

# PATENT SPECIFICATION

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## (54) CONTROL OF ELECTRONIC FLASHLIGHT APPARATUS

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ROLLEI-WERKE FRANKE & HEIDECHE, of  
196 Salzdhumerstrasse, 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 invention relates to the control  
of electronic flashlight apparatus for photographic  
purposes.

It is known to extinguish a flash tube when  
the voltage at its terminals is reduced to the  
quenching voltage and when steps are taken  
to ensure that the latter does not re-ascend  
to the ignition-voltage threshold until the  
tube has been de-ionized. Otherwise the  
flash tube would immediately re-ignite.

In one customary arrangement, in which  
the flash tube is connected in parallel with  
the main capacitor serving as a source of  
flash tube current, the said steps involve the  
removal of the voltage in the flash tube and  
thus for all practical purposes the short-  
circuiting of the latter, the capacitor being  
short-circuited at the same time and thus  
completely discharged. In practice a quench-  
ing impulse can be utilized for the ignition  
of a so-called quenching tube, which is connected  
in parallel with the flash tube. The  
re-charging of the main capacitor then need  
only be retarded by the time required to  
ensure that the ignition voltage is certain to  
be deferred until the de-ionization of the  
flash tube. Neither is this situation in any  
way altered if a "short circuit switch" used  
consists of an electronic component of which  
the de-ionization or recovery time is considerably  
shorter than the de-ionization time of the  
flash tube.

According to the Patent Application No.  
33435/70 (Serial No. 1,314,908) the quench-  
ing impulse is conducted into a discharge  
circuit in such a way that the discharge process,  
i.e. the flow of current, is interrupted for  
the duration of the quenching impulse. The  
time occupied by this interruption must

be longer than the de-ionization time of the  
circuit. A thyristor was thus added to the  
discharge circuit and is ignited together together  
with the flash tube. The introduction of the  
quenching impulse is effected by means of a  
transformer included in the circuit. As the  
recovery time of the thyristor is very short by  
comparison with the de-ionization time of the  
flash tube, the counter-current need only take  
effect for a slightly longer period than the  
recovery time of the thyristor.

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 operative in  
response to discharge current of the capacitor  
and a control element for controlling the  
flow of discharge current to the flash tube;  
a switch device connected across the control  
element and a photoelectric integration  
measuring device connected with the switch  
device, whereby upon ignition of the flash  
tube and when a correct exposure of a subject  
has been reached the integration measuring  
device operates the switch device to provide  
a quenching current effective to render the  
control element non-conductive and interrupt  
the flash tube discharge current whereupon  
the flash tube is extinguished, the duration  
of the quenching current being longer than  
the de-ionization time of the flash tube or  
the recovery time of the control element.

By utilising the present invention the  
advantages of short recovery time and preservation  
of unconsumed capacitor charge are retained  
as a result of the fact that the function of  
the transformer and that of the thyristor  
mentioned above are combined in one and  
the same control element. The duration of  
interruption of flash tube current thus  
depends on the recovery time of the control  
element, which recovers more rapidly, but  
which need not necessarily consist of a  
thyristor. In addition, the quenching-impulse  
voltage introduced depends solely on the

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voltage drop in this control element. The necessary current impulse can therefore be obtained with a relatively low voltage, so that only low energy is consumed in the quenching operation. The expenditure on control and switching apparatus is thus likewise reduced, both as regards the dimensions required for the individual components and owing to the fact that the transformer is dispensed with.

A constructional embodiment of the invention will now be described by way of example with reference to the accompanying drawing which illustrates schematically the basic details required for the comprehension of the invention.

Referring now to the drawing in more detail in capacitor 4 and a control element 3, preferably a thyristor, are shown connected in series. The flash tube 1 is ignited by an ignition device 2, which simultaneously ignites the thyristor 3. If the full charging voltage of the capacitor 4 is higher than the ignition voltage of the flash tube 1, the additional operation of igniting the flash tube can be dispensed with. In this case, only the thyristor 3 need be ignited.

A capacitor 5 and a switch device 6, for example a thyristor or thyatron are connected in series across the terminals of the thyristor 3. The switch device 6 is controlled by a photo-electric integration device 7, by which light emanating from the flash tube and reflected from a subject is measured on the integration principle. The device 7 generates a quenching impulse after a certain pre-selectable limit, corresponding to the correct exposure of the subject, has been reached. This quenching impulse short circuits or closes the switch device 6 so that the voltage of the capacitor 5 is applied to the terminals of the thyristor 3. The main capacitor 4 is charged up from a current supply via a transformer 8 and a diode 9.

The operation of charging up the capacitor 5 takes place via diodes 10 so that the discharge current of the capacitor 5 in the thyristor 3 flows in the opposite direction to the discharge current of the flash tube. As the resistance of the thyristor 3, in its conductive state, is comparatively low, and the recovery time of the thyristor 3 is very short, the necessary counter-current can be obtained, for the required period, with a comparatively low capacity in the capacitor 5. When the quenching impulse of the integration device 7 occurs the condenser 5 discharges, in the opposite direction to the flash tube current, via the thyristor 3, so that at this point the flow of the flash tube current is interrupted for the duration of the recovery time of the thyristor 3 i.e. the

time taken to render the thyristor non-conductive the flash tube 1 thus being extinguished.

With control elements having longer recovery times than de-ionization time of the flash tube it is necessary to ensure by selection of the value of capacitor 5 that the discharge current of capacitor 5 interrupts the flash tube current for the duration of the de-ionization time of the flash tube, thereby to prevent further ignition of the flash tube.

The unconsumed part of the charge of the capacitor 4 is preserved. Only the consumed part of the charge therefore has to be replenished, and as the recovery time of the thyristor 3 is very short the operation of recharging the capacitor 4 and thus the capacitor 5 can be carried out very rapidly.

#### 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 operative in response to discharge current of the capacitor and a control element for controlling the flow of discharge current to the flash tube, a switch device connected across the control element and a photoelectric integration measuring device connected with the switch device, whereby upon ignition of the flash tube and when a correct exposure of a subject has been reached, the integration measuring device operates the switch device to provide a quenching current effective to render the control element non-conductive and interrupt the flash tube discharge current whereupon the flash tube is extinguished, the duration of the quenching current being longer than the de-ionization time of the flash tube or the recovery time of the control element.

2. A control circuit as claimed in claim 1, wherein the control element consists of a thyristor and wherein a capacitor and the switch device are connected in series across the terminals of the said thyristor.

3. A control circuit as claimed in claim 1 or 2, wherein the switch device consists of a thyristor having its ignition electrode connected with the photoelectric integration measuring device.

4. A control circuit substantially as described herein with reference to, and as illustrated by, the accompanying drawing.

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voltage drop in this control element. The necessary current impulse can therefore be obtained with a relatively low voltage, so that only low energy is consumed in the quenching operation. The expenditure on control and switching apparatus is thus likewise reduced, both as regards the dimensions required for the individual components and owing to the fact that the transformer is dispensed with.

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