnet 71 cooperates with the stem 70 for the purpose of actuating this stem inwardly to reset the device by engaging the valve 20 and moving the valve to open position and the armature 23 to attracted position. In the embodiment of the invention illustrated in the drawing, the reset electromagnet 71 has a magnet frame 72 with the magnet coil 73 surrounding the same. The stem 70 is preferably formed of non-ferro magnetic material, and its outer end carries an armature 75 formed of a suitable magnetic material. When the circuit through the coil 73 is closed, the electromagnet 71 is energized and moves the armature 75 to attracted position, this movement of the armature actuating the reset stem inwardly to reset the device.

For the purpose of shutting off the supply of fuel to the main burner during the resetting operation, the reset stem 70 is provided with a valve member 78 of the general character disclosed and claimed in my prior Patent No. 2,114,446, granted August 19, 1938. A stop 79 fixed on the stem 70 limits the outward movement of the reset stem, and a coiled spring 80, interposed between the stop 79 and the valve 78 which is loose on the stem, moves the valve 78 yielding to closed position engaging the valve seat 19 by the movement of the stem 70 in the resetting operation. A coiled spring 82, interposed between the valve 78 and a fixed part of the control device, moves the valve 78 to open position and the armature 75 to retracted position upon completion of the resetting operation.

One terminal of the reset coil 73 is connected by a conductor 84 to the conductor 55 of the circuit 55, 56, and the other terminal of the coil 73 is connected through a conductor 85 to a contact 86 in juxtaposition to the electromagnet 49. A leaf spring 87, fixedly supported at 88 and connected at its fixedly supported end by a conductor 90 with the conductor 56 of the circuit 55, 56, carries a contact 91 which is adapted to engage the contact 86 for closing the circuit through the coil 73 of the reset electromagnet whereby the resetting operation is secured. The leaf spring is tensioned to open circuit position against a stop 89 as shown in the drawing. An arm may be employed instead of the leaf spring 87, and this arm may be pivoted at 88 and normally held in open circuit position by a suitable spring. The contact 86 may be in the form of a leaf spring carrying a contact for cooperation with the contact 91, as shown.

The free end of the spring or arm 87 projects beyond the contact 91, and the electromagnet 49 is provided with an armature 94 pivoted, for example, at 95. The armature 94, upon completion of the circuit through the electromagnet 49, is actuated to attracted position, and, by such actuation, engages the projecting end of the spring or arm 87 and moves the contact 91 into engagement with the contact 86 to close the

reset coil circuit 84, 85. A spring 86, connected to the armature 84 at one end and fixedly anchored at the other end, returns the armature 84 to retracted position when the electromagnet 49 is deenergized.

For the purpose of automatically igniting and reigniting the pilot burner upon setting up or reestablishing the supply of fuel to the pilot burner, a spark gap igniter is provided at 100. The particular form of igniter may vary widely within the scope of the present invention. One terminal of the igniter is connected through a conductor 102 and the conductor 54 to the conductor 55 of the circuit 55, 56. The other terminal of the igniter 100 is connected through a conductor 103 and conductor 85 to the contact means at 86.

The relay at 53 is shown as of a form generally similar to that disclosed in the copending application of Clarence Wantz, Serial No. 733,722, filed July 5, 1934. Any other relay or equivalent device is contemplated within the scope of the present invention.

The operation of the device is as follows:

When the pilot flame 15 is burning, the heat thereof upon the thermal junction 36 of the thermocouple produces a thermo-electric current in the coil 32 and the connected thermo-electric circuit. The magnet frame 30 and armature 23 are preferably formed of an alloy of relatively low magnetic reluctance and, as a result, with the switch 42, 43 closed at 46, the relatively weak thermo-electric current produces a magnetic force of sufficient strength so that when the armature 23 is placed in contact with the pole ends of the magnet frame the magnetic attraction holds the armature in attracted position with a force greater than the force exerted by the spring 24, thereby holding the valve 20 open, so long as the pilot flame is burning, and the contacts 42, 43 closed at 46. Fuel then passes through the pipe 11 to the main burner 10, and through the pipe 11, port 17 and tube 16 to the pilot burner 14.

If the pilot flame at 15 is extinguished, the holding action of the electromagnet 28 ceases to be sufficient to hold the armature 23 in attracted position and the spring 24 moves the valve 20 to closed position. The closing of the valve 20 shuts off the supply of fuel to the main burner 10 and also to the pilot burner 14.

On the other hand, with the pilot burner 14 ignited and the valve 20 held open by the thermo-electric current developed by the pilot burner, opening of the trip switch 42, 43 at 46, for example by the thermostat 60 at a predetermined maximum temperature, or by some other form of device at a predetermined pressure, humidity or other condition, opens the thermo-electric circuit including the coil 32. Upon opening of this circuit by the thermostat in the manner set forth, the holding action of the electromagnet ceases to be sufficient to hold the armature 23 and valve 20 in attracted position and the spring 24 moves the valve to closed position to shut off the supply of fuel to the main burner and to the pilot burner.

Where the temperature to which the thermostat 60 is subject drops below the predetermined minimum temperature, the contact means at 63 is moved by the thermostat 60 into engagement with the contact 48 and, by completion of the circuit for the electromagnet 49, closes the contacts 91, 86. This closes the circuit 84, 85 for the resetting coil 73 which energizes the resetting

electromagnet. The armature 75 is attracted and actuates the reset stem 70 inwardly to reset the armature 23 to attracted position and the valve 20 to open position. If the pilot burner is lighted, the energization of the electromagnet 28 thereby will retain the armature 23 in attracted position and the valve 20 open.

To prevent the escape of unburned fuel from the main burner during the resetting operation and until the supply of fuel is set up to the pilot burner and this burner has been ignited or reignited, the valve 78 operates to shut off the supply of fuel to the main burner during the resetting operation. In the inward movement of the stem 70 in the resetting operation, the valve 20 is opened and sets up a supply of fuel through the valve opening 13, but the valve 78 immediately closes off the supply of fuel to the main burner. Fuel then passes out through the port 17 and tube 16 to the pilot burner. The pilot burner being extinguished so that the thermocouple is not heated thereby, the relays 53 will be in the position with the igniter circuit closed at 120. The circuit from one side of the spark gap igniter 100 is thereby completed through the conductors 102 and 54 to one side of the circuit 55, 56, and from the other side of the circuit 55, 56 through the closed contacts 86, 91, and conductors 85 and 103, to the other side of the spark gap igniter. As a result, sparking occurs across the spark gap igniter, and this ignites the fuel issuing from the pilot burner to form the pilot flame 15.

As soon as the pilot burner 15 is thus ignited it heats the junction 36 of the thermocouple and, as a result, the relay 53 is operated to open the circuit at 120 by the thermo-electric current. The opening of the relay 53 thus opens the circuit for the igniter 100 and also the circuit for the electromagnet 49. During the time the electromagnet 49 is energized and until the pilot burner is ignited and has heated the thermocouple, the switch 86, 87 is held closed at 91, thereby maintaining energization of the reset coil 73 and holding the armature 23 in attracted position and the valve 20 open as well as the valve 78 closed, until the thermocouple is heated by the pilot flame and thermo-electric current is set up to energize the electromagnet 28 sufficiently to hold the armature 23 attracted and the valve 20 in open position, whereupon the thermo-electric current, by opening the relay 53 at 120 and deenergizing the electromagnet 49, opens the reset circuit 84, 85 at 91. The reset stem is thereupon projected outwardly by the spring 82, opening the valve 78 to provide a supply of fuel for the main burner, the valve 20 being retained open by the thermo-electric current.

Where a thermally responsive control is provided at 60, the thermostat thereof may, as already pointed out, be of any suitable or preferred form. Where the apparatus is employed in connection with a water heater, the thermostat may be subject to the temperature of the water in the tank, and where the apparatus is employed in connection with a space or room heater, the thermostat may be subject to the temperature of the space or room which is heated. Other controls at 60 will be subject to other conditions at which it is desired to trip and reset the device as herein described.

With the present invention, the valve 20 is tripped and reset automatically upon the occurrence of predetermined conditions. The fuel supply for the pilot burner is arranged to be shut off by the valve 20 which shuts off the fuel supply

to the main burner upon extinguishment of the pilot burner and also at a predetermined maximum temperature. At the same time, the device operates automatically at a predetermined minimum temperature to reset the valve 20 to open position and valve 78 to closed position to set up the supply of fuel to the pilot burner without setting up a supply of fuel to the main burner which would escape unburned until the pilot burner is reignited.

By opening the thermo-electric circuit at 46 at a predetermined maximum temperature, the electromagnet 28 is tripped and the valve 20 closed at that time regardless of the circuit 58. Overheating, therefore, cannot result, even upon failure of the line 58.

The spark gap igniter 100 is operated by the means 60 which operates the reset means, and, as a result, the fuel which issues from the pilot burner is ignited. The pilot burner, upon being thus ignited, heats the thermocouple, which sets upon a thermo-electric current, thereby energizing the electromagnet 28 to hold the valve 20 open, the thermo-electric current also opening the relay 53 at 120. The opening of the relay at 120 discontinues the operation of the igniter and deenergizes the electromagnet 49 so that the reset circuit is opened. The reset stem is then actuated outwardly as previously set forth, and the valve 78 moves to open position to set up the desired supply of fuel for the main burner.

I do not intend to be limited to the precise details shown or described.

I claim:

1. Safety device for heating and other apparatus comprising, in combination, heat generating means, pilot means for said heat generating means, means to control the supply of operative energy to said heat generating means and said pilot means, an igniter for said pilot means, a thermocouple subject to the heat of said pilot means, an electromagnet connected in circuit with said thermocouple and adapted to cause said control means to supply operative energy to said heat generating means and said pilot means while said pilot means is operative and to shut off the supply of operative energy to said heat generating means and to said pilot means when said pilot means becomes inoperative, means for resetting said electromagnet and said control means to operative position to supply operative energy to the apparatus and for rendering said igniter operative, and means controlled by said thermocouple for rendering said resetting means and said igniter inoperative when said electromagnet is operative to cause said control means to supply operative energy to said heat generating means and to said pilot means.

2. Safety device for heating and other apparatus comprising, in combination, heat generating means, pilot means for said heat generating means, means to control the supply of operative energy to said heat generating means and said pilot means, an igniter for said pilot means, a thermocouple subject to the heat of said pilot means, an electromagnet connected in circuit with said thermocouple and adapted to cause said control means to supply operative energy to said heat generating means and said pilot means while said pilot means is operative and to shut off the supply of operative energy to said heat generating means and to said pilot means when said pilot means becomes inoperative, means for resetting said electromagnet and said control means to operative position to sup-

ply operative energy to the apparatus and for rendering said igniter operative, means controlled by said thermocouple for rendering said resetting means and said igniter inoperative when said electromagnet is operative to cause said control means to supply operative energy to said heat generating means and to said pilot means, and means subject to abnormal, defective, or insufficient or non-functioning of the apparatus for tripping said electromagnet to shut off the supply of operative energy to said heat generating means and said pilot means.

3. Safety device for heating and other apparatus comprising, in combination, heat generating means, pilot means for said heat generating means, means to control the supply of operative energy to said heat generating means and said pilot means, an igniter for said pilot means, a thermocouple subject to the heat of said pilot means, an electromagnet connected in circuit with said thermocouple and adapted to cause said control means to supply operative energy to said heat generating means and said pilot means while said pilot means is operative and to shut off the supply of operative energy to said heat generating means and to said pilot means when said pilot means becomes inoperative, means for resetting said electromagnet and said control means to operative position to supply operative energy to the apparatus and for rendering said igniter operative, means controlled by said thermocouple for rendering said resetting means and said igniter inoperative when said electromagnet is operative to cause said control means to supply operative energy to said heat generating means and to said pilot means, and means subject to abnormal, defective, or insufficient or non-functioning of the apparatus for tripping said electromagnet to shut off the supply of operative energy to said heat generating means and said pilot means, said resetting means and said igniter being controlled by another condition of the apparatus and by said thermocouple.

4. Safety device for heating and other apparatus comprising, in combination, heat generating means, pilot means for said heat generating means, means to control the supply of operative energy to said heat generating means and said pilot means, an igniter for said pilot means, a thermocouple subject to the heat of said pilot means, an electromagnet connected in circuit with said thermocouple and adapted to cause said control means to supply operative energy to said heat generating means and said pilot means while said pilot means is operative and to shut off the supply of operative energy to said heat generating means and to said pilot means when said pilot means becomes inoperative, means for resetting said electromagnet and said control means to operative position to supply operative energy to the apparatus and for rendering said igniter operative, means controlled by said thermocouple for rendering said resetting means and said igniter inoperative when said electromagnet is operative to cause said control means to supply operative energy to said heat generating means and to said pilot means, and means actuated to operative position by the resetting operation to shut off the supply of operative energy to the heat generating means during the resetting operation.

5. Safety device for heating and other apparatus comprising, in combination, means to control the supply of operative energy to the apparatus, heat generating means, pilot means for

said heat generating means, a thermocouple subject to the heat of said pilot means, an electromagnet connected in circuit with said thermocouple and adapted to cause said controlling means to supply operative energy to the apparatus while said pilot means is operative and to shut off the supply of operative energy to the apparatus when said pilot means becomes inoperative, means subject to a condition of said apparatus for opening the circuit including said thermocouple and said electromagnet to shut off the supply of operative energy to the apparatus when the functioning of the apparatus is such as not to require a supply of operative energy, means other than said electromagnet alone and subject to another condition of the apparatus for resetting said electromagnet and said controlling means to operative position to maintain the supply of operative energy to the apparatus when the functioning of the apparatus is such as to require a supply of operative energy thereto, an igniter for said pilot means, and means controlled by the thermocouple for rendering said igniter and said resetting means inoperative when the pilot flame is established and said electromagnet energized by the thermo-electric current set up by the thermocouple.

6. Safety device for heating and other apparatus comprising, in combination, means to control the supply of operative energy to the apparatus, heat generating means, pilot means for said heat generating means, a thermocouple subject to the heat of said pilot means, an electromagnet connected in circuit with said thermocouple and adapted to cause said controlling means to supply operative energy to the apparatus while said pilot means is operative and to shut off the supply of operative energy to the apparatus when said pilot means becomes inoperative, means other than said electromagnet alone for resetting said electromagnet and said controlling means to operative position to supply operative energy to said heat generating means and said pilot means, an igniter for said pilot means, and thermally responsive means for opening the thermo-electric circuit including said electromagnet and said thermocouple at a predetermined maximum temperature and for rendering said resetting means and said igniter operative at a predetermined minimum temperature.

7. In a device of the character described, in combination, a burner, a fuel supply pipe leading to said burner, a valve in said pipe, a supply pipe for a pilot light in juxtaposition to said burner, an electromagnet, an armature for said electromagnet which, when attracted, maintains said valve in open position and, when retracted, compels closing of said valve, a thermocouple placed in position to be heated by said pilot light and connected in circuit with said electromagnet, a second electromagnet connected in circuit with a source of current and adapted for resetting said armature to attracted position, an igniter for said pilot light connected in circuit with said second electromagnet, and relay means controlled by the thermo-electric current generated by the heat of the pilot light on the thermocouple for rendering said igniter and said second electromagnet inoperative.

8. In a thermoelectric control apparatus for a burner, the combination with a burner, a fuel supply pipe leading to said burner, a valve in said pipe, a pilot light in position to ignite said burner, an electromagnet, an armature for

said electromagnet which, when attracted, maintains said valve in open position, and when retracted frees said valve for movement to closed position, and thermocouple placed in position to be heated by said pilot light and connected in circuit with said electromagnet so as to energize said electromagnet sufficiently to hold said armature in attracted position and said valve in open position, said valve being incapable of being actuated to open position by the thermo-electric current generated by the heat of the pilot light on said thermocouple, of a second electromagnet connected in circuit with a source of current and adapted for resetting said armature to attracted position and said valve to open position, and means for interrupting the circuit through said second electromagnet upon completion of the resetting operation.

9. In a device of the character described, in combination, a burner, a fuel supply pipe leading to said burner, a valve in said pipe, a supply pipe for a pilot light in juxtaposition to said burner, an electromagnet, an armature for said electromagnet which, when attracted maintains said valve in open position and, when retracted, compels closing of said valve, a thermocouple placed in position to be heated by said pilot light and connected in circuit with said electromagnet, a second electromagnet connected in circuit with a source of current and adapted for resetting said armature to attracted position, means subject to the heat supplied by said burner for closing the circuit through said second electromagnet at a predetermined temperature, and means under the control of the thermoelectric current generated by the heat of the pilot light on said thermocouple for interrupting the circuit through said second electromagnet upon energization of said first electromagnet.

10. In a control device for heating and other apparatus, in combination, a main burner, a fuel supply pipe leading to said burner, a valve in said pipe, a fuel supply pipe for a pilot light in juxtaposition to said burner, an electromagnet, an armature for said electromagnet which, when attracted, maintains said valve in open position and, when retracted, frees said valve for movement to closed position, a thermocouple placed in position to be heated by said pilot light and connected in circuit with said electromagnet, means subject to a condition of said apparatus for opening automatically, upon the occurrence of such condition, the circuit including said thermocouple and said electromagnet to shut off the supply of fuel to said main burner when the functioning of the apparatus is such as not to require a supply of fuel to said main burner, means independent of said electromagnet and subject to another condition of the apparatus other than the heat of the pilot light on the thermocouple for automatically resetting said armature to attracted position and said valve to open position to establish and maintain a supply of fuel to said main burner when the functioning of the apparatus is such as to require the same, and means under the control of the thermoelectric current generated by the heat of the pilot light on said thermocouple for disabling said resetting means upon energization of said electromagnet.

11. In a device of the character described, in combination, a burner, a fuel supply pipe leading to said burner, a valve in said pipe, a supply pipe for a pilot light in juxtaposition to said

burner, an electromagnet, an armature for said electromagnet which, when attracted, maintains said valve in open position and, when retracted, compels closing of said valve, a thermocouple placed in position to be heated by said pilot light and connected in circuit with said electromagnet, a second electromagnet connected in circuit with a source of current and adapted for resetting said armature to attracted position, means subject to the heat supplied by said burner for closing the circuit through said second electromagnet at a predetermined temperature, and a relay in the thermocouple circuit for interrupting the circuit through said second electromagnet upon energization of said first electromagnet.

12. In a device of the character described, in combination, a burner, a fuel supply pipe leading to said burner, a valve in said pipe, a supply pipe for a pilot light in juxtaposition to said burner, an electromagnet, an armature for said electromagnet which, when attracted, maintains said valve in open position and, when retracted, compels closing of said valve, a thermocouple placed in position to be heated by said pilot light and connected in circuit with said electromagnet, a second electromagnet connected in circuit with a source of current and adapted for resetting said armature to attracted position, means subject to the heat supplied by said burner for closing the circuit through said second electromagnet at a predetermined temperature, ignition means for said pilot light, and a relay in the thermoelectric circuit for interrupting the circuit through said ignition means and the circuit through said second electromagnet upon energization of said first electromagnet.

13. In a control device for heating and other apparatus, in combination, a main burner, a fuel supply pipe leading to said burner, a valve in said pipe, a fuel supply pipe for a pilot light in juxtaposition to said burner, an electromagnet, an armature for said electromagnet which, when attracted, maintains said valve in open position and, when retracted, frees said valve for movement to closed position, a thermocouple placed in position to be heated by said pilot light and connected in circuit with said electromagnet, means subject to a condition of said apparatus for opening automatically, upon the occurrence of such condition, the circuit including said thermocouple and said electromagnet to shut off the supply of fuel to said main burner when the functioning of the apparatus is such as not to require a supply of fuel to said main burner, means independent of said electromagnet and subject to another condition of the apparatus other than the heat of the pilot light on the thermocouple for automatically resetting said armature to attracted position and said valve to open position to establish and maintain a supply of fuel to said main burner when the functioning of the apparatus is such as to require the same, ignition means for said pilot light, and means under the control of the thermoelectric current generated by the heat of the pilot light on said thermocouple for disabling said resetting means and said ignition means upon energization of said electromagnet.

14. In a control device for heating and other apparatus, in combination, a main burner, a fuel supply pipe leading to said burner, a valve in said pipe, a fuel supply pipe for a pilot light in juxtaposition to said burner, an electromagnet, an armature for said electromagnet which, when attracted, maintains said valve in open position

and, when retracted, frees said valve for movement to closed position, a thermocouple placed in position to be heated by said pilot light and connected in circuit with said electromagnet, means subject to a condition of said apparatus for opening automatically, upon the occurrence of such condition, the circuit including said thermocouple and said electromagnet to shut off the supply of fuel to said main burner when the functioning of the apparatus is such as not to require a supply of fuel to said main burner, and means independent of said electromagnet and subject to another condition of the apparatus other than the heat of the pilot light on the thermocouple for automatically resetting said armature to attracted position and said valve to open position to establish and maintain a supply of fuel to said main burner when the functioning of the apparatus is such as to require the same.

15. In a control device for heating and other apparatus, in combination, a main burner, a fuel supply pipe leading to said burner, a valve in said pipe, a fuel supply pipe for a pilot light in juxtaposition to said burner, an electromagnet, an armature for said electromagnet which, when attracted, maintains said valve in open position and, when retracted, frees said valve for movement to closed position, a thermocouple placed in position to be heated by said pilot light and connected in circuit with said electromagnet, a second electromagnet connected in circuit with a source of current and adapted for resetting said armature to attracted position and said valve to open position, and means subject to a condition of the apparatus for closing the circuit through said second electromagnet automatically to reset said armature to attracted position and said valve to open position to establish and maintain a supply of fuel to said main burner when the functioning of the apparatus is such as to require the same.

16. In a device of the class described, in combination, heat generating means, means for controlling the supply of operative energy to said heat generating means, a pilot light for said heat generating means, a thermoelectric generator subject to the heat of said pilot light, an igniter for said pilot light, condition responsive means for rendering said igniter operative, and means connected in circuit with said thermoelectric generator and controlled by the thermoelectric current generated by the heat of the pilot light on said thermoelectric generator automatically to render said igniter inoperative upon energization of said thermoelectric generator.

17. In a device of the class described, in combination, a burner, a fuel supply pipe leading to said burner, a valve in said pipe, a pilot light in position to ignite said burner, an electromagnet, an armature for said electromagnet which, when attracted, maintains said valve in open position and, when retracted, frees said valve for movement to closed position, a thermoelectric generator placed in position to be heated by said pilot light and connected in circuit with said electromagnet so as to energize said electromagnet sufficiently to hold said armature in attracted position and said valve in open position, an igniter for said pilot light, condition responsive means for rendering said igniter operative, and means connected in circuit with said thermoelectric generator and controlled by the thermoelectric current generated by the heat of the pilot light on said thermoelectric generator automatically

to render said igniter inoperative upon energization of said thermoelectric generator.

18. In a device of the class described, in combination, a burner, a thermoelectric generator subject to the heat of said burner, an igniter for said burner, condition responsive means for rendering said igniter operative, and means connected in circuit with said thermoelectric generator and controlled by the thermoelectric current generated by the heat of the pilot light on said thermoelectric generator automatically to render said igniter inoperative upon energization of said thermoelectric generator.

19. In a device of the character described, in combination, a control device having an electromagnet provided with an armature connected to

a controlling member and adapted when energized to hold said member in operating position and when deenergized to release said member for movement to a safety position, a second electromagnet adapted for resetting said armature to attracted position and said controlling member to operating position, means responsive to the heat of a pilot light for interrupting the circuit through said second electromagnet upon completion of the resetting operation, and igniter means connected in circuit with said second electromagnet and disabled by the interruption of the circuit through said second electromagnet by said last mentioned means, said control device controlling the fuel igniter by said igniter.

CHARLES V. HILDEBRECHT.

DISCLAIMER

2,290,048.—*Charles V. Hildebrecht*, Chicago, Ill. SAFETY DEVICE FOR HEATING AND OTHER APPARATUS. Patent dated July 14, 1942. Disclaimer filed July 13, 1944, by the assignee, *Milwaukee Gas Specialty Company*; the inventor, assenting.

Hereby enters this disclaimer to claims 1, 2, 3, 16, and 18 of said patent.

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