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(72) Inventor WULF WARLITZ



(54) CONTROL OF ELECTRONIC FLASHLIGHT APPARATUS

(71) We, FRANKE & HEIDECKE, G.m.b.H., a German Body Corporate, trading as ROLLEI-WERKE FRANKE & HEIDECKE, of 196 Salzdahlumerstrasse, Braunschweig, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present relates to an electronic flash-light apparatus for photographic purposes, a part of the light reflected from a subject interrupting the flash tube discharge, via a photographic integrating measuring device, when a certain pre-selectable value of the quantity of light measured has been reached.

It has already been suggested that this problem should be solved by a system in which a measuring device short-circuits the discharge path of the flash tube by igniting a quenching tube i.e. a tube which in the conductive state has a low ohmic resistance, connected in parallel with the discharge path. In these systems the main capacitor is completely discharged. Each time a photograph is taken, therefore, the full capacitor charged is consumed, regardless of the amount of light required in that individual case.

According to the present invention there is provided a control circuit for controlling electronic flashlight apparatus, including a discharge circuit comprising connected in series a capacitor, a flash tube, a control element and an inductive element, and a photo-electronic integration device associated with said inductive element, whereby upon ignition of the flash tube and when a correct exposure of the subject is obtained, the integration measuring device inductively provides a quenching current in the inductive element in opposition to the discharge current, thereby to interrupt the discharge current and to render the control element non-conductive, the duration of the quenching current being longer than the recovery time of the control element.

It has already been suggested that the charging of the capacitor should be limited to that required by the particular photograph, either by discharging the fully charged capacitor to the necessary extent before actuating the flash tube or by only charging the capacitor to the extent required. It is true that this latter method enables power to be saved, but this solution necessitates a preliminary flash for the actual measuring process and further means for keeping the lens shutter closed during the said preliminary flash, while if one and the same flash tube is used for the preliminary flash and the main flash this necessitates still further measures for connecting and disconnecting the main capacitor in accordance with the shutter opening.

The invention makes use, in the known manner, of one flash light apparatus only, the measurement being effected with the light emitted by it, after which the discharge is interrupted when the necessary quantity of light has been reached, but in a manner which enables the unused charge to be saved, so that it is available as a capacitor charge for the next flashlight operation.

In the known system the discharge of the flash tube is interrupted by short-circuiting, by means of a discharge path connected in parallel thereto, the capacitor thus being discharged completely. The system to which the invention relates enables the capacitor to remain permanently connected up to the flash tube, insofar as the time for the capacitor to re-charge to the ignition voltage is longer than the de-ionization time of the flash tube, so that any unintentional re-ignition of the flash tube is avoided. The control element may be a thyristor.

In the system to which the invention relates the decisive factor in this connection is not the de-ionization time of the flash tube but the considerably shorter "release time" of the thyristor. This enables the capacitor to be re-charged far more rapidly, which is in any case already a shorter process because the only re-charging necessary

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is that required to counteract the charge which was consumed in the individual flash.

A constructional embodiment will now be described by way of example with reference to the accompanying drawing in which only the components required for the comprehension of the invention are shown.

Referring now in more detail to the drawing there is shown a flash tube 1 which may be actuated by an ignition device 2, which at the same time ignites a thyristor 3. If the full charging voltage of a capacitor 4 is higher than the ignition voltage of the flash tube 1, the latter need not be separately ignited, so that in this case the ignition of the thyristor 3 is sufficient to cause ignition of the flash tube 1. A secondary winding 5 of a transformer 6, which transmits an impulse from a photo-electric control 7, is connected in series with the flash tube 1 and the thyristor 3.

The control 7 consists of a photo-electric integrating device which is known in connection with apparatus of this type and by which the light emanating from the flash tube 1 and reflected from a subject is measured on the integration principle and by which an impulse is generated after a certain preselected limit, corresponding to the correct exposure of the subject, has been reached.

This impulse generates a current in opposition to the flash tube discharge current in the winding 5 in the flash tube discharge circuit, so that the current in the flash tube circuit rapidly becomes zero causing the thyristor 3 to be reversed biased and thus rendered non-conductive or quenched. The flash tube discharge is thus interrupted and the charge in capacitor 4 which has not been used is preserved in the capacitor.

The impulse of quenching current applied via winding 5 is of such duration as to be longer than the recovery time of the thyristor so that the thyristor 3 will not be rendered conductive until the quenching current is removed and the thyristor is re-ignited by the application of a pulse to the

gate electrode thereof, whereupon the flash tube will discharge again.

An alternative arrangement of rendering the control thyristor non-conductive is described and claimed in our copending Application No. 33434/70 (Serial No. 1,314,907).

WHAT WE CLAIM IS:—

1. A control circuit for controlling electronic flashlight apparatus, including a discharge circuit comprising connected in series a capacitor, a flash tube, a control element and an inductive element, and a photo-electric integration device associated with said inductive element, whereby upon ignition of the flash tube and when a correct exposure of the subject is obtained, the integration measuring device inductively provides a quenching current in the inductive element in opposition to the discharge current, thereby to interrupt the discharge current and to render the control element non-conductive, the duration of the quenching current being longer than the recovery time of the control element.

2. A circuit as claimed in claim 1, wherein the inductive element is a transformer having its primary winding connected to the integration measuring device and its secondary winding is connected in series with the capacitor, flash tube and control element.

3. A circuit as claimed in claim 1 or 2, wherein the control element comprises a thyristor ignitable by an ignition device, whereby the ignition of the thyristor is sufficient to ignite the flash tube.

4. A control circuit substantially as hereinbefore described with reference to and as illustrated in the accompanying drawing.

For the Applicants:
MATTHEWS, HADDAN & CO.,
Chartered Patent Agents,
Haddan House,
33 Elmfield Road,
Bromley, BR1 1SU.



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