

PATENT SPECIFICATION (11)

1 480 982



- (21) Application No. 38330/75 (22) Filed 18 Sept. 1975 (19)
 (31) Convention Application No. 2 446 453
 (32) Filed 28 Sept. 1974 in
 (33) Fed. Rep. of Germany (DT)
 (44) Complete Specification published 27 July 1977
 (51) INT. CL.² G03B 15/05
 (52) Index at acceptance
 G2X 1K1

(54) AN ELECTRONIC FLASHLIGHT APPARATUS WITH AUTOMATIC LIGHT CONTROL

(71) I, PAUL METZ, of German Nationality, sole proprietor of the firm METZ APPARATEWERKE, of 8510 Furth/Bay., Ritterstrasse 5, Germany, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an electronic flashlight apparatus with automatic light control comprising a storage capacitor dischargeable through a flash tube and a series connected thyristor and a quenching capacitor for applying a blocking potential to the thyristor to prevent the storage capacitor from further discharging through the flash tube when a pre-set exposure is reached.

In such electronic flashlight apparatus it is determined up to what maximum distance of the object to be photographed sufficient illumination is obtainable. This determination, however, is valid only for the case of direct illumination of the object by the apparatus. When the object is illuminated indirectly the user must resort to estimate, as it is not known how high the reflectivity of the reflecting surface (wall or ceiling) is. Especially in such cases the user has no precise knowledge of whether the illumination of the object has been sufficient for the correct exposure of the film.

Switching arrangements in an electronic flashlight apparatus have already been disclosed (German Auslegeschrift No. 1,940,383) where the signal emitted by a light meter lights up directly or indirectly a glow lamp which is connected in parallel together with a biasing resistor to a charged capacitor, or switches over a monostable multivibrator in unstable state, a glow lamp or some other indicator means being provided in the collector circuit of the transistor which is blocked in the rest condition.

These conventional circuits necessitate for the desired indication a number of structural elements which raise the price of the ap-

paratus as well as requiring additional space. Moreover, such circuitry can be used to advantage only in flashlight devices with so-called quench tubes.

According to the present invention, an indication that the pre-set exposure has been attained is provided by a light emitting diode connected in the charging circuit of the quenching capacitor.

The invention will now be described further, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a circuit diagram of an electronic flashlight apparatus according to the invention, and

Figures 2, 3 and 4 show details of modifications of the circuit shown in Figure 1.

When the apparatus is switched on a source of direct current, which is not shown, e.g. a direct current converter supplied by a battery, begins charging to the operating voltage a storage capacitor C1 through a diode D2. A quenching capacitor C2 is also charged at the same time through a series path including resistors R1 and R2 a light emitting diode D1 and an inductor L. As the associated camera is actuated, its synchronizing contact SK is closed, whereby a triggering device Z applies a trigger pulse simultaneously to the gate electrode of a first thyristor Ty 1 and to the trigger electrode of a flash tube R₀ 1. As a result the storage capacitor C1 can discharge through the flash tube R₀ 1, which will then emit light while the discharge lasts.

A light meter LM measures the light reflected by the photographed object. As soon as a pre-set light value has been registered, which corresponds to the correct exposure of the film in the camera, a second thyristor Ty 2 is made conductive by a pulse from the light meter LM, so that the plate of the quenching capacitor C2, which has been charged to the operating potential, is connected via this thyristor Ty 2 to the negative pole (earth) of the storage capacitor C1. This produces on the quenching capacitor C2 a negative going voltage step

so that the plate of capacitor C2 connected to the thyristor Ty 1 becomes negative in relation to earth to the extent of the operating voltage. This voltage step acts upon the anode of the first thyristor Ty 1, which interrupts the discharge circuit. The discharge current of the capacitor C1 now flows from the positive plate of the storage capacitor C1 over the inductor Dr, the flash tube Rø 1, the quenching capacitor C2 and the second thyristor Ty 2 back to the negative pole of the storage capacitor C1, until the quenching capacitor C2 has been discharged, then recharged in the opposite sense. Not until this opposite charging process approaches its end does the current in the thyristor Ty 2 drop below the stop-current value and interrupts this circuit.

Now the quenching capacitor can be discharged by current flowing from the storage capacitor C1 over the charging circuit, made up of the choke Dr, the resistor R2, the quenching capacitor C2 and the resistor R1 and be recharged in the original sense. Since this charging circuit includes a light emitting diode D1, which may be placed at some other point of this charging circuit, this lights up during the whole of the recharging process and thus indicates that the light meter has responded and actuated the thyristor Ty 2, as only in this case can the charging process take place. This process last for about half a second, so that the lighting up of the glow diode D1 is readily observable.

Although when the apparatus is switched on there is also a charging current flowing through the glow diode D1, this current is considerably weaker, because the voltage at the storage capacitor C1 rises but slowly. If, however, this current is so strong as to cause the glow diode D1 to light up, this can be prevented by suitably dimensioning a resistor R4, shown in Figures 2, 3 or 4, and connected in parallel with the light emitting diode D1.

A further diode D3 or D5 may be arranged in reverse parallel connection (Figure 2) or in series (Figure 4) with the light diode D1 to protect the light emitting diode D1 against damage should excessive reverse voltages arise.

A Zener diode D4 (Figure 3) may be used to keep the current passing through

the light emitting diode D1 and thus its brightness constant within wide limits of applied voltage, the Zener diode D4 being connected in parallel with a series combination including the diode D1 and a resistor R3.

WHAT WE CLAIM IS:—

1. An electronic flashlight apparatus with automatic light control comprising a storage capacitor dischargeable through a flash tube and a series connected thyristor, and a quenching capacitor for applying a blocking potential to the thyristor to prevent the storage capacitor from further discharging through the flash tube when a pre-set exposure is reached, wherein a light emitting diode is arranged in the charging current path of the quenching capacitor.

2. An electronic flashlight apparatus as claimed in claim 1, wherein a further diode is arranged in reverse parallel connection with the light emitting diode.

3. An electronic flashlight apparatus as claimed in claim 1, wherein a Zener diode is arranged in reverse parallel connection with the light emitting diode.

4. An electronic flashlight apparatus as claimed in claim 3, wherein a resistor is connected in series with the light-emitting diode.

5. An electronic flashlight apparatus as claimed in claim 1, wherein a further diode is connected in series with and in the same sense as the light emitting diode.

6. An electronic flashlight apparatus as claimed in any preceding claim, wherein a further resistor is arranged in parallel with the light emitting diode.

7. An electronic flashlight apparatus constructed and adapted to operate substantially as herein described with reference to and as illustrated in Figure 1 of the accompanying drawings.

8. An electronic flashlight apparatus as claimed in claim 7, and modified substantially as herein described with reference to and as illustrated in Figure 2, Figure 3 or Figure 4 of the accompanying drawings.

MARKS & CLERK,
Chartered Patent Agents,
57—60 Lincoln's Inn Fields,
London, WC2A 3LS.
Agents for the Applicants.

so that the plate of capacitor C2 connected to the thyristor Ty 1 becomes negative in relation to earth to the extent of the operating voltage. This voltage step acts upon the anode of the first thyristor Ty 1, which interrupts the discharge circuit. The discharge current of the capacitor C1 now flows from the positive plate of the storage capacitor C1 over the inductor Dr, the flash tube R6 1, the quenching capacitor C2 and the second thyristor Ty 2 back to the negative pole of the storage capacitor C1, until the quenching capacitor C2 has been discharged, then recharged in the opposite sense. Not until this opposite charging process approaches its end does the current in the thyristor Ty 2 drop below the stop-current value and interrupts this circuit.

Now the quenching capacitor can be discharged by current flowing from the storage capacitor C1 over the charging circuit, made up of the choke Dr, the resistor R2, the quenching capacitor C2 and the resistor R1 and be recharged in the original sense. Since this charging circuit includes a light emitting diode D1, which may be placed at some other point of this charging circuit, this lights up during the whole of the recharging process and thus indicates that the light meter has responded and actuated the thyristor Ty 2, as only in this case can the charging process take place. This process lasts for about half a second, so that the lighting up of the glow diode D1 is readily observable.

Although when the apparatus is switched on there is also a charging current flowing through the glow diode D1, this current is considerably weaker, because the voltage at the storage capacitor C1 rises but slowly. If, however, this current is so strong as to cause the glow diode D1 to light up, this can be prevented by suitably dimensioning a resistor R4, shown in Figures 2, 3 or 4, and connected in parallel with the light emitting diode D1.

A further diode D3 or D5 may be arranged in reverse parallel connection (Figure 2) or in series (Figure 4) with the light diode D1 to protect the light emitting diode D1 against damage should excessive reverse voltages arise.

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1. An electronic flashlight apparatus with automatic light control comprising a storage capacitor dischargeable through a flash tube and a series connected thyristor, and a quenching capacitor for applying a blocking potential to the thyristor to prevent the storage capacitor from further discharging through the flash tube when a pre-set exposure is reached, wherein a light emitting diode is arranged in the charging current path of the quenching capacitor.

2. An electronic flashlight apparatus as claimed in claim 1, wherein a further diode is arranged in reverse parallel connection with the light emitting diode.

3. An electronic flashlight apparatus as claimed in claim 1, wherein a Zener diode is arranged in reverse parallel connection with the light emitting diode.

4. An electronic flashlight apparatus as claimed in claim 3, wherein a resistor is connected in series with the light-emitting diode.

5. An electronic flashlight apparatus as claimed in claim 1, wherein a further diode is connected in series with and in the same sense as the light emitting diode.

6. An electronic flashlight apparatus as claimed in any preceding claim, wherein a further resistor is arranged in parallel with the light emitting diode.

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