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FLASH PRODUCING APPARATUS

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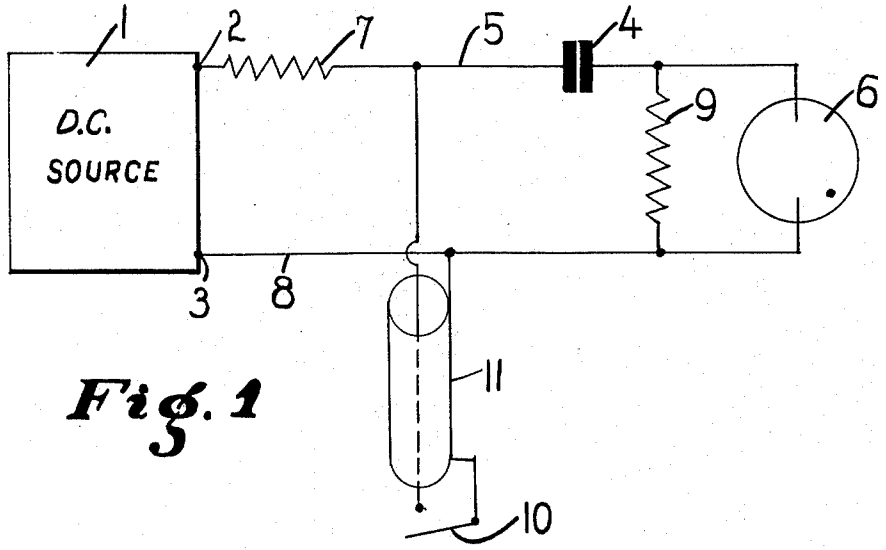


Fig. 1

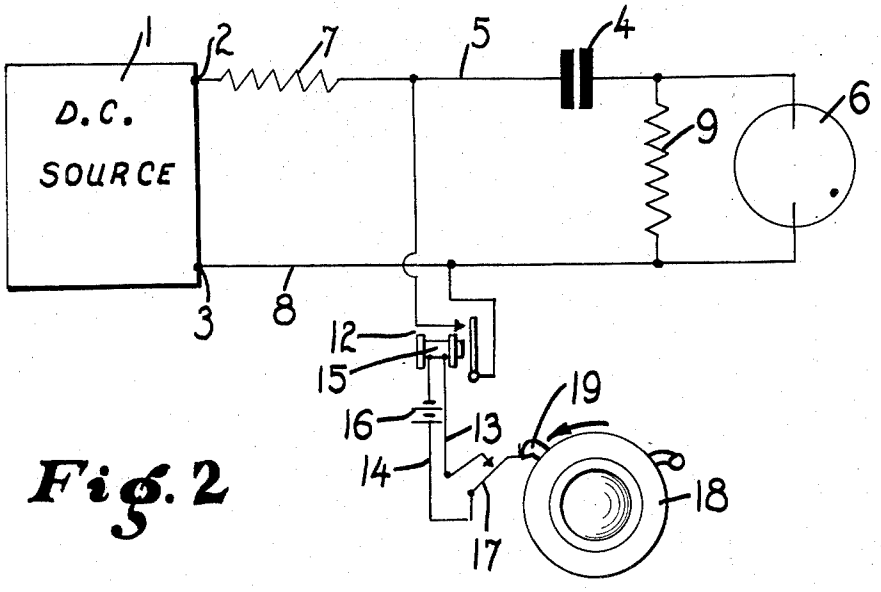


Fig. 2

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FLASH PRODUCING APPARATUS

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3 Claims. (Cl. 315—227)

1

This invention relates to apparatus for producing short flashes of light of high intensity and particularly to such apparatus employing an arc discharge flash tube as the light source.

In such apparatus a charge contained in a relatively large capacitor is caused to discharge through the tube to produce the light flash. In apparatus in use prior to the present invention accurate control of the flash has been unsatisfactory due to the instability of the circuits used.

It is conventional practice to use electronic switching to control the flash. For example, the triggering action of an internal or external grid element associated with the tube has been employed to fire the flash tube. Means are provided through the action of another tube such as a thyratron to apply a voltage to the trigger grid of the flash tube of sufficient intensity to ionize and thus fire the tube.

There are many disadvantages inherent in existing apparatus. One such disadvantage lies in the fact that the condenser charging voltage is continuously impressed upon the flash tube terminals. Normally this voltage is not sufficient to fire the tube. However, when increased to an intensity determined by the flash tube characteristics it will fire the tube.

It has been found very difficult to design circuits of the conventional type in which the margin of voltage between non-firing and firing is sufficiently great to forestall accidental firing of the tube. Supply line voltage surges or other variables in the circuit may cause unintentional firing of the tube.

Moreover, the conventional circuits are complicated and expensive to manufacture and when they are intended for service requiring portability their weight is a disadvantage.

It is an object of the present invention to provide a flash tube apparatus which is protected against accidental firing.

A further object of the invention is to provide a flash apparatus of simplified and efficient construction.

A further object of the invention is to provide a flash apparatus of minimum weight particularly adapted for portable use.

Other objects and features will more fully appear from the following description and will be pointed out in the claims.

The apparatus consists essentially of a unit for supplying direct current which is connected to and acts to charge a relatively high capacity condenser. A high intensity arc discharge type tube is connected in the circuit to receive the discharge of the condenser.

2

To control the firing of the lamp a manually operated switch is arranged when closed to complete a non-impedance path from the condenser to the lamp.

To provide a better understanding of the invention a particular embodiment thereof will be described and illustrated in the accompanying drawings in which Figure 1 is a circuit diagram illustrating the invention. Figure 2 is a diagrammatic view illustrating one means of timing the flash to the action of a camera shutter.

In Fig. 1 of the drawings the firing of the flash lamp is controlled by manual means. The invention however, is adaptable to any type of automatic or synchronized operation.

Power for the operation of the apparatus is obtained from a suitable source such as the direct current power unit 1. The characteristics of the power supply 1 should be such that its internal resistance is great enough to prevent damage thereto when its output terminals 2 and 3 are shortcircuited momentarily.

The output terminal 2 is connected to one terminal of a large capacity condenser 4 through the lead 5. The other terminal of the condenser is connected to one terminal of an arc discharge tube 6. The tube 6 may be of any type having low discharge impedance and capable of conducting high volume momentary surges of current. If the resistance of the power supply is not suitable a series resistor 7 may be inserted in the circuit from the supply unit 1.

The output terminal 3 of the supply unit is connected to a lead 8 which is connected to the other side of the tube 6. To provide a path for the current from the source 1 to charge the condenser an impedance 9 or direct-current-conductive shunt is connected in parallel with the tube 6. The impedance 9 is substantially less than the impedance 7 plus the impedance of the source 1, but substantially greater than the discharge impedance of the tube 6. For example, the discharge impedance of the tube may be approximately from 2 to 5 ohms, the value of the impedance 9 substantially 100 ohms while that of the unit 1 and the impedance 7 may be several thousand ohms.

A switch 10 is connected to close a low impedance path from the condenser through the tube 6. The switch may be situated at any convenient position upon the apparatus or it may be located at the end of a coaxial cable 11 or other suitable conductor having low impedance and large current capacity. By using the cable 11 the firing of the tube may be controlled from a remote

point as in the case where the operator wishes to manipulate a camera when firing the flash tube; the camera being at a substantial distance from the flash apparatus.

The power supply 1 is so connected to the circuit that the condenser becomes charged and the left terminal of the condenser as shown in the diagram reaches the full voltage of the supply 1 while the other terminal of the condenser remains at zero potential. The condenser charging current flows from the source 1 through the leads 7 and 8 and the resistor 9.

When the switch 10 is open no current flows in the tube 6 because the zero potential side of the condenser only is connected thereto. While the switch 10 is open therefore the condenser becomes charged and the circuit remains stabilized and the tube cannot be fired without closing the switch 10.

When the switch 10 is closed the high voltage of the condenser terminal is applied to the tube 6. This voltage is adjusted to cause ionization of the gaseous atmosphere in the tube 6 thus reducing its impedance at its low value which effects discharge of the condenser through the tube and through the low impedance path including the switch 10 and cable 11. The high volume pulse of current through the tube causes a desired high intensity flash of very short duration.

The switch 10 is closed only momentarily to fire the tube and then opened. Immediately upon opening the switch the source of supply 1 is rendered effective and the condenser is again charged. The momentary short circuit across the supply created by the closing of the switch causes no damage to the supply unit because of its high internal reactance plus any external reactance added thereto such as the reactance 7.

Upon discharge of the condenser the voltage upon the terminals of the tube 6 is removed thus the tube again becomes deionized and the circuit again is stabilized. The above described cycle of events may be repeated as rapidly as the charging time of the condenser will allow.

Fig. 2 of the drawings illustrates an additional means for firing the tube. This form of the invention is the same as above described with the exception that a relay switch 12 is inserted in place of the switch 10. Desirably the switch 12 is mounted adjacent the flash apparatus and is provided with an actuating extension in the form of a pair of wires 13 and 14. One end of each wire being connected to the relay magnet 15.

A source of current for actuating the relay may be obtained from the main source 1 or a battery 16 may be inserted in one of the leads 13 or 14. The outer ends of the leads 13 and 14 are connected to a manual switch for completing the circuit to the relay which closes the switch terminals and fires the tube.

A further highly useful arrangement may be provided by a switch 17 mounted upon and mechanically associated with and actuated by a camera shutter 18. The switch 17 is arranged to be actuated by a lever 19 or other part of the shutter. The adjustment between the lever 19 and the switch 17 is such that the relay will fire the tube 6 while the shutter is wide open. In this manner the tube is fired by remote control by merely tripping the camera shutter. Moreover, by using the relay 12 the advantage of short leads from the condenser to the tube may be gained without sacrificing the advantages of remote control.

A further advantage is gained by providing the relay in that relatively small current volume is required to be carried by the leads 13 and 14 and controlled by the switch 17.

What I claim is:

1. Apparatus for producing light flashes comprising an arc discharge lamp containing an ionizable gas, a condenser having one terminal connected to a terminal of said lamp, and a switch having two terminals connected respectively to said condenser and said lamp and furnishing a low impedance path for discharging the condenser through the lamp, a resistor having a resistance high in relation to the lamp impedance in its conductive state in parallel with said lamp for furnishing a charging path for said condenser when said lamp is non-conductive, and a direct-current source having a current-limiting resistor and connected to the terminals of said switch for charging said condenser when said switch is open, the impedance of said current-limiting resistor plus said direct-current source being high in relation to that of said first-mentioned resistor.

2. Apparatus for producing light flashes comprising an arc discharge lamp containing an ionizable gas, a condenser having one terminal connected to a terminal of said lamp, a switch having two terminals connected respectively to said condenser and said lamp and furnishing a low impedance path for discharging the condenser through the lamp, a direct-current-conductive shunt in parallel with said lamp for furnishing a charging path for said condenser when said lamp is non-conducting, said shunt having an impedance that is high in relation to that of the lamp when the latter is conductive, and a direct-current source having a current-limiting resistor and connected to the terminals of said switch for charging said condenser when said switch is open.

3. Apparatus for producing light flashes comprising an arc discharge lamp containing an ionizable gas, a condenser having one terminal connected to a terminal of said lamp, a switch having two terminals connected respectively to said condenser and said lamp and furnishing a low impedance path for discharging the condenser through the lamp, a direct-current-conductive shunt in parallel with said lamp for furnishing a charging path for said condenser when said lamp is non-conducting, said shunt having an impedance that is high in relation to that of the lamp when the latter is conductive, a direct-current source having a current-limiting resistor and connected to the terminals of said switch for charging said condenser when said switch is open, and a relay magnet in control relation to said switch.

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