Nov. 21, 1950 J. KAPLAN 2,531,220

FLASH LAMP

Filed Oct. 17, 1947

Fig 1

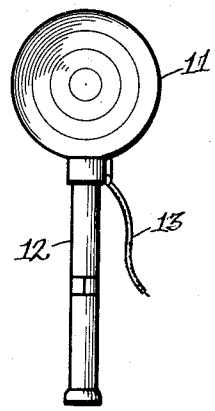


Fig 2

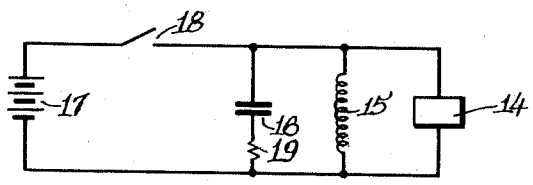
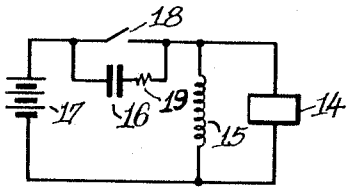


Fig 3



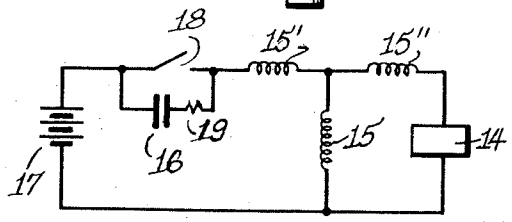
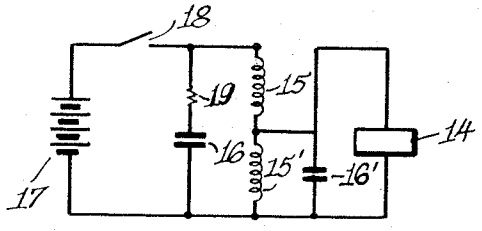


Fig 4

Fig 5



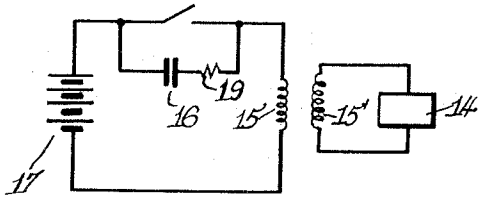


Fig 6

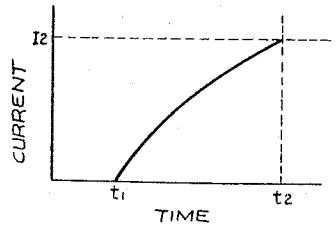


Fig 7

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Patented Nov. 21, 1950

2,531,220

UNITED STATES PATENT OFFICE

2,531,220

FLASH LAMP

Jack Kaplan, Brooklyn, N. Y.

Application October 17, 1947, Serial No. 780,382

2 Claims. (Cl. 315—219)

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This invention relates to flash type illuminating devices and is particularly adapted for use in photography.

The invention has for one of its objects the provision of a gas-filled flash lamp which is capable of repeated use, together with an energizing circuit for the lamp which will produce a short interval flash of high intensity.

A further object of the invention is the provision of an energizing circuit as an electrical source of energy of relatively low capacity.

A further object of the invention is a provision of electrical circuits suitable for use in obtaining the most effective energization of the flash lamp.

Still another object of the invention is to provide an ionization type of flash lamp in conjunction with a battery of a relatively low voltage and to include a simple, compact, and efficient voltage transformation circuit, suitable for energization from the battery which will in turn deliver a high voltage impulse of relatively short duration to the lamp.

Still another object is to provide a surge generating circuit which is easily controllable, light in weight and small in dimensions, thus being readily portable and economical to manufacture.

Other and further objects will become apparent upon reading the following specification together with the accompanying drawing forming a part thereof.

Referring to the drawing,

Figure 1 shows a front view in elevation of a lamp holder suitable for use in practicing the invention.

Figure 2 shows a form of pulse generating circuit for use in energization of the lamp.

Figures 3, 4, 5 and 6 show various forms of pulse generating circuits for use in energization of the lamp illustrated in Figure 1.

Figure 7 is a graphical representation of time and current relationships in the battery circuit.

Referring to Figure 1, a reflector 11 is mounted on a handle 12 adapted to receive at its upper end a flash lamp, (not shown) of the ionization type which may be of any desired construction. Lamps of this type are known in the art and accordingly no particular form of lamp has been indicated. Handle 12 may be hollow and may be adapted to receive batteries and other electrical circuit components for energization of the flash lamp. Mechanical means or a pair of conductors in the form of a cord 13 may be extended to auxiliary control contacts suitably coordinated with the shutter mechanism of a camera

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(not shown) with which the lamp may be used. The auxiliary control contacts should be arranged so that the instant of maximum of camera shutter opening will occur substantially simultaneously with the instant of maximum flash lamp brilliance; correct coordination of these two maxima will produce optimum results.

Referring to Figure 2, a flash lamp 14 of any suitable construction is shown connected in multiple with an inductor 15 and a capacitor 16. A battery 17 is connected to energize inductor 15 upon closure of a switch 18. To limit the surge current upon closure of switch 18, a resistor 19 of small value may be provided as shown. Upon the closure of switch 18 at a time t_1 the battery current will increase exponentially to a value i_2 at a time t_2. At the time t_2 there will be energy stored in a magnetic field which may be expressed as $\frac{1}{2}Li_2^2$ joules where L represents the inductance of the coil in henries and i_2 is the current through the coil in amperes at the time t_2.

The energy that can be stored in the electrostatic field of the capacitor 16 can be expressed as $\frac{1}{2}CV^2$ where C represents the capacity of capacitor 16 in farads and V is the voltage across the capacitor in volts. Equating the energy stored in the coil to the energy that can be stored in the capacitor will give the maximum voltage that can be developed across flash lamp 14 which is $V=i_2\sqrt{L/C}$ if all of the energy stored in the magnetic field is transferred into energy stored in the electrostatic field. The maximum potential generated will be somewhat less than this ideal value because of loss of energy in the circuit elements such as resistance of the winding of the coil, iron losses in its core, and other effects such as dielectric hysteresis in the capacitor. However, by proper design and selection of circuit components, this loss of energy can be made very small.

From an analysis of the last equation it is readily apparent that as C becomes smaller, V becomes larger and that as C approaches 0, the peak voltage generated will become very large. The minimum value of C which can be obtained will be that due to the inherent self internal capacitance effects within the coil and similar effects necessarily present between conductors interconnecting the circuit elements. By proper selection of the values of L, C and i_2 it is possible to generate a sufficient potential to ionize the lamp and upon ionization thereof the energy stored in the condenser will be discharged into the lamp together with the energy stored in the

coil. The energy distribution throughout the spectrum will depend upon the type of gas in the lamp and this may be selected to give the distribution best suited to the type of use or application of the apparatus.

Figure 3 shows a modification of the arrangement illustrated in Figure 2 in which capacitor 16 is connected across the terminals of switch 18. When switch 18 is open, capacitor 16 is charged to the voltage of batteries 17. In order to prevent injury to the switch contacts upon closure thereof, it may be desirable to include in the circuit of capacitor 16 a small resistor 19 of relatively low value which will limit the maximum discharge current upon the closure of switch 18 to a value which will not be injurious to the switch contacts.

When switch 18 is opened, using the modification of Figure 3, the arcing across the switch contacts will be minimized by the action of capacitor 16. The voltage will build up as determined by the charging rate of capacitor 16 and the characteristics of coil 15. When this voltage reaches a sufficient value, the lamp 14 will ionize and capacitor 16 will discharge therethrough together with the remaining energy stored in the magnetic field of coil 15.

In Figure 4, a modified arrangement is shown in which three coils 15, 15' and 15'' are connected in the form of a T, capacitor 16 being connected across switch 18 as in Figure 3. This will modify the shape of the voltage pulse produced upon opening switch 18. Coil 15' tends to sustain the battery current after switch 18 is opened, thus building up voltage in capacitor 16. Coil 15'' does not become effective until after ionization of lamp 14. It tends to delay the start of the flash and to extend its duration.

Figure 5 illustrates a further modification of the arrangement of the circuit elements in which a further coil 15' in parallel combination with a further capacitor 16' is connected in series with coil 15.

The effect upon the pulse shape will be determined by the relative values of these circuit elements.

In Figure 6, voltage increase or decrease may be obtained by providing a secondary winding 15' inductively coupled to coil 15. The lamp 14 is shown connected directly across secondary winding 15'.

Other modification may be made and circuit elements of various values may be used to obtain the optimum effects with the particular lamp used for the intensity and duration of flash required.

The device operates by closing switch 18 to allow energy storage in the coil 15 and then opening switch 18 to fire the illuminating device.

I have shown what I believe to be the best embodiment of my invention. I do not wish, however, to be confined to the embodiment shown but what I desire to cover by Letters Patent is set forth in the appended claims.

I claim:

1. A flash type illuminating device comprising a source of direct current, a switch and an ionizable flash lamp forming a circuit with the said source of current, an inductor across the said flash lamp and adapted to be energised from the source upon closure of the switch, the said flash lamp being adapted to be energized by the discharge from the inductor upon opening of the said switch, and another inductor in series with the said flash lamp adapted to modify the rate of energization of the lamp by the first mentioned inductor.

2. A flash type illuminating device as set forth in claim 1 and having a capacitor across the switch and adapted to further modify the rate of energization of the lamp.

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