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3,198,984

REPEATING FLASH CIRCUIT FOR AN ELECTRIC LAMP

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2 Sheets-Sheet 1

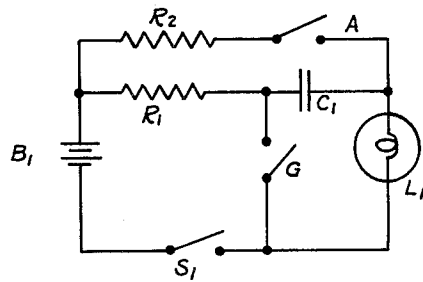


fig.1

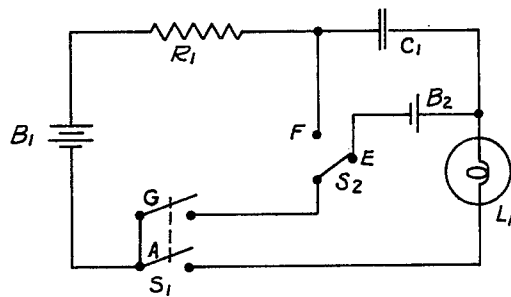


fig.2

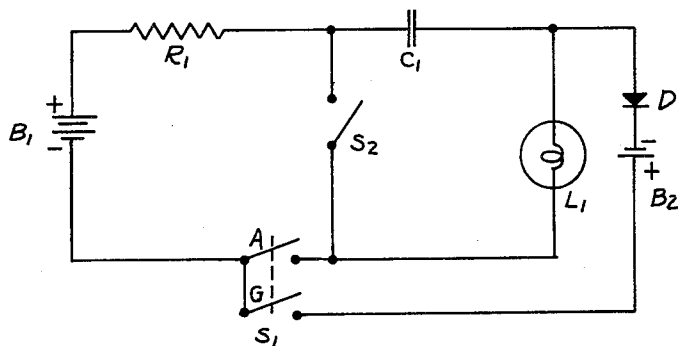


fig.3

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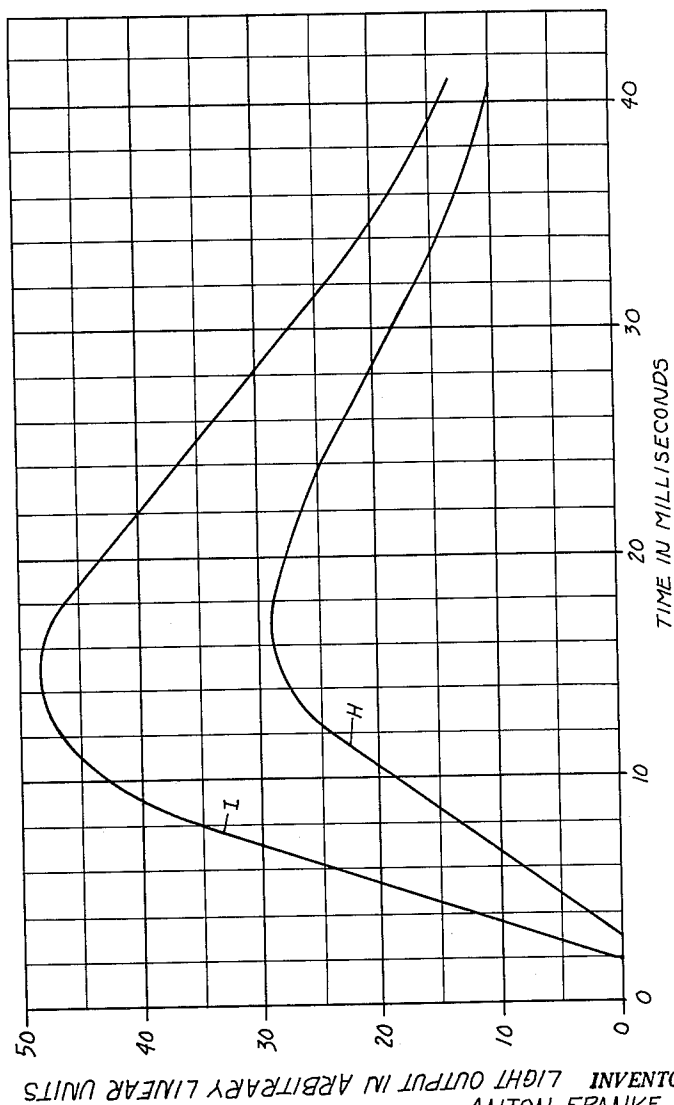
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fig. 4



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REPEATING FLASH CIRCUIT FOR AN ELECTRIC LAMP

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This invention relates to methods and apparatus for producing an electric flash of short duration. Such flashes are very useful in photography and can be used also for other purposes.

The customary and usual means of producing such flashes is by the rapid combustion of a metal foil or wire in an oxygen atmosphere in a sealed glass bulb. Such devices are commonly called flashbulbs and have been very effective for photographic purposes. They do, however, have the disadvantage that a new flashbulb is required for each flash, thus necessitating the carrying about of a large number of flashbulbs if a number of pictures are to be taken and requiring a time delay while the bulb is replaced. Moreover, the use of a new bulb for each flash is expensive.

Accordingly, the use of a gaseous discharge lamp, actuated by a condenser discharge has been suggested, the gaseous discharge lamp being used over and over again for a large number of flashes. Such a device generally requires bulky awkward and expensive equipment, however, and the discharge lamp does not have as complete a color spectrum as does the flashbulb.

The use of a condenser discharge to flash an incandescent lamp has also been suggested. Such an arrangement overcomes many of the above difficulties and is useful with cameras of slow shutter speeds, but the flash is of too long a duration to be effective at the high shutter speeds which are commonly in use.

I have discovered, however, that if the filament of the incandescent lamp is preheated to a low temperature, one at which there will be no appreciable light emitted, or in any event not enough light for the taking of the desired photograph, and the filament is then flashed by the condenser discharge, the period of the flash is extremely short and the time required to reach the maximum value is such that the flash can be used at higher shutter speeds and with shutters designed for lamps with short peak times (M2, AG1, etc.). In addition, the use of preheating will increase the brightness of the eventual flash.

However, the preheating battery, if connected directly across the lamp filament to energize the same, acts as a short-circuit on the condenser when the latter discharges and absorbs most of the energy of the discharge, making the flash ineffective unless the battery is cut out before the flash.

A high resistance can be used in series with the battery, but then the battery voltage must be raised greatly to take care of the voltage drop in the resistance. Moreover, if the current loss through the battery is to be cut to as small as even one-tenth that through the lamp, the series resistance would have to be ten times that of the lamp filament. This gives an inefficient bulky and costly arrangement.

The preheating current can be taken from the same battery that charges the condenser by means of a suitable dropping resistor, but the extra drain on the battery will shorten its life.

Since the current through the lamp during the flash is a transient one, an inductance coil might be used to pass the steady, direct current from the preheating battery while preventing the passage of the transient flash. However, an inductance large enough to do that would also be bulky and expensive.

I have discovered, however, that all the foregoing dis-

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advantages can be eliminated and a very effective flash produced by placing a rectifier in series with the preheating battery, the battery and rectifier being connected to send current therefrom in a direction opposite to that in which the condenser discharge would send it. In that way, the condenser discharge is prevented from entering the preheating battery circuit, and the consequent short-circuiting of the condenser discharge is eliminated.

I have further discovered that a semi-conductor diode will be effective as a rectifier in such a circuit thereby eliminating the need for an additional battery to heat the filament, as would be necessary with a vacuum tube rectifier.

Other objects, advantages and features of the invention will be apparent from the following description taken in conjunction with the accompanying drawing, in which:

FIGURE 1 is a schematic diagram of one circuit according to the invention;

FIGURE 2 is a schematic diagram of another such circuit;

FIGURE 3 is a schematic diagram of such a circuit including a rectifier; and

FIGURE 4 is a graph showing the intensity against time for various types of flashes.

In FIGURE 1, the lamp L_1 is the light-emitting element and can be, for example, a No. 428 incandescent flashlight lamp, that is, one which normally operates without flashing at 12.5 volts and 0.25 ampere. The lamp, of course, has a coiled tungsten filament.

The lamp L_1 is connected in series with a battery B_1 , which can be a so-called B-battery of about 45 volts such as used in radio work. A resistor R_1 , condenser C_1 and switch S_1 are also included in the series circuit. The resistor R_1 and condenser C_1 in series are shorted by the resistor R_2 and switch A in series. A switch G is connected across condenser C_1 and lamp L_1 in series for discharging the condenser through the lamp L_1 .

In operation, the switch S_1 is closed to allow condenser C_1 to charge. Switch A is closed then, or earlier, to allow a preheating current to flow through lamp L_1 . For the lamp specified, the resistor R_2 is of a value allowing about 75 milliamperes to pass if the lamp is the No. 428 previously mentioned. That value of current may cause a slight glow from the filament. The resistance R_1 is high enough to prevent any harmful short-circuit of the battery when the switch G is closed, but not high enough to make the charging time for the condenser to be so long as to be inconvenient.

When the lamp L_1 is to be flashed, the switch G is closed, thereby discharging the condenser through the lamp. The closing of switch G is synchronized with the opening of the camera shutter by means well known in the art of flash photography. In some cases, it may be desirable to actuate switch G through a relay, transistor or the like in order to permit the use of a smaller current in the triggering circuit for the flash.

If switch A is left closed during the flash, some of the condenser discharge current will be lost through the resistor R_2 . Nonetheless, the maximum current, through lamp L_1 , will be increased about 50% with a condenser C_1 .

In FIGURE 2, the resistor R_1 is again in series with condenser C_1 , lamp L_1 and battery B_1 , through one arm A of double pole switch S_1 . Battery B_2 is connected across lamp L_1 through switch arm S_2 which meets contact E and through arm G of switch S_1 . The contact F connected between resistor R_1 and condenser C_1 is in position to be contacted, when desired, by switch arm S_2 .

In operation, the double-pole switch S_1 is closed and switch arm S_2 set on contact E . The battery B_2 is then connected across the lamp L_1 to preheat it, and the main battery B_1 is connected to charge condenser C_1 . Since

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battery B_1 is across the lamp L_1 , and smaller in voltage than B_1 , it would take most of the condenser discharge current if it were left in circuit during the discharge.

However, the switch arm S_2 must be disconnected from contact E and connected to contact F to discharge the condenser, so battery B_2 is automatically disconnected during discharge. The time consumed by the switch arm S_2 in going from E to F should be small enough so that the lamp filament does not cool greatly during the switching.

In FIGURE 3, the battery B_1 is again connected in series with switch arm A, resistor R_1 , condenser C_1 and lamp L_1 . Switch S_2 is connected to discharge condenser C_1 across lamp L_1 , as shown. But now battery B_2 is connected in series with a diode D, which may be a germanium diode capable of withstanding high inverse voltages, and with arm G of switch S_1 , the series combination of the three being connected across the lamp L_1 or, as in the figure, across lamp L_1 and switch arm A.

Battery B_2 is connected to be opposite in polarity to the polarity of charged condenser C_1 when taken around a series circuit including them both. The diode D is connected to pass current in the direction of current flow from battery B_2 and to block current in the reverse direction.

In one embodiment of the invention according to FIGURE 3, the following values were used:

$B_1=78$ volts

$B_2=1.5$ volts

$C_1=150$ microfarads

$R_1=1000$ ohms

L_1 was a General Electric No. 432 lamp rated at 18 volts and 0.25 ampere.

D is a Sylvania germanium diode No. SR-776.

The resultant circuit had a peak time, that is, time to reach the peak light intensity of 15 milliseconds with preheating and 17 without preheating, that is, without the preheating battery in circuit. Under the same conditions, the light output was 336 peak lumens without preheating and 500 with preheating, a gain of about 50% with preheating.

If the condenser value is reduced with preheating to give merely the same total light output as without preheating, there will be a much greater difference in peak time with and without preheating.

Similar values can be used for B_1 , R_1 , C_1 and lamp L_1 in the other figures. R_1 in FIGURE 1 can also be about 1000 ohms.

Other suitable values can be used but those given are especially effective.

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In FIG. 4, the instantaneous light output in arbitrary but linear units is plotted against time in milliseconds. Curve H in this figure is for the discharge without preheating of the filament and Curve I is for the same discharge with preheating. In the latter case, the circuit of FIG. 3 was used. A condenser of 300 microfarads was used in each case, and a voltage of 45 volts. The peak of the curve is seen to be shifted from about 17 to about 14 milliseconds, and a larger proportion of its energy is contained below the 19 or 20 second point which is the closing time of the usual shutter, known in the trade as Class F, $\frac{1}{60}$ second. With a smaller condenser the curve would be even sharper, and the difference between preheating and not preheating even more marked. In fact, with a 150 microfarad condenser, the difference is about 4 to 1.

What I claim is:

1. An electric flashing circuit comprising: a lamp filament; a condenser; a resistance; a battery for charging said condenser connected to said condenser through said resistance; a switch connected to discharge said condenser across said filament when closed; and a circuit in shunt to said filament to preheat the same prior to discharging said condenser across it, said circuit including a separate battery connected across said filament.

2. An electric flashing circuit comprising: a lamp filament; a condenser; a resistance; a battery for charging said condenser connected to said condenser through said resistance; a switch connected to discharge said condenser across said filament when closed; and a circuit in shunt to said filament to preheat the same prior to discharging said condenser across it, said circuit including a separate battery and a diode connected in series opposition to the voltage of said condenser when the latter is charged by the first-mentioned battery, and in which the diode is connected to pass current in the direction of current flow from said separate battery but not from said first-mentioned battery.

References Cited by the Examiner

UNITED STATES PATENTS

1,939,332	12/33	Bouwers et al.	315—240 X
2,290,264	7/42	Wuerfel	315—241
2,407,113	9/26	Tuck	315—291
2,609,523	9/52	Stein et al.	315—241
2,656,488	10/53	Gray et al.	315—173

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