

Feb. 28, 1967

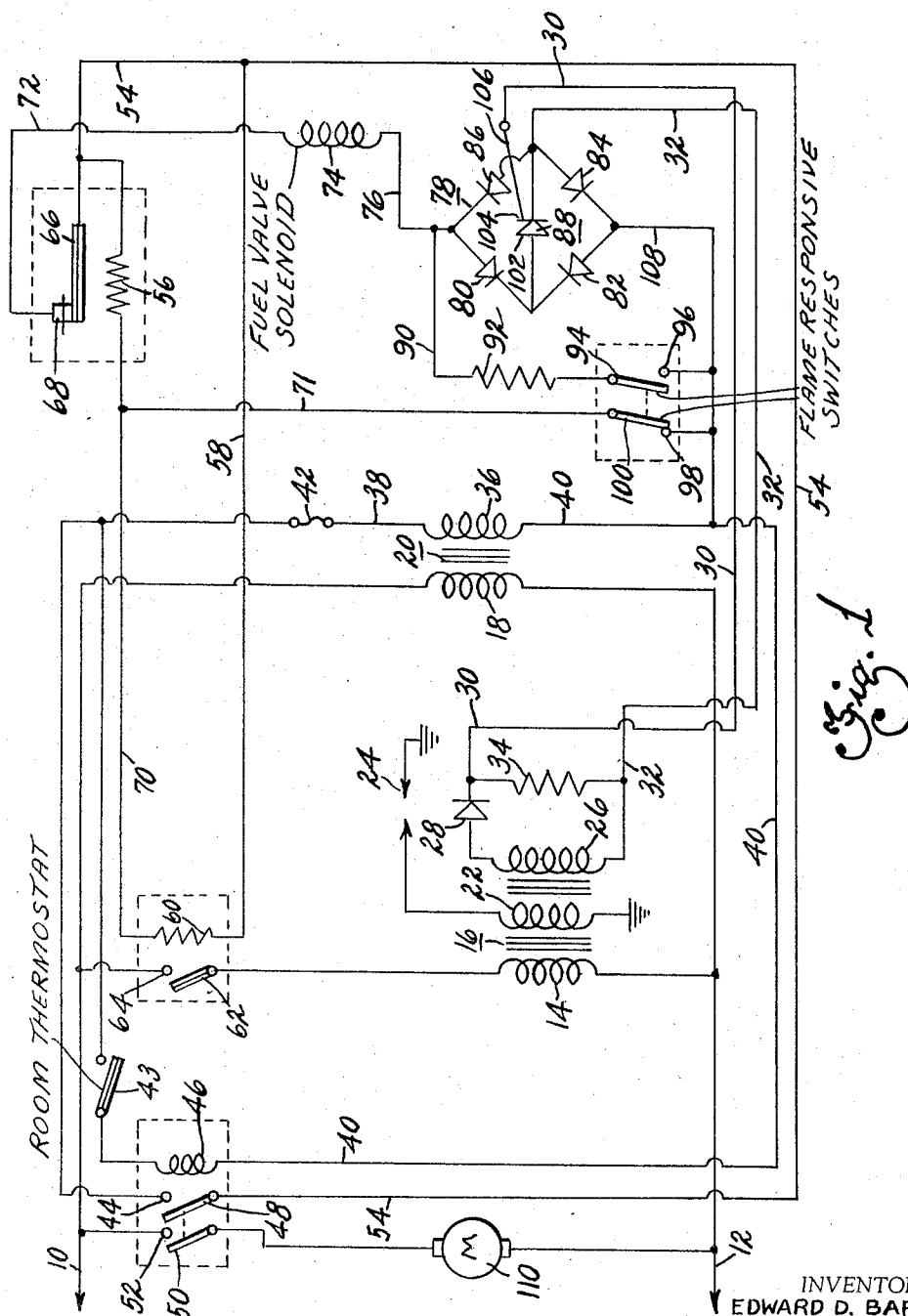
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3,306,339

GAS FURNACE IGNITION CONTROL SYSTEM

Filed June 5, 1964

2 Sheets-Sheet 1



BY

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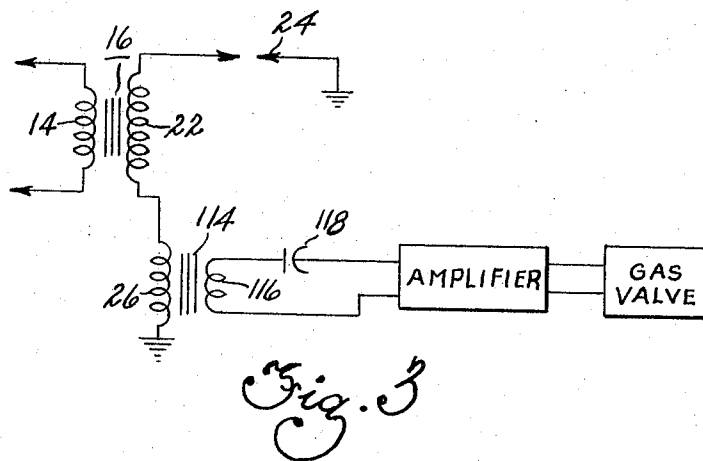
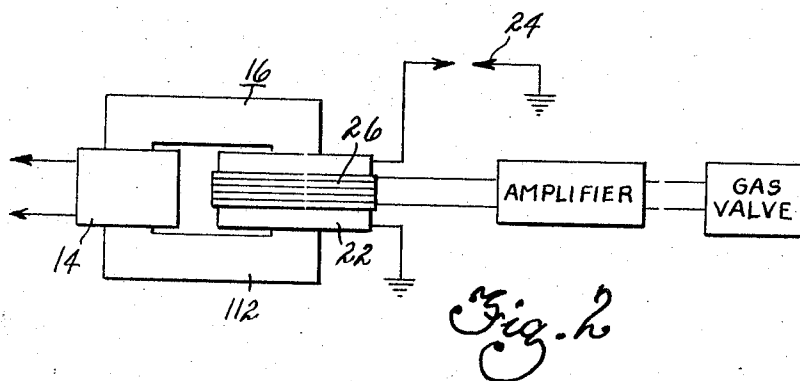
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GAS FURNACE IGNITION CONTROL SYSTEM

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1

3,306,339

GAS FURNACE IGNITION CONTROL SYSTEM
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Filed June 5, 1964, Ser. No. 372,893

3 Claims. (Cl. 158—124)

This invention pertains to furnace control systems, particularly to improved ignition control systems for pressurized gaseous fuel burners.

In co-pending application S.N. 330,170, filed December 12, 1963, in the name of Licata et al., of common assignee, a control system for a pressurized gaseous fuel burner is disclosed including a spark igniter controlled by an ignition relay. With the aforescribed control system it is possible for gaseous fuel to be admitted to the burner even though the spark igniter is inoperative. The present invention relates to improved ignition control systems for pressurized gaseous fuel burners embodying safety means whereby an ignition spark must be present in order to open the gaseous fuel valve.

Accordingly, among my objects are the provision of an improved safety ignition control system for a pressurized gaseous fuel burner; the further provision of an ignition control system for a gaseous fuel burner including means responsive to operation of the spark igniter for controlling the gaseous fuel valve; the still further provision of means responsive to the radio frequency signal of the igniter for actuating a gaseous fuel valve, and the still further provision of a silicon controlled rectifier responsive to a radio frequency signal generated by the spark igniter for controlling a gaseous fuel valve.

The aforementioned and other objects are accomplished in the present invention by embodying a pick-up coil associated with the secondary winding of the ignition transformer in which a radio frequency signal is induced upon operation of the spark igniter, and wherein this radio frequency signal is amplified to control the operation of a solenoid operated gaseous fuel valve.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein preferred embodiments of the present invention are clearly shown, and wherein similar numerals depict similar parts throughout the several views.

In the drawings:

FIGURE 1 is an electrical schematic of the preferred ignition control system.

FIGURE 2 is a schematic layout of the preferred ignition control system.

FIGURE 3 is a schematic layout of a modified ignition control system.

Referring to FIGURE 1, the preferred embodiment of the ignition control system includes input wires 10 and 12 connected to a 115 alternating current power supply which energizes the primary winding 14 of the step-up ignition transformer 16 as well as the primary winding 18 of a step-down transformer 20. The ignition transformer 16 includes a secondary winding 22 connected to a spark igniter 24 and an auxiliary winding 26 wound around the secondary winding 22 in which a radio frequency signal is induced upon successful operation of the spark igniter 24. The radio frequency coil 26 is connected to a diode 28 for rectifying the radio frequency signal, and the output leads 30 and 32 are shunted by a resistor 34.

The step-down transformer 20 includes a low voltage secondary winding 36 connected to wires 38 and 40. Wire 38 includes a fuse 42 and is connected through a room thermostat switch 43 to a stationary contact 44 of a motor relay operated switch including a coil 46, gang

2

connected movable contacts 48 and 50 and a second stationary contact 52. The movable contact 48 is connected to wire 54 that connects with a safety switch heater 56 and a wire 58 connected to a heater 60 of a time delay relay including a movable switch contact 62 and a stationary switch contact 64. The safety switch includes a movable contact 66 and a stationary contact 68. The other end of the resistance heater 60 is connected to wire 70 which, in turn, is connected to wire 71. The safety switch contacts 66 and 68 are connected to wire 72. Wire 72 is connected to the coil 74 of a solenoid operated gaseous fuel valve, the other end of the coil being connected by wire 76 to one terminal of a rectifier bridge 78 containing four diodes 80, 82, 84 and 86 and a silicon controlled rectifier 88 connected across two terminals thereof. The wire 76 is also connected by wire 90 through a resistor 92 to a movable contact 94 of a flame sensor switch having stationary contacts 96 and 98 and a second movable contact 100.

The silicon controlled rectifier including an anode 102 connected to one terminal of the single phase, full wave rectifier bridge 78, a cathode 104 connected to another terminal of the rectifier bridge, and a gate 106 connected to the wire 30. The cathode 104 is connected to the wire 32. The fourth terminal of the rectifier bridge is connected by wire 108 to the stationary switch contacts 96 and 98 of the flame sensor switch which, in turn, are connected to wire 40. Flame sensor switch contacts 98 and 100 are normally closed as are the safety switch contacts 66 and 68. On the other hand, flame sensor switch contacts 94 and 96 close upon successful establishment of combustion at which time switch contacts 98 and 100 will be open.

Operation of the ignition control system depicted in FIGURE 1 is as follows. Upon a demand for heat the room thermostat switch 43 closes thereby energizing the coil 46 of the motor relay so as to close switches 44, 48 and 50, 52. Upon closure of switch 50, 52 the combustion air motor 110 which operates a circulating air blower and a combustion blower becomes operative. Upon closure of switch 44, 48 the ignition time delay heater 60 and the safety switch heater 56 will be energized. After 10 seconds, the ignition time delay switch 62, 64 will be closed to energize ignition transformer 16. If the igniter 24 and the ignition transformer are operative a spark will be generated that will induce a radio frequency signal in the pick-up coil 26. The radio frequency signal will be rectified by the diode 28 and supplied to the silicon controlled rectified 88 through wires 30 and 32. This rectified signal will turn on the silicon controlled rectifier 88 so as to complete the energizing circuit for the solenoid coil 74 of the gaseous fuel valve thereby admitting gaseous fuel to the burner.

Upon the successful establishment of combustion, the flame sensor switch will operate to open contacts 98, 100 thereby deenergizing the safety switch heater 56, and to close contacts 94, 96 thereby shunting the rectifier bridge 78. Opening of flame sensor switch contacts 98 and 100 also deenergizes the ignition time delay heater 60 allowing contacts 62, 64 to open after a predetermined time interval to deenergize the ignition transformer 16. Deenergization of ignition transformer 16 will cut off the igniter 24, and accordingly, the radio frequency signal generated in the pick-up coil 26 will terminate. However, since the rectifier bridge 78 is shunted by the resistor 92 and closed contacts 94, 96, the gaseous fuel valve solenoid coil 74 will remain energized. When the demand for heat has been satisfied the room thermostat switch 43 will open thereby deenergizing the motor control relay 46, thus open circuiting the primary winding 18 of the transformer 20 to shut down the unit.

The improved ignition control system precludes the admission of gaseous fuel in the event of ignition malfunction. Thus, if there is no spark at the igniter 24, the silicon controlled rectifier 88 will not be rendered conductive, and accordingly, the gas valve will remain closed. If the motor relay fails to operate, the furnace will likewise not operate since power will not be supplied to the primary winding 14 of the transformer 16. If there is no combustion after the gas valve has been opened, the flame sensor switch does not operate, and the safety switch comprising contacts 66, 68 will deenergize the safety control. Likewise, if there is no spark to the igniter 24 when the ignition is turned on, switch contacts 66, 68 will open after a 20 second interval to shut down the unit.

Accordingly, it is manifest that the improved safety ignition control operates to prevent the flow of gaseous fuel to the burner when there is no spark due to failure of the ignition transformer, either by way of a short circuit or by way of an open circuit. In addition, upon a failure of combustion the entire control will be shut down since the flame sensor switches will not be operated. Likewise, if there is a flame failure after initial ignition the flame sensor will return to the cold position as seen in FIGURE 1. Moreover, if there is a flame failure the gas valve will immediately close.

Referring to FIGURE 2, in the preferred embodiment the ignition transformer 16 includes the primary coil 14 and the secondary coil 22 wound on a magnetic core 112. The pick-up coil 26 is wound around the secondary winding 22. The secondary winding 22 is shown connected to the spark igniter 24 and the pick-up coil is connected to an amplifier which is constituted by the silicon controlled rectifier 88, and thence to the gas valve. In the modified embodiment shown in FIGURE 3 the ignition coil 16 likewise includes primary 14 and a winding 22 connected to the spark igniter 24, but in this instance a pick-up coil 26 is connected in series to the secondary winding 22. This pick-up coil 26 constitutes the primary of an additional transformer 114 having a secondary winding 116 connected through a capacitor 118 to the amplifier and the gas valve. The capacitor 118 is utilized to filter out the 60-cycle alternating current signal so that the amplifier responds only to the radio frequency signal induced by operation of the igniter 24.

While the embodiments of the present invention as herein disclosed constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. An ignition control system for a fluid fuel burner having an electrically activated fuel supply means including, a spark igniter, an electric power supply for energizing said spark igniter, a radio frequency detection means associated with said spark igniter in which a radio frequency signal is derived in response to operation of said spark igniter, a fuel control solenoid, a silicon controlled rectifier controlled full wave rectifier bridge means connecting said fuel control solenoid with said power supply when gated, circuit means connecting said radio frequency detection means with the gate of said silicon controlled rectifier so as to cause said fuel control solenoid to be energized when a radio frequency signal is detected by said detection means, flame sensor switching circuit means shunting said rectifier bridge means and operable to be closed responsive to fuel ignition to provide a shunt path around said bridge means so that said fuel control solenoid is maintained energized independent of the operative condition of said bridge means.

2. The ignition control system set forth in claim 1 wherein an ignition time delay means is provided for delaying energization of said spark igniter for a predetermined period of time after said control system has been activated.

3. The ignition control system as set forth in claim 2 wherein said ignition time delay means is also responsive to said flame sensor switching means, such that said ignition means is rendered inoperative after a predetermined period of time following fuel ignition.

References Cited by the Examiner

UNITED STATES PATENTS

1,924,304	8/1933	Breisky et al.	158—28
2,196,442	4/1940	Maynard	158—125 X
2,406,185	8/1946	Aubert	158—125 X
2,628,676	2/1953	Shottenfeld.	
2,662,591	12/1953	Hanson	158—28 X
3,161,759	12/1964	Gambill et al.	
3,181,032	4/1965	Myers	317—33

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