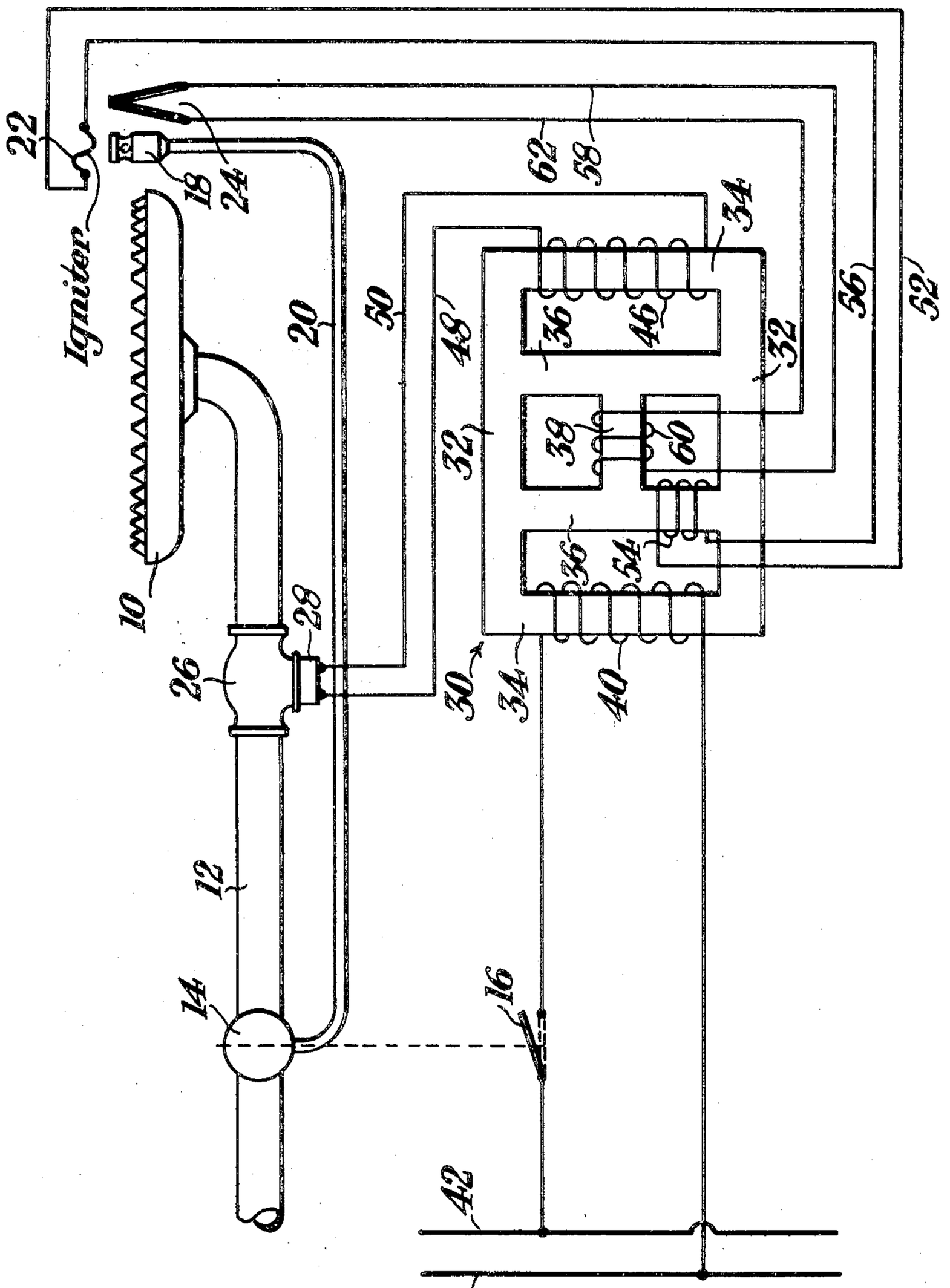
Oct. 25, 1949. R. C. MAIN 2,486,306

SAFETY CONTROL AND IGNITION SYSTEM FOR FUEL BURNERS

Filed Dec. 20, 1946



INVENTOR
Robert C. Main.
BY
Albert J. Henderson
HIS ATTORNEY

Patented Oct. 25, 1949

2,486,306

UNITED STATES PATENT OFFICE

2,486,306

SAFETY CONTROL AND IGNITION SYSTEM FOR FUEL BURNERS

Robert C. Main, Los Angeles, Calif., assignor to Robertshaw-Fulton Controls Company, a corporation of Delaware

Application December 20, 1946, Serial No. 717,397

5 Claims. (Cl. 158—117.1)

1

This invention relates to safety control and ignition systems for fluid fuel burners and, more particularly, to electrically operated systems therefor.

In systems of the foregoing type, it has been proposed to use alternating current from a commercial source of supply for energizing an electromagnetic control means, such as a solenoid fuel valve through a transformer, while depending upon direct current from a thermoelectric device, such as a thermocouple exposed to the burner flame for shifting the magnetic flux in the transformer to provide desired safety control.

An object of the present invention is to preserve the safety control features of existing systems while incorporating automatic electric igniting means for the fuel.

Another object of the invention is to deenergize the igniting means after the burner has produced a flame and the safety control is in operation.

Another object of the invention is to energize both the fuel controlling means and the igniting means through the same transformer.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawing which is a schematic representation of the improved safety control and ignition system in conjunction with a fluid fuel burning apparatus.

Referring more particularly to the drawing, the main burner 10 is shown as being supplied with fuel from a main fuel pipe 12 under control of a main fuel valve or cock 14 which, if desired, may also incorporate a thermostatic device (not shown) responsive to temperatures caused by operation of the main burner 10 for controlling the operation thereof. The main fuel cock 14 also includes a main switch 16 which is operated to closed position when the main fuel cock is opened and is normally open when the main fuel cock is closed.

A pilot burner 18 is located in proximity of the main burner 10 to ignite the fuel flowing therefrom and is supplied with fuel by a conduit 20 under control of the main fuel cock 14. Electric igniting means 22, preferably in the form of a coil of resistance wire is located in lighting proximity to the pilot burner 18 to ignite the fuel issuing therefrom. Thermoelectric means in the form of a thermocouple 24 is located in proximity of the pilot burner 18 and is responsive to the heat of the flame therefrom for a purpose to be more fully described hereinafter.

Electrically operable means is provided for controlling the flow of fuel to the main burner 10

2

and may take the form of an electromagnetic or a solenoid valve 26 normally biased to closed position by gravity, spring or the like means, to prevent the supply of fuel to the main burner 10. The valve 26 has an energizing coil 28 operatively associated therewith for causing it to open when electric energy of sufficient value is supplied to the coil 28. As will be apparent, the supply of fuel to the main burner 10 is under control of both the main fuel cock 14 and the solenoid valve 26 while the supply of fuel to the pilot burner 18 is under control of the main fuel cock 14 only.

A transformer 30 is shown as comprising a saturable core having a plurality of paths for the magnetic flux. In this embodiment, the transformer 30 has a pair of oppositely disposed side legs 32 connected by a pair of end legs 34 to form a first path for the magnetic flux. A second pair of end legs 36 is connected to the side legs 32 intermediate the end legs 34 and, together with a connecting leg 38 extending between the intermediate end legs 36, constitutes a shunt path for the magnetic flux.

A line voltage primary winding 40 is positioned on one of the end legs 34 and is connected at one end through the main switch 16 to a line wire 42 and at the opposite end to a line wire 44. While any suitable voltage may be employed, depending on the voltage of the power source available, the primary winding 40 in this instance is connected to a 110-volt source of alternating current supply. A secondary winding 46 is positioned on the opposite leg 34 of the transformer 30 and is connected at one end by a wire 48 to one terminal of the coil 28 and at the opposite end by a wire 50 to the other terminal of the coil 28. The secondary winding is thus adapted for energizing the coil 28 of the valve 26 and overcoming the bias thereof in response to the magnetic flux in the first path produced by the alternating current supply in the circuit of the primary winding 40 as will be more apparent hereinafter.

The igniting means 22 has one terminal connected by a wire 52 to one end of a winding 54 and the other terminal connected by a wire 56 to the opposite end of the winding 54. The winding 54 is positioned on the intermediate end leg 36 adjacent the winding 40 and is adapted for energizing the igniting means 22 in response to the alternating current flux in the shunt path as will be more apparent hereinafter.

The thermocouple 24 has one terminal connected by a wire 58 to one end of a winding 60 which has its opposite end connected by a wire

62 to the other terminal of the thermocouple 24. The winding 60 is positioned on the connecting leg 38 between the intermediate end legs 36 and is energizable by the thermocouple 24 for producing a direct current flux for saturating the shunt path when the thermocouple 24 is sufficiently heated.

In the operation of the system, the various elements may be assumed to be in the position shown and described, wherefore the system is inoperative. The fuel supply for the burners 10 and 18 and the electric energy supply to the primary winding 40 of the transformer 30 are turned on simultaneously by operation of the main fuel cock 14. Thus, fuel will flow in the conduit 20 to the pilot burner 18 and the transformer 30 will be energized. As the solenoid valve 26 is biased closed there is no flow of fuel in the main fuel pipe 12 to the main burner 10 at this time.

The transformer 30 is so constructed that the magnetic flux path will be through the shunt path constituted by the end leg 34 carrying the winding 40, a portion of one side leg 32, the intermediate end leg 36 carrying the winding 54, and back through a portion of the other side leg 32 to the end leg 34 first mentioned. Thus, as long as the thermocouple 24 is unheated by a flame from the pilot burner 18, the alternating current flux in the shunt path just traced will serve to energize the igniting means 22 through the described circuit. The fuel flowing from the pilot burner 18 is consequently ignited as soon as the igniting means 22 reaches igniting temperature.

The flame from the pilot burner 18 serves to heat the thermocouple 24 sufficiently to produce a direct current flux which saturates the intermediate end legs 36 and the connecting leg 38. Consequently, the alternating current flux in the shunt path is shifted to the first path constituted by the end leg 34 upon which winding 40 is positioned, one side leg 32, end leg 34 upon which secondary winding 46 is positioned, and the other side leg 32 back to the end leg 34 first mentioned.

As the alternating current flux is now confined to the first path, the coil 28 of the solenoid valve 26 becomes energized from the secondary winding 46. Fuel is then permitted to flow to the pilot burner 10 where it is ignited by the flame from the pilot burner 18. Meanwhile, the shift in the magnetic flux path of the circuit of the primary winding 40 has caused the circuit of the winding 54 including the igniting means 22 to become deenergized. It is apparent, therefore, that the electrically operable fuel control means comprising solenoid valve 26 is energized alternatively to the igniting means 22. Thus, during normal running period of the main burner 10, the igniting means 22 remains deenergized and the useful life thereof is prolonged.

In the event that the flame from the pilot burner 18 is extinguished, then the thermocouple 24 will cool and cause the circuit of the winding 60 to become deenergized. The magnetic flux set up by the circuit of the alternating current winding 40 ceases to be confined to the first path for energizing the circuit of the coil 28 of the solenoid valve 26. The solenoid valve 26 then closes under its bias and the fuel flowing to the main burner 10 is shut-off. However, upon this occurrence the alternating current flux again takes the easiest path through the shunt path described and the circuit of the igniting means 22 becomes energized. Thus, the system is automatically recycling as long as the main switch 16 remains closed.

It will be apparent that many changes may be made in the details of construction and arrangement of parts herein shown and described. For example, the pilot burner 18 could be dispensed with and manual means employed for holding the solenoid valve 26 open during the time that the thermocouple 24 is becoming heated by a flame at the main burner 10. This and other changes could be made within the scope of the appended claims without departing from the invention.

I claim:

1. A safety control and ignition system for fuel burning apparatus, comprising electrically operable means for controlling a fuel supply to be burned, a transformer having a core with primary and secondary windings thereon and a plurality of paths for magnetic flux, means connecting said primary to a source of current supply, means connecting said secondary for controlling said electrically operable means in response to the magnetic flux in one of said paths, electric igniting means for the fuel and being operable in response to the magnetic flux in another said path, and means responsive to the presence and absence of heat of the burning fuel for causing said magnetic flux to shift respectively between said one and the other of said paths to effect operation of said electrically operable means and said igniting means alternatively.

2. A safety control and ignition system for fuel burning apparatus, comprising electrically operable means for controlling a fuel supply to be burned, a transformer having a core with primary and secondary windings thereon and a plurality of paths for magnetic flux, means connecting said primary to a source of current supply, means connecting said secondary for controlling said electrically operable means in response to the magnetic flux in one of said paths, electric igniting means for the fuel and being operable in response to the magnetic flux in another said path, and thermoelectric means subject to the heat of the burning fuel and responsive to temperature changes caused by the presence and absence of said heat for producing or not producing respectively a second magnetic flux in said other path, said second magnetic flux being adapted for confining the first said magnetic flux to said one path so that operation of said electrically operable means and said igniting means is effected alternatively in response to said temperature changes.

3. A safety control and ignition system for fuel burning apparatus, comprising electrically operable means for controlling a supply of fuel to be burned, a transformer having a core with primary and secondary windings thereon and a plurality of paths for magnetic flux including a shunt path, means connecting said secondary for controlling said electrically operable means in response to the magnetic flux in one of said paths, electric igniting means for the fuel and being operable in response to the magnetic flux in said shunt path, and thermoelectric means subject to the presence and absence of heat of the burning fuel and responsive to temperature changes caused thereby for producing or not producing respectively a second magnetic flux in said shunt path, said second magnetic flux being adapted for confining the first said magnetic flux to said one path so that operation of said electrically operable means and said igniting means is ef-

fected alternatively in response to said temperature changes.

4. A safety control and ignition system for fuel burning apparatus having main and pilot burners, comprising electrically operable means for controlling a fuel supply to the main burner, a transformer having a core with primary and secondary windings thereon and a plurality of paths for magnetic flux including a shunt path, means connecting said primary to a source of current supply, means connecting said secondary for controlling said electrically operable means in response to the magnetic flux in one of said paths, electric igniting means for the pilot burner and being operable in response to the magnetic flux in said shunt path, and means responsive to the heat of a flame at the pilot burner for causing said magnetic flux to be confined to said one path to effect operation of said electrically operable means and to render said igniting means inoperative.

5. A safety control and ignition system for fuel burning apparatus having main and pilot burners, comprising an electro-magnetic valve means for controlling a supply of fuel to the main burner and being biased to prevent said supply, a transformer having a core with primary and secondary windings thereon and a plurality of paths for magnetic flux including a first path and a shunt path, means connecting said primary to a source of alternating current supply, means connecting said

secondary for energizing said valve and overcoming said bias thereof in response to the magnetic flux in said first path produced by said alternating current supply, electric igniting means for the pilot burner, a winding connected to said igniting means for energizing the same in response to the alternating current flux in said shunt path, thermoelectric means subject to the heat of a flame at the pilot burner, and a winding connected to said thermoelectric means and energizable thereby when said thermoelectric means is heated by the flame for producing a direct current flux in said shunt path and causing the alternating current flux to be confined to said first path to effect energization of said valve and deenergization of said igniting means.

ROBERT C. MAIN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,117,820	O'Hagan	May 17, 1938
2,143,076	Koerner	Jan. 10, 1939
2,238,892	Fanger	Apr. 22, 1941
2,243,602	Lange	May 27, 1941
2,301,446	Ott	Nov. 10, 1942
2,306,578	Wetzel	Dec. 29, 1942