

July 22, 1969

L. P. HINE, JR

3,457,020

DIRECT IGNITION OF FLUID FUEL BURNERS

Filed Dec. 7, 1967

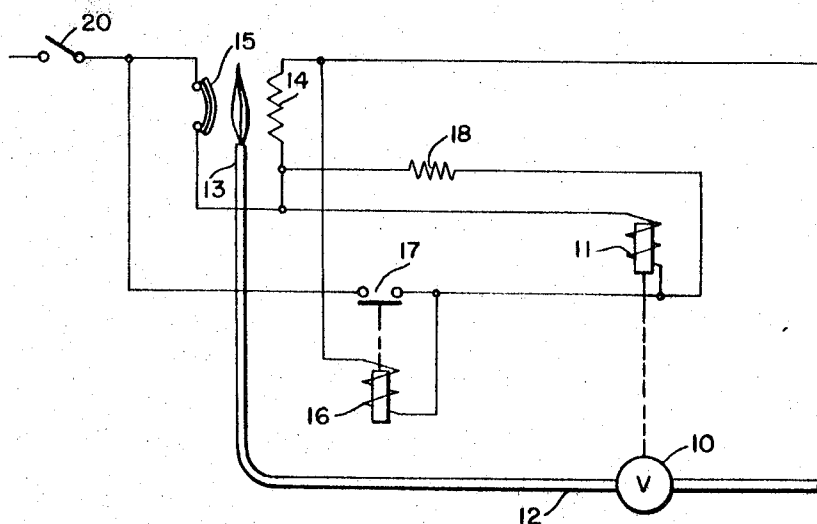


FIG. 1

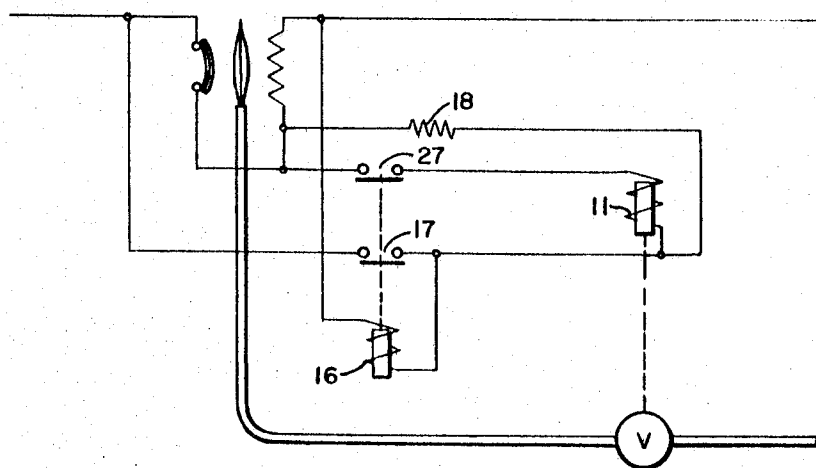


FIG. 2

WITNESSES:

Helen M. Farbas

James F. Young

INVENTOR

Louis P. Hine, Jr.

BY

James E. Blake
ATTORNEY

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3,457,020

DIRECT IGNITION OF FLUID FUEL BURNERS
Louis P. Hine, Jr., Elyria, Ohio, assignor to Luxaire, Inc.,
Elyria, Ohio, a corporation of Delaware
Filed Dec. 7, 1967, Ser. No. 688,715
Int. Cl. F23n 5/02; F23q 2/28
U.S. Cl. 431-66

4 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to fluid fuel burners and an electrical ignition system therefor that is directly energized upon the need for heat to ignite the fuel without the use of continuously operating pilot flames or the like characterized by a heat sensitive switch which in the cold condition is closed shorting the gas supply valve operator, but when heated by an electrical resistance igniter or by an established flame is open thus removing the short.

CROSS REFERENCES TO RELATED APPLICATIONS

So far as is known, this application is not related to any other copending patent applications.

BACKGROUND OF THE INVENTION

Fluid fuel burners and particularly gas fueled burners and furnaces have mostly employed continuously burning pilot flames for their ignition systems because of the safety features that have been provided for such systems. However, provided that equivalent or better safety features can be obtained, a direct ignition system without continuously burning pilot flames would be more advantageous under many conditions of operation. Recent electrical developments in radiation sensing switches have encouraged the development and application of a glow wire type of direct ignition system having the desired safety features of closing the fuel valve when ignition is not obtained or when the flame goes out. It may also be desirable to provide a direct ignition system with means to cycle the fuel valve from open to closed position if the fuel fails to ignite after a short period of time and to thereafter again cycle on the glow wire ignition element so that the valve and ignition element may alternately cycle off and on until fuel ignition does take place.

PRIOR ART

United States Reissue Patent 25,976 is typical of the prior art patents relating to a glow wire type of direct ignition system for fluid fuel burners and this patent is classified in class 431 subclass 31 of the United States patent classification.

SUMMARY

In accordance with the invention, a direct ignition system for fluid fuel burners having the above-described objects and advantages is obtained with the use of a radiation sensing switch having normally closed contacts connected in a series circuit with a resistance glow wire to a source of electric current. A relay switch and coil with a set of normally open contacts is provided with its coil connected in series with a voltage dropping resistance in a circuit in parallel with the glow wire so that the relay coil is first energized simultaneously with the energization of the glow wire. The relay contacts are connected in a series holding circuit with the relay coil to the source of current so that the relay will remain energized after the radiation sensing contacts are opened for deenergizing the glow wire after the glow wire is emitting sufficient radiation for ignition of the fuel. An electric fuel valve is connected in series with the relay contacts in a circuit in parallel with the sensor contacts so that after the sensor contacts are

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opened with the relay energized, the fuel valve coil is energized to open the fuel valve. If the fuel is ignited, the sensor contacts will remain closed by radiation from the burning fuel but if after a short time, the fuel is not ignited, the glow wire will have cooled sufficiently to reclose the sensor contacts thus deenergizing the fuel valve coil to close the valve. Thereafter, when the igniter wire again glows to a level sufficient to reopen the sensor contacts, the cycle will repeat until fuel ignition is obtained. Failure of the electric supply causes the valve to close; if the sensor contacts fail closed the valve cannot open; if the flame goes out the valve is closed; and if the sensor contacts fail open before ignition, the glow wire cannot glow or the relay cannot energize and therefor the ignition system of the invention is effectively fail-safe. Further features and advantages of the invention will be apparent with reference to the following specification and drawings in which:

FIGURE 1 is a wiring diagram of the preferred embodiment of the invention; and

FIG. 2 is a wiring diagram of a slightly modified form of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGURE 1 of the drawings, the wiring diagram for the direct electrical ignition system of the invention will now be described. An electrically controlled fluid fuel valve 10 having an operating coil 11 is connected in the fuel line 12 extending to the burner jet 13. An electrical resistance glow igniting wire 14 is positioned in proximity to the fuel jet 13 so as to ignite fluid fuel by the radiation emitted from the glow wire 14 when it is heated. A radiation sensing switch 15 having normally closed contacts is also positioned to respond to radiation emitted by the direct ignition glow wire 14 when it is heated sufficiently to cause ignition of the fuel flowing from the burner jet 13. A relay switch having a coil 16 and a set of normally open contacts 17 is provided with its coil connected in a series operating circuit including the fixed voltage dropping resistor 18 in series with the normally closed radiation sensor contacts 15. With this arrangement, upon the closure of the thermostat or main switch 20 to the source of electric current, the glow wire 14 will be energized through the normally closed radiation sensor switch 15 and the control relay coil 16 will also be energized simultaneously therewith. The normally open relay contacts 17 are thereby closed to provide a holding circuit so that the relay coil 16 will remain energized after the normally closed radiation sensor switch 15 is opened subsequent to the detection of sufficient radiation energy from the igniter wire 14 for igniting the fluid fuel.

It will be noted that electric valve coil 11 is connected through the operated contacts 17 of the relay 16 in a circuit that is in parallel with the normally closed sensor switch 15 so that the fluid valve coil 11 will not be energized until the normally closed sensor switch 15 is opened upon detection of the requisite level of radiant energy from the glow wire 14. After sufficient radiant energy for ignition is being generated by the glow wire 14 to cause the sensor switch 15 to open, the valve coil 11 will be energized in series with the igniter wire 14 to open the valve 10 and pass fluid fuel to the burner jet 13. Thereafter the fuel valve 11 remains open in series with the igniter wire 14 which continues to pass current, although with the valve coil 11 in series therewith, the energy through the glow wire 14 is insufficient to maintain it in a glowing condition. However this arrangement assures that should the glow wire break to open the series circuit to the fuel valve coil 11, the valve will be closed.

Assuming that the glow wire 14 has heated sufficiently to emit radiation for igniting fuel from the fuel jet 13

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and the sensor switch 15 is thereby opened, should the fuel fail to ignite within a reasonable short period of time, the cooling of the glow wire 14 that is then connected in series with the valve coil 11, will cause the radiation sensor switch 15 to reclose to again short circuit the operating coil 11 of the valve 10 and close the valve 10 and again pass full electrical current through the glow wire 14 to reheat the wire to ignition temperature. Thus the ignition wire 14 and the fuel valve coil 11 are alternately energized in cycles until ignition is obtained but the fuel valve 10 is not kept open for any sufficient period of time to cause unsafe amounts of gas to be released without ignition. If the sensor contacts should fail closed, the fuel valve coil 11 will remain shorted at all times and it will be impossible to open the fuel valve. Should the igniter wire fail open the fuel valve 11 will close since its operating circuit is extended through the igniter wire 14.

Referring now to FIGURE 2 of the drawings, a slightly modified form of the invention is shown in which the control relay is provided with a second set of normally open contacts 27 which are connected in the series circuit through the coil 11 of the fuel valve 10. This arrangement is somewhat more complicated than that described in FIGURE 1 in view of the provision of the second set of normally open contacts for the control relay but may have some advantage where the relative values of the fixed voltage dropping resistance 18 together with the resistance of the fuel valve operating coil 11 and the relay operating coil 16 are not precisely predetermined. It should be apparent that the fuel valve operating coil 11 cannot be energized until after the relay coil 16 has been energized to close its normally open contacts. 27. It is also apparent that the parallel sum of the resistance of the gas valve coil 11 and the fixed resistance 18 is not present in the series operating circuit for the relay 16, until the relay 16 is energized to have closed its second set of normally open contacts 27.

Various modifications may be made within the spirit of the invention.

I claim as my invention:

1. A direct ignition circuit for a fluid fuel burner comprising, an electric fuel valve having a coil to be energized for opening the valve, a radiation sensor switch having normally closed contacts to be opened when a predeter-

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mined level of radiation is sensed, an electrical resistance glow wire adapted to emit radiation in proximity to fuel released by said valve, a relay switch and coil having a set of normally open contacts to be closed when its coil is energized, means connecting said glow wire and sensor contacts in series to a source of electric current for energizing said glow wire, means connecting said relay coil in series with a voltage dropping resistance in a parallel circuit to said wire whereby said relay coil is energized with said glow wire, means connecting the coil of said valve in series with said relay contacts to said source in a parallel circuit to said normally closed contacts, and means connecting said relay coil in a series holding circuit with its normally open contacts to said source whereby the coil of said valve is energized to open the valve when said sensor contacts are opened upon detection of radiation from said wire and is maintained energized so long as said sensor contacts remain open upon detection of radiation from ignited fuel with said relay coil remaining energized through its holding circuit.

2. The invention of claim 1 in which the series circuit of the fuel valve coil and normally open relay contacts is connected in series with said glow wire to said source of current.

3. The invention of claim 1 in which said relay switch is provided with a second set of normally open contacts, said second set of contacts being connected in series with said valve coil to form a series circuit in parallel with said dropping resistance when said second set of contacts are closed.

4. The invention of claim 2 in which said relay switch is provided with a second set of normally open contacts, said second set of contacts being connected in series with said valve coil to form a series circuit in parallel with said dropping resistance when said second set of contacts are closed.

References Cited

UNITED STATES PATENTS

Re. 25,976	3/1966	Mattews	431—66 X
2,382,216	8/1945	Eskin et al.	431—66 X

FREDERICK KETTERER, Primary Examiner