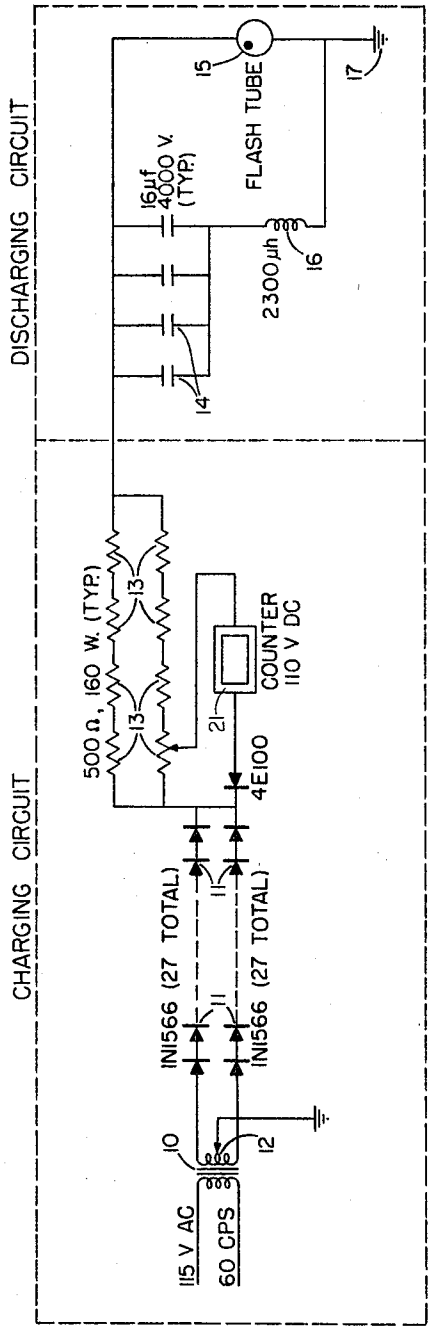
Nov. 29, 1966 G. L. STAMM ETAL 3,289,039

DISCHARGE AND COUNTING CIRCUITS FOR FLASHING BEACON

Filed Jan. 20, 1964



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United States Patent Office 3,289,039
Patented Nov. 29, 1966

3,289,039

DISCHARGE AND COUNTING CIRCUITS FOR FLASHING BEACON

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Filed Jan. 20, 1964, Ser. No. 339,038
3 Claims. (Cl. 315—243)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The present invention relates to flashing lamps and more particularly to a system for extinguishing a flashing light for rapid flashing of said light and a system for counting the number of flashes produced by the flashing light.

Heretofore, lamp flasher systems have been provided in which the lamp does not have a quick recovery time for repeated flashes or either the light flash is not extinguished completely to enable a quick repetition flash rate. Light flashes are emitted from a flashtube by discharging energy stored in a plurality of capacitors through the flashtube. Upon discharge of the capacitors, an arc of ionized gas is established within the tube, and light is emitted therefrom. The energy storage capacitors are charged between light flashes from a high voltage supply through current limiting resistors. In order for the arc to extinguish, the current must fall below a certain value depending upon the flashtube characteristics. Standard practice to extinguish the arc is to use a resistance large enough to limit the charging current to a value which will cause the arc to extinguish. However, when capacitors of high value must be charged at a fast rate, the charging current must be high in order to fully charge the capacitors before each flash. When the charging current is too high, the high current sustains the arc continuously in some flashtubes. Thus it is impossible to charge the capacitors to produce another flash.

In some instances, it is desirous to count the number of flashes made by the flashtube. These flashes are usually counted by a light sensitive means actuated by incident light from the light flash. In some situations, it is not feasible to detect light flashes by light sensitive means. Thus other systems must be used in order to determine the number of flashes produced by the flash system at a position other than in optical alignment with the light flash.

It is therefore, an object of the present invention to provide a means for extinguishing the arc of a flashtube after each flash for a fast repetition rate.

Another object is to provide a counter for counting each light flash which does not depend on the light from the flashtube.

Still another object is to provide a flashtube system which is reliable, efficient, and has a relative low operating cost.

Yet another object is to provide a flashtube system which discharges high energies at a fast repetition.

The nature of this invention as well as other objects and advantages thereof will be readily apparent from consideration of the following specification relating to the annexed drawing in which:

The drawing represents charging and discharging circuits for a flashtube and a counter in conjunction with the charging circuit.

The present invention is directed to a circuit for charging a plurality of capacitors which are discharged through a flashtube to produce a flashing light. In order to insure extinguishment of the arc that produces the flashing light, a coil of wire is placed in series with the flashtube which reduces the current through the flashtube sufficiently to extinguish the arc. The coil permits rapid recovery for fast flash rates.

Now referring to the drawing there is shown by illustration a charging and discharging circuit for a flashtube. The charging circuit includes a transformer **10** with an input of 115 volts, 60 cycle/sec. with an output that is directed to a series of twenty-seven 1N1566 silicon rectifiers **11** in each output line from the transformer. The current flow through the rectifiers is in the direction of the arrow and since the rectifiers are included in each output line, each cycle of the A.C. input is rectified. The output side of the transformer includes a center tap **12** which is connected to ground. The outputs of the silicon rectifiers are directed through a plurality of series-parallel current limiting 500 ohm-160 w. resistors **13** to a plurality of sixteen mfd. capacitors **14** connected in parallel and charged to 4000 volts by the outputs. One side of the capacitors are connected to one side of a gas-filled flashtube **15** such as a General Electric FT–524 and the other side of the capacitors is connected to a coil **16** having an inductance of about 2300 mh., which is connected in series with the other side of the flashtube. The side of the flashtube to which the coil is connected is grounded at **17**.

In operation the 115 volts, 60 c.p.s. input into the transformer is increased to 2375 volts and rectified by the 54 silicon rectifiers. The capacitors **14** are charged through the current limiting resistors **13** to a voltage of 4000 volts D.C. When a slight amount of ionization is introduced in the flashtube gas, the capacitors discharge through the flashtube **15** and coil **16** which produces a flash of light. Upon discharging of the capacitors, the coil causes the current through the flashtube to be reduced momentarily to a value lower than that necessary to sustain an arc in the gas-filled flashtube. Once extinguished, the arc does not appear again until another discharge is initiated. However, immediately upon discharging the capacitors and extinguishment of the arc, the capacitors are recharged by the high voltage power supply. As soon as the capacitors build up sufficiently, the gas in the flashtube is again ionized then, the flashtube flashes which discharges the capacitors and again the coil reduces the current sufficiently to extinguish the arc. The charging and discharging cycle is repeated as long as the capacitors are recharged, discharged, and the arc is extinguished by the coil. With the values as illustrated applied to the elements, the flashtube has a repetition rate of two or more flashes per second.

In some instances, it is desired to count the number of flashes, therefore, a counter is provided. The counter of the present invention is actuated by a surge of current through the limiting resistors which current recharges the capacitors. Since a surge of current will be produced after each light flash, a counter counts the number of surges through the limiting resistors, and will indicate the number of flashes made by the flashtube. The counter used is a Veeder-Root 110 volt D.C. counter. The counter **21** is connected in series with a 4E100 four-layer diode and connected between the output of the silicon rectifiers and across an appropriate portion of one of the limiting resistors **13**. Without the 4E100 diode in series with the counter it has been determined that the current through the counter does not fall off quickly enough to allow the counter to reset for the next count. The 4E100 diode is necessary to permit fast recount setting. The diode does not conduct below 28 ma. which is sufficient to allow the counter to reset. Since the counter and diode are at a high voltage they must be insulated from ground and positioned

so that personnel cannot come in contact with them. Since the counter is connected to the high voltage line that causes the flashtube to flash, there is no possibility that the counter will count flashes of other nearby flashtubes or detect any type of light.

Thus the counter counts the number of current surges that pass through the limiting resistors which is an indication of the number of times that the flashtube flashes.

The impedance coil in series with the flashtube insures a sufficient drop in the current through the flashtube that the arc will extinguish thereby permitting the capacitors to charge sufficiently to produce ionization of the gas in the flashtube thereby producing a flash of light. Without the impedance coil, the arc would be retained and the capacitors would not charge sufficiently to produce a flashing light in the tube, especially since there would be a continuous glow in the tube.

The current produced by the high voltage charging circuit operates the counter and also supplies the current to operate the flashtube.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A flashtube control circuit which comprises:
an arc discharge flashtube,
an inductance coil connected in series with said flashtube,
a plurality of parallel connected capacitors connected across said flashtube and said inductance coil to discharge a current therethrough to establish an arc in said flashtube,
said inductance coil reducing the current through said flashtube subsequent to discharge of said capacitors to extinguish the arc produced in said flashtube,
a high voltage power supply for charging said capacitors,
and a plurality of current limiting resistors connected in the circuit between said power supply and said plurality of capacitors,
an electrical pulse counter, said counter connected to said voltage supply and to one of said current limiting resistors,
whereby said counter records surges of current through said resistor during charging said capacitors.

2. A flashtube control circuit as claimed in claim 1 which includes a diode connected between said voltage supply and said counter.

3. In a flashtube control circuit which comprises:
a plurality of capacitors for discharging a current through said flashtube,
a high voltage power supply for supplying a charging current to said plurality of capacitors,
a plurality of current limiting resistors connected in the control circuit between said high voltage power supply and said capacitors,
a current surge counter that counts the current surges from said power supply to said capacitors,
said counter connected to said power supply and to one of said current limiting resistors,
a silicon diode connected between said counter and said high voltage power supply,
said diode having a cut off at a specific current flow to control said current surge counter.

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