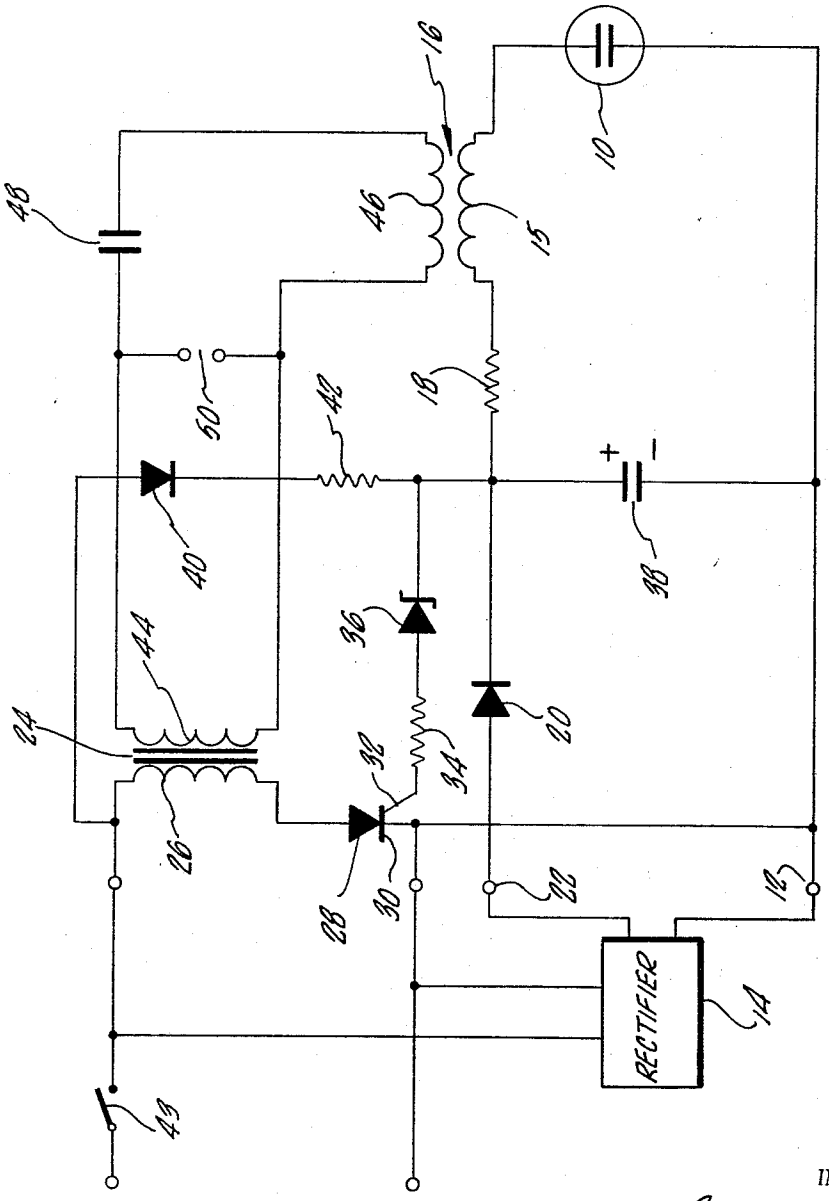
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POWER SUPPLY FOR A COMPACT-ARC LAMP

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POWER SUPPLY FOR A COMPACT-ARC LAMP

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This invention relates to a power supply circuit for a compact-arc lamp and, more particularly, is concerned with a self-starting circuit for igniting and maintaining the arc of a compact-arc lamp load.

Arc discharge lamps are well known in which a gas such as mercury, neon, xenon, or other gases are ionized to sustain an arc. This excites the gas molecules to give off visible radiation. Compact-arc lamps of this type have been developed which are capable of producing extremely high brightness levels by employing gases at relatively high pressures. To initiate an electrical discharge through such compact-arc lamps requires the momentary application of very high voltage pulses in the radio frequency range. For example, a short-arc xenon discharge lamp requires a pulse of radio frequency energy in the 1 to 10 megacycle region and of approximately 1500 volts potential. In addition, to sustain the electron discharge once it is initiated, a surge of lower voltage energy is required immediately upon ionization. Once the arc is established, it may be maintained by a relatively low voltage D.C. potential across the lamp.

The present invention is directed to a power supply for an arc discharge lamp which is self-starting. One of the unique features of this power supply is that it has the ability to restart a lamp, which has been accidentally extinguished by power failure, in approximately 2 milliseconds. The starting cycle is completely automatic and very rapid usually being accomplished within two cycles at the line frequency. The circuit requires no relays in its operation, and the entire circuit can be sealed in a potting compound and completely shielded to prevent any RF radiation.

In brief, the present invention provides a power supply circuit for igniting a compact-arc lamp in which the lamp is connected across a D.C. source through a diode and load resistance in series with the lamp. A storage capacitor is coupled across the lamp and the storage capacitor is charged up from an A.C. power source through a diode rectifier to the peak voltage of the A.C. source. Means is provided for generating an RF voltage which is coupled across the lamp. Means is also provided which is controlled by the voltage across the storage capacitor for turning on the RF voltage generating means when the capacitor is charged to the peak voltage of the A.C. source. The same means turns off the RF voltage generating means when the capacitor discharges through the lamp down to the level of the D.C. supply voltage.

For a more complete understanding of the invention, reference should be made to the accompanying drawing wherein the single figure is a schematic diagram of the power supply circuit of the present invention.

Referring to the drawing in detail, the numeral **10** indicates generally a short arc lamp, such as, for example, the 45-watt short-arc xenon discharge lamp sold by P.E.K. Labs. The lamp **10** is connected at one end to a negative terminal **12** of a D.C. voltage source indicated generally at **14**. The source **14** may be the **27** volt D.C. source commonly encountered in aircraft or it may be an equivalent D.C. supply driven from a 115 volt A.C. line as shown.

The other end of the almp **10** is connected through the secondary winding **15** of an RF transformer **16**, a series load resistance **18** and a diode **20** to the positive terminal

22 of the D.C. supply. Once an arc discharge is established in the lamp **10**, the supply **14** provides a continuous D.C. current through the lamp **10** to maintain the arc. The diode **20** is polarized to provide a low impedance path to the D.C. current from the supply **14**.

The starting circuit for the lamp **10** includes a power transformer **24**, the primary winding **26** of the transformer **24** being connected across an A.C. supply line through a silicon controlled rectifier **28**. The cathode **30** of the silicon controlled rectifier **28** is connected to one side of the A.C. line and is also connected to the negative terminal **12** of the D.C. supply **14**. A control electrode **32** of the silicon controlled rectifier is connected through a resistor **34** and zener diode **36** to the cathode side of the diode **20**.

A storage capacitor **38** is connected between the cathode of the diode **20** and the negative terminal **12** of the supply **14**. The storage capacitor **38** is arranged to be charged up from the A.C. line by means of a diode **40** and resistor **42**.

When a switch **43** is closed completing a circuit to the A.C. line, the storage capacitor **38** is charged up through the capacitor **40** to the peak voltage of the A.C. line. The storage capacitor can not discharge through the D.C. supply source because of the diode **20** or through the lamp **10** until it is ignited. As the storage capacitor is charged up to the peak voltage of the A.C. line, the avalanche voltage of the zener diode **36** is exceeded, permitting gate current to flow into the control electrode of the silicon controlled rectifier **28**. As a result, the silicon controlled rectifier is fired connecting the primary of the transformer **26** across the A.C. line.

The transformer **24** produces a high voltage, for example, of the order of 3000 volts across the secondary winding **44**. The secondary winding **44** is connected across a primary winding **46** of the RF transformer **16** through a series capacitor **48**. A spark gap element indicated at **50** is connected across the secondary winding **44** of the transformer **24**. The spark gap **50** generates RF energy in response to the high voltage from the transformer **24**. The capacitor **48** resonates with the primary winding **46** at a frequency between 1 and 10 megacycles to concentrate the energy of the spark gap in this frequency range. This RF energy is coupled to the secondary winding **15** across the lamp **10** producing an initial ionization of the gas in the lamp.

As the gas ionizes in the lamp, the energy in the storage capacitor **38** discharges through the lamp providing an additional energy surge. This is produced for sustaining the electrical discharge once it is initiated by the RF energy. As the capacitor **38** discharges, the voltage across the capacitor drops, causing the silicon controlled rectifier to be cut off. The potential across the storage capacitor **38** drops back to the voltage of the supply **14**. The D.C. voltage of the source **14** is sufficient to sustain the discharge arc in the lamp **10**. When the silicon controlled rectifier is turned off, further generation of RF energy is interrupted.

As pointed out above, one of the unique features of the present invention is that if there is a momentary failure of supply voltage to the lamp **10**, permitting it to become extinguished, the storage capacitor **38** immediately begins to recharge, causing the silicon controlled rectifier to be fired and the RF generator to be re-activated to initiate ignition of the lamp **10**.

What is claimed is:

1. A self-starting power supply circuit for igniting a compact-arc lamp comprising a power transformer having a high voltage secondary, a silicon controlled rectifier connected in series with the primary of the transformer directly across an alternating current source and having

a control electrode, a source of D.C. supply voltage of sufficient magnitude to sustain an arc in the lamp but substantially smaller than the voltage of the alternating current source, means including a first diode, a first resistor, and one winding of a radio frequency transformer in series connecting the lamp across the D.C. source, a storage capacitor connected across the D.C. source through the first diode, means including a second diode and a second resistor in series connecting the storage capacitor across the alternating current source, means including a series capacitor for connecting the secondary of the power transformer across the primary of the radio frequency transformer, a spark gap radio frequency generator connected across the secondary of the power transformer, and means including a zener diode connecting the control electrode of the silicon controlled rectifier to one end of the storage capacitor for turning on the silicon controlled rectifier when the storage capacitor is charged to the peak voltage of the alternating current source.

2. A self-starting power supply circuit for igniting a compact-arc lamp comprising a power transformer having a high voltage secondary, a silicon controlled rectifier connected in series with the primary of the transformer directly across an alternating current source and having a control electrode, a source of D.C. supply voltage of

sufficient magnitude to sustain an arc in the lamp but substantially smaller than the voltage of the alternating current source, means including one winding of a radio frequency transformer in series connecting the lamp across the D.C. source, a storage capacitor connected across the lamp, means including a rectifier connecting the storage capacitor across the alternating current source, means including a radio frequency generator energized from the secondary of the power transformer, and connected across the lamp by said radio frequency transformer, and means connecting the control electrode of the silicon controlled rectifier to one end of the storage capacitor for turning on the silicon controlled rectifier when the storage capacitor is charged to the peak voltage of the alternating current source.

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