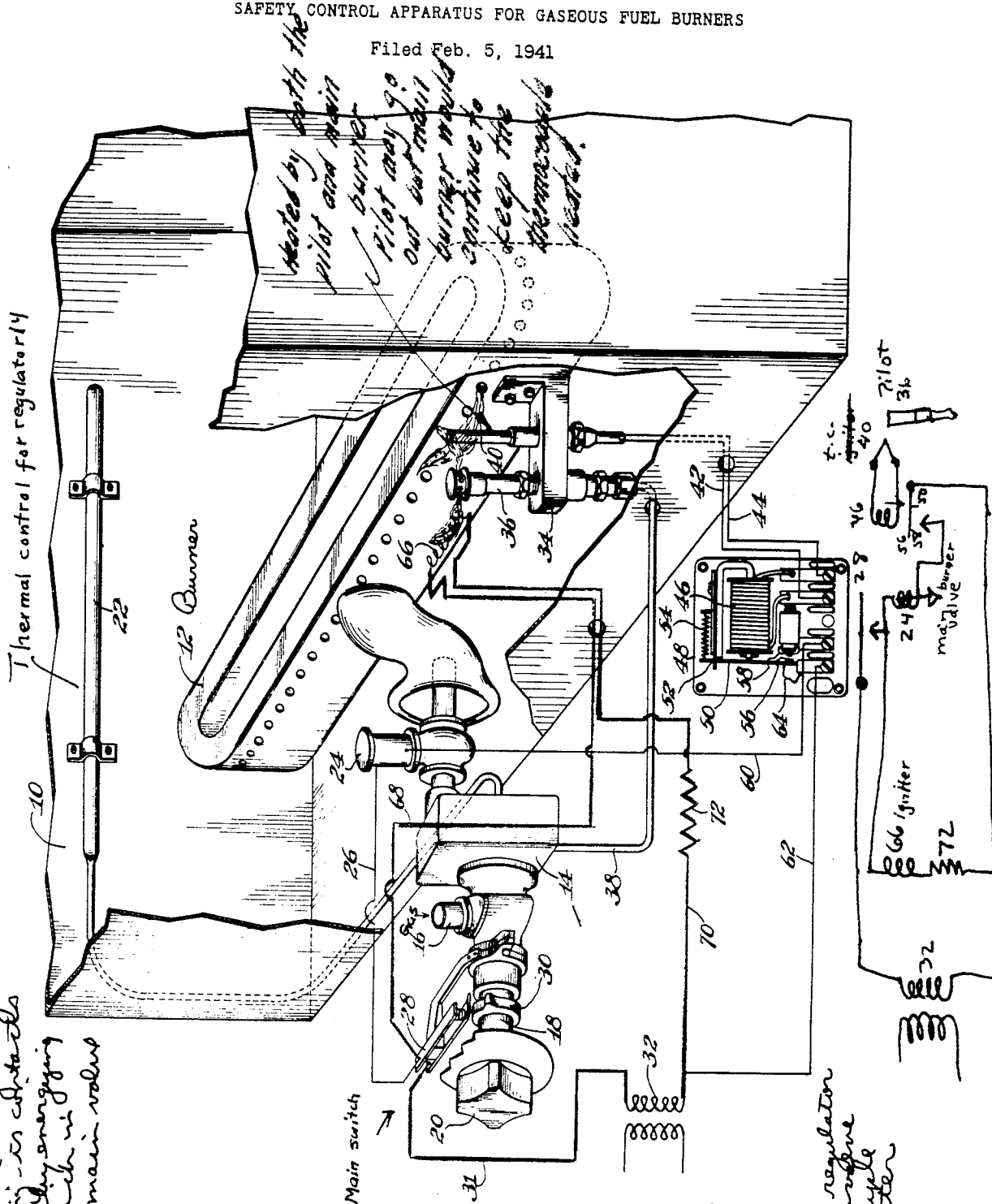


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SAFETY CONTROL APPARATUS FOR GASEOUS FUEL BURNERS

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BY

14 = thermostatic regulator
24 = solenoid gas valve
40 = thermocouple
66 = elec. igniter

Operation:
1. in knob 20 to close switch 28.
Igniter 66 is energized in as to
ignite pilot 34, this influences
thermocouple 40, causing energizing
of relay 48, closing its contacts
36, 58 and thereby energizing
solenoid 24 which in
turn opens the main valve
to burner 12.

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SAFETY CONTROL APPARATUS FOR GASEOUS FUEL BURNERS

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This invention relates to safety control apparatus for gaseous fuel burners and more particularly to thermoelectric controls therefor.

In various gas appliances, including domestic gas ranges, it is customary to have a pilot burner from which the main burner is ignited. The fuel supplied to the main burner is controlled by a main fuel valve which may be either manually or thermostatically adjusted to vary the quantity of fuel flowing to the main burner. Safety devices are used to prevent the escape of unburned fuel when the valve in the fuel supply line is opened when the pilot burner is not ignited. Such means may take the form of a thermocouple heated by the pilot flame to generate an electric current to move a normally closed solenoid valve to open position. When the pilot flame fails to light for any reason the circuit of the thermocouple cannot become energized and the solenoid valve remains closed, thus preventing the escape of unburned fuel at the main burner.

It is of some advantage in domestic gas ranges that the safety device be arranged to maintain the main burner flame in operation even if the pilot flame ceases. Such condition may arise during broiling operations if the small ports of the pilot burner become clogged by grease or fats. If such failure of the pilot flame causes extinguishment of the main burner flame through operation of the safety control, then the food being broiled may become spoiled. In water heaters, however, there is no advantage in thus continuing operation of the main burner upon extinguishment of the pilot flame. Both conditions should, therefore, be met if a universally satisfactory control is to be provided.

When a thermocouple is utilized to control the supply of fuel to the main burner, it will be apparent that after both the main burner and the pilot flames are extinguished, as by closure of the main gas valve, that the thermocouple will retain considerable heat. Such condition of the thermocouple results in continued flow of electric current in the solenoid valve circuit and consequent continued energization of the solenoid valve to maintain it in the open position. If, therefore, the main gas valve is again opened and fuel is flowing past the solenoid gas valve to the main burner, this gas will escape unburned through the atmosphere.

It is an object of this invention to prevent the flow of fuel to the main burner whenever the pilot burner fails to light.

Another object of the invention is to cause

the pilot burner to be ignited only when it is desired to use the appliance.

Another object of the invention is to render the device either immediately responsive to extinguishment of the pilot flame or alternatively not responsive thereto as desired.

Another object of the invention is to construct the device of a simple, compact and rugged design which will render it inexpensive to manufacture and reliable in operation.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawing wherein is shown a diagrammatic view of a safety control apparatus constructed in accordance with this invention.

Referring more particularly to the drawing, an oven compartment 10 of a gas range is shown as having the usual gas burner 12 supported therein. In this instance, the flow of gas to the burner 12 is under control of a thermostatic regulator 14 which is interposed between the gas inlet 16 and the burner 12. The regulator 14 also embodies a main gas cock (not shown) having a rotatable operating stem 18 carrying the dial 20 and by means of which the inlet 16 may be opened and closed in the usual manner. The thermostatic control of the oven 10 is completed by the provision of the thermal element 22 supported in the oven and operatively connected to the regulator 14. As such controls are well known and form no part of the present invention, further description is deemed unnecessary.

A solenoid gas valve 24 of any known type is interposed in the gas inlet line, preferably between the regulator 14 and the burner 12. Such valves may be arranged, as in this instance, to be opened by energization of the solenoid and closed by gravity as is well known. A wire 26 connects the solenoid gas valve 24 to one terminal of a main switch 28 shown as supported by the regulator 14 adjacent the gas cock stem 18. Operation of the main switch 28 may be effected by a cam 30 carried on the stem 18 and arranged to close the switch when the gas cock is rotated to open position. It will be understood that the thermostatic control may be omitted, leaving the main switch operable upon rotation of the gas cock, or separately operated if desired. The other terminal of the main switch 28 is connected by a wire 31 with the secondary of a transformer 32, the primary of which is connected to the power line.

A bracket 34 is secured to the main burner and forms a support for a pilot flame burner

36 of any suitable type. The pilot flame burner 36 is located within the oven compartment 10 and is supplied through conduit 38 with fuel from the inlet 16 upon initial movement of the dial 20 toward open position. The bracket 34 also carries a thermocouple 40 of the tubular type and, in this instance, having a pair of wires 42 and 44 leading therefrom. The structure of the thermocouple is not important in connection with the invention, it being essential, however, that the hot junction thereof be exposed in the path of the flame from the pilot burner 36 as indicated diagrammatically in the drawing. In the drawing the thermocouple 40 is shown as exposed in the path of the flame from the main burner 12 also, but it will be understood that such arrangement is subject to variation to suit different conditions under which the device is used. As pointed out hereinafter, it may be desirable to locate the thermocouple out of range of the main burner flame and subject only to the pilot flame. Such arrangement would require only slight changes in the position of the parts shown and is included in the scope of this invention.

The wires 42 and 44 are connected to the terminals of an electromagnet 46 forming part of a relay designated generally by the numeral 48. The electromagnet 46 is provided with an armature bar 50 which is pivoted, as at 52, and is normally held in disengaged position by means of the spring 54. The end of the armature bar 50 opposite the pivot 52 is provided with a contact 56 adapted to engage in its attracted position with a fixed contact 58 with which a wire 60 from the solenoid gas valve 24 is associated. The movable contact 56 is connected to a wire 62 leading to the secondary of the transformer 32 through the medium of a flexible wire 64 permitting free movement thereof toward and away from attracted position with respect to the electromagnet 46. It will be apparent that other known means of connecting the relay into the circuit may be utilized and that the structure of the relay itself may be modified without departing from the scope of this invention.

In order that any flow of gas to the pilot flame burner will be followed by its immediate ignition at that point without attention on the part of the operator, there is provided automatic means for igniting the pilot burner 36. This ignition means may take the form of an ignition coil 66 positioned within the oven compartment and adjacent the pilot flame burner 36. The ignition coil is energized through a circuit comprising a wire 68 connected to one terminal of the switch 28 and a wire 70 connected to the secondary of the transformer 32. A resistor 72 may be included in the circuit of the ignition coil to limit the current flow thereto and permitting the use of a relatively short coil. While the resistor 72 is shown as being a wire or ribbon type it will be apparent that a lamp, or a combination lamp and coil, may be substituted.

In the operation of the apparatus described, the closing of the main switch 28 by operation of the dial 20 establishes a circuit through the ignition coil 66 which, in a very short period, reaches igniting temperature. Operation of the dial 20 to close the switch 28 also opens the main gas cock controlling the inlet 16 and permits gas to flow through the conduit 38 to the pilot flame burner 36. As the solenoid gas valve is normally closed, no gas can flow at this time to the main burner. The gas flowing from the pilot flame burner 36 is quickly ignited by the ignition coil

66 and the flame heats the hot junction of the thermocouple to produce a current flow in the wires 42 and 44 that lead to the electromagnet 46. The normally open switch of the relay 48 is thereupon closed due to energization of the electromagnet 46 and movement of the armature bar 50 to attracted position, thereby closing the contacts 56 and 58. The circuit of the solenoid gas valve 24 being thus closed will cause this valve to be actuated to open position. The fuel from the inlet 16 will then flow without interception to the main burner where it is ignited by the flame from the pilot flame burner 36.

It will be apparent that when the dial 20 is operated to permit gas to flow to the pilot flame burner 36 and this burner does not produce a flame, then no fuel can flow to the main burner. Such interruption of normal operation would occur by reason of failure of the ignition coil to ignite the fuel at the pilot flame burner and only pilot gas would escape.

In the arrangement shown in the drawing the thermocouple is subjected to flames from both the pilot burner 36 and main burner 12. This arrangement is desirable on domestic cooking ranges in order that clogging and extinguishment of the pilot burner will not discontinue operation of the main burner flame. The thermocouple 40 remains heated by the main burner regardless of the condition of the pilot burner and thus the solenoid valve 24 remains open. If such condition is not desired the thermocouple can be located out of the path of the main burner flame and subject only to the flame from the pilot burner 36. Hence, when the pilot flame is extinguished for any cause the thermocouple would cool off and deenergize the circuit of the solenoid gas valve 24 to shut off the supply of fuel to the main burner 12.

When the dial 20 is moved to closed position after a period of operation of the range the fuel flow to both the pilot and the main burners is discontinued. However, the thermocouple in such case would still be hot and would serve to hold the solenoid gas valve in open position. If, then, the dial is turned once again to open position the gas will flow to both the main and pilot burners simultaneously, as the solenoid gas valve is still retained in the open position due to the heat remaining in the thermocouple from the previous operation causing energization of the circuit. However, due to the provision for automatic ignition in this invention upon closing of the main switch, the gas flowing from the pilot flame burner is immediately ignited and in turn ignites the gas flowing from the main burner. It will be apparent that without provision for automatic ignition a considerable amount of gas might escape under these circumstances from the main burner before the thermocouple cooled off sufficiently to deenergize the solenoid gas valve and shut off the flow of gas to the main burner.

The interposition of the pilot burner between the ignition coil and the main burner permits igniting a relatively small pilot flame before the main burner can be ignited. Such arrangement prevents an initial rush of cold gas and air mixture out of the main burner upon and around the ignition coil. Such mixture might not be ignitable and would cool the coil to an extent sufficient to prevent it from functioning when the gas commenced to flow more steadily. In any case where the electric circuit is disconnected or the gas supply shut off, the safety features of

this invention will prevent the escape of large quantities of unburned fuel such as might otherwise occur.

I claim:

1. A safety control apparatus for gaseous fuel burners comprising in combination, main and pilot burners, means for controlling the supply of fuel thereto, a normally closed solenoid valve preventing the supply of fuel from passing to the main burner from said controlling means, a main control switch in circuit with said solenoid valve and operable by said controlling means to open and closed positions, electric ignition means for said pilot burner energized by operation of said controlling means to said closed switch position, a thermocouple in circuit with said solenoid valve and operable by the pilot burner when ignited by said ignition means, and a normally open switch in circuit with said solenoid valve and adapted to be closed by operation of said thermocouple to complete the circuit of said solenoid valve and cause actuation of said solenoid valve to open position.

2. A safety control apparatus for gaseous fuel burners comprising in combination, main and pilot burners, means for controlling the supply of fuel thereto, a normally closed solenoid valve preventing the supply of fuel from passing to the main burner from said controlling means, a main control switch in circuit with said solenoid valve and operable by said controlling means to open and closed positions, electric ignition means for said pilot burner energized by operation of said controlling means to said closed switch position, a thermocouple in circuit with said solenoid valve and operable by the pilot burner when ignited by said ignition means, and a relay in circuit with said solenoid valve and energizable by said thermocouple to complete the circuit of said solenoid valve and cause actuation of said solenoid valve to open position.

3. A safety control apparatus for gaseous fuel burners comprising in combination, main and pilot burners, means for controlling the supply of fuel thereto, a normally closed solenoid valve preventing the supply of fuel from passing to the main burner from said controlling means, a main control switch in circuit with said solenoid valve and operable by said controlling means to open and closed positions, an ignition coil in operative relation with said pilot burner and energized by operation of said controlling means to said closed switch position, a thermocouple disposed in the path of the flame from said pilot burner when ignited by said ignition coil, and a

relay in circuit with said solenoid valve, said relay having an electromagnet energizable by said thermocouple to complete the circuit of said solenoid valve and cause actuation of said solenoid valve to open position.

4. A safety control apparatus for gaseous fuel burners comprising in combination, main and pilot burners, manually operated means for controlling the supply of fuel thereto, a normally closed solenoid valve preventing the supply of fuel from passing to the main burner from said controlling means, a main control switch in circuit with said solenoid valve and operable by said controlling means to open and closed positions, an ignition coil in operative relation with said pilot burner and energized by operation of said controlling means to said closed switch position, a thermocouple disposed in the path of the flame from said pilot burner when ignited by said ignition coil, and a relay in circuit with said solenoid valve and thermocouple having an electromagnet and normally open switch, said thermocouple generating sufficient current to energize the electromagnet and close said switch to complete the circuit of said solenoid valve and cause actuation of the solenoid valve to open position.

5. A safety control apparatus for gas ranges comprising in combination, a main burner in the oven compartment of said range, a pilot burner in said oven compartment and adapted to light said main burner, a main gas valve controlling the supply of fuel to both the main and pilot burners, a solenoid gas valve for controlling the flow of gas to said main burner from said gas valve, a main control switch in circuit with said solenoid valve and operable by said gas valve to open and closed positions, an electric ignition coil energized by operation of said gas valve to said closed switch position but independently of said solenoid valve and disposed in operative relation with said pilot burner, a resistor in circuit with said ignition coil located outside the oven compartment and adapted to limit the current flow to said ignition coil, a thermocouple disposed in the path of the flame from said pilot burner when ignited by said coil, and a relay in circuit with said solenoid valve and thermocouple having an electromagnet and a normally open switch, said thermocouple generating sufficient current when heated by said pilot burner to energize the electromagnet and close said switch to complete the circuit of said solenoid valve and cause actuation of the solenoid valve to open position.

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