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SPARK IGNITION SYSTEM FOR GAS BURNERS WITH IGNITION INDICATOR

Filed March 26, 1962

FIG. 2.

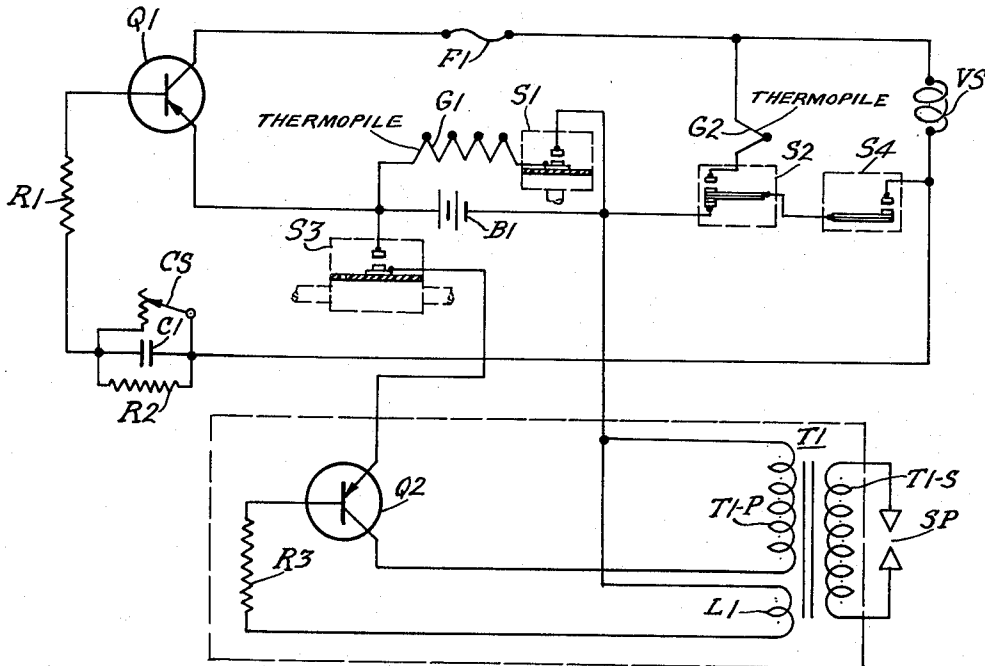
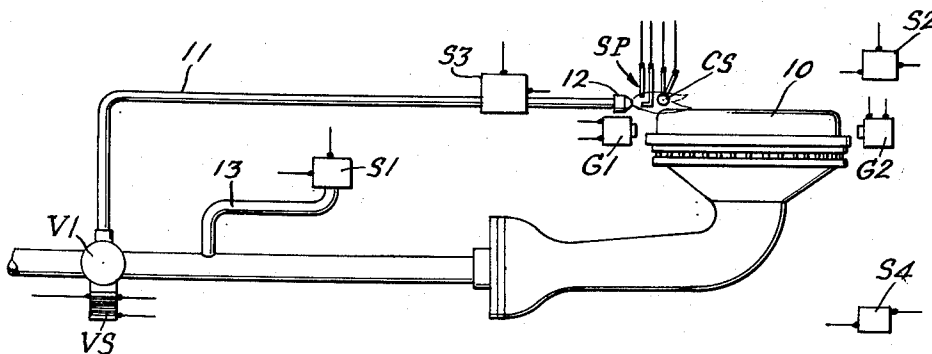


FIG. 1.



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SPARK IGNITION SYSTEM FOR GAS BURNERS WITH IGNITION INDICATOR

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2 Claims. (Cl. 158-123)

This invention relates to an ignition system for gas burners of the kind described in my copending application Serial No. 182,279, filed March 26, 1962. That system comprises a self-powered power-regenerating organization in which a capacitor is used to cut off the igniting operation if the burner is not lighted and brought up to a circuit-establishing condition before the capacitor acquires a charge of cut-off magnitude. That is, a time contest is established between the charging cut-off capacitor and the heat-energized circuit establishing means.

According to the present invention, means are provided for more quickly detecting successful ignition at the pilot burner and thereupon rendering the cut-off device ineffective whereby the circuit-establishing devices will have as much time as may be needed to complete the holding circuit.

It is therefore an object of the invention to provide a pre-sensing ignition-indicating device which will render a time-responsive cut-off device inoperative in case a reliable ignition condition is established.

Specifically, a device which changes quickly from a high resistance condition to a low resistance condition in the presence of a small amount of heat is provided to shunt out the cut-off timing capacitor as soon as a pilot flame has been reliably established at the burner.

The above and other objects of the invention as well as certain features of novelty and advantages will be apparent from the following description of an exemplary embodiment, reference being made to the accompanying drawings, wherein:

FIG. 1 is a semi-diagrammatic view of a burner and ignition system embodying the invention; and

FIG. 2 is a wiring diagram.

Inasmuch as the present system is based on the system of the copending application that system will first be described. Most of the explanations of the details of the basic system and their advantages will be found in the other application and only a brief description is needed here.

A main gas burner 10 is supplied with gas by a main gas valve V1 which is controlled by a solenoid VS. The main gas valve V1 which is controlled by the solenoid, when open, supplies gas by a branch or bleed line 11 to a pilot gas burner 12, the pilot burner being of the flame thrower type which projects a flame to the main burner.

The fuel of the pilot burner is ignited by a spark device or igniter SP (a model airplane spark coil system will serve to operate the igniter) which is disposed in the path of the jet of gas from the pilot burner. The spark device is energized for the short time necessary by a pressure actuated switch S3 which is momentarily closed by the flow of gas in the pilot burner pipe line 11. A variety of conventional arrangements for providing such momentary closing of switch S3 will readily occur to one skilled in the art; for example only, one may employ an ordinary diaphragm-type switch having a small bleeder hole through the diaphragm so that, after initial actuation of the switch by turning on of the gas, the pressure on opposite sides of the diaphragm will equalize and the switch re-open. Disposed in a position to derive heat from the burner are a thermostat heat switch S2, a thermopile battery charging generator G1, and a pilot valve operating generator G2.

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There is also a rapid acting heat responsive capacitor shunting element CS, with which the present invention is concerned, disposed in the path of the jet flame from the pilot burner 12 and also in a position to be heated by the flame of the main gas burner.

The generator G1 is cut into circuit by a pressure-operated switch S1 which is operated and kept closed by gas pressure in a branch line 13 when the main burner valve V1 is turned on. A space heat-demand thermostat switch S4 initiates the operation of the entire system.

The spark device SP is supplied with current by the secondary T1-S of a transformer or spark coil T1 having a primary T1-P supplied with current (initially) from a battery B1 through a high-frequency oscillator transistor Q2.

The oscillator transistor Q2 causes a rapid build-up and collapse of a magnetic field (T1) which induces a voltage in the high-voltage secondary of the transformer to create a gas-igniting spark discharge at the electrode gap SP.

A winding L1 of the transformer produces a feed-back oscillation-producing voltage at the base of the transistor Q2, the feed-back path including a series resistor R3.

The generator G1 is in shunt with the battery B1 so that when the switch S1 is closed by gas pressure after the valve V1 is opened the battery will be recharged as soon as the thermopile current generating device G1 is made operative by heat created at the burner.

A capacitor C1 is in circuit with the solenoid VS of the main valve V1, the circuit being in shunt with the circuit through the battery for the solenoid VS of the valve V1 and the circuit through the battery for the spark igniter elements Q2, T1, etc.

A transistor Q1, which acts as an electronic switch, is in circuit with the solenoid VS of the valve V1 and the bias base of the transistor is in circuit with the capacitance C1 and a series resistance R1. A shunt resistance R2 assists in timing the build-up of the charge on the capacitor and also later bleeds off the capacitor charge in preparation for the next operation.

The heat responsive switch S2 is a snap-type single pole two-way device which when cold allows current to flow through from the battery B1 and when hot cuts out the battery and causes current to flow through the pilot generator G2 which operates the solenoid VS of the valve V1. A safety fuse F1 is placed in the line from the electrical valve Q1 to the solenoid VS of the gas valve V1.

In operation, as so far described and for the present omitting reference to the pilot heat-operated capacitor shunt CS, when the heat-demand or control switch S4 closes it puts the transistor Q1 in circuit with the battery B1 and the solenoid VS of the main gas valve V1 to open the valve. The capacitor C1 in the shunt circuit begins to take a charge so as to act as a timer for the transistor Q1. Within a predetermined time, say 25 seconds, the capacitor, which is connected to the base of the transistor to apply a cut-off bias thereto, will be charged to the cut-off point and will render the transistor non-conductive.

During the same time that the capacitor is being charged to the cut-off point ignition should have been effected to heat the thermal switch S2 to shift from battery to generator operation of the solenoid VS of the valve V1 to hold the valve open.

If switch S2 does not so operate before capacitor C1 has caused Q1 to cut off current to the solenoid VS, the valve V1 will close and the gas pressure-operated switches S1 and S3 will open to shut down operation. This will be an indication that the ignition cycle has been ineffective and the entire starting operation will remain shut down.

It is planned that the heat-operated generator G2 will be fully activated before the heat switch S2 snaps over from its battery contact to its generator contact.

If successful ignition has been effected before the capacitor receives its full bias cut-off charge, the good order

of the system will have been established and the generator G1 will charge the battery B1 due to the flame heating of the generator G1. Actually, then, the active time of operation of the battery is very short and in normal operation it is kept fully charged.

Returning to the function of the pilot flame-responsive capacitor shunting element CS heretofore described and which is specially added by the present invention, there are, as mentioned, certain conditions where the pilot burner flame has actually been produced and a flame established at the main burner but where the heat-responsive switch S2 has not been operated prior to cut-off time at the capacitor.

In such a case the capacitor shunt CS, which responds almost immediately to the heat of the pilot flame and main burner flame will shunt out the capacitor and keep the circuit through the battery B1 and transistor Q1 alive until the other heat-responsive elements have time to act. They can now be designed more ruggedly and with less required precision than before when they were required to act before the cut-off by the transistor switch action.

While a well protected quick-acting heat-responsive thermostat-type switch may be used to shunt out the capacitor if heat has been generated, inasmuch as a shunt resistor R2 is already provided at the capacitor, there are other devices which can be placed in the path of the pilot flame to shunt out the capacitor as soon as a pilot flame appears. One such device, here illustrated, has adjacent but slightly spaced apart conductors sealed in a small globule of glass having added in its composition certain ingredients which cause a very high resistance to exist between the conductors or electrodes when cold and cause a very low resistance to appear when heated.

If there is no flame at the pilot burner the device CS will have no effect on the capacitor.

There is an added advantage in the use of a low-mass rapidly-heated capacitor cut-out of this type and that is that the size and time of action of the capacitor can be reduced so that it will time out operations in a shorter time, say 5 seconds, instead of the 25 seconds previously used, in case of failure to produce a flame.

It is thus seen that the present invention by very simple, inexpensive and reliable means has improved the basic ignition system in such a way that there is a greater chance of successful starting if any ignition at all has been effected.

While one embodiment of the invention has been described for purposes of illustration, it is to be understood that there may be various embodiments and modifications within the general scope of the invention.

I claim:

1. In an automatic ignition gas burner system comprising a gas burner; a source of supply of gas for said burner; a normally closed gas valve supplied with gas from said source and having a control element responsive to electrical current to open said valve and supply gas to said burner; a rechargeable battery; a control switch; a first thermally responsive double-throw switch positioned adjacent said burner so as to be heated by flame from said burner when said burner is ignited, said first thermally responsive switch being closed to its first position in the absence of flame from said burner and responsive to flame from said burner to change from its first position to its second position; electronic switch means having a control electrode responsive to changes in voltage applied thereto to turn said electronic switch means on and off; a resistance-capacitance timing circuit connected to said control

electrode for permitting said electronic switch means to turn on upon initial flow of current through said switch means and then automatically to turn off after an interval the duration of which is determined by the value of resistance in said timing circuit; circuit means connecting said control switch, said thermally responsive double-throw switch, said electronic switch means, said battery and said valve control element in common series circuit with each other so that closing of said control switch in the absence of flame from said burner causes current initially to pass through said series circuit to open said valve and supply gas to said burner and, after said interval, to interrupt said current thereby to permit said valve to return to its normal closed state if said flame is still absent from said burner; gas igniter means for said burner; means for operating said igniter means when said gas is supplied to said burner; a thermo-electric current generator positioned to be heated by flame from said burner and connected in common series circuit with said control switch, with said first thermally responsive switch and with said valve control element so that when said control switch is closed, when said first thermally responsive switch is in said second position thereof, and when said thermo-electric current generator has been sufficiently heated by said flame, said generator supplies current to said valve control element to hold said valve open so long as said flame persists, said thermo-electric generator responding to heating by said flame to develop a current through said valve control element which is sufficient to hold said valve open before said first thermally responsive switch changes from said first position to said second position thereof:

the combination therewith of temperature-sensitive resistance means connected in said timing circuit to control said duration of said interval for which said electronic switch means is on, said temperature-sensitive resistance means being positioned to be heated by flame from said burner and having a temperature characteristic such as to respond quickly to said heating to increase the duration of said interval for which said electronic switch means is on beyond the time required for said first thermally responsive switch to operate in response to heating by said flame.

2. The system of claim 1, in which said timing circuit comprises a capacitor, a resistor, means for charging said capacitor by way of said resistor, and means connecting said temperature-sensitive resistance means in parallel with said capacitor, said temperature-sensitive resistance means having a negative temperature coefficient of resistance.

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