

Sept. 21, 1943.

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2,329,888

ELECTRICAL IGNITION SYSTEM FOR GASEOUS FUEL BURNERS

Filed May 7, 1941

Fig. 1.

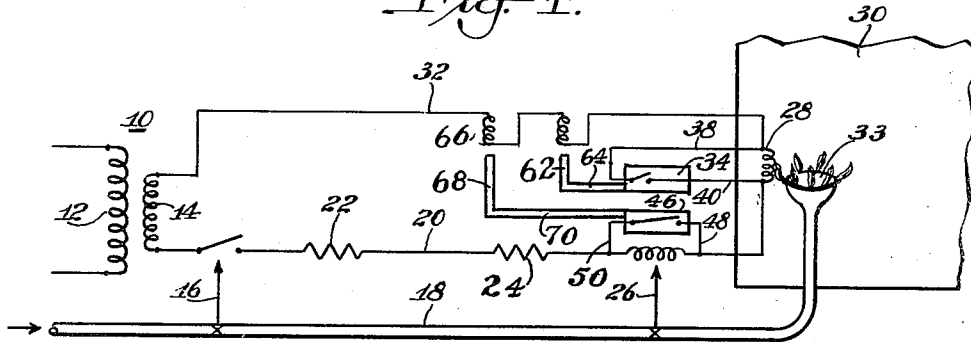


Fig. 2.

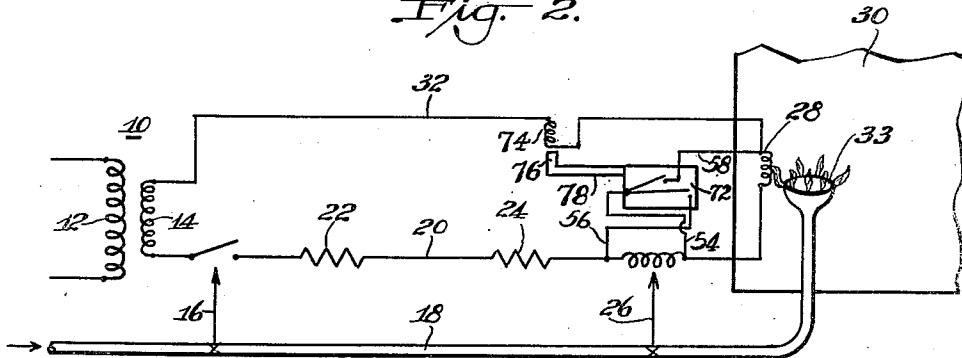
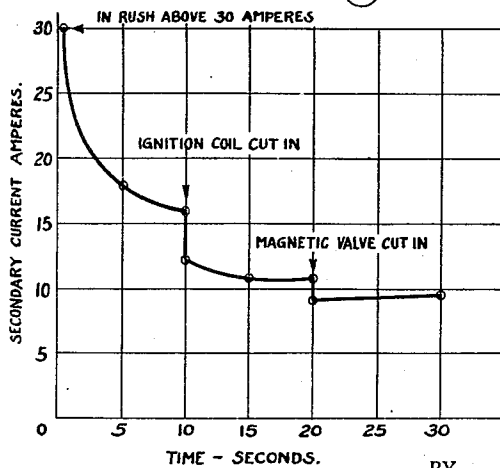


Fig. 3.



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UNITED STATES PATENT OFFICE

2,329,888

ELECTRICAL IGNITION SYSTEM FOR GASEOUS FUEL BURNERS

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Application May 7, 1941, Serial No. 392,288

8 Claims. (Cl. 175—115)

This invention relates to ignition systems and, more particularly, to electrical ignition systems for gaseous fuel burners.

In systems employing electrically heated wires for ignition of a gaseous fuel burner, it is necessary to heat the wire to incandescence in order to obtain a flame at the burner. The line voltage of commercial current is subject to fluctuation in most localities and also varies between different sections of the country. Such variations obviously cause changes in the current supplied to the ignition device unless means are provided in the circuit of the secondary coil of the usual transformer to maintain substantially constant current flow and protect the ignition wire against excessive current values.

Resistors which increase in temperature with increases in the current, and thus increasing their resistance, are well known. It has been proposed to include such so-called ballast resistors in the circuit with the secondary coil of the usual transformer and in series with the ignition device, in order to regulate the current which flows to the igniter. In this manner, changes in the line voltage, causing changes in the current, are utilized to alter the resistivity of the ballast resistor to control the current in the circuit within relatively narrow limits.

It has been found, however, that the use of a ballast resistor to regulate the current results in high inrush current before the resistor can heat sufficiently. Although this inrush is of momentary duration, it may heat the igniter wire to a temperature close to the fusion point. Hence, while the regulation of the current by such devices is of considerable value, the disadvantage of the high inrush current detracts therefrom.

It is an object of this invention to regulate the current flow within close limits while preventing any inrush from reaching the ignition device.

Another object of this invention is to prevent continued flow of fuel upon failure of the electric circuit of the system or of the power supply.

Another object of the invention is to permit the igniter wire to reach igniting temperature before fuel is supplied to the burner.

Another object of the invention is to ensure satisfactory ignition of the fuel at the lowest voltage which may be encountered.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawing, wherein:

Fig. 1 is a schematic view of a fuel burner and

associated parts in conjunction with a wiring diagram of the ignition circuit,

Fig. 2 is a view similar to Fig. 1 but showing a modified form, and

Fig. 3 is a graphical representation of the operation of the system.

Referring more particularly to the arrangement shown in Fig. 1 of the drawing, the transformer 10 has its primary coil 12 connected to a source of commercial current supply which may vary between ninety-five volts and one hundred twenty-five volts. The secondary coil 14 of the transformer 10 receives current of varying voltage from the primary coil 12, the average of which may be either six volts or twelve volts, depending on the transformer used. One end of the coil 14 is connected to the terminal of a switch which, in this instance, may be carried by the operating handle of a thermostat 16 having a main valve controlling the flow of gaseous fuel through the conduit 18. The other terminal of the switch of thermostat 16 carries a wire 20 connected to one end of an adjusting resistance coil 22, the other end of which is connected to one end of a ballast resistance coil 24. The ballast resistance coil 24 is made of a material having a high temperature coefficient of electrical resistivity and is connected at its opposite end to one terminal of an electromagnetic fuel valve 26 also controlling the flow of fuel through the conduit 18. The electromagnetic fuel valve 26 may be of any well known form comprising a solenoid serving to maintain the valve closed when deenergized.

The other terminal of the electromagnetic valve 26 is connected to one end of an electric resistance igniting coil 28 which may be positioned within the oven or other chamber of a domestic range, a portion of which is shown diagrammatically at 30. The opposite end of the igniting coil is connected by a wire 32 to the secondary coil of the transformer, thus completing the secondary circuit. It will be observed that the parts described are all connected in series in the circuit.

The conduit 18 conveys gaseous fuel from a source of supply to a burner 33 connected thereto and which may be positioned within the oven or other chamber 30 in position to be ignited by the igniting coil 28. With the circuit described, any fluctuations in voltage which may occur in the line current and, consequently, in the secondary circuit, will cause variations in the resistance of the ballast resistor 24. Such variations will be regulated by the ballast resistor and a substan-

tially constant current will flow to the ignition coil during operation of the system.

This invention is more particularly directed toward the provision of means for protecting the ignition coil from the effects of high inrush current which may occur due to the use of the ballast resistor. To this end, an auxiliary circuit is provided composed of a mercury switch 34 movable between open and closed positions and shunted across the ignition coil 28. As shown schematically in Fig. 1, the mercury switch 34 has one terminal connected by a wire 38 to the wire 32 and the other terminal connected by a wire 40 to the wire 20. The mercury switch 34 is of the type having time delayed operation and is arranged to be closed during periods of deenergization of the secondary circuit. The mercury switch 34 is preferably of the type having a specified time delay period upon opening and an instantaneous closing. Switches of this type are disclosed in Patents Nos. 1,778,439 and 2,224,873 among others, to which reference may be had for a fuller description. When the switch is tilted upon energization of the secondary circuit to open the auxiliary circuit, a predetermined period of time elapses before this occurs. Thus, upon energization of the secondary circuit, the igniter coil 28 is shunted out for a predetermined period of time until the current in the secondary circuit has dropped down to a reasonable value as a result of the heating up of the ballast resistor 24.

In order to permit the igniter coil 28 to reach igniting temperature before any fuel flows from the burner 33, means are provided to maintain the electromagnetic valve 26 in closed position for a predetermined period of time after the igniter coil has become energized. Accordingly, a second auxiliary circuit composed of a mercury switch 46 is shunted across the solenoid coil of the electromagnetic valve 26. As shown in Fig. 1, one terminal of the mercury switch 46 is connected by a wire 48 to the wire 20 on one side of the electromagnetic valve 26 while the other terminal of the switch 46 is connected by a wire 50 to the wire 20 of the opposite side of the electromagnetic valve 26. The switch 46 may be in all respects identical with the switch 34 except that it operates from closed to open position after a longer time delay period than the switch 34. Whereas the actuating mechanism for the switches 34 and 46 may assume a form somewhat similar to those of the patents already referred to or those of the patents to Larson, No. 2,232,878, or Curtis, No. 2,042,925, or other forms now well known in the art, by way of example and illustrating diagrammatically one operative form of actuator, a solenoid 60 connected in series with the secondary circuit of Fig. 1 is provided to actuate an armature 62, which, through a suitable link 64 will rock the switch 34 to circuit making or breaking positions. Similarly, a solenoid 66 in the same series circuit will act upon an armature 68 and through a link 70 to rock the switch 46.

In the embodiment shown in Fig. 2 a modified form of time delay is utilized comprising a single mercury switch having two control electrodes and one common electrode enclosed in a suitable housing and adapted to perform the same functions as the two separate switches 34 and 46. As shown diagrammatically in Fig. 2, the common electrode 52 is connected to one side of the coil of the electromagnetic valve 26 by a wire 54. The terminal of the control electrode switch

having the longer time delay period is connected by a wire 56 to the other side of the coil of the electromagnetic valve 26. The terminal of the control electrode switch having the shorter delay period is connected by a wire 58 to the side of the igniter coil 28 opposite the wire 54, the igniter coil and valve being in series. The multiple electrode switch 72 may be operated in a suitable manner, an example of which has been depicted for purposes of illustration in this figure of the drawing in a manner similar to that shown in connection with Fig. 1. In this case, a solenoid 74 is connected in series with the secondary circuit and through a core 76 and link 78 will serve to rock the switch 72 for sequentially breaking the circuits controlled thereby in the desired order. As the other elements of the system may be identical with those of the system shown diagrammatically in Fig. 1, similar reference symbols have been used to designate the similar parts.

The operation of the system is as follows: Operation of the main switch 16 to closed position will cause the main fuel valve in conduit 18 to be opened. Current then flows through the secondary circuit to the adjusting resistance 22 and ballast resistance 24 in series by way of wire 20. The igniter coil 28 and the solenoid gas valve 26 are at this time shunted out by the auxiliary circuits comprising the mercury switches 34 and 46 respectively in the arrangement shown in Fig. 1 and by the single mercury switch in the modification shown in Fig. 2. These switches are tilted, however, upon energization and are in position to open after the time delay period.

Upon energization of the ballast resistance 24 as described it will be apparent that variations in the current supplied thereto will cause variations in the temperature of the resistance and consequent variations in its resistivity to the end that a substantially constant current flow will be obtained. The effect of using such self-regulating means in the circuit is, however, to produce high inrush currents in the secondary circuit when the main switch is closed. Thus until such currents have dropped to a safe value the ignition coil 28 remains deenergized for the period that the mercury switch 34 takes to open or, in Fig. 2, until the appropriate control electrode is disconnected from the common electrode. A suitable period has been found to be of ten seconds duration.

After the expiration of such period the mercury switch opens and the igniter coil becomes energized. The mercury switch 46 in Fig. 1, or the control electrode in Fig. 2, maintains the solenoid valve 26 in deenergized condition for a longer period until the igniter coil reaches igniting temperature. A suitable period is twenty seconds from the time of closing the main switch and then fuel may flow to the burner 33 to be ignited by the coil.

In Fig. 3 the secondary current is shown as reaching about 30 amperes with a transformer receiving 115 volts at the primary and having 6 volts at the secondary upon closing of the main switch 16 but this drops in ten seconds to a safe value of about 15 amperes. The igniter coil is introduced into the circuit at this time as described. A further drop to about 11 amperes occurs during the next ten seconds and the solenoid valve 26 then opens to permit fuel to flow to the burner. Subsequent fluctuations of the line voltage do not cause substantial variation in the current reaching the igniter coil due to the self-regulating function of the ballast resistance. The

current through the igniter coil therefore remains within safe limits under all operating conditions.

It will be apparent from the foregoing that the invention is not limited to the particular elements shown and described in connection with the system. Other types of time delay units having means for delaying energization of the igniter until after the resistance element becomes operative could be used in place of the mercury switch. This and other modifications could be made without departing from the spirit of the invention which generally consists in an arrangement capable of carrying out the objects set forth and in the combination defined in the appended claims.

We claim:

1. An electric ignition device for fuel burners, comprising in combination, a transformer having its primary coil energized from a source of current supply subject to voltage variation, an electric igniter in circuit with the secondary coil of said transformer, means responsive to energization of said secondary circuit for maintaining a substantially constant current through the igniter, and means for delaying the energization of said igniter until after the last said means becomes operative.

2. An electric ignition device for fuel burners, comprising in combination, a transformer having its primary coil energized from a source of current supply subject to voltage variation, an electric igniter in circuit with the secondary coil of said transformer, means responsive to energization of said secondary circuit for maintaining a substantially constant current through the igniter, and means in shunt with said igniter for delaying energization thereof until after the last said means becomes operative.

3. An electric ignition device for fuel burners, comprising in combination, a transformer having its primary coil energized from a source of current supply subject to voltage variation, an electric igniter in circuit with the secondary coil of said transformer, means responsive to energization of said secondary circuit for maintaining a substantially constant current through the igniter, and a delayed opening switch in shunt with said igniter for delaying energization thereof until after the last said means becomes operative.

4. An electric ignition device for fuel burners, comprising in combination, a transformer having its primary coil energized from a source of current supply subject to voltage variation, an electric igniter in circuit with the secondary coil of said transformer, electromagnetic means interposed in said secondary circuit, means actuated by the energization of the electromagnetic means to supply fuel to the igniter, means responsive to energization of said secondary circuit for maintaining a substantially constant current through the igniter, and means for delaying the energization of said igniter and electromagnetic means until after the last said means becomes operative.

5. An electric ignition device for fuel burners, comprising in combination, a transformer having its primary coil energized from a source of current supply subject to voltage variation, an electric igniter in circuit with the secondary coil of said transformer, electromagnetic means interposed in said secondary circuit, means actuated

by the energization of the electromagnetic means to supply fuel to the igniter, means responsive to energization of said secondary circuit for maintaining a substantially constant current through the igniter, and means for delaying the energization of said igniter and electromagnetic means until after the last said means becomes operative, said delay means being operable on said electromagnetic means for a longer period than on said igniter.

6. An electric ignition device for fuel burners, comprising in combination, a transformer having its primary coil energized from a source of current supply subject to voltage variation, an electric igniter coil in series with the secondary coil of said transformer, electromagnetic means in series with said igniter coil, means actuated by the energization of the electromagnetic means to supply fuel to the igniter, means responsive to energization of said secondary circuit for maintaining a substantially constant current through the igniter, a delayed action switch connected across said igniter coil, and a delayed action switch connected across the coil of said electromagnetic means, said switches being operable to maintain said igniter and electromagnetic means deenergized for different periods after said secondary circuit becomes energized.

7. An electric ignition device for fuel burners, comprising in combination, a transformer having its primary coil energized from a source of current supply subject to voltage variation, an electric igniter coil in series with the secondary coil of said transformer, electromagnetic means in series with said igniter coil, means actuated by the energization of the electromagnetic means to supply fuel to the igniter, a resistance element in said secondary circuit adapted to vary its resistance with variations in said supply voltage and maintain a substantially constant current through the igniter, and a mercury switch having time delayed operation to open position connected across said igniter coil to maintain said coil deenergized until after said resistance element becomes operative.

8. An electric ignition device for fuel burners, comprising in combination, a transformer having its primary coil energized from a source of current supply subject to voltage variation, an electric igniter coil in series with the secondary coil of said transformer, electromagnetic means in series with said igniter coil, means actuated by the energization of the electromagnetic means to supply fuel to the igniter, a resistance element in said secondary circuit adapted to vary its resistance with variations in said supply voltage and maintain a substantially constant current through the igniter, a mercury switch having time delayed operation to open position connected across said igniter coil to maintain said coil deenergized until after said resistance element becomes operative, and a second mercury switch having longer time delayed operation than the other said switch connected across the coil of said electromagnetic means to maintain said coil deenergized until after said igniter reaches igniting temperature.

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