United States Patent [19]

DeGraaf et al.

[11] **3,728,067**

[45] **Apr. 17, 1973**

[54] **DEVICE FOR FLASHING COMBUSTION FLASH BULBS ONE AFTER THE OTHER**

[75] Inventors: **Wilhelmus Polycarpus DeGraaf; Peter Andreas Waltherus Tielemans,** both of Emmasingel Eindhoven, Netherlands

[73] Assignee: **U.S. Philips Corporation,** New York, N.Y.

[22] Filed: **Sept. 23, 1970**

[21] Appl. No.: **74,811**

[30] **Foreign Application Priority Data**

Oct. 3, 1969 Netherlands 6915056

[52] **U.S. Cl.**.....**431/95**

[51] **Int. Cl.**.....**F21k 5/02**

[58] **Field of Search**.....431/93, 94, 95; 315/232, 240

[56] **References Cited**

UNITED STATES PATENTS

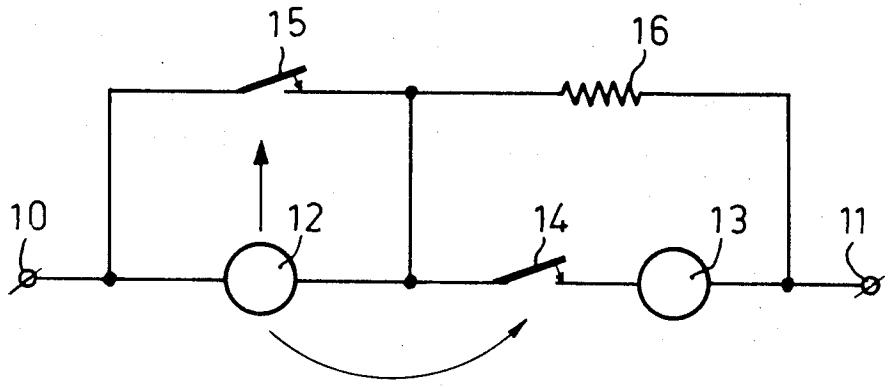
3,532,931	10/0197	Cote et al.	315/240
3,443,875	5/1969	Herrman	431/95
3,458,270	7/1969	Ganser	431/95
3,544,251	12/1970	Brandt	431/95

Primary Examiner—Carroll B. Dority, Jr.
Attorney—Frank R. Trifari

[57] **ABSTRACT**

The invention relates to a device for flashing flash bulbs one after the other. In a device according to the invention the flash bulbs are arranged in series, and a bulb is shunted by a make contact which reacts to the radiation heat which is released when said lamp is flashed.

1 Claim, 2 Drawing Figures



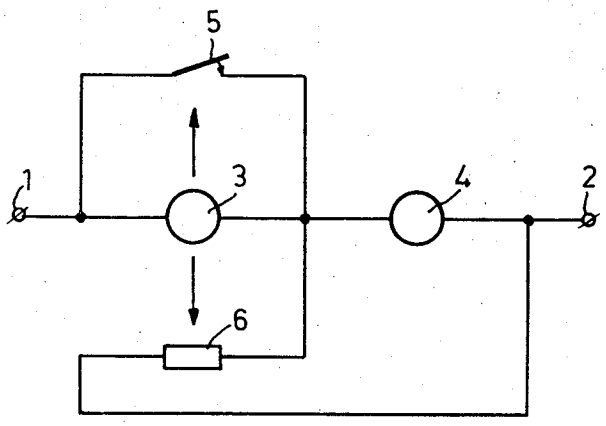


Fig.1

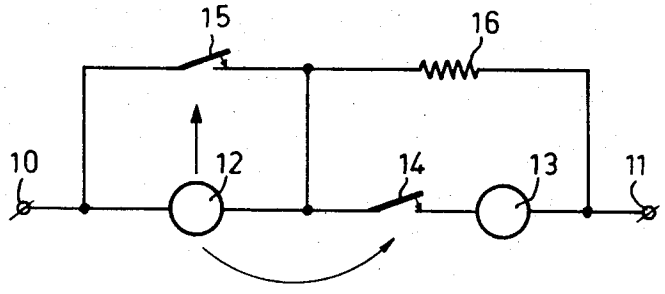


Fig.2

INVENTORS
WILHELMUS P. DE GRAAF
PETER A.W. TIELEMANS
BY Frank R. Jackson
AGENT

DEVICE FOR FLASHING COMBUSTION FLASH BULBS ONE AFTER THE OTHER

The invention relates to a device provided with at least two combustion flash bulbs and with means for flashing said bulbs one after the other, a filament of at least one flash bulb being shunted by a circuit which includes a switching element formed as a make contact which reacts to the energy released in said flash bulb upon flashing.

A known device of the kind mentioned above is described, for example, in the U.S. Pat. No. 3,458,270. In the device described in said patent application the bulbs are arranged in parallel. The make contact in said arrangement serves to make the next bulb ready for operation. A drawback of said known device is that when a bulb has been flashed it is possible that this flashed bulb has a low resistance so that the circuit still does not operate satisfactorily.

Up till now a series arrangement of flash bulbs has not been used because after flashing a first bulb a closed circuit is no longer present for flashing the second bulb.

It is true that there is a solution for series-arranged bulbs. In that case, however, two mechanically movable contacts are present with which always one of the bulbs of such a series-arranged row can be flashed. Said movable contacts make the device complicated and vulnerable.

It is an object of the present invention to provide a solution which does not have the above-mentioned drawbacks, but in which a simple series arrangement of the bulbs is used.

According to the invention a device provided with at least two combustion flash bulbs and with means for flashing said bulbs one after the other, in which a filament of at least one flash bulb is shunted by a circuit which includes a switching element formed as a make contact which reacts to the energy released in said flash bulb upon flashing is characterized in that the bulbs are arranged in series.

An advantage of a device according to the invention is that a bulb once flashed is automatically shunted by a conducting connection which is constituted by the then closed make contact so that a further bulb may be flashed via this connection. The circuit arrangement may therefore be very simple.

It is feasible that the switching element reacts to an increased pressure in the flash bulb upon flashing. Due to said increased pressure the contact may be closed, for example, in a separate space of this combustion flash bulb.

The switching element may alternatively be formed as a chemical switch. Then this switch consists for example, of a mass which becomes satisfactorily electrically conducting due to the action of radiation. In that case Ag_2O is used, for example, as the material for this mass with the addition of an organic binder such as polyvinyl resin.

In an advantageous embodiment of the device according to the invention in which the switching element reacts to the energy which is released as heat upon flashing in the flash bulb shunted by the switching element, the switching element consists of a make melt contact.

An advantage of this solution is that the switching element may be very simple and may be influenced without further auxiliary devices being required.

It is possible to arrange this make melt contact, for example, outside the bulb. It is likewise feasible that this make melt contact is present within the bulb.

Furthermore it is feasible that a next bulb is shunted by a resistor and is also shunted by a make contact according to the invention, the last-mentioned make contact reacting to the energy which is released upon flashing in the bulb shunted by this contact. The first bulb is then flashed through this resistor.

In a further advantageous embodiment of a device according to the invention in which in addition to the first switching element also a second switching element is present which reacts to the energy released upon flashing of said bulb, said second switching element is formed as a break contact and that the latter contact is located in a circuit shunting the other bulb.

An advantage of this preferred embodiment is that the supply energy for the device, for example, the energy in an ignition capacitor can be limited because none of the bulbs is to be fed through a resistor but is fed directly through strips which may have a low resistance.

In a further advantageous embodiment of a device according to the invention in which also a second make contact reacts to the energy released upon flashing of the bulb, said second make contact is arranged beside—and in series with — a next bulb, the series arrangement of said second make contact and the next bulb being shunted by a resistor.

An advantage of the last-mentioned embodiment is that upon flashing of the first bulb the current is completely supplied through the said resistor to said first bulb and that no current at all flows through the second bulb because a make contact which has not yet operated is incorporated in series with said second bulb. The risk of so-called double flashing, that is to say, simultaneous flashing of two bulbs is entirely excluded in the last-mentioned embodiment.

In order that the invention may be readily carried into effect a few embodiments thereof will now be described in detail by way of example with reference to the accompanying diagrammatic drawing in which

FIG. 1 shows the circuit of a device according to the invention;

FIG. 2 shows a circuit of a further device according to the invention.

In FIG. 1 the reference numerals 1 and 2 denote connecting terminals which are connected, for example, to a capacitor. The connection to the capacitor may be established by means of a switch which is closed for a short period when a shutter mechanism of a photocamera is activated. The capacitor is charged, for example, to 9 to 15 Volts by a device not further shown. The terminals 1 and 2 are connected by means of a series arrangement of two low-voltage combustion flash bulbs 3 and 4. The bulb 3 is shunted by a make contact 5. The bulb 4 is shunted by a break melt contact 6. The contacts 5 and 6 both react to the release of energy when the bulb 3 is flashed.

The operation of the circuit of FIG. 1 is as follows. When a voltage is applied to the terminals 1 and 2, the bulb 3 will receive current mainly through the strip 6.

This bulb 3 will then be flashed. When energy is released as a result of said flashing the melt strip 6 is melted and furthermore the make contact 5 is closed. This closing results in the bulb 3 being fully short-circuited. Melting of the strip 6 implies that a short circuit across the bulb 4 is eliminated. When a voltage is applied once again to the terminals 1 and 2 the bulb 4 will be flashed. It is feasible that this row of two series-arranged flash bulbs is extended to a row in which more than two low-voltage flash bulbs are arranged in series. In that case substantially all bulbs may be shunted by a make contact and substantially all bulbs may also operate a melt contact shunting the next bulb.

In FIG. 2 the reference numerals 10 and 11 denote connecting terminals which are comparable with terminals 1 and 2 of FIG. 1. The reference numerals 12 and 13 denote two flash bulbs. These bulbs are arranged in series. A make contact 14 is connected between these bulbs 12 and 13. In addition the bulb 12 is shunted by a make contact 15. Finally the series arrangement of bulb 13 and make contact 14 is shunted by a resistor 16.

The operation of the circuit of FIG. 2 is as follows. When a voltage is applied to the terminals 10 and 11, the bulb 12 will first receive current through the resistor 16. The bulb 13 does not receive current yet, because the contact 14 which is arranged in series therewith is still open. The bulb 12 will now be flashed. This has two results. In the first place the make contact 15 will close and in the second place the make contact 14 will close. Closing of the make contact 15 means that the bulb 12 is short-circuited. Closing of the make contact 14 means that the bulb 13 is incorporated in the circuit. When a voltage is applied once again to the connecting terminals 10 and 11, the bulb 13 will be flashed namely because this bulb receives current from terminal 10 through make contact 15, through make contact 14 and the return connection to terminal 11.

The make contact 5 of FIG. 1 and the make contact 15 of FIG. 2 may optionally be provided in the relevant bulb. It is obvious that in that case the number of lead-through wires through the envelope of the bulb need not be more than two.

Also in the case of FIG. 2 the series-arranged row of flash bulbs may of course alternatively be extended to a series arrangement of more than two flash bulbs.

In a practical embodiment the melt strip 6 had a resistance of less than 0.1 Ohm prior to melting. The resistance of each make contact 5, 14 and 15 was approximately 0.2 Ohm after flashing. The resistor 16 had a value of approximately 2 Ohms. Prior to flashing the bulbs 3, 4, 12 and 13 had a resistance of approximately 1 Ohm, and after flashing in approximately 75 percent of the cases a resistance of more than 1,000 Ohms and a resistance of between approximately 0.5 Ohm and 10 Ohms in the other cases.

What is claimed is:

1. An electrical arrangement for the sequential operation of flash bulbs in series comprising:

at least two combustion flash bulb units connected in a series circuit;

means for flashing said bulb coupled to the outer terminals of said series circuit;

a first switching element, one of said bulb units being electrically connected in shunt arrangement with said first switching element, said first switching element being formed as a "make" contact and also being juxtaposed and physically responsive to energy released by said bulb upon flashing, whereby the first bulb upon flashing causes the switching element to "make" thereby effecting electrical coupling of remaining bulbs to said flashing means;

a second switching element which is also responsive to the energy released by said first bulb upon flashing, said second switching element also being connected in series arrangement with a second one of said series connected bulbs, said second switching element also formed as a "make" element;

and a resistor connected in shunt with the series arrangement of said second "make" element and second bulb.

* * * * *