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PROTECTIVE SYSTEM FOR OIL BURNERS

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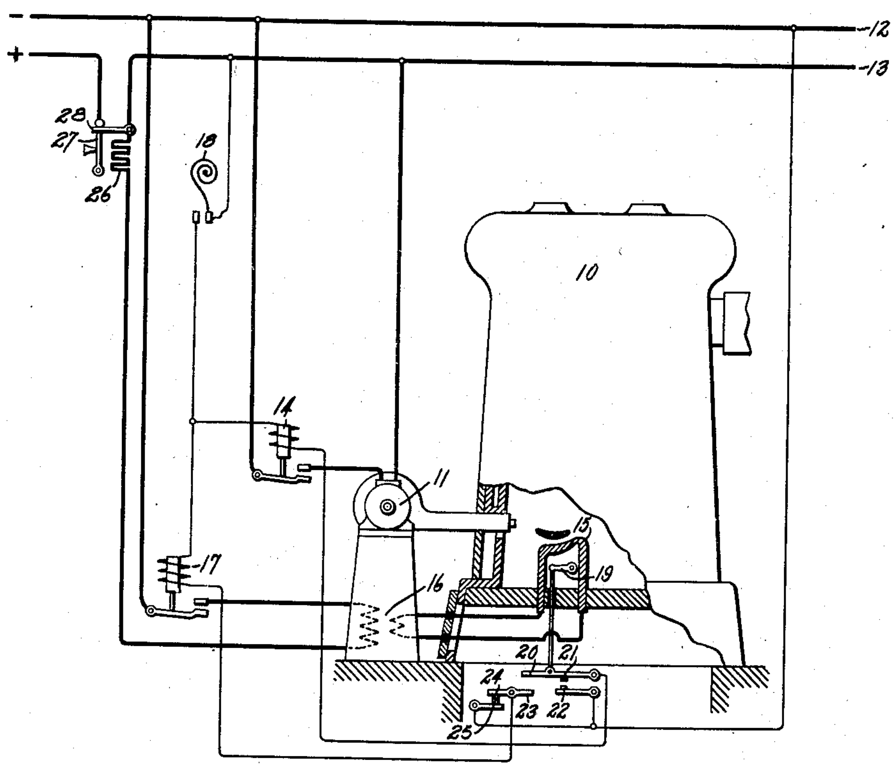

Inventor:
Elliott D. Harrington.
by Charles E. Tullar
His Attorney.

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PROTECTIVE SYSTEM FOR OIL BURNERS

Elliott D. Harrington, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York

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12 Claims. (Cl. 158—28)

My invention relates to automatic protective systems and apparatus for burners, more particularly automatic control systems and devices for burners for fluids such as oil or gas or other burners which depend for ignition upon an electric igniter such as a hot filament or the like, and it is a principal object of my invention to provide an oil burner control in which fuel cannot be furnished unless the ignition system is in condition instantly to establish combustion.

In oil burners which make use of an electric igniter it is necessary for safe operation to have the igniter reach a condition which will insure ignition of the oil spray before energizing the fuel supply motor which supplies fuel to the combustion chamber of the oil burner furnace. Otherwise if the fuel supply motor is energized before this condition is reached considerable spray will accumulate in the furnace. As a result, when the igniter finally becomes effective to cause ignition an explosion of the accumulated fuel spray is liable to occur. It is also desirable from the standpoint of safety to provide ignition for the oil burner spray which is instantly effective in case of a temporary flame failure such as might be caused by water slugs in the spray device, or a momentary voltage failure. In the usual oil burner, if the flame is momentarily extinguished before the combustion responsive devices within the burner have had time to deenergize the burner, considerable spray can be introduced into the combustion chamber before ignition is reestablished and thus cause damage due to explosion. It is desirable, therefore, to have an ignition system which will in case of a temporary flame failure be instantly effective to re-ignite the spray. It is also desirable to provide means for deenergizing the oil burner in case of flame failure for a predetermined period.

Hence it is an object of my invention to provide a control device in which an igniter system for a burner will be instantly effective to reestablish ignition in case of a temporary flame failure.

It is another object of my invention to provide means for deenergizing the burner in case of flame failure for a predetermined period.

It is a particular object of my invention to provide a thermostatic switching mechanism jointly responsive both to temperatures of the ignition element and of combustion conditions for controlling the burner operation.

Briefly, one embodiment of my invention includes a fuel supply motor and an ignition system therefor which makes use of a hot filament igniter of the type described and claimed in my copending application, Serial No. 393,028, filed September 16, 1929, and assigned to the same assignee as the present invention. Mounted adjacent the igniter element is a thermostatic switch which controls the energization for the fuel supply motor and the ignition system in which the hot filament igniter is included. A room thermostat is provided for controlling energization of the fuel supply motor to supply heat. The thermostatic switch is provided with two switching mechanisms, one normally open which controls the fuel supply motor, and the other normally closed which controls the ignition circuit. The room thermostat causes energization of the igniter element, and in response to proper temperatures of the igniter element the thermostatic switch closes the fuel supply motor circuit and upon establishing flame conditions opens the ignition circuit. A thermal responsive device in case of flame failure due to voltage failure or the like will open the lines to the oil burner after a predetermined period. In case of temporary fuel failure which will cause extinguishment of the flame the igniter will retain sufficient heat to reignite the fuel spray when it is again furnished by the oil burner. Before the igniter reaches the bottom limit of temperature which will ignite a return oil spray the thermostatic switch will operate to permit the igniter switch to reclose to heat the igniter element and maintain it at the proper temperature. In this way there is no danger of fuel being supplied to the furnace without insuring ignition.

The drawing represents a schematic showing of my invention showing one form of control for an oil burner. In the drawing, a furnace 10 is supplied with liquid fuel by means of the oil burner apparatus 11. The oil burner is energized from the lines 12—13 when the relay 14 is energized to close its contacts. An igniter element 15 of the hot filament type, such as shown and described in my copending application referred to above, is provided for obtaining ignition of the fuel spray introduced into the furnace 10. This igniter element is energized from the secondary of a transformer 16 which is placed across the lines 12—13 when the relay 17 is energized by means of the closing of the contacts of the room thermostat 18.

A thermostatic switch designated generally at 19 is placed adjacent the hot wire filament igniter and is provided with a lever member 20 carrying a contact 21 which cooperates with the contact 22 carried by a second lever. Another lever 23 carries a contact 24 cooperating with the contact 25. These contacts 24 and 25 are normally closed to provide a circuit to one side of the line 12 for the relay 17. A circuit to the other side of the line 13 is completed when the room thermostat 18 closes. When the contacts 21 and 22 are closed and thermostat 18 closed the relay 14 is energized to place the oil burner 11 across the lines to thereby energize the same. In the primary circuit of the transformer 16 is a resistor element 26 which after a predetermined time generates sufficient heat to operate the thermostatic responsive element 27 to open the switch 28 controlling one side of the lines 12—13, thereby deenergizing the fuel supply motor in the ignition system.

In operation, when the room thermostat 18 closes, a circuit is completed from line 13 through the relay 17, lever 23, contacts 24 and 25 to the other side of the line 12. This energizes the transformer 16 which in turn causes the ignition element 15 to become heated. The thermostatic switch 19 in response to the rise in temperature causes the lever 20 carrying the contact 21 to move downward to close the contact 22 when the igniter 15 has reached a predetermined temperature sufficient to cause ignition of the fuel spray from burner 11. This completes a circuit from line 12 through contacts 22 and 21, relay 14 and thermostat 18 to the other side of the line 13 to energize burner 11. If combustion is established the thermostatic switch 19 responds to move the lever 20 still further down maintaining contacts 21 and 22 closed. The lever 20 will then eventually contact with the lever 23 to open the contacts 24 and 25, thereby deenergizing the relay 17 and permitting the ignition circuit to be deenergized. When the desired temperature has been obtained thermostat 18 opens to deenergize the relay 14 and the burner 11, the apparatus assuming its initial condition upon cooling of the ignition element 15.

If for some reason combustion is not initially established the thermostatic switch will fail to open the contacts 24 and 25 so that the relay 17 is maintained closed. After a predetermined period of time resistor element 26 will generate sufficient heat to cause operation of the thermostatic switch 27—28 to open one side of the line and thereby deenergize the oil burner.

In case of a temporary failure of oil supply such as might be due to a water slug which will cause extinguishment of the flame, it is important that the temperature of the ignition device be sufficient to cause re-ignition when the oil spray returns. The ignition element has sufficient mass so that it will cool slowly and if the fuel supply fails momentarily it will have retained sufficient heat to re-ignite the spray. Before the temperature of the igniter reaches a lower limit of temperature which will ignite a return oil spray it will operate to permit reclosing of the contacts 24—25 to reestablish the ignition circuit. Thus any return oil spray must meet this element at a temperature sufficient to ignite it. Of course, if the failure of fuel supply is permanent, the thermostatic switch 27—28 will allow the igniter to remain on a predetermined period and then will deenergize the oil burner apparatus.

It will thus be seen that I have provided a unique control system which is extremely safe since the oil spray is never admitted to the combustion chamber under any circumstances unless the temperature of the hot filament igniter is sufficient to ignite the oil spray and burn it before it has collected in sufficient quantities to cause explosion by delayed ignition.

The embodiment of the invention illustrated and described herein has been selected for the purpose of clearly setting forth the principles involved. It will be apparent, however, that the invention is susceptible of being modified to meet the different conditions encountered in its use, and I, therefore, aim to cover by the appended claims all of the modifications within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a control system for a fluid fuel burner having a hot filament igniter, the combination of thermostatic means responsive to the temperature of the hot filament igniter for insuring operation of the burner only when said igniter is at a predetermined temperature, and means operatively associated with said thermostatic means for deenergizing said igniter when combustion is established, said thermostatic means and said last means cooperating to maintain said igniter at an igniting temperature upon temporary failure of combustion after combustion has been established.

2. In a control for a fluid fuel burner having a fuel supply means, a hot filament igniter, and a thermostatic device responsive to the igniter temperature for energizing the fuel supply means when said igniter has reached a predetermined temperature, said thermostatic device having means arranged to deenergize said igniter when flame is established and to reenergize temporarily said igniter upon temporary failure of combustion after flame has once been established.

3. A control for an electrically operated fluid fuel burner including, in combination, a hot filament igniter, a thermostatic device responsive to a predetermined igniter temperature for energizing the burner, said device also being responsive to combustion and having means for deenergizing said igniter upon establishing combustion and for maintaining said igniter above said predetermined temperature upon temporary combustion failure.

4. A control for a fluid fuel burner including in combination, a hot filament igniter, a thermostatic device responsive to a predetermined igniter temperature for energizing the burner, said device also being responsive to combustion and having means for deenergizing said igniter upon establishing combustion, and for preventing said igniter from cooling below said predetermined temperature upon temporary combustion failure, and means for deenergizing the burner and igniter after a predetermined period of flame failure.

5. In a control system for a fluid fuel burner including a fuel supply motor, the combination of a hot filament igniter for said burner, means for energizing said igniter, a thermostatic device responsive to the temperature of said igniter for energizing said fuel supply motor and responsive to combustion conditions for deenergizing said igniter and operable for maintaining said igniter at an igniting temperature during a temporary combustion failure, and means controlled by said igniter energizing means for deenergizing said fuel supply motor and said igniter energizing means upon failure to establish combustion.

6. In a control for a fluid fuel burner having a fuel supply motor, the combination of an electro-responsive means for controlling operation of the motor, a hot filament igniter, a thermo-

static device for energizing said electro-responsive means and responsive to the temperature of said igniter, means controlling energization of said igniter, said thermostatic device controlling said igniter energizing means to deenergize said igniter when combustion is established and to reenergize said igniter upon a temporary failure of combustion to maintain said igniter above a predetermined temperature.

7. In a control for a fluid fuel burner having a fuel supply motor, a hot filament igniter therefor, means for energizing said igniter to heat the same, a switch biased to closed position for controlling said energizing means, a thermostatic device responsive to igniter temperature for energizing said fuel supply motor when said igniter reaches a predetermined temperature and for opening said biased switch to deenergize said igniter energizing means upon the establishment of combustion, said thermostatic means permitting said biased switch to reclose upon temporary failure of combustion whereby said igniter is maintained above said predetermined temperature during said temporary flame failure.

8. In combination, a furnace having a combustion chamber, means for feeding fuel to the combustion chamber, an incandescent igniter located in the path of the fuel for igniting the fuel, and control means including an element located in the combustion chamber in proximity to said igniter to be responsive both to the heat radiated from said igniter and the heat of combustion of the burning fuel for selectively controlling operation of the fuel feeding means and said igniter in accordance with predetermined variations of said radiated heat and said heat of combustion.

9. In combination, a furnace having a combustion chamber, electrically controlled means for feeding fuel to the combustion chamber, an electric incandescent igniter located in the path of the fuel for igniting the fuel, and control switching means including an element located in the combustion chamber in proximity to said igniter to be responsive both to the heat radiated from said igniter and the heat of combustion of the burning fuel for selectively controlling energization of said fuel feeding means and said igniter in accordance with predetermined variations of said radiated heat and said heat of combustion.

10. In combination, a furnace having a combustion chamber, means for feeding fuel to the combustion chamber, an incandescent igniter located in the path of the fuel for igniting the fuel, control means having an element operable between a plurality of positions for selectively controlling operation of said fuel feeding means and said igniter, and an actuating element located in the combustion chamber in proximity to said igniter to be responsive to both the heat radiated from said igniter and the heat of combustion of the burning fuel for operating said first element between said positions in accordance with predetermined variations of said radiated heat and said heat of combustion.

11. In combination, a furnace having a combustion chamber, electrically controlled means for feeding fuel to the combustion chamber, an electric incandescent igniter located in the path of the fuel for igniting the fuel, control means including a switching element having a plurality of controlling positions for selectively controlling energization of said fuel feeding means and said igniter, and means including an element located in the combustion chamber in proximity to said igniter to be responsive to both the heat radiated from said igniter and the heat of combustion of the burning fuel for operating said switching element in accordance with predetermined variations of said radiated heat and heat of combustion.

12. In combination, a furnace having a combustion chamber, electrically controlled means for feeding fuel to the combustion chamber, an electric incandescent igniter located in the path of the fuel for igniting the fuel, switching means for energizing said igniter, switching means having an element located in the combustion chamber in proximity to said igniter to be responsive both to the heat radiated from said igniter and the heat of combustion of the burning fuel for selectively controlling the energization of said fuel feeding means and said igniter in accordance with predetermined variations of said radiated heat and said heat of combustion, and an automatic timing switch means energized in response to the energization of said ignition means and operable when energized for a time period to render said fuel feeding and ignition means inoperative.

ELLIOTT D. HARRINGTON.