

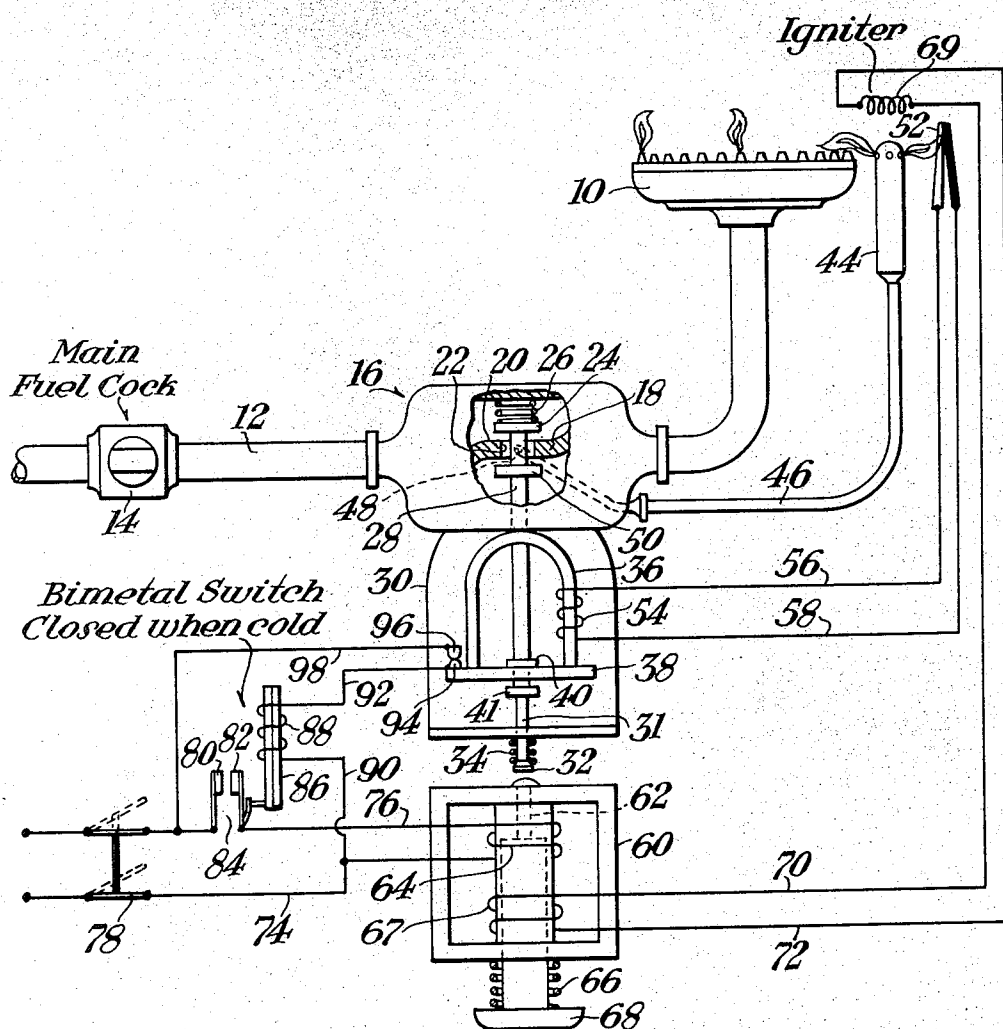
Dec. 25, 1945.

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2,391,753

SAFETY CONTROL AND IGNITION SYSTEM

Filed May 4, 1945



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2,391,753

SAFETY CONTROL AND IGNITION SYSTEM

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Application May 4, 1945, Serial No. 591,959

7 Claims. (Cl. 158—117.1)

This invention relates to safety control and ignition systems for gaseous fuel burners and, more particularly, to electrical systems therefor.

In apparatus of this general character the flow of fuel to the main burner may be controlled by an electromagnetic control device which is energized by the current generated by a thermocouple or thermopile responsive to the heat of a flame at the pilot burner. Means are employed for placing the armature of the electromagnet in attracted position and the fuel control device in a flow permitting position, such operation being generally termed "resetting." The means employed for resetting may be electrically operated from a source of current separate from that generated by the thermocouple. It is apparent that once the resetting operation is completed, the current from this separate source is no longer required and the electromagnetic control device may be left under the sole control of the thermoelectric current which is generated as long as the pilot burner produces a flame.

An object of this invention is to reset an electromagnetic device by electrically operated means which are rendered inoperative upon completion of the resetting operation.

Another object of the invention is to eliminate unnecessary noise in a recycling control system having the electrically operated resetting means.

Another object of the invention is to reduce the electrical energy from external sources required during the running period to a negligible value.

Another object of the invention is to incorporate a purge period in the recycling operation during which all fuel and electrical energy are shut-off.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawing, wherein a schematic view of a safety control and ignition system embodying the invention is shown.

Referring more particularly to the drawing, a main burner 10 is supplied with fuel by a main fuel pipe 12 in which the flow of fuel is under the separate control of a main control device, shown as a valve or cock 14, and of a safety valve 16 forming an electromagnetic control means. The safety valve 16 is provided with a partition 18 having a valve seat 20 with an opening 22 therethrough controlled by a reciprocable valve member 24. A coil spring 26 is operable between the valve member 24 and a wall of the safety valve 16 for biasing the valve member 24 toward the valve seat 20. The valve member 24 is provided on the side opposite the coil spring 26 with

a valve stem 28 which extends through the opening 22 to the exterior of the safety valve 16.

The electromagnetic operator for the safety valve 16 comprises a support 30 through which a reset stem 31 extends in axial alignment with the projecting end of the valve stem 28 to which it is connected. The reset stem 31 terminates in a button 32 supporting a second coil spring 34 which extends to the adjacent support 30 and cooperates with the coil spring 26 in its biasing action.

The support 30 carries a horseshoe magnet 36 having a movable armature 38 engageable with the pole faces thereof and supported on the valve stem 28 for alternative engagement with a pair of spaced collars 40 and 41 formed thereon. When pressure is applied to the button 32 to move the valve stem 28 and the valve member 24 against the bias of the springs 26 and 34 the armature 38 will be engaged by the collar 41 and reset against the pole faces of the magnet 36.

The safety valve 16 also controls the flow of fuel to a pilot burner 44 located in proximity to the main burner 10. The pilot burner 44 is connected to the safety valve 16 by a conduit 46 which communicates with an aperture 48 in the partition 18 to receive fuel from the valve seat opening 22 when the valve member 24 is disengaged from its seat. In order that flow of fuel to the main burner 10 may be prevented during the resetting operation while such flow is permitted to the pilot burner 44, the valve stem 28 carries a closure member 50 for the underside of the valve seat opening 22. Thus, when the collar 41 is engaged with the armature 38 during the resetting operation the closure member 50 is simultaneously engaged with the underside of the valve seat opening 22 for the described purpose. It will be apparent that the closure member 50 could be dispensed with and the resetting operation could be conducted while fuel flows simultaneously in both the main fuel pipe 12 and the pilot conduit 46.

A thermocouple 52 is located in proximity to the flame of the pilot burner 44 to be heated thereby. The magnet 36 is adapted to be energized by the current generated by the thermocouple 52 sufficiently to hold the armature 38 against the pole faces of the magnet 36 upon completion of the resetting operation. Hence, a suitable coil or winding 54 is provided for the magnet 36 and connected in circuit with the thermocouple 52 by wires 56 and 58.

The reset stem 31 is adapted to be moved inwardly against the bias of the springs 34 and 26

by electrically operable means now to be described. This means comprises a transformer 60 combined with an electromagnetically operated plunger 62 which is positioned in axial alignment with the reset stem 31. The plunger 62 is adapted to be moved into operative engagement with the button 32 when the primary coil 64 of the transformer 60 is energized. The plunger 62 is biased away from the button 32 by a coil spring 66 extending between the transformer 60 and a head 68 formed on the end of the plunger 62 opposite that which engages with the reset stem 31. Associated with the primary coil 64 is a secondary coil 67 connected in circuit with an electric igniter 69 for the pilot burner 44 by means of the wires 70 and 72. It will be apparent that the safety valve 16 and its associated operating magnet 36 together with the transformer 60 could be combined in a unitary construction and the elements have been shown schematically in the drawing for illustrative purposes without intending any limitation to the exact form shown.

The primary coil 64 of the transformer 60 is connected to a source of electrical energy by wires 74 and 76 under control of a main switch 78. The main switch 78 may be manually operated, either separately from the operation of the main fuel cock 14 or combined therewith. Moreover, it will be apparent that the switch 78 could be thermostatically operated independently of the main fuel cock 14 or a combined main valve, thermostatic valve and electric switch such as disclosed in Weber Patent No. 2,276,751, March 17, 1942, could be employed.

Additional switching means for controlling the transformer 60 are provided in the form of contacts 80, 82 adapted to open and close the circuit thereof by operation of a switch 84 with which these contacts are associated. Preferably, the switch 84 is of the snap-action type as indicated in the drawing and is arranged for operation by a thermally responsive means, such as the bimetal operator 86 positioned adjacent thereto. An electric heater 88 in the form of a coil is associated with the bimetal 86 for operating the switch 84 to open the contacts 80—82 when the bimetal 86 is heated. When the bimetal 86 is cold the contacts 80—82 are closed in the circuit of the wires 76 and 74.

The heater 88 of the bimetal switch 84 is connected in shunt with the contacts 80—82 by a wire 90 connected at one end to the wire 74 and the other to one end of the coil 88; a wire 92 connected at one end to the opposite end of the coil 88 and at the other end to a contact 94 which is carried by the armature 38 and is movable therewith into engagement with a stationary contact 96 carried on the support 30; and a wire 98 connected at one end to the contact 96 and at the opposite end to the wire 76 to complete the shunt circuit.

In the operation of the device, assuming cold-start conditions, the main fuel cock 14 is opened to admit fuel to the safety valve 16 and the main switch 78 is closed to energize the transformer circuit. Since the bimetal switch 84 is closed under the cold-start condition, the primary winding 64 of the transformer 60 is connected directly to the power supply and is energized. This causes the plunger 62 to be picked up and the igniter 69 to be energized by the secondary 67.

In its pick-up position the plunger 62 engages the button 32 of the reset stem 31 and forces the armature 38 against the pole faces of the magnet 36. In this armature position the con-

tacts 84—86 are closed. Moreover, the valve member 24 is disengaged from the valve seat 26 and the closure member 50 interrupts the flow of fuel through the valve seat opening 22 to the main burner 10. The passage of fuel to the pilot burner 44 is permitted through the conduit 46 due to the aperture 48 provided in the valve seat opening 22. The fuel flowing from the pilot burner 44 is ignited by the igniter 69 and the thermocouple 52 becomes heated by the resulting flame.

The heating of the thermocouple 52 is accompanied by a simultaneous heating of the heater 88 due to the closing of the contacts 84—86 by operation of the armature 38. It is apparent that in normal operation the bimetal switch 84 is adjusted so that the time for the bimetal operator 86 to become heated sufficiently to open the switch 84 is longer than the time required for the thermocouple 52 to become heated sufficiently to generate current and cause the armature 38 to be retained against the pole faces of the magnet 36. When the bimetal switch 84 is opened by the operation of the heated bimetal 86 the circuit controlled thereby is discontinued and the transformer 60 becomes deenergized. Thus, the force of the plunger 62 against the reset stem 31 is removed and the coil springs 26 and 34 would serve to disengage the armature 38 from the pole faces of the magnet 36 unless the thermocouple 52 is generating sufficient current in the coil 54 to cause retention of the armature in attracted position.

With the armature 38 held against the pole faces of the magnet 36 by the energy supplied by the thermocouple 52 and the plunger 62 no longer exerting force on the reset stem 31, then the only movement which occurs in response to the bias of the coil springs 26 and 34 is lost motion permitted by the spacing of the collars 40 and 41. Such movement causes the collar 40 to become engaged with the armature 38 and the collar 41 to be spaced therefrom with the result that the closure member 50 becomes disengaged from the partition 18. Fuel is now permitted to flow through the valve seat opening 22 to the main burner 10 to be ignited by the flame from the pilot burner 44. The control is then in steady state running condition.

During the steady state operation the only external power required by the system is that supplied to the heater coil 88 through the shunt circuit established by closed contacts 94—96. The energization of this heater coil 88 is required at this time to maintain the switch 84 in its open position and to cooperate in the recycling procedure in case of flame failure. In the event that flame failure occurs, the thermocouple 52 would cool off and the main burner fuel would escape until the energy generated by the thermocouple 52 became reduced sufficiently to allow the armature 38 to be released. Engagement of the armature 38 with the collar 41 would then occur and the bias of the coil springs 26 and 34 would cause closure of the valve member 24. A complete shut-off of all fuel to the main burner 10 and the pilot burner 44 occurs when the valve member 24 is closed. As the contacts 94—96 are opened by movement of the armature 38 to released position, the heater 88 becomes deenergized and a purge period ensues during which all fuel and external power is shut off. This purge period is equal to the time required for the bimetal 86 to cool off sufficiently to cause closure of the contacts 80—82 of the switch 84.

The recycling operation occurs immediately following the purge period due to this closing of the contacts 20—32 of the switch 84 and the consequent energizing of the primary 64 of the transformer 60. The sequence of operations is then the same as that described in the case of a cold start and further description is deemed unnecessary. The operation of the bimetal switch 84 under cold-start and recycling conditions is silent and a comparatively noiseless control has been provided. The main burner fuel is ignited within a few seconds of turning on the system which is advantageous in oven and broiler installations. In steady state operation there is no possibility of disturbances due to line voltage variation or large starting currents of other equipment connected to the same supply line as a separate thermo-electric current supply is relied upon.

While a relatively simple safety control and ignition system for gaseous fuel burners has been described and shown, it will be apparent that many changes can be made in the arrangement and combination of parts and in the details of construction herein disclosed within the scope of the appended claims without departing from the spirit of the invention.

I claim:

1. A safety control system for fuel burners having main and pilot burners and a source of electrical energy, comprising in combination, electromagnetic control means biased to a fuel flow preventing position, electromagnetic reset means for overcoming said bias and resetting said control means in a fuel flow permitting position, an energizing circuit including the source and said reset means, means responsive to the presence of a flame at the pilot burner for energizing said control means sufficiently to hold the same in said fuel flow permitting position thereof, switching means having contacts for opening and closing said circuit, thermally responsive means adapted when heated for operating said switching means to open said contacts, an electric heater for said thermally responsive means, and means for establishing another energizing circuit including the source and said heater upon completion of said resetting operation.

2. A safety control system for fuel burners having main and pilot burners and a source of electrical energy, comprising in combination, electromagnetic control means biased to a fuel flow preventing position, electromagnetic reset means for overcoming said bias and resetting said control means in a fuel flow permitting position, an energizing circuit including the source and said reset means, means responsive to the presence of a flame at the pilot burner for energizing said control means sufficiently to hold the same in said fuel flow permitting position thereof, switching means having contacts for opening and closing said circuit, thermally responsive means adapted when heated for operating said switching means to open said contacts, an electric heater for said thermally responsive means, and means responsive to resetting operation of said reset means for establishing another energizing circuit including the source and said heater and in shunt with said contacts, said other circuit maintaining said heater in energized condition while said control means is held in said flow permitting position.

3. A safety control system for fuel burners having main and pilot burners and a source of electrical energy, comprising in combination, electromagnetic control means biased to a fuel flow preventing position, electromagnetic reset means for

overcoming said bias and resetting said control means in a fuel flow permitting position, an energizing circuit including the source and said reset means, a thermocouple located to be heated by a flame at the pilot burner for energizing said control means sufficiently to hold the same in said fuel flow permitting position thereof, switching means having contacts for opening and closing said circuit, thermally responsive means adapted when heated for operating said switching means to open said contacts, an electric heater for said thermally responsive means adapted to cause said operation thereof subsequent to energization of said control means by said thermocouple, a second energizing circuit including the source and said heater and in shunt with said contacts, and a second switching means having contacts for opening and closing said second circuit, said second switching means being responsive to resetting operation of said reset means for closing the last said contacts.

4. A safety control and ignition system for fuel burners having main and pilot burners and a source of electrical energy, comprising in combination, an electric igniter for the pilot burner, electromagnetic control means biased to a fuel flow preventing position, electromagnetic reset means for overcoming said bias and resetting said control means in a fuel flow permitting position, an energizing circuit including the source, said igniter and said reset means, means responsive to the presence of a flame at the pilot burner for energizing said control means sufficiently to hold the same in said fuel flow permitting position thereof, switching means having contacts for opening and closing said circuit, thermally responsive means adapted when heated for operating said switching means to open said contacts, an electric heater for said thermally responsive means, and means for establishing another energizing circuit including the source and said heater upon completion of said resetting operation.

5. A safety control system for fuel burners having main and pilot burners and a source of electrical energy, comprising in combination, electromagnetic control means biased to a fuel flow preventing position, reset means including a transformer having a plunger for overcoming said bias and resetting said control means in a fuel flow permitting position, an energizing circuit including the source and said reset means, means responsive to the presence of a flame at the pilot burner for energizing said control means sufficiently to hold the same in said fuel flow permitting position thereof, switching means having contacts for opening and closing said circuit, thermally responsive means adapted when heated for operating said switching means to open said contacts, an electric heater for said thermally responsive means, and means for establishing another energizing circuit including the source and said heater upon completion of said resetting operation.

6. A safety control and ignition system for fuel burners having main and pilot burners and a source of electrical energy, comprising in combination, electromagnetic control means biased to a fuel flow preventing position, reset means including a transformer having a coil and a plunger for overcoming said bias and resetting said control means in a fuel flow permitting position, an energizing circuit including the source, said coil and said reset means, an electric igniter for the pilot burner connected to said coil, means respon-

sive to the presence of a flame at the pilot burner for energizing said control means sufficiently to hold the same in said fuel flow permitting position thereof, switching means having contacts for opening and closing said circuit, thermally responsive means adapted when heated for operating said switching means to open said contacts, an electric heater for said thermally responsive means, and means for establishing another energizing circuit including the source and said heater upon completion of said resetting operation.

7. A safety control and ignition system for fuel burners having main and pilot burners and a source of electrical energy, comprising in combination, electromagnetic control means having an armature and biased to a fuel flow preventing position, reset means including a transformer having a coil and a plunger operatively engageable with said armature for overcoming said bias and resetting said control means in a fuel flow permitting position, an energizing circuit including the source, said coil and said reset means, an elec-

tric igniter for the pilot burner connected to said coil, a thermocouple located to be heated by a flame at the pilot burner for energizing said control means sufficiently to hold the same in said fuel flow permitting position thereof, switching means having contacts for opening and closing said circuit, thermally responsive means adapted when heated for operating said switching means to open said contacts, an electric heater for said thermally responsive means and adapted to cause said operation thereof subsequent to energization of said control means by said thermocouple, a second energizing circuit including the source and said heater and in shunt with said contacts, and a second switching means having contacts operable by said armature for opening and closing said second circuit, said second switching means being responsive to resetting operation of said reset means for closing the last said contacts.

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