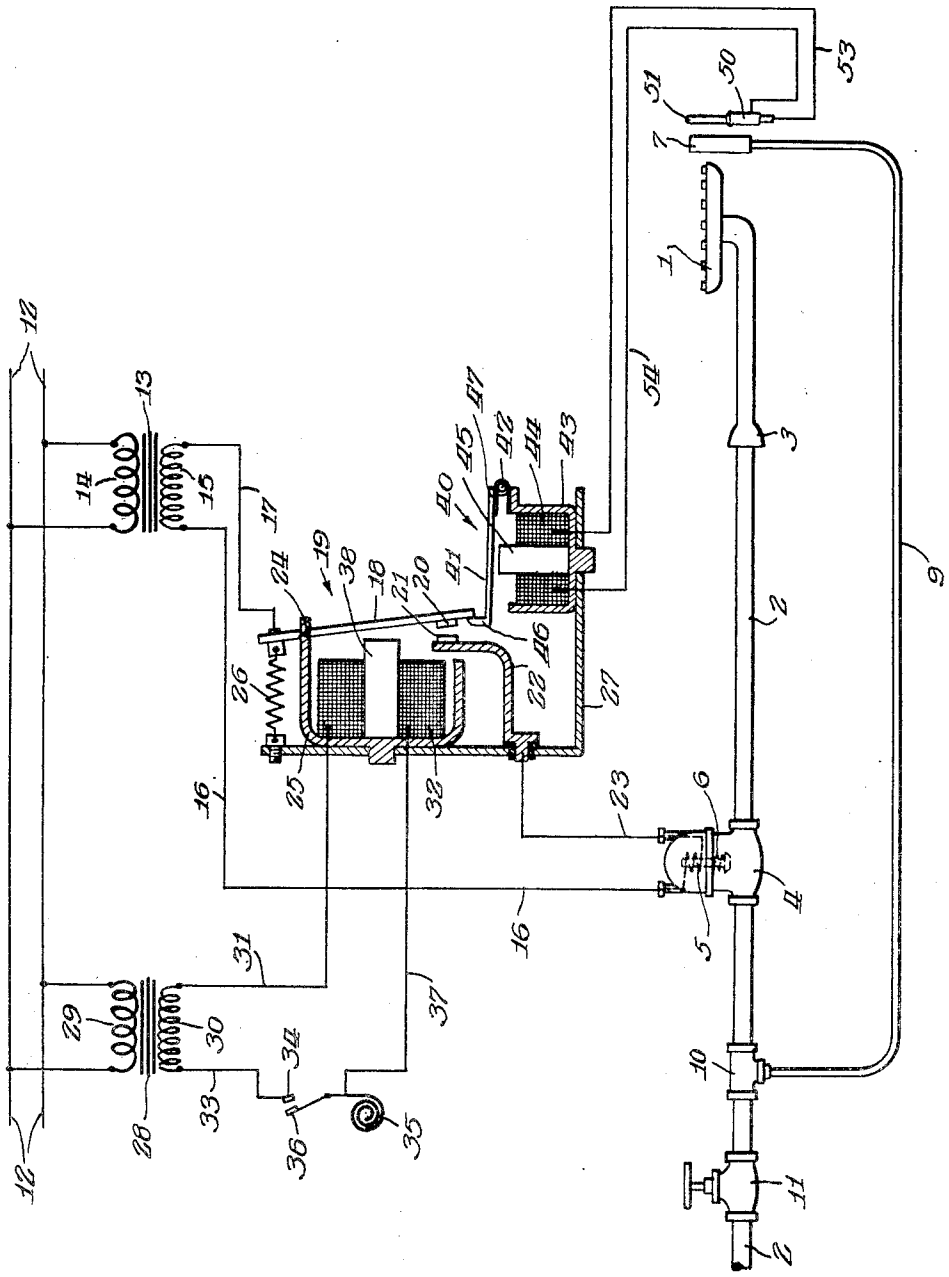
Aug. 1, 1950 J. H. THORNBERY 2,517,363

AUTOMATIC SAFETY CUTOFF FOR GAS BURNERS

Filed Aug. 23, 1947



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Patented Aug. 1, 1950

2,517,363

UNITED STATES PATENT OFFICE

2,517,363

AUTOMATIC SAFETY CUTOFF FOR GAS BURNERS

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Application August 23, 1947, Serial No. 770,295

8 Claims. (Cl. 158—117.1)

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This invention relates, in general, to a burner control system, and has particular relation to a new and improved safety shutoff employing interlocking relay means controlled by a thermoelectric generator—such as a thermocouple or thermopile—and powered by an outside or external source of electric power, such as a source of household current supply or the like.

While the particular system which I shall describe hereinafter in connection with the drawing is, in general, of the type having an electroresponsive valve in the fuel supply conduit for controlling the supply of fuel to the main burner and a thermocouple safety shutoff, it is to be understood that the invention is not limited in all respects to use in this particular type of system, but may be employed elsewhere as suitable or desired.

In prior systems of the type using an outside or external source of power for the electroresponsive valve in the fuel supply conduit, the thermocouple safety shutoff has usually included a switch connected into the circuit for the electroresponsive valve (except for manual reset means where required) under the sole control of a thermoelectric generator, such as a thermocouple or thermopile. Then where a thermostat or other temperature responsive means is desired it has usually been connected directly into the circuit for the electroresponsive valve.

One of the main objects of the present invention is to provide in a system of the character described, a relay arranged to open and close the circuit for the electroresponsive valve and connected into a circuit other than the circuit for the valve so that such other circuit may supply, for example, from an outside or external source of electric power, only the electric power required to operate such relay.

Another object of the invention is to provide an improved system of interlocking relays in which one relay is of the general character above decribed and the other relay is adapted to interlock with the first mentioned relay to hold, for example, an armature of the first relay in open circuit position and/or actuate such armature to open circuit position in the event the pilot or other flame is extinguished.

Another object of the invention is to provide a system of the character described in which where a thermostat or other temperature responsive means is desired, such means may be connected into the circuit for the first mentioned relay instead of being connected directly into the circuit for the electroresponsive valve.

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Another object of the invention is to provide a burner control system of the character described having various features of novelty and advantages, and which is particularly characterized by its simplicity in construction, its economy in manufacture, and its effectiveness in use.

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 diagram showing schematically the parts and circuit connections of one form of system embodying the present invention.

Referring now to the drawing, the burner shown at 1 is the main burner. It may be the main burner for a room or space heater, or it may be the burner for a water heater or for a floor furnace, an oven burner, one or more top burners for a gas range, or any other burner, and of any suitable construction.

A fuel supply pipe or conduit 2 leads to the burner 1 for the delivery of gaseous or other fuel thereto, for example, through a mixing chamber 3 to which air is admitted through adjustable inlets (not shown) as well understood in the art. The flow of gas through the conduit 2 is controlled by a valve 4 of any suitable electroresponsive or electrically operated type. For purposes of illustration, the valve 4 may be of the type which is operated to open position by the flow of current through its coil 5, and to closed position by a spring 6. This particular form of valve 4 is merely illustrative, and it is to be understood that any other suitable form of electroresponsive or electrically operated valve may be employed.

The pilot burner 7, which is located in juxtaposition to the burner 1 to maintain a pilot flame 8 for igniting the burner 1, is supplied with gaseous fuel by a pilot supply pipe 9. The pilot supply pipe 9 may be connected, for example, at 10 to the pipe 2 anterior of the valve 4, or the pilot burner 7 may be supplied with gaseous fuel otherwise as desired. A main manually operated shutoff valve 11 is shown positioned in the pipe 2 anterior of the valve 4 and anterior of the pilot supply connection at 10.

Electric power for operating the valve 4 is supplied from a suitable source, for example from the line wires 12 of a source of alternating current, such as a household current supply line of the type which averages about 115 volts. Power for the operation of the valve 4 may be supplied by a step-down transformer 13. This transformer 13 comprises a high voltage primary 14 connected to the line wires 12, and a low voltage sec-

ondary 15, one side of which is connected by a conductor 16 to one side of the coil 5. The other side of the secondary 15 is connected by a conductor 17 to one end of armature 18 of a first relay 19. The other end of armature 18 has a contact 20 movable into and out of contact with a contact 21 on a conducting member 22 which is connected by a conductor 23 to the other side of the coil 5.

The armature 18 is pivoted, for example, at 24 on the shell 25 of relay 19. A coiled spring 26, connected between the armature 18 and the adjacent end of one leg of angular bracket 27, actuates the armature 18 to retracted position and holds it in such position when relay 19 is deenergized.

Power for the relay 19 is supplied from a small, low wattage and low voltage; for example, 24 volt transformer 28. This transformer comprises a high voltage primary 29 connected to the line wires 12, and a low voltage secondary 30 one side of which is connected by a conductor 31 to one side of coil 32 of relay 19. The other side of secondary 30 is connected by a conductor 33 to a fixed contact 34 of a thermostat or other temperature responsive device 35. The other contact 36 is carried by the thermostatic element which is connected by a conductor 37 to the other side of coil 32. Relay 19 is provided with a core 38.

The interlocking relay 40 has a locking armature 41 pivoted, for example, at 42 on the shell or case 43 of relay 40; also a coil 44 and a core 45. The locking armature 41 has an angular end 46 for interlocking engagement with the adjacent end of the armature 18. A spring 47 actuates the armature 41 to retracted position, and holds it in such position when relay 40 is deenergized.

The relays 19 and 40 may be mounted in interlocking relation, for example, with one relay supported on one arm of bracket 27 and the other relay supported on the other arm of this bracket. The system permits the use of a small, low wattage, low voltage—for example, about 24 volt—transformer 28 which need supply only the power required for operation of relay 19. This small transformer 28 may be built into the interlocking relay combination so that the entire combination of interlocking relays and transformer 28 may be furnished as a unit.

Power for the relay 40 is supplied by a thermoelectric generator 50, such as a thermocouple or thermopile. In the illustrated embodiment of the invention the thermoelectric generator 50 is shown in the form of a thermocouple of the general character disclosed and claimed in Oscar J. Leins Patent No. 2,126,564, granted August 9, 1938, although it may be of any other suitable character, or in the form of a thermopile or other thermoelectric generator. The thermoelectric generator has one or more hot junctions, for example, the hot junction 51 which is placed in position to be heated by the flame 52 of the pilot burner 7. One of the thermoelectric elements of the thermoelectric generator 50 is connected by a conductor 53 to one side of the coil 44, and the other thermoelectric element is connected by a conductor 54 to the other side of the coil 44.

In operation, opening of the gas valve 11 admits gas to solenoid valve 4 and pilot 7. Ignition of pilot 7 heats thermoelectric generator 51 which energizes relay coil 44 and disengages locking armature 41 from armature 18. Line voltage applied to primary 29 energizes secondary 30 which applies voltage to the circuit consisting of the following elements: one side of secondary 30 to conductor 33, thermostat contacts 34, 36, conductor 37, relay coil 32, conductor 31, and back to the other side of secondary 30. When the thermostat contacts 36, 34 are closed, relay 19 becomes energized, closing contacts 20, 21, which energizes solenoid valve 4 by the following circuit: one side of secondary 15 to conductor 17, through armature 18, to contacts 20, 21, to conductor 23, solenoid valve 4, conductor 16, and back to the other side of secondary 15. Energization of solenoid valve 4 opens this valve for the admission of gas to the main burner 1. Thermostat contacts 34, 36 therefore control the supply of fuel to main burner 1 by means of solenoid valve 4 and relay 19.

In case pilot 7 becomes extinguished, the thermocouple or other thermoelectric generator 50 cools, which decreases the flow of thermoelectric current to relay coil 44 to the point where spring 47 moves armature 41 to retracted position and engages armature 18, thereby preventing the armature 18 from moving to attracted position which prevents the flow of fuel to the main burner 1 even though thermostat contacts 34, 35 may call for heat.

In the event that pilot 7 should become extinguished while main burner 1 is on, relay coil 44 becomes deenergized, and locking armature 41 is moved to retracted position by spring 47. In such movement and with the armature 18 in attracted position the armature 41 engages the armature 18 and forces it to retracted position, thus separating contact 20 from contact 21. This opens the circuit for the electroresponsive valve 4 which operates to closed position to shut off the supply of gas to the main burner 1 and prevents the electroresponsive valve 4 from opening until the pilot 7 is reignited.

The movement of the locking armature 41 to attracted position may be accomplished automatically by the flow of thermoelectric current through the coil 44, or manual reset means may be provided for manually resetting the armature 41 to attracted position, in which case a much smaller electromagnet will be sufficient in strength to hold the locking armature 41 in its attracted or disengaged position.

The embodiment of the invention shown in the drawing is for illustrative purposes only, and it is to be expressly understood that said drawing and the accompanying specification are not to be construed as a definition of the limits or scope of the invention, reference being had to the appended claims for that purpose.

I claim:

1. In a burner control system of the class described wherein there is a main burner having a fuel supply pipe leading thereto, a pilot burner in juxtaposition to said main burner, fuel supply means for said pilot burner, and a valve in the fuel supply pipe for shutting off the flow of fuel to said main burner, the combination with said valve of valve operating means for operating said valve to open position, means interlocking with said valve operating means for preventing valve opening operation thereof when said pilot burner is extinguished, and means positioned to be subject to the heat of said pilot burner and connected to said interlocking means and operable to release said interlocking means from said valve opening means to permit said valve opening means to operate said valve to open position when said pilot burner is ignited.

2. A system according to claim 1 wherein the means positioned to be subject to the heat of the

pilot burner comprises a thermoelectric generator, and wherein the means interlocking with said valve opening means comprising a relay having a coil connected in circuit with said thermoelectric generator.

3. A system according to claim 1 wherein the fuel supply means for the pilot burner is connected to the fuel supply pipe for the main burner anterior to the valve in said fuel supply pipe.

4. In a burner control system of the class described wherein there is a main burner having a fuel supply pipe leading thereto, a pilot burner in juxtaposition to said main burner, and an electroresponsive valve in the fuel supply pipe for shutting off the flow of fuel to said main burner, the combination with said system of a first circuit for supplying electric power to said valve to operate said valve to open position, a first relay having an armature for opening and closing said first circuit, said first relay having a coil connected into a second circuit and operable to move said armature to position closing said first circuit, a second relay having an armature operable to retracted position interlocking with the armature of said first relay to prevent movement of the armature of said first relay to position closing said first circuit when said pilot burner is extinguished, said second relay having a coil, and a thermoelectric generator positioned to be subject to the heat of the pilot burner and connected in circuit with the coil of said second relay whereby to energize said coil and operate the armature of said second relay to attracted position released from the armature of said first relay when said pilot burner is ignited.

5. A system according to claim 4 wherein the armature of said first relay forms a conducting part of said first circuit and has a contact movable into and out of engagement with another contact in said first circuit to close and open said circuit.

6. A system according to claim 4 wherein there is a source of electric power, and a first step-down transformer having a low voltage secondary connected into said first circuit for supplying power for operating the valve to open position, and wherein there is a small, low wattage and low voltage transformer connected to the source of electric power and in circuit with the coil of said first relay for supplying to said coil less electric power than is supplied to said first circuit.

7. In a device of the class described, in combination, an angular bracket having first and second legs disposed at an angle to one another, a first relay having a generally cup-shaped shell mounted on the first leg of said bracket, said shell having a base with a core projecting at substantially right angles thereto and within said shell, a coil surrounding said core and disposed within said shell, a relatively stationary contact, a first armature pivoted on the shell of said first relay and having a contact movable into and out of engagement with said relatively stationary contact, a second relay having a generally cup-shaped shell mounted on the second leg of said bracket, the shell of said second relay having a base with a core projecting at substantially right angles thereto and within said shell, a coil surrounding the core of said second relay and disposed within the shell thereof, and a second armature pivoted on the shell of said second relay and having an angular projection thereon for interlocking engagement with the armature of said first relay to hold the same against movement to attracted position when said second armature is in retracted position, said angular projection being released from said first armature to permit movement thereof to attracted position when the armature of said second relay is in attracted position.

8. A device according to claim 7 wherein both said first and second armatures are provided with spring means for operating the armatures to retracted positions when the coils of said relays are deenergized.

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