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IGNITION SYSTEM FOR BURNERS

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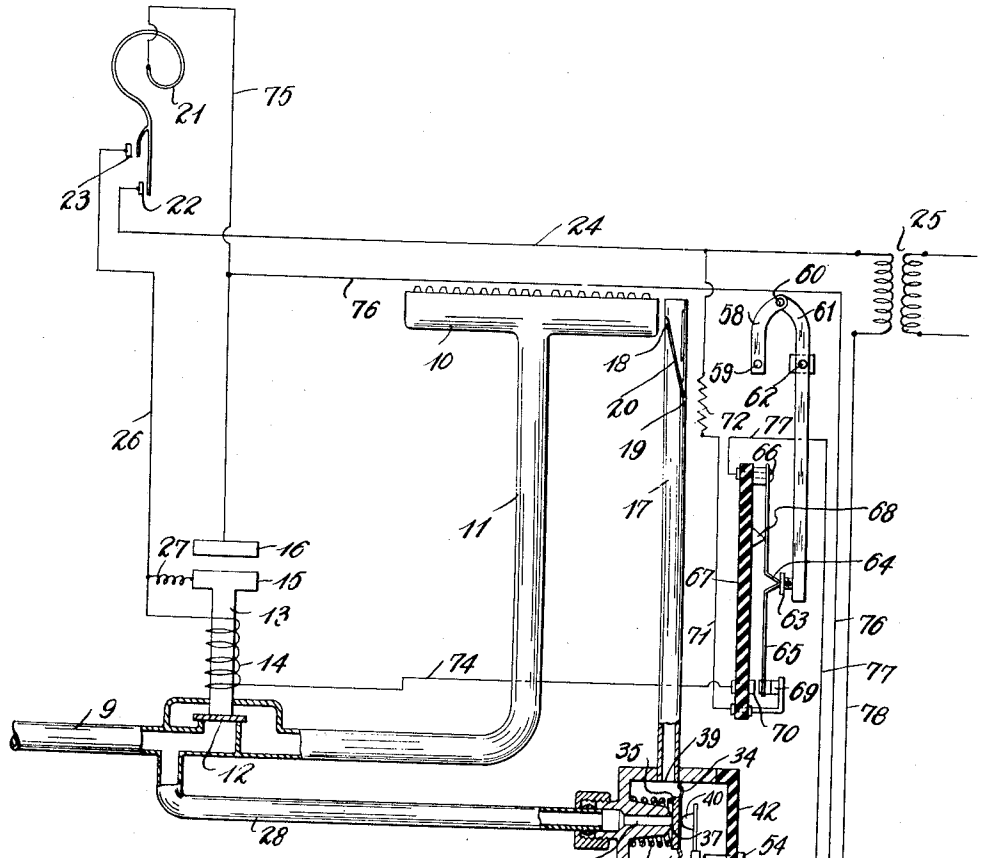


FIG. 1

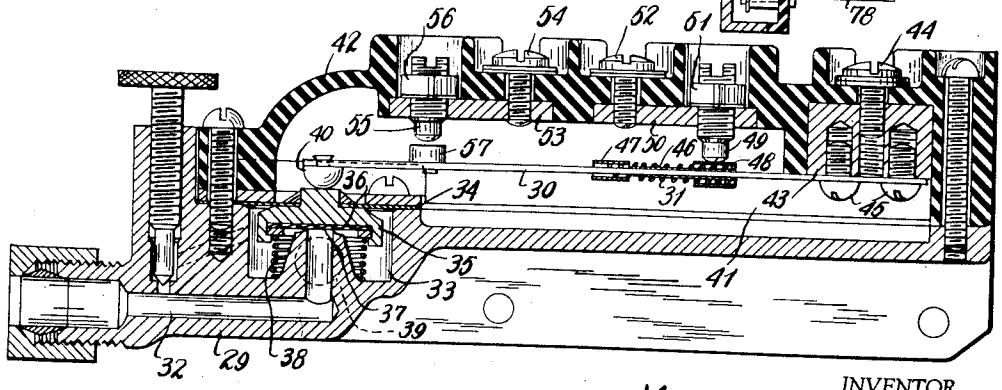


FIG. 2

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IGNITION SYSTEM FOR BURNERS

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5 Claims. (Cl. 158—117.1)

This invention relates to improvements in ignition systems for burners, that is to say electrical systems for igniting gaseous or other fluid fuel in burners for domestic heaters or the like. It relates chiefly to the provision of simplified means for accomplishing automatic ignition while avoiding waste of fuel and guarding against the hazards of explosion in the event of temporary failure of the fuel supply or the like, and also means for stopping the operation of the burner in the event of a failure in the electrical control system.

One of the objects of the invention is the provision of simple apparatus and wiring such that the electrical operation of the main fuel valve is subject to control by the flame from the pilot, whereby in the event of failure of fuel supply the absence of flame from the pilot will cause closing of the main fuel valve.

Another object is the provision of a double throw switch through which current for the ignition and current for the main valve operator must pass alternatively and whenever those parts of the system are in operation, so that the ignition must be turned off before the main burner may be turned on, and the main burner must be turned off before the ignition may be turned on.

Other objects and features of novelty will appear as I proceed with the description of that embodiment of the invention which, for the purposes of the present application, I have illustrated in the accompanying drawing, in which

Fig. 1 is a diagrammatic illustration of wiring and apparatus used in carrying out the invention.

Fig. 2 is a longitudinal section view of apparatus which may be employed in connection with the invention.

In the drawing I have shown at 10 a burner for the heater, the gaseous or other fuel supply for which is delivered to the burner by a pipe 11. In this pipe I locate at a suitable point a main valve 12 which may be operated electrically in any known manner. By way of example I have shown the valve attached to the lower end of the core 13 of a solenoid 14, the core 13 having a head 15 which is adapted to contact a fixed plate 16 when the solenoid is energized. A pilot 17 is arranged adjacent burner 10 and has an exit port 18 positioned to direct a flame toward the main burner, and an exit port 19 on the opposite side of the pilot for a purpose presently to appear, these two ports being connected by a slot 20.

A room thermostat 21 cooperates with two fixed contacts 22 and 23. These contacts are so mounted or adjusted that under a call for heat contact 22 closes first and a short time thereafter, when the temperature in the room has fallen a trifle lower, contact 23 closes. Contact 22 is connected by means of a conductor 24 with the secondary of a transformer 25. This transformer is preferably one of the constant current, high impedance type, although other transformers of the proper power rating function satisfactorily provided they are not of the constant voltage type. Contact 23 is connected by a conductor 26 with one end of solenoid 14, and also by a flexible lead 27 to the head 15 of core 13.

Fuel for the pilot 17 is taken from a pipe 28 which connects with the main fuel supply pipe 9 beyond the valve 12. Pipe 28 extends into a housing 29 which also contains a bi-metal thermostat element 30 that may be warped from its natural state by the action of an electric heating coil 31 which is under control of the room thermostat. These parts are illustrated somewhat in detail in Fig. 2, wherein the housing 29 is shown as provided with a passage 32 for connecting pipe 28 with a valve chamber 33 that is closed on the side opposite the passage 32 by a flexible diaphragm 34. This diaphragm carries centrally a valve piece 35 having on its lower face a gasket 36 which is adapted to have a tight engagement with a circular seat 37 at the inner extremity of passage 32. A coil spring 38 tends to unseat the valve. An exit port 39 connects chamber 33 with the pilot 17. During periods when the system is idle the valve 35 is held against its seat by a button 40 on the free extremity of bi-metal element 30, which is so adjusted that under those conditions it exerts a firm pressure tending to seat the valve and cut off the flow of fuel to the pilot.

Bi-metal element 30 is contained in an elongated cavity 41 in the housing 29, the housing being constituted partly of a molded cover member 42 of insulating material. The cavity 41 and the chamber 33 are of course effectively separated from each other by the diaphragm 34, which is sealed at its periphery and at the joint with valve piece 35.

The lower side of cover 42 may be provided with a pocket to receive a metal block 43 which may be held in place by a screw 44, the latter serving also as a binding post. Bi-metal element 30 is secured to the lower surface of block 43 by screws 45 or the like.

The major part of heating coil 31 is separated from the bi-metal element 30 by a wrapping 46 of insulating material. One end of the coil is electrically joined to the bi-metal element beyond the wrapping 46 in some suitable manner, as by a metal clamping band 47, while the other end is held in place and electrically joined to another clamping band 48. The latter band bears at all times against an abutment 49 which has a threaded shank that extends through a threaded hole in a metal plate 50 embedded in the bottom of cover 42. A nut 51 serves to hold abutment 49 in adjusted position. Abutment 49 acts as a conductor of electric current, and also by its ad-

justment regulates the normal deflection of the free end of the bi-metal member and accordingly the pressure exerted by the button 40 on the valve 35. 52 is a screw that takes into plate 50 assisting to hold that plate in place and serving also as a binding post. Another metal plate 53 embedded in the cover 42 is electrically connected with a binding post 54 similar to binding post 52, and plate 53 carries an abutment screw 55 similar to abutment screw 49, which is adapted to be threadably adjusted and held in adjustment by a nut 56. Abutment screw 55 is contacted at times by a button 57 fastened to the upper surface of bi-metal element 30. Current may pass from binding post 54, plate 53, and abutment 55, through button 57, bi-metal element 30, screws 45, and block 43 to binding post 44, or from binding post 52, plate 50 and abutment screw 49 through clamp 48, heating coil 31, bi-metal element 30, screws 45, and block 43 to binding post 44. This combined switch and valve operating means, actuated by a heating coil, is disclosed in my prior application 136,847, filed April 14, 1937, and per se forms no part of the present invention.

When the pilot 17 is burning the flame issuing from port 19 envelops a metal link 58 which is formed of material having a high coefficient of expansion. This link is mounted at one end upon a fixed pivot 59, while the other end is pivotally connected at 60 with the upper extremity of a lever 61 which is pivotally supported intermediate its ends upon a fixed pivot 62. When link 58 is heated by a pilot flame it lengthens, due to expansion, and this produces a small angular displacement of lever 61 in a clockwise direction around its pivot 62. Because of the considerable length of the lower arm of lever 61 as compared with that of its upper arm, a button 63 on the lower extremity partakes of a movement which may be twice or three times as great as the movement of pivot 60, and is therefore sufficient to actuate a switch. Button 63 is caused to press against a hump 64 formed in a switch blade 65 that is fastened at one end by clamp 66 to an insulation support 67. 68 is a knife blade projection on the support 67, which engages blade 65 between hump 64 and clamp 66. The free end of blade 64 is adapted normally to make electrical connection with a fixed contact 69 carried by the support 67. When however the lower end of lever 61 swings clockwise under the influence of a flame from the pilot, blade 65 is forced to the left breaking engagement with contact 69 and engaging a contact 70 which is also carried by the support 67. Contact 69 is connected by a conductor 71 with an ignition coil 72 located opposite pilot burner port 19. The opposite end of the coil is connected by a conductor 73 with conductor 24. Contact 70 is connected with the lower end of solenoid 14 by a conductor 74.

The remainder of the wiring consists of a conductor 75 which extends from the fixed part of thermostat 21 to plate 16, a conductor 76 which extends from conductor 75 to binding post 52, a conductor 77 which runs from the clamp 66 at the fixed end of switch blade 65 to binding post 54, and a conductor 78 which runs from binding post 44 to the secondary of transformer 25.

Operation.—Assuming that the burner has been quiescent for a time, and that the temperature of the premises has fallen sufficiently to cause room thermostat 21 to engage contact 22, plate 16 will then be made alive because of the current path through conductor 24, contact 22, thermostat 21, and conductor 75. Also, current will flow from conductor 75 through conductor 76 to binding post 52, through heating coil 31, energizing that coil, through bi-metal element 30 to binding post 44, and back through conductor 78 to the transformer. The heat from coil 31 will, after a predetermined time has elapsed, produce a flexure in bi-metal element 30, relieving the pressure of its free end against the valve 35. Spring 38 will then lift the valve from its seat and fuel will flow to the pilot. This flexure of the bi-metal element 30 will proceed far enough also to bring button 57 into contact with abutment screw 55. As soon as this contact is made current will flow from the transformer through conductors 24 and 73 to the ignition coil 72, energizing that coil, and by way of conductor 71, contact 69, and switch blade 65 to clamp 66, and thence through conductor 77 to binding post 54, through bi-metal element 30 to binding post 44, and back through conductor 78 to the transformer. Fuel emerging from the port 19 of pilot 17 may under favorable circumstances ignite immediately. If it does not the additional load of coil 72 will reduce the voltage across the secondary coil of the transformer, which in turn will reduce the heating effect of coil 31, permitting bi-metal element 30 to bend away from abutment screw 55, thereby breaking the circuit through ignition coil 72. This movement of bi-metal element 30 will not however be sufficient to close the pilot fuel valve. The load of the ignition coil then being taken off the line, the voltage will again increase and more energy will be available for the heating coil 31, which presently will again cause engagement between button 57 and abutment screw 55, thereby bringing the ignition coil again into action. The intermittent action of the ignition coil in this manner will continue until the pilot is ignited. When this occurs the heat responsive link 58 will lengthen and swing lever 61 clockwise upon its pivot 62. The lever will then act through button 63 to force the lower end of switch blade 65 to the left, thereby breaking the ignition coil circuit. Within a short time interval however blade 65 will come into engagement with contact 70. The pilot will continue to burn and the lever 61 will continue to hold the switch plate against contact 70. The pilot flame will also travel upwardly along slot 20 to port 18, and flame will extend from that port into position to ignite fuel emerging from main burner 10.

Now, as soon as the room thermostat completes its action under the call for heat, that is when it engages contact 23, the valve 12 for the main burner will be opened by solenoid 14, the energization of that solenoid taking place through the flow of current from the transformer through conductor 24, contact 22, thermostat 21, contact 23, conductor 26, solenoid 14, conductor 74, contact 70, switch blade 65, clamp 66, conductor 77, binding post 54, bi-metal element 30, binding post 44, and conductor 78 back to the transformer. The movement of switch blade 65 away from contact 69 of course breaks the circuit through igniter coil 72, and the intermittent energization of that coil stops. As soon as the head 15 of core 13 rises into contact with plate 16, valve 12 is latched in open position independently of thermostat contact 23, that is current flows from the transformer through conductor 24, contact 22, theormostat 21, conductor 75, plate 16, core head 15, flexible conductor 27, solenoid 14, conductor 74, contact 70, switch blade 65, clamp 66, conductor 77, binding post 54, bi-metal element 30, binding post 44 and conductor 78 back to the transformer.

Now, when the temperature of the premises rises sufficiently to cause the room thermostat to break contact **23** nothing happens, for the path of current to the solenoid through conductor **26** is short-circuited by conductor **75**. It is not until the temperature rises far enough to open contact **22** that the circuit through the solenoid is broken and the main valve **12** closes. When this occurs the circuit through heating coil **31** is also broken, since that circuit passes through the thermostat contact **22** also. The bi-metal element **30** then cools and moves back to its normal position, illustrated in Fig. 2, breaking electric connection with binding post **54** and closing pilot valve **35**. The pilot then goes out, the link **58** cools and shortens, and the lever **61** swings anti-clockwise, withdrawing button **63** and permitting switch plate **65** to move by its own resilience away from contact **70** and into engagement with contact **69**. The system will then be set to resume starting operation the next time the room thermostat calls for heat.

Now, in the event that there should be a failure of fuel during operation of the burner the present system will cause the closing of the main valve and the avoidance of any explosion hazard. As the lack of fuel causes the pilot burner to go out, link **58** cools, lever **61** swings away from switch blade **65**, and that blade breaks the solenoid circuit at the contact **70**. The valve **12** then falls to its closed position, and it cannot be raised again until after the pilot flame is resumed. When the fuel supply fails while the room thermostat is still calling for heat, the heating coil **31** remains energized and the pilot fuel valve remains open. Also, within a very short time the intermittent energization of ignition coil **72** is resumed, so that as soon as the failure of fuel is overcome the pilot again ignites and the cycle of ignition of the main burner occurs in the regular way.

The system herein disclosed incorporates features that will cause automatic recycling in the event of an electric power failure of appreciable duration, that is a power failure long enough to cause the bi-metal element **30** to cool and close the pilot valve. The main valve will of course close immediately upon a power failure because the solenoid **14** will then be deenergized. Also, the various components of the entire valve assembly are so arranged and connected that a failure of any part of the assembly will prevent the main gas valve from opening or will close that valve if it is open at the time the failure occurs.

Having thus described my invention, I claim:

1. In fluid fuel burning equipment, a main burner, a valve for the fuel supply thereto, a pilot, a valve for the fuel supply to the pilot, an electric igniter for the pilot, a room thermostat, an electric circuit for operating the main valve, a circuit for the igniter, a double throw switch adapted when in one position to make contacts in said main valve operating circuit and when in another position to make contacts in said igniter circuit, means embodying a heating coil under the control of the room thermostat for opening said pilot valve and completing either of said circuits through said double throw switch, and means responsive to the presence or absence of a pilot flame for moving said double throw switch from one operative position to the other, whereby the presence or absence of a pilot flame determines which of the said circuits shall be completed subject always to the control of the heating coil.

2. In fluid fuel burning equipment, a main burner, a valve for the fuel supply thereto, a pilot, a valve for the fuel supply to the pilot, an electric igniter for the pilot, a room thermostat, a circuit controlling the valve for said main burner, said circuit including a first switch and a second switch, a heating coil working under the control of the room thermostat for opening said pilot valve, closing said first switch and energizing said igniter, and means under the control of the flame from said pilot for closing said second switch and deenergizing said igniter.

3. In fluid fuel burning equipment, a main burner, a valve for the fuel supply thereto, a pilot, a valve for the fuel supply to the pilot, a room thermostat, a circuit controlling at all times the valve for said main burner, said circuit including a first switch and a second switch, delayed action means working under the control of the room thermostat for opening said pilot valve and closing said first switch when the thermostat calls for heat and for closing said pilot valve and opening said first switch when the heat requirement of the thermostat is satisfied, and means under the control of the flame from said pilot for closing said second switch and for opening the same upon the cessation of flame from said pilot.

4. In fluid fuel burning equipment, a main burner, a valve for the fuel supply thereto, a pilot, a valve for the fuel supply to the pilot, an electric igniter for the pilot, a room thermostat, a circuit controlling at all times the valve for said main burner, said circuit including a first switch and a second switch, delayed action means working under control of the room thermostat for opening said pilot valve, closing said first switch, and energizing said igniter when the thermostat calls for heat, and means under control of the flame from said pilot for deenergizing said igniter and closing said second switch, and upon the cessation of flame from the pilot for opening said second switch.

5. In fluid fuel burning equipment, a main burner, a valve for the fuel supply thereto, a pilot, a valve for the fuel supply to the pilot, an electric igniter for the pilot, an electric circuit for operating the main valve, a circuit for the igniter, a double throw switch adapted when in one position to make contacts in said main valve operating circuit and when in another position to make contacts in said igniter circuit, electrical means functioning a predetermined time after energization to open said pilot valve and complete either of said circuits through said double throw switch, and means responsive to the presence or absence of a pilot flame for moving said double throw switch from one operative position to the other, whereby the presence or absence of a pilot flame determines which of the said circuits shall be completed subject always to the control of said electrical means.

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