

[54] **IGNITION AND CONTROL SYSTEM FOR GAS BURNERS**

[75] Inventor: **Carl F. Fernstrom**, St. Louis, Mo.

[73] Assignee: **Emerson Electric Co.**, St. Louis, Mo.

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[58] Field of Search **431/66, 67**

[56] **References Cited**

UNITED STATES PATENTS

3,620,659	11/1971	Fox	431/66
3,597,139	8/1971	Elders	431/66

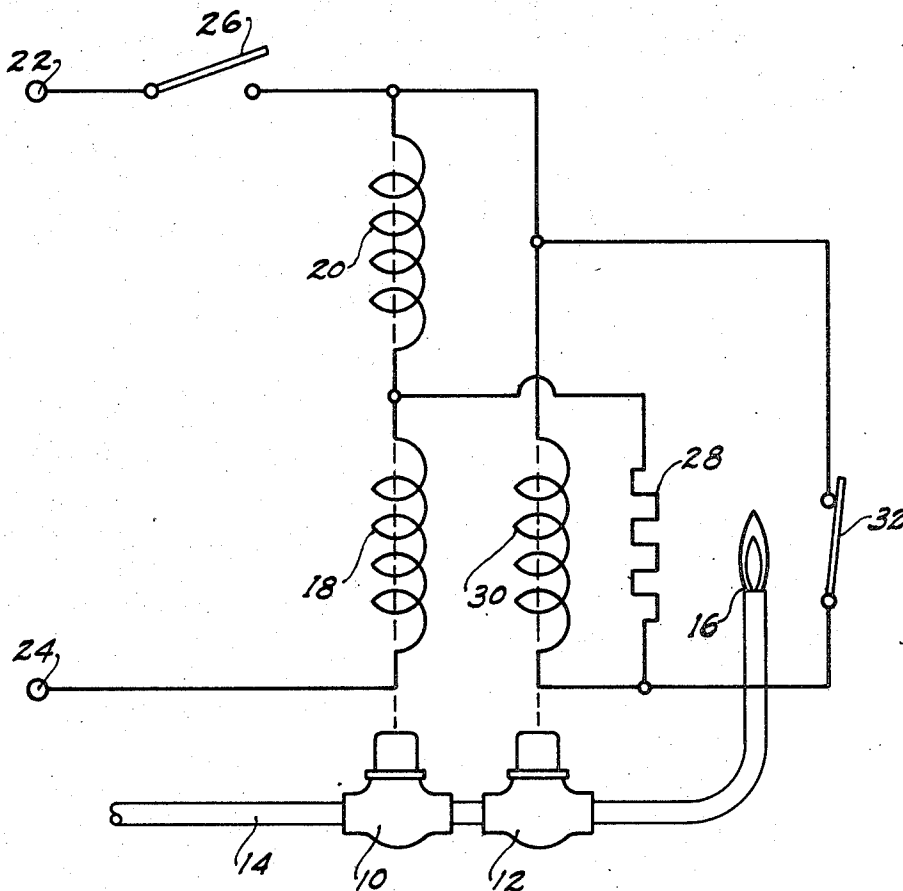
Primary Examiner—Edward G. Favors

Attorney, Agent, or Firm—Charles E. Markham

[57] **ABSTRACT**

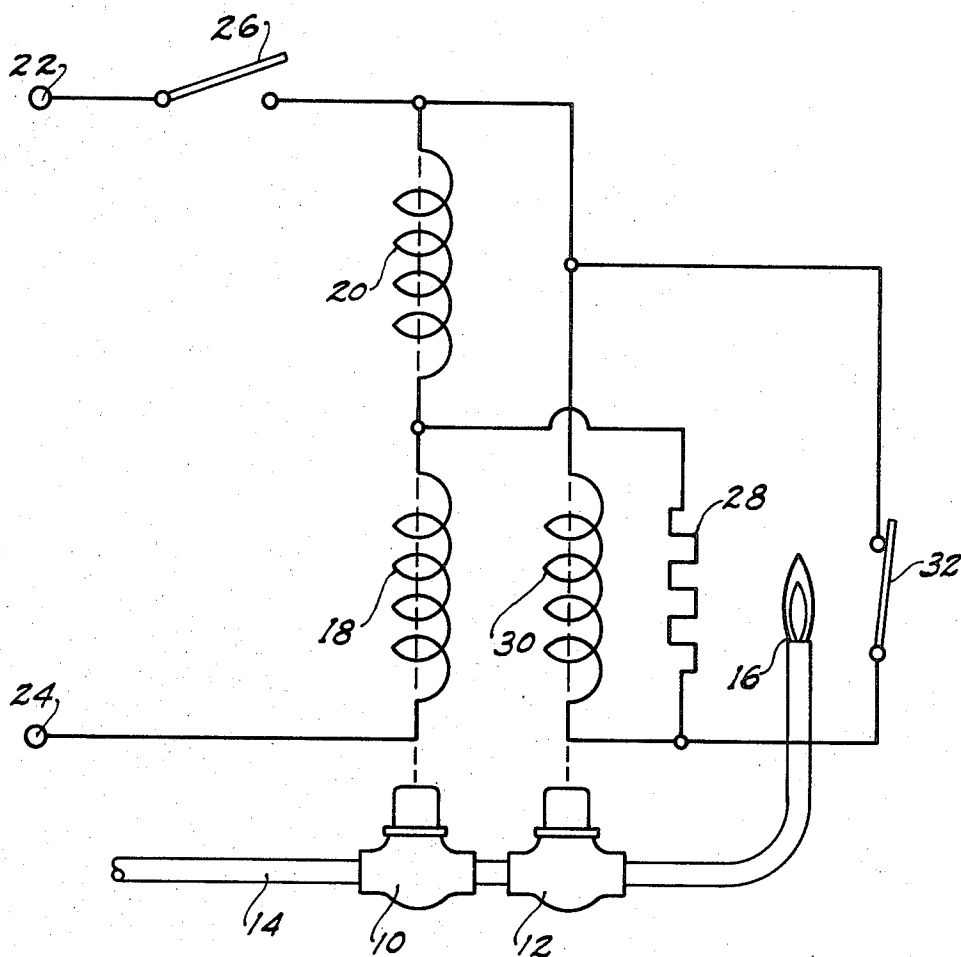
The system comprises a burner, a glow igniter, two series flow connected biased closed solenoid valves and a normally closed sensor switch. The first valve has two windings series connected across a power source, one winding having high impedance limits current flow and prevents opening of the valve. The other winding having low impedance is series connected with the igniter across the power source through a sensor switch causing the first valve to open and the igniter to heat. The second valve has a single winding in parallel with the sensor switch. When the igniter reaches ignition temperature, the sensor switch opens. This energizes the second valve winding and opens the valve and reduces current flow through the igniter and through the low impedance valve winding, which in conjunction with the high impedance winding holds the first valve open but will not pull it open. Burner flame maintains the sensor switch open.

6 Claims, 1 Drawing Figure



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INVENTOR
CARL F. FERNSTROM
BY *Charles E. Markham*
HIS AGENT

IGNITION AND CONTROL SYSTEM FOR GAS BURNERS

This invention relates generally to gas burner ignition and control systems, and particularly to those systems employing a glow igniter with sensor means operative to initiate the flow of gas to the burner only when the igniter has reached a gas ignition temperature and operative to maintain the flow thereafter only so long as burner flame is present.

Systems of this general character employing two solenoid operated fuel valves connected in series in the fuel supply line are shown and described in U.S. Pat. Nos. 3,589,846 and 3,597,139.

An object of this invention is to provide a generally new and improved system of this kind which provides assurance that neither of the series flow connected valves will be opened unless electrical current is flowing through the igniter.

A further object is to provide a system of this kind in which at least one of the series flow connected solenoid valves will not open unless the current flow through the igniter is sufficient to result in its being heated to ignition temperature.

Further objects and advantages will appear from the following description of a preferred form of the invention when read in connection with the accompanying drawing.

The single FIGURE of the drawing is a diagrammatic representation of a burner ignition and control system constructed in accordance with the present invention.

Referring to the drawing, first and second biased closed solenoid operated valves 10 and 12 are connected in series in a fuel supply conduit 14 leading to a burner 16. First valve 10 has two solenoid windings 18 and 20 connected in series with a thermostat 26 across terminals 22 and 24 of a power supply having a predetermined nominal voltage. Winding 18 is also connected in series with a glow igniter 28 and a solenoid winding 30 of the second valve 12 across power supply terminals 22 and 24 through thermostat 26.

A normally closed sensor switch 32 connected across the solenoid winding 30 shunts this winding so that when sensor switch 32 is closed only solenoid winding 18 and glow igniter 28 are effectively series connected across the power supply. Solenoid windings 18 and 20 of valve 10 are wound on the same spool surrounding the solenoid plunger, and both generate flux tending to pull the valve 10 open when they are energized. The winding 20 has high impedance and is not capable of generating sufficient flux alone to open valve 10 against its bias. Series connected winding 18, on the other hand, has quite low impedance. Sufficient current flow through series connected windings 18 and 20 to effect opening of valve 10 is precluded, however, by the impedance of winding 20.

Glow igniter 28 requires a predetermined current flow therethrough to insure that it will attain ignition temperature, and solenoid winding 18 is so designed as to require substantially this predetermined current flow therethrough to develop in conjunction with winding 20 sufficient flux to pull open valve 10. The normally closed sensor switch 32 is disposed with relation to igniter 28 so as to respond to the radiant energy thereof and open when the igniter reaches gas ignition temperature. Sensor switch 32 is also disposed with relation to the burner 16 so as to be maintained in an open position in response to the radiant energy of the burner flame when the igniter drops below ignition temperature.

tion in response to the radiant energy of the burner flame when the igniter drops below ignition temperature.

The solenoid winding 30 of valve 12 is designed so as to pull open the valve when it becomes effectively connected in series with solenoid winding 18 and igniter 28 upon opening of the shunting sensor switch 32. The total impedance of series connected solenoid winding 18, glow igniter 28, and solenoid winding 30 is such that current flow through igniter 28 and winding 18 is reduced considerably when sensor switch 32 opens. This reduced current flow through winding 18 results in the reduction of flux generated thereby to a value below that which, even in conjunction with flux generated in high impedance winding 20, is sufficient to pull open valve 10 against its bias. However, the flux jointly developed by these two windings under these conditions is sufficient to hold valve 10 in open position. The reduction in current flow through igniter 28, which occurs when sensor switch 32 opens, also results in a drop in the temperature of the igniter to a point below that which will maintain sensor switch 32 in an open position. The switch 32 will, however, remain open under these conditions in response to the radiant energy of burner flame if it exists.

It is essential, of course, that the igniter temperature remain sufficiently high to ignite gas for the short period of time required for gas to flow from the valves to the burner following the opening of sensor switch 32. To meet this requirement, a glow igniter having sufficient mass to retain an ignition temperature for this short period may be employed, or the sensor switch may be calibrated to open at some temperature above ignition temperature, or both of these expedients may be employed.

NORMAL OPERATION

When thermostat 26 closes in response to a requirement for burner operation, low impedance winding 18 and igniter 28 are series connected across the power source through closed sensor switch 32. This causes heating of the igniter 28 and the opening of valve 10. When igniter 28 reaches gas ignition temperature, the sensor switch 32 opens. The opening of sensor switch 32 places solenoid winding 30 in series with winding 18 and igniter 28, causing valve 12 to open. Gas now flows to burner 16 and is ignited.

The opening of sensor switch 32 also results in a considerable reduction in current flow through igniter 28 and, consequently, a considerable drop in the temperature thereof, but the radiant energy of the now existing burner flame maintains the sensor switch open. The burner now continues to operate normally until the thermostat 26 opens. Opening of sensor switch 32 further results in such reduction of current flow through winding 18 so that the flux now jointly developed in windings 18 and 20 is sufficient only to hold valve 10 open and not sufficient to pull it open.

ABNORMAL CONDITIONS

If the sensor switch 32 fails to close during a period of inoperation of the burner, the valve 10 will not open upon subsequent closure of the thermostat because of the impedance of winding 30, which would be in series with winding 18 and igniter 28 under these conditions.

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Even though sensor switch 32 is closed, valve 10 will not open upon closure of the thermostat unless sufficient current is flowing through winding 18 and the series connected igniter 28 to result in its attaining ignition temperature. Insufficient current flow may occur due to low power supply voltage, a local area of high resistance to the igniter, or poor lead connections.

If during normal operation of the burner the electrical power supply is interrupted, causing valves 10 and 12 to close and the burner flame to be extinguished, valve 10 will not reopen upon a resumption of power until sensor switch 32 cools and closes. This provision prevents the flow of unburned gas from the burner if power is restored during the period required for the sensor switch to cool and close and for the igniter to again reach ignition temperature.

By requiring that current flow through igniter 28 and series connected solenoid winding 18 be sufficient to result in the igniter attaining ignition temperature before valve 10 is opened, an unsafe condition is prevented, which may otherwise occur if sensor switch 32 opens in response to an igniter temperature below that required to ignite gas.

I claim:

1. In an ignition and control system for gas burners, a burner, first and second biased closed solenoid operated valves arranged in series in a gas supply conduit leading to said burner, a solenoid winding for each of said valves, a glow igniter, and a normally closed sensor switch which opens when said igniter reaches gas ignition temperature and is maintained open thereafter by burner flame, circuit connections series connecting said first valve winding, said glow igniter, and said second valve winding across a power source and circuit connections connecting said sensor switch across said second valve winding, thereby shunting it when said switch is closed, said first valve winding being operative to effect opening of said first valve only when said sensor switch is closed and the current flow through said first valve winding and said series connected igniter is sufficient to heat said glow igniter to gas ignition temperature, and said second valve winding being operative to open said second valve when said sensor switch opens.

2. The ignition and control device claimed in claim 1 in which the current flow through said first valve winding and said igniter is reduced below that required to open said first valve and below that required to maintain said igniter at ignition temperature when said sensor switch opens, and in which said sensor switch is maintained in open position jointly by burner flame and the heat of said igniter.

3. In an ignition and control system for gas burners, a burner, first and second biased closed solenoid operated valves arranged in series in a gas supply conduit leading to said burner, a high impedance solenoid winding and a low impedance solenoid winding for said first valve connected in series across a power supply, a solenoid winding for said second valve, a glow igniter, and a normally closed sensor switch which opens when said igniter reaches gas ignition temperature, circuit

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connections connecting said first valve low impedance winding, said glow igniter, and said second valve winding in series across said power supply and in parallel with said high impedance winding, circuit connections connecting said sensor switch across said second valve winding thereby shunting it when said switch is closed, said series connected high and low impedance windings being jointly capable of opening said first valve only when said sensor switch is closed and when sufficient current is flowing through said low impedance winding and said series connected igniter to heat said igniter to gas ignition temperature, and said second valve being opened when said sensor switch opens, said series connected high and low impedance windings being capable of holding said first valve open when said sensor switch is open, and said sensor switch being maintained in open position by burner flame.

4. The ignition and control device claimed in claim 3 in which the total impedance of the series connected first valve low impedance winding, the glow igniter, and the second valve winding is such when said sensor switch opens as to result in a substantial reduction in the temperature of said igniter.

5. The ignition and control device claimed in claim 3 in which said first valve low impedance winding has relatively few turns and in which the total impedance of the series connected low impedance winding, the glow igniter, and the second valve winding is such when the sensor switch opens that said low impedance winding provides only a relatively small portion of the magnetic force required to hold said first valve open.

6. In an ignition and control system for gas burners, a burner, an electrical power source, first and second biased closed solenoid operated valves arranged in series in a gas supply conduit leading to said burner, a solenoid winding for each of said valves, a glow igniter, and a normally closed sensor switch which opens when said igniter reaches ignition temperature and is thereafter maintained open by burner flame, circuit connections connecting said first valve winding in series with said glow igniter and with said second valve winding across said power source, and circuit connections connecting said sensor switch across said second valve winding thereby shunting it when said switch is closed, a second solenoid winding for said first valve, said windings for said first valve being series connected across said power source and being jointly operative to effect opening of said first valve only when said sensor switch is closed and when sufficient current is flowing through said igniter to heat it to ignition temperature, and said second valve winding being operative to open said second valve only when said sensor switch opens, the total impedance of said series connected first and second valve windings and said igniter being such when said sensor switch is open that the current flow through said first valve winding is reduced below that required to hold said first valve open and both windings of said first valve being jointly operative to hold said first valve open when sensor switch opens.

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