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SPARK GENERATING CIRCUIT HAVING A VOLTAGE DOUBLER AND SOLID STATE CONTROL COMPONENTS

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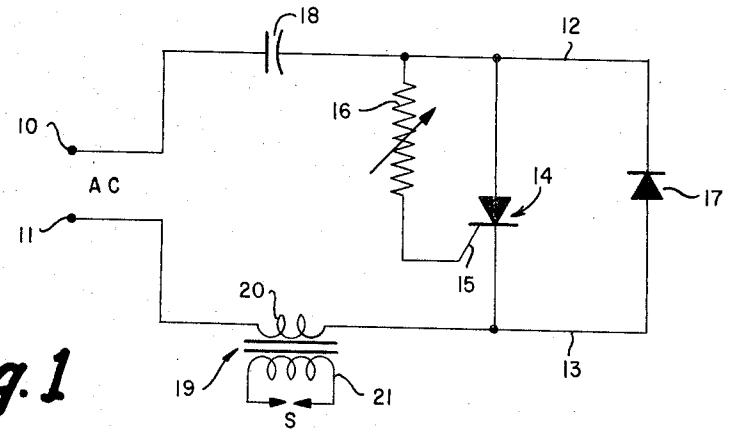


Fig. 1

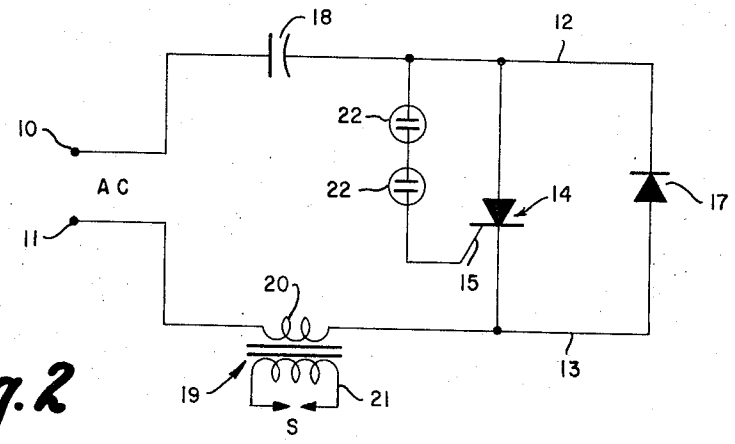


Fig. 2

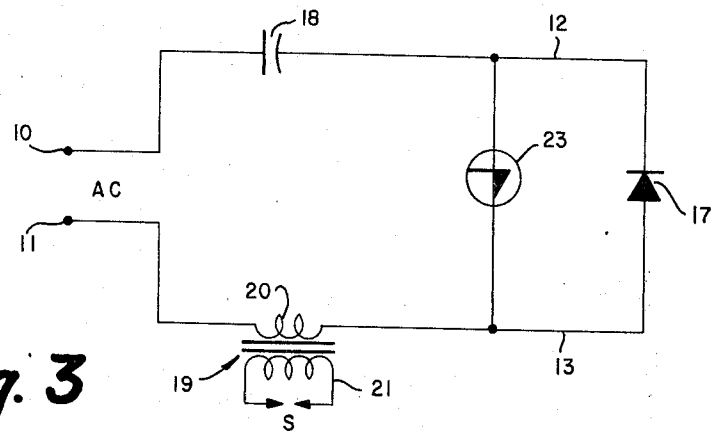


Fig. 3

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SPARK GENERATING CIRCUIT HAVING A VOLTAGE DOUBLER AND SOLID STATE CONTROL COMPONENTS

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7 Claims. (Cl. 315—223)

This invention relates to a spark generating circuit for ignition of fluids in fuel burning apparatuses. More specifically, this invention relates to an ignition circuit including solid state components and in which the electrical energy stored by a capacitor is discharged through the primary of a spark coil to generate a high voltage current in the secondary which will cause a spark between a pair of conventional sparking points.

Ignition systems in which a capacitor is used to store electrical energy and is periodically discharged through the primary in the spark coil are well known in the prior art. Because the energy required to induce a sufficient spark in the secondary of the spark coil is fixed by external requirements such as the type of fluid to be ignited, and because the power for such ignition systems is preferably AC line current, the capacitor must be of a size to store sufficient energy for discharge to the primary of the spark coil. Due to space and cost limitations, a simple circuit which increases the voltage impressed upon the primary of the spark coil is desirable to increase the energy available, thus reducing the size and cost of the capacitor. Because the energy stored within a capacitor is equal to $\frac{1}{2}CV^2$, a voltage doubler in combination with a controlled rectifier for discharging the capacitor through the primary of the spark coil will greatly increase the energy available to the secondary of the spark coil and may be provided as a relatively low cost, reliable, and compact unit.

It is therefore an object of this invention to provide a fluid ignition system wherein energy available from a capacitor is increased by a voltage doubler and which includes a solid state device which periodically conducts to discharge the capacitor through the primary of a spark coil.

It is another object of this invention to provide a fluid ignition powered by alternating current and which utilizes a solid state controlled rectifier to periodically release energy from a capacitor to the primary of a spark coil.

Other objects of the invention will be apparent from the following detailed description of a preferred embodiment thereof, reference being made to the accompanying drawings, in which:

FIGURE 1 is a circuit diagram of a first preferred embodiment of this invention, schematically showing a pair of spark points S connected to the secondary of a spark coil;

FIGURE 2 is another preferred embodiment of this invention in which the control means associated with the control electrode of a solid state controlled rectifier is a pair of neon glow lamps; and

FIGURE 3 is a third preferred embodiment of this invention in which the means for controlling the discharge of the energy storage means is a four layer diode.

Referring to FIGURE 1, a pair of terminals **10** and **11** are provided for connection to an external source of alternating current, which, as previously explained, may be house current. Connected across lines **12** and **13** which extend from the terminals **10** and **11** is a solid state controlled rectifier **14** with its anode to cathode circuit directly across lines **12** and **13** and its control electrode **15** connected to line **12** through an adjustable resistor **16**. The diode **17** is connected across lines **12** and **13** in parallel to the solid state control rectifier **14** and oppositely biased thereto. A capacitor **18** is connected in the line **12** with one side directly connected to the anode of the controlled rectifier **14** and the top of the adjustable resistor **16**. A spark coil or pulse transformer **19** with its primary **20** connected in the line **13** and its secondary **21** connected to the points S completes the igniter circuit of FIGURE 1.

The operation of the circuit of FIGURE 1 is as follows. Assuming that the peak value of the applied AC voltage at the terminals **10** and **11** is E volts, when the applied voltage is positive at terminal **11**, the capacitor **18** charges to E volts through the diode **17**. When the applied voltage becomes positive at the terminal **10**, the diode **17** and the controlled rectifier **14** block the discharge of the capacitor **18**, and the voltage across the controlled rectifier **14** increases to approximately the value of 2E volts.

Because the resistance between the control electrode or gate **15** of the controlled rectifier **14** and its cathode is practically zero, the voltage drop across the adjustable resistor **16** is very nearly equal to the voltage across the anode-to-cathode circuit of the controlled rectifier **14**. The controlled rectifier **14** is such that it will not fire until the current into its gate **15**, which may be adjusted by the adjustable resistor **16**, is at a suitable value. When the current into the gate **15** reaches this value, the control rectifier **14** fires and the energy stored in capacitor **18** is discharged through the control rectifier **14** and the primary **20** of the pulse transformer **19**. As soon as the current flow from the AC power source has reversed its direction, the control rectifier **14** stops conducting and energy is again stored in the capacitor **18**, as previously explained.

It has been found that the above described circuit, when used in connection with fluid burning apparatuses such as gas driers and the like, will operate satisfactorily on 117-volt AC house current and that the components, such as the controlled rectifier **14** and the diode **17**, are relatively inexpensive and require a bias characteristic of only double line voltage. Furthermore, the capacitor **18** may be of relatively small size, as previously explained.

FIGURE 2 is a second preferred embodiment of the igniter circuit in which the variable resistor **16** in FIGURE 1 has been replaced with a pair of neon tubes **22**. The neon tubes **22** are selected with characteristics such that their breakdown or conduction point is about 2E volts, or twice line voltage. When this point is reached, the flow of current through the neon tubes **22** at the gate **15** of the controlled rectifier **14** will trigger this device, which consequently discharges the capacitor **18** through the pulse transformer primary **20** as previously described. In the embodiments of both FIGURES 1 and 2, the controlled rectifier **14** is preferably a silicone controlled rectifier (SCR), as previously explained.

In FIGURE 3, the control electrode **14** and its gate control circuit are replaced with a four layer diode **23** having the characteristic that it will not conduct until the voltage pressed across its anode-cathode circuit is approximately 2E volts, or twice line voltage. Operation of the igniter circuit with the four layer diode **23** is in other respects identical to the operation of the circuits of FIGURES 1 and 2 and previously described.

Various modifications of the above described preferred embodiments of the invention will be apparent to those skilled in the art and it is to be understood that such modifications can be made without departing from the scope of the invention, if within the spirit and tenor of the accompanying claims.

What I claim is:

1. An igniter circuit for a fluid burning apparatus com-

prising, in combination, a pair of terminals for connection to a source of alternating current, a solid state controlled rectifier having an anode, cathode and control electrodes with the anode-cathode circuit connected across said terminals, a voltage doubling means including a capacitor operably connected to said anode, a spark generating means operably connected to said controlled rectifier whereby conduction of said controlled rectifier will energize said spark generating means, and a control means operably connected between said voltage doubler means and the control electrode of said controlled rectifier whereby said controlled rectifier will fire when the voltage drop across said control means is approximately twice the source voltage.

2. The igniter circuit of claim 1 in which said control means is a resistor.

3. The igniter circuit of claim 1 in which said control means is at least one neon glow lamp connected in series between said voltage doubler means and said control electrode.

4. The igniter circuit of claim 1 in which said controlled rectifier is a silicon controlled rectifier.

5. An igniter circuit for a fluid burning apparatus, comprising, in combination, a pair of terminals for connection to a source of alternating current, a solid state controlled rectifier having an anode, cathode and control electrodes with the anode-cathode circuit connected across said terminals, a diode connected in parallel with said controlled rectifier and oppositely biased thereto, a spark generating means operably connected to said controlled rectifier whereby conduction by said controlled rectifier will energize said spark generating means, an energy storage device

connected to the anode of said controlled rectifier and a control means operably connected between said energy storage device and the control electrode of said controlled rectifier whereby said controlled rectifier will fire when the voltage drop across said control means is approximately twice the source voltage.

6. An igniter circuit for a fluid burning apparatus, comprising, in combination, a pair of terminals for connection to a source of alternating current, a four layer, solid state rectifier connected across said terminals, a diode connected in parallel with said four layer rectifier and biased oppositely thereto, a spark generating means operably connected to said four layer rectifier whereby conduction by said four layer rectifier will energize said spark generating means, and an energy storage device operably connected to said four layer rectifier whereby the energy stored in said energy storage device will be discharged through said four layer rectifier when the voltage across said rectifier is approximately twice line voltage.

7. The igniter circuit of claim 6 in which said energy storage device is a capacitor.

References Cited

UNITED STATES PATENTS

3,297,889	1/1967	Breskend	307—88.5

FOREIGN PATENTS

1,302,526	7/1962	France.
970,553	9/1964	Great Britain.

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