

July 31, 1945.

S. G. ESKIN

2,380,640

SAFETY CONTROL APPARATUS FOR GASEOUS FUEL BURNERS

Filed Nov. 8, 1941

Fig. 1.

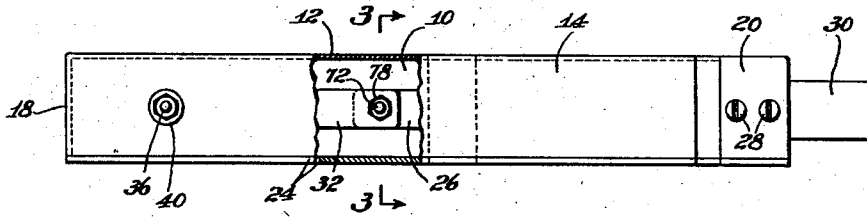


Fig. 2.

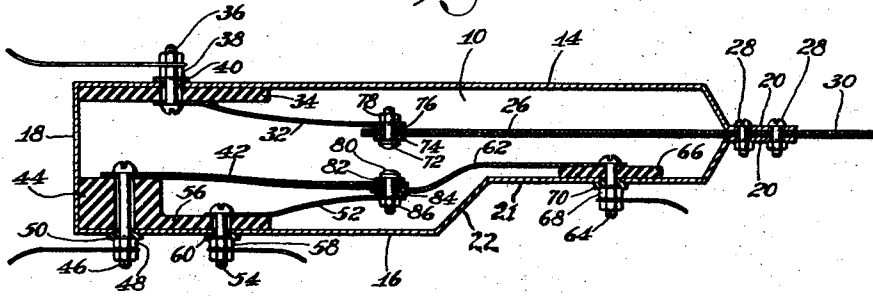


Fig. 3.

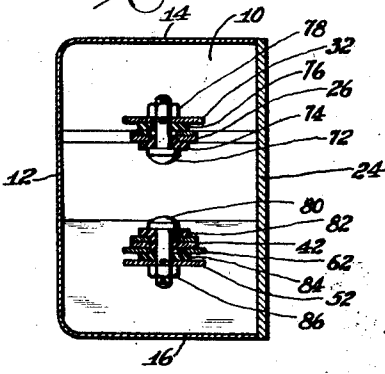
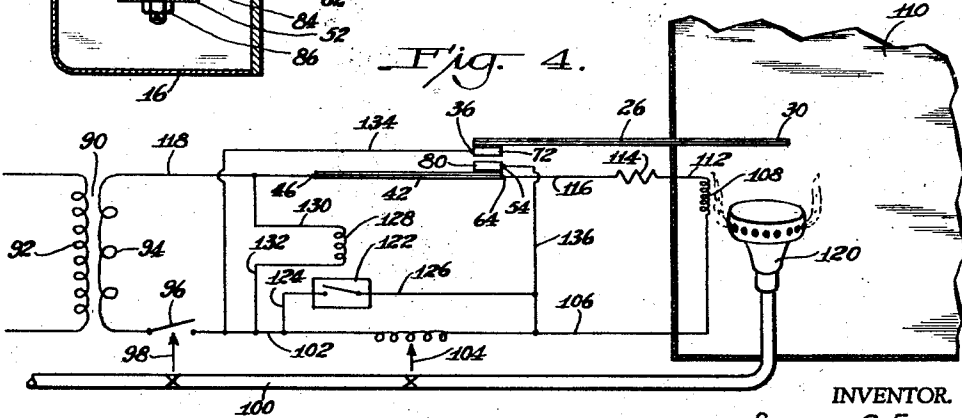


Fig. 4.



INVENTOR.
SAMUEL G. ESKIN.

BY *Albert J. Henderson*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,380,640

SAFETY CONTROL APPARATUS FOR
GASEOUS FUEL BURNERS

Samuel G. Eskin, Pittsburgh, Pa., assignor to
Robertshaw Thermostat Company, Youngwood,
Pa., a corporation of Pennsylvania

Application November 8, 1941, Serial No. 418,340

4 Claims. (Cl. 158—117.1)

This invention relates to safety control apparatus for gaseous fuel burners embodying control relays of the bimetallic type.

Gaseous fuel burners are often arranged to be ignited by electric or other ignition means which is energized or otherwise rendered operable sometime prior to the passage of fuel to the main burner. In the event that ignition does not occur within reasonable time, it is important that the fuel supply be automatically shut off so that hazardous conditions do not arise. One of the objects of this invention is to ensure automatic shut-off of the fuel supply if ignition does not occur.

Another object of the invention is to render the safety means directly responsive to the presence or absence of a flame at the burner.

Another object of the invention is to construct the device of few parts which will be simple in design and dependable in operation.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawing, wherein:

Fig. 1 is a plan view of the control relay of this invention;

Fig. 2 is a longitudinal sectional view of the relay;

Fig. 3 is an enlarged cross-section taken on the line 3—3 of Fig. 1; and

Fig. 4 is a diagrammatic view of the safety control apparatus embodying the control relay.

Referring more particularly to the drawing, the control relay may comprise a housing 10 of sheet metal or other suitable material shaped in the form of a rectangular box having a side portion 12 and top and bottom portions 14 and 16 respectively. The three portions named may be connected by an end portion 18 and provided with a bifurcated projection 20 at the opposite end which projects from the housing proper to form a clamp. If desired, the section 21 of the housing 10 adjacent the clamp 20 may be reduced in width by bending the bottom 16 inwardly intermediate its ends forming a shoulder portion 22. The terms "top," "bottom" and "side" are purely relative and do not necessarily indicate any particular position the box will occupy in use. As will be apparent from the foregoing description, one side of the housing 10 is left open and may be closed after assembly of the interior parts by a plate 24 to provide a dust-proof housing.

A bimetal strip 26 extends within the reduced section 21 of the housing 10 and is secured by

screws 28 carried by the clamp 20. A portion 30 of the bimetal strip 26 projects beyond the clamp 20 and is thereby adapted to be exposed to a flame. Extending from adjacent the end of the bimetallic strip 26 within the housing 10 is a flexible conductor 32 having its opposite end anchored in position on the portion 14 of the housing. The flexible conductor 32 is insulated from the housing 10 by a strip 34 of insulating material interposed between the conductor 32 and the housing 10. A terminal 36 projects through both the conductor 32 and the insulation 34 to the exterior of the housing 10 and serves to secure the parts together by engagement with a nut 38. Preferably, a bushing 40 of insulating material is interposed between the nut 38 and the exterior face of portion 14 of the housing 10 to provide the necessary insulation.

A second bimetallic element 42 is provided in the housing 10 and located opposite the conductor 32. The bimetallic element 42 has one end anchored to the portion 16 of the housing 10 by being secured to an insulating block 44 thereon. A terminal 46 extends through the bimetallic element 42 and insulating block 44 to the exterior of the housing 10, and is secured by means of the nut 48 engaging with an insulating bushing 50 carried by the terminal 46. The bushing 50 serves to insulate the terminal 46 and nut 48 from the housing 10.

A flexible conductor 52 is positioned between the bimetallic element 42 and the portion 16 of the housing 10 and is anchored at one end to the housing by a terminal 54. Preferably, the insulating block 44 is provided with a reduced extension 56 which the conductor 52 partly overlies. The terminal 54 extends through the conductor 52 and insulating extension 56 to the exterior of the housing 10, and is secured by means of the nut 58 engaging with an insulating bushing 60 carried by the terminal 54. As in the previous instances, the bushing serves to insulate the terminal 54 and nut 58 from the housing 10.

The bimetallic element 42 and the flexible conductor 52 terminate at their free ends adjacent the shoulder 22 of the housing 10. Interposed between these free ends is the free end of a flexible conductor 62 which extends beyond the shoulder 22 into the reduced section 21 of the housing and is anchored to the portion 16 thereof by a terminal 64. An insulating strip 66 is interposed between the conductor 62 and the interior face of portion 16 of the housing. The terminal 64 projects exteriorly of the hous-

ing 18 and is secured in position by means of a nut 68 engaging with the usual insulating bushing 70 carried on the terminal 64.

Suitable contact making and breaking means are provided for the bimetallic elements 26 and 42. A contact button 72 has a threaded end projecting through the bimetallic element 26 from which it is insulated by an insulating bushing 74 on one side thereof. The button 72 is in good electrical contact with the free end of conductor 32 which is insulated from the bimetallic element 26 by an insulating washer 76 interposed therebetween. The parts described may be secured together by means of the nut 78 engaging with the threaded end of the contact element or button 72.

A contact button 80 has a threaded end projecting through the free end of the bimetallic element 42 and through the free ends of the flexible conductors 62 and 64. The bimetallic element 42 and the flexible conductor 62 are engaged in good electrical contact at their free ends and are insulated from button 80 by an insulating bushing 82 carried on the contact button 80. The flexible conductor 62 is insulated from both the bimetallic element 42 and the flexible conductor 64 by an insulating washer 84 but is in electrical contact with the contact button 80. The parts described may be secured in position by means of the nut 86 engaging with the threaded end of the contact button 80.

The safety control apparatus for a gaseous fuel burner embodying the control relay described may be arranged as shown in Fig. 4. In this arrangement a transformer 90 has its primary coil 92 connected to a source of current supply and its secondary coil 94 connected at one end to the terminal of a switch 96. In this instance, the switch 96 may be carried by the operating handle of a thermostat 98 having a main valve controlling the flow of gaseous fuel through the conduit 100. The other terminal of the switch 96 of thermostat 98 carries a wire 102 connected to one terminal of an electromagnetic fuel valve 104 controlling the flow of fuel through the conduit 100 after the main fuel valve 98 is opened. The electromagnetic fuel valve 104 may be of any well known form comprising a solenoid serving to maintain the valve closed when deenergized.

The other terminal of the electromagnetic valve 104 is connected to a wire 106 which is connected at one end to a suitable electric ignition device indicated diagrammatically at 108. In this instance the ignition device may be in the form of an electric resistance igniting coil positioned within the oven or other chamber of a domestic range, a portion of which is shown diagrammatically at 110. The opposite end of the ignition coil 108 is connected by a wire 112 to one end of a resistance coil 114, the other end of which is connected by a wire 116 to the terminal 64 of the control relay.

The terminal 46 of the control relay, which is electrically connected to terminal 64 thereof, carries a wire 118 which is connected to the opposite end of the secondary 94 of the transformer 90. The conduit 100 conveys gaseous fuel from a source of supply to a burner 120 connected thereto and which may be positioned within the oven or other chamber 110 in position to be ignited by the ignition coil 108.

In order to permit the ignition coil 108 to reach igniting temperature before any fuel flows from the burner 120, means are provided to maintain the electromagnetic valve 104 in closed position for a predetermined period of time after the igni-

tion coil 108 has become energized. Accordingly, a time delay relay is provided temporarily to shunt the coil of the electromagnetic valve 104 and prevent the valve from opening until after a predetermined period of time.

The time delay relay, in this instance, is in the form of a mercury switch 122 having one terminal connected by a wire 124 to the wire 102 and the other terminal thereof connected by a wire 126 to the wire 106. The mercury switch 122 is preferably of the type having a specified time delay period upon opening and an instantaneous closing and is arranged to be normally closed. Switches of this type are disclosed in Patents Nos. 1,778,439 and 2,224,873 among others, to which reference may be had for a fuller description. The operating coil 128 for the mercury switch 122 may be connected at one end by a wire 130 to the wire 118 and at the other end to the wire 102 by a wire 132.

The projecting end 30 of the bimetallic strip 26 of the control relay projects into the oven 110 adjacent to the burner 120 and is thereby exposed to the burner flame. The contacts 72 and 80 of the control relay are normally open and, in the absence of a flame at the burner 120, the current flowing through the bimetallic strip 42 heats it and causes it to warp sufficiently to close the contacts 72 and 80. When, however, the end 30 of the bimetallic strip 26 is heated by the burner flame, this strip also warps and causes the contact 72 to retain open circuit relation with the contact 80.

This ability of the contact making and breaking device to assume different positions depending on the presence or absence of a flame at the burner 120 is made use of in this invention to provide safety control for the burner. To this end, the terminal 36 of the relay is connected by a wire 134 to the wire 102 and the terminal 54 is connected by a wire 136 to the wire 106. Closing of the contacts 80 and 72 will thus complete a shunt around the electromagnetic fuel valve 104.

The operation of the device is as follows: Movement of the main switch 96 to closed position will cause the main fuel valve in conduit 100 to be opened. Current in the secondary circuit then flows through the wire 102 to the electromagnetic fuel valve 104 which remains closed due to the shunt of the mercury switch 122 which is normally closed. The current through the wires 124 and 126 of the shunt continues through the wire 106 to the ignition coil 108 and through the wire 112, resistance coil 114 and wire 116 to terminal 64 of the control relay. The current passes by way of conductor 62 through the bimetallic strip 42 of the relay to the terminal 46 and thence through wire 118 connected thereto, back to the secondary 94 of the transformer 90, thus completing the secondary circuit. The current in this circuit heats the ignition coil 108 to ignition temperature and, at the expiration of the predetermined delay period, the mercury switch 122 opens and removes the shunt from the electromagnetic fuel valve 104. Upon energization of this valve and movement thereof to open position, fuel then passes to the burner 120 where it is ignited by the ignition coil 108.

During this cycle of operation the current is heating the bimetallic strip 42 of the relay and causing it to warp, moving the contact 80 toward the contact 72. However, assuming that ignition of the burner 120 has occurred in normal operation, the flame therefrom is concurrently heating the projecting end 30 of the bimetallic

strip 26 causing the strip to warp and move the contact 72 thereon away from the contact 80. Hence, the circuit through the wires 134 and 136 which would shunt the electromagnetic valve 104 remains incomplete and passage of fuel to the burner 120 is not interrupted.

In the event that ignition does not occur at the burner, no heat will be applied to the projecting end 30 of the bimetallic strip 26 and no movement will occur to change the position of the contact 72. The bimetallic strip 42 which is heated by the current in the secondary circuit will move sufficiently to engage contact 80 with contact 72 and close the circuit through the wires 134 and 136. When this shunt is thus completed, the electromagnetic valve 104 moves to closed position, consequently shutting off the supply of fuel to the burner 120.

It will be apparent in such systems that if the control relay were absent and the ignition coil failed to ignite the burner, the gas would continue to flow thereto until such time as it was discovered and shut off. Under such circumstances it is conceivable that the gas flowing from the burner would be ignited from some outside source and cause a serious explosion. With the safety control apparatus of this invention in operation, the unburned fuel can only escape for a short period until the electromagnetic valve is deenergized by the shunt and becomes closed, whereupon the fuel supply is cut off.

In the event that the gas supply should fail during the normal operation of the oven and is resumed after a short period without ignition occurring, fuel would flow only until the control relay operates and closes the electromagnetic valve. In the latter instance, sufficient time would have to elapse to permit the projecting end 30 of the bimetallic strip 26 to cool but the operation is certain to occur with the safety control of this invention.

I claim:

1. In a safety control apparatus for gaseous fuel burners comprising a normally closed solenoid valve preventing the supply of fuel to the burner, electric ignition means for said burner in circuit with said valve, means for energizing said ignition means and valve to produce a flame at the burner, an automatic time-delay device electrically connected to said valve for causing said valve to remain unactuated for a predetermined period following energization of said circuit, said device including an initially closed switch which opens after a predetermined time-delay and resets substantially instantaneously upon deenergization of said circuit, a temperature responsive element connected in series circuit with said ignition means and valve to be heated upon energization thereof, a second temperature responsive element heated by the presence of a burner flame, and relay contacts carried by said elements and connected in parallel circuit with said valve, said contacts being normally open and operable to closed position for causing deenergization of said valve when only the first said element is heated.

2. In a safety control apparatus for gaseous fuel burners comprising a normally closed solenoid valve preventing the supply of fuel to the burner, electric ignition means for said burner in circuit with said valve, means for energizing said ignition means and valve to produce a flame at the burner, an automatic time-delay device electrically connected to said valve for causing said valve to remain unactuated for a predetermined

period following energization of said circuit, said device including an initially closed switch which opens after a predetermined time-delay and resets substantially instantaneously upon deenergization of said circuit, a bimetallic element connected in series circuit with said ignition means and valve to be heated upon energization thereof, a second bimetallic element supported to be heated by the burner flame, said elements being movable in the same direction when heated, and relay contacts carried by said elements on opposing surfaces thereof and connected in parallel circuit with said valve, said contacts being normally open and relatively movable to closed position for causing deenergization of said valve when only the first said element is heated, but being jointly movable to retain open contact relation when both said elements are heated.

3. A control relay comprising a housing, a temperature responsive element mounted for movement in said housing and having a portion extending exteriorly thereof for exposure to the heat of a burner, a contact carried on the inner end of said element and electrically insulated therefrom, a second temperature responsive element mounted for movement in said housing, a contact carried by said second element and electrically insulated therefrom, said contacts being movable into and out of operative engagement upon movement of the associated elements, means for conducting electric current from a source of supply through said second element and being electrically insulated from said housing, said element thereby becoming heated for changing the position of the contact carried thereby and causing said operative engagement unless the first said element is heated, and means electrically insulated from the housing for conducting said current from said elements in one position of the contacts.

4. A control relay comprising a housing, a temperature responsive element mounted intermediate its ends in the housing and having a portion extending exteriorly thereof for exposure to the heat of a burner, a contact carried on the inner free end of said element and electrically insulated therefrom, a flexible conductor associated with said contact within said housing and electrically insulated from said housing and said element, a second temperature responsive element mounted at one end thereof in said housing, a contact carried on the free end of said second element and electrically insulated therefrom, said last recited contact being movable into and out of operative engagement with the first said contact by movement of the free end of said second element, a flexible conductor electrically connected to the free end of said second element and electrically insulated from said housing, means for establishing an electric circuit through said second element and the conductor connected thereto, said means being electrically insulated from the housing and adapted to heat said second element for causing engagement of said contacts unless the first said element is heated, a flexible conductor associated with the last said contact and insulated from the second element and said housing, and means electrically insulated from and secured to said housing and associated with the flexible conductors for said contacts to conduct electric current from the housing when said contacts are engaged.

SAMUEL G. ESKIN.