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Switsen

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[54] **LOW HEAT STROBOSCOPE CIRCUIT**

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[51] **Int. Cl.** **H05b 37/00**

[58] **Field of Search** ..... 315/227, 241 R, 241 P, 315/241 S

[56] **References Cited**

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Primary Examiner—Roy Lake
Assistant Examiner—Lawrence J. Dahl

[57] **ABSTRACT**

A very simple circuit to eliminate unwanted heating and avoid power waste in A.C. powered stroboscopes by insuring that the flash-lamp does not fire while the A.C. supply can charge the lamp storage capacitor, by rearranging the same basic parts used in a conventional stroboscope. In one circuit the lamp is fired when the A.C. supply is at a negative or low positive voltage, while the capacitor charging diode allows current flow only during the positive A.C. cycle. In another circuit the lamp is fired when the A.C. supply is at a positive or low negative voltage, but the capacitor-charging diode allows current flow only during the negative A.C. half cycle.

8 Claims, 4 Drawing Figures

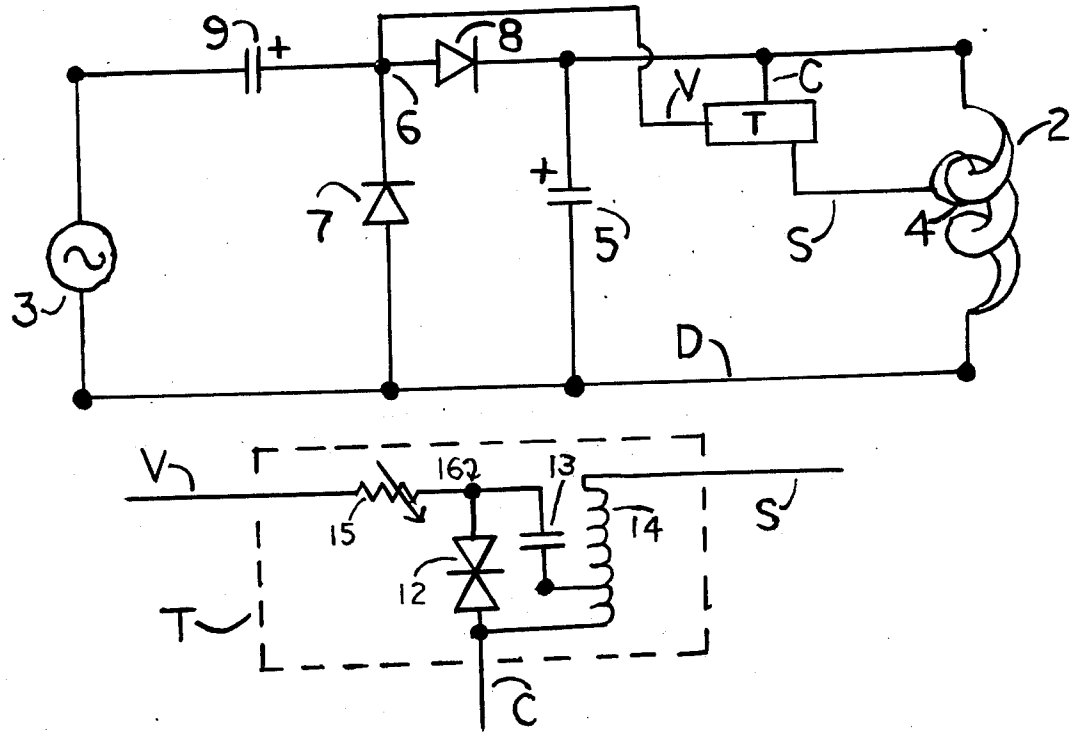


FIG 1
PRIOR ART

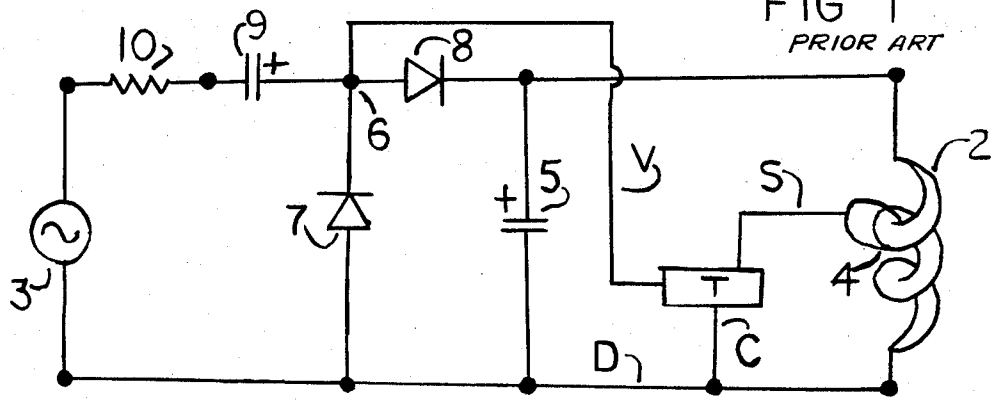
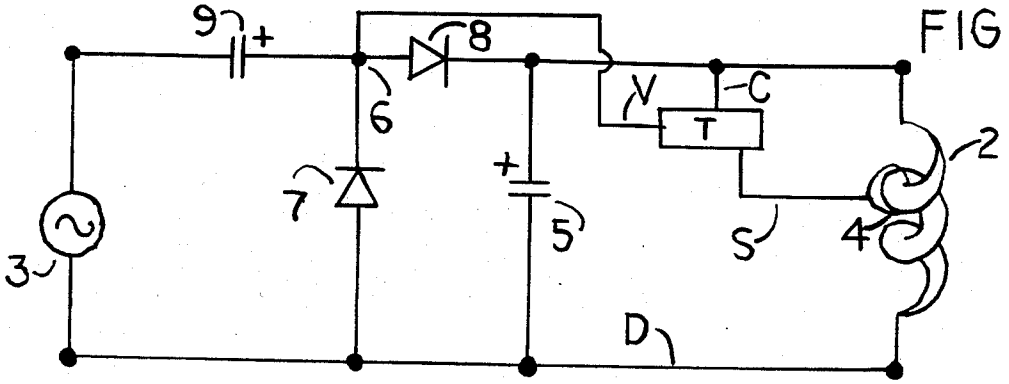


FIG 2



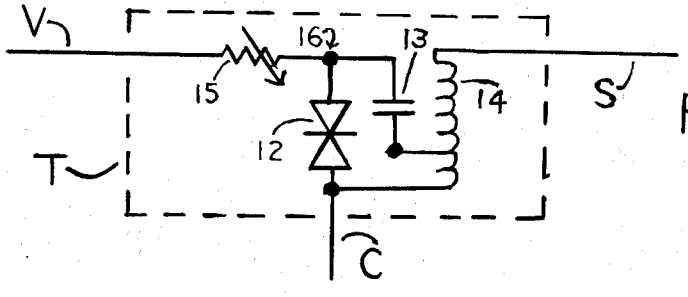
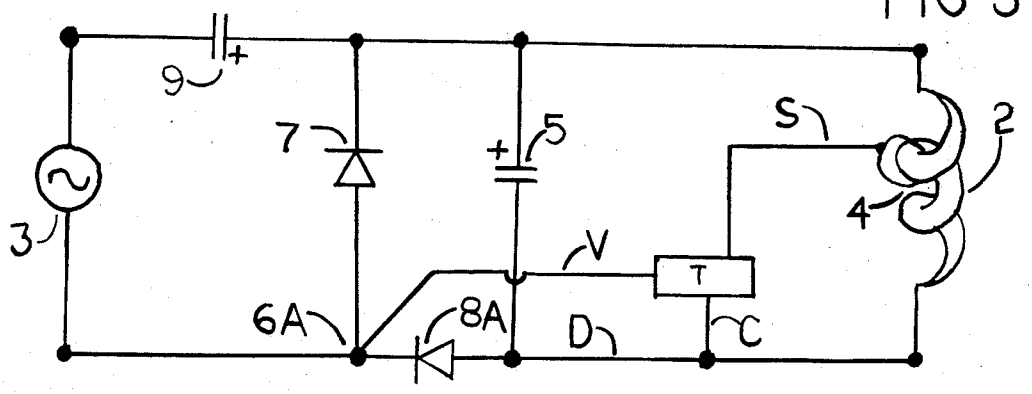


FIG 2A

FIG 3



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LOW HEAT STROBOSCOPE CIRCUIT

BACKGROUND OF THE INVENTION

Stroboscopic lamps are often energized by a simple power capacitor that is charged from an A.C. source through a diode and current limiting resistor. Sometimes also additional diodes and capacitors and even transformers are used to further boost the capacitor voltage. If the lamp should fire during certain positive portions of the A.C. cycle, which is usually the case, then the lamp could draw a large unwanted current directly from the A.C. power source through the power supply components. Normally, a large current limiting resistor is required to limit such a current. However, if the circuit were constructed to assure that firing does not occur during these positive portions of the A.C. source, then the current limiting resistor could be eliminated and heating of the circuit could be considerably reduced. Reduction of such heating of the circuit is of great concern because heating can cause many malfunctions, so that steps taken to reduce heating have resulted in undesired limitations in circuit design.

OBJECTS AND SUMMARY OF THE INVENTION

An object of the present invention is to rearrange a timing circuit to fire only when the A.C. Supply is negative or below the ionization maintaining voltage of the lamp.

Another object of the invention is to rearrange the power supply components so that while the timer fires the lamp during the positive excursions of the A.C. cycle in the normal way, the power supply components are arranged to charge the power storage capacitor only during negative excursions of the A.C. cycle, and hence can supply power directly to the lamp only during the negative excursions.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic drawing of the prior art;

FIG. 2 shows the rearranged timing circuit of the prior art circuit of FIG. 1 in accordance with one embodiment of the present invention;

FIG. 2A is a schematic drawing of a timing circuit which is useable for FIG. 1 and FIG. 2; and

FIG. 3 is a schematic drawing of the rearranged power supply of the prior art circuit of FIG. 1 in accordance with another embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a prior art circuit for striking and energizing a stroboscopic lamp 2 from an alternating current source 3. The lamp 2 has a striking member 4 which is supplied with a high voltage from line S of timer T to create an arc that ionizes gas within the lamp, to start it. The resistance of the lamp then drops to a very low level so that a large current can flow from a power capacitor 5 through the lamp to create a brief high intensity flash of light. The high voltage pulse at the striking member 4 of the lamp is obtained by circuitry within the timer which is well known in the art, and can be any one of a variety of circuits, particularly those that have a connection to a positive voltage point in the circuit. For example, the circuit of FIG. 2A can be used. Since the capacitor 5 is discharged with every flash, almost any point chosen for the positive voltage

point for the timer lead V will have ripple on it which makes the timer most apt to strike the lamp during a positive excursion of the A.C. source. The point 6 shown in FIG. 1 is only one possible choice, but is excellent for explanational purposes because it contains a very large ripple. The voltage at point 6 varies between zero and 300 volts, if the A.C. source is a standard 115 volt household outlet. Two diodes 7, 8, a capacitor 9 and a current limiting resistor 10 comprise a standard voltage doubler. The timer T is most likely to activate the striking member 4 when the voltage at point 6 is a large positive voltage, and will never activate it when point 6 is at zero volts since the common lead C of timer T is returned to circuit common line D. Yet it is when point 6 is at or near zero volts that one would like to have the timer activate the striking member 4 in order to prevent A.C. supply current from feeding directly into the lamp.

FIG. 2 illustrates one embodiment of the present invention where the same timer has its common terminal C connected to the positive side of capacitor 5 and its terminal V connected to the same point 6 as before. Since the voltage at point 6 varies between zero and 300 volts just as before, the timer is once again most likely to fire when the voltage at point 6 is greatest with respect to timer T. Now however, the voltage at point 6 is a maximum with respect to timer T when the A.C. source is at or near zero, which is where we would like the timer to fire. When the timer fires at or near zero voltage on the point 6, no current can flow directly from the A.C. source to the lamp; this is when the instantaneous amplitude of the A.C. source is such that the diode 8 can block the current, since the ionization maintaining voltage of the lamp is not exceeded by the A.C. source, and the diode 8 is reversed biased. Also note that the current limiting resistor has been ommitted. It should be noted that not all of the possible timer systems are suited for such a change, but anyone wishing to use this invention can simply change to a timer system which is so suited, or can use the embodiment of the invention described for FIG. 3.

FIG. 2A illustrates schematically one possible timer circuit which is suited for use in FIG. 1 or FIG. 2. The timer shown is extremely simple in design, and the pulsing switch 12 shown functions as the sensing device and the firing device. The capacitor 13 serves the dual role as both the timing capacitor for the resistance-capacitor function, and as the pulse energy storage element for the pulse transformer 14. The resistor 15 serves as the resistance for the rc circuit function, and can be made variable to adjust the time between successive firings.

The resistor 15 and the capacitor 13 are in series across the pair of timer leads V and C. The voltage at the point 16 with respect to the timer common lead C is the exponential rc charging curve expected according to the actual values of the resistor 15, the capacitor 13, and the voltage input at the lead V.

The switch means 12 illustrated in FIG. 2A is a two terminal device with characteristics similar to a Diac switching doide or gas filled tube resembling a neon tube. When the voltage across the element 12 reaches a predetermined value, the switch 'breaks back' suddenly and then discharges the capacitor 13 into the primary winding of the pulse transformer 14, which causes a high voltage pulse to be available at the lead S.

The illustrated switch 12 is a two terminal device, and can be bilateral or unilateral since the requirement is only for operation in one polarity. Thus the timer can be used in either the circuit of FIG. 1, or FIG. 2 by simply connecting the switch properly oriented.

Since the switch is conected effectivly in part between the timer leads C (common) and V (voltage input), the switch is most likely to 'fire' when the voltage at the lead V is greatest with respect to the common lead C, since this is when the charging current is greatest for the rc portion, and is when the rate of rise of the voltage at the point 16 is the greatest with respect to the common.

The resistor 15 can be varied to cause the speed of the stroboscope to be varied.

FIG. 3 illustrates another embodiment of the present invention where the timer is connected in the conventional way, but the power supply is rearranged so that the A.C. supply can charge the storage capacitor 5 only during the negative excursions of the cycle. Also the A.C. supply can supply power directly to the lamp only during the negative excursions of the cycle. This is accomplished by substituting a diode at 8A for the diode 8.

In this circuit, the timer acts as in FIG. 1, being most likely to fire when the A.C. supply is most positive, since the point 6A once again goes between zero and 300 volts just as before. Firing at this time, however, is now when we would like it to fire since now the A.C. supply cannot supply any lamp current until point 6A falls to zero or a low value, which occurs during the negative half cycle of the A.C. supply. Thus when the lamp fires, during the positive half cycle, no current can flow through diode 8A from the A.C. source directly to the lamp.

The requirements of the firing time to accomplish this operation are as follows;

The voltage of the A.C. source at point 6A at the time of firing must not be greater in magnitude than the ionization maintaining voltage of the lamp. This will cause the diode 8A to be reversed biased; or

if the voltage of the A.C. source at point 6A at the time of firing is of greater magnitude than the ionization maintaining voltage of the lamp, the polarity of the voltate at point 6A must be such that the diode 8A is reversed biased.

Any timer fulfilling either one of the above requirement will accomplish the desired low heating stroboscope circuit, and most conventional timers have the desired characteristics for proper operation of the circuit of FIG. 3.

Also note that the current limiting resistor is not require in FIG. 3, just as it was ommited in FIG. 2. It should be noted that if such an omission was made to the prior art circuit of FIG. 1, the stroboscopic lamp would probably melt or be destroyed, as would the power supply be likly to be damaged, especially if components of the smaller power handling capability such as would be required for the invention were to be used in the prior art circuitry.

Although particular embodiments of the invention have been described and illustrated herein, it is recognized that modifications and variation may readily occur to those skilled in the art, and consequently, it is intended that the claims be interpreted to cover such modifications and equivalents.

What is claimed is:

1. A stroboscope circuit for firing and energizing a stroboscopic lamp from an A.C. source comprising:
a power capacitor;
means for connecting said power capacitor across said lamp to supply lamp energizing current to it;
diode means for connecting said power capacitor to said A.C. source to allow charging of said power capacitor therefrom, said diode means connected to prevent current flow therethrough during the negative half cycle of the A.C. source; and
timing means containing an impedance coupled to said A.C. source to sense the voltage of said A.C. source and supplying a firing pulse to fire the stroboscopic lamp during the portion of a cycle of said A.C. source when said A.C. source is below the ionization maintaining voltage of said lamp causing said diode to be reverse biased during the firing of said lamp, whereby to prevent the flow of current to the lamp directly from the A.C. source.

2. The circuit described in claim 1 wherein:
said timing means includes a two terminal switching means.

3. The circuit described in claim 1 wherein:
said timing means includes a pulse transformer.

4. The circuit described in claim 1 wherein:
said timing means includes a capacitor to serve as both the timing capacitor and the pulse energy capacitor.

5. A stroboscopic circuit for firing and energizing a stroboscopic lamp from an A.C. source comprising:
a power capacitor;
means for connecting said power capacitor across said lamp to supply lamp energizing current to it;
diode means for connecting said power capacitor to said A.C. source to allow charging of said power capacitor therefrom, said diode means connected to prevent current flow therethrough during the positive half cycle of the A.C. source; and
timing means containing an impedance coupled to said A.C. source to sense the voltage of said A.C. source and supplying a firing pulse to fire the stroboscopic lamp during the portion of a cycle of said A.C. source when said A.C. source is supplying a voltage of such polarity and magnitude as to cause current flow from said A.C. source to said lamp to be blocked by said diode means, whereby to prevent the flow of current to the lamp directly from the A.C. source.

6. The circuit described in claim 5 wherein:
said timing means includes a two terminal switching means.

7. The circuit described in claim 5 wherein:
said timing means includes a pulse transformer.

8. The circuit described in claim 5 wherein:
said timing means includes a capacitor to serve as both the timing capacitor and the pulse energy capacitor.

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