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2,071,369

FLASH LAMP

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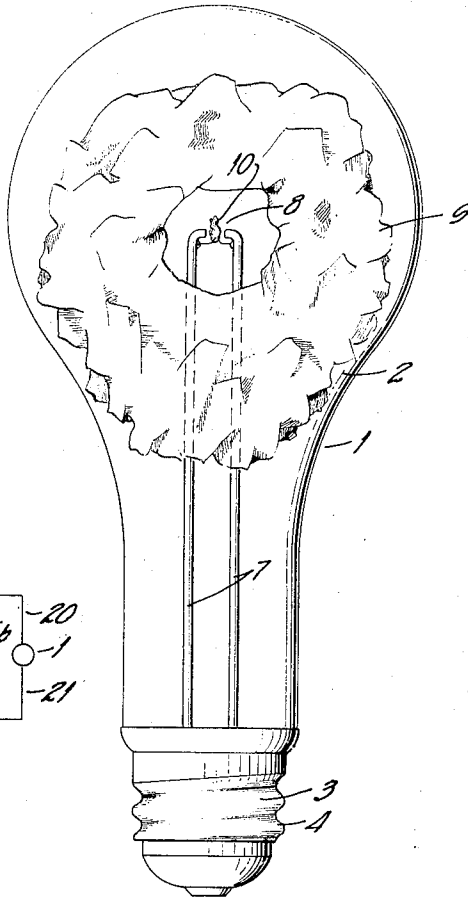


FIG. 1

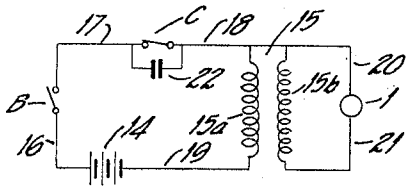


FIG. 5

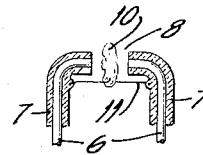


FIG. 3

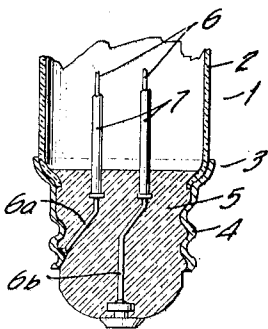


FIG. 2

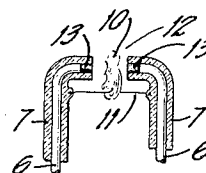


FIG. 4

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FLASH LAMP

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Application January 24, 1934, Serial No. 708,081

6 Claims. (Cl. 67—31)

In the art of photography, many pictures are taken with the aid of flash lamps. The exposures, in this case, should be made during the range of maximum brilliancy of light emission in order to obtain a clearly defined image on the film or plate. This can be accomplished with some degree of accuracy under favorable circumstances. However, the majority of flash light pictures must be taken under adverse conditions. For example, the object may be in motion. It is known that timed exposures or exposures of ordinary duration could not be made in order clearly to photograph an object in motion. On the contrary, a very short exposure, say of the order of 1/100th or 1/200th of a second, is necessary. Furthermore, in making short exposures where flash lamps are used as a means of providing light, it is evident that the light emission therefrom must be very accurately synchronized or timed with the camera shutter in order to insure clear and well defined pictures.

In the present type of flash lamps, an ignition device comprising an electrical resistance element is utilized which becomes incandescent when current is supplied thereto and ignites a combustible or oxidizable substance suitably disposed in the lamp. This type of ignition necessarily involves an appreciable and variable time element in view of the precision which is defined by the shutter speed of the camera in conjunction with which it is used.

Our invention therefore has for an object the provision of a flash lamp for photographic purposes which is endowed with the characteristics of substantially instantaneous ignition and light emission, the operation of which may be readily and accurately synchronized with the operation of a camera shutter.

With this and other objects in view, our invention includes the novel elements and combinations and arrangements thereof described below and illustrated in the accompanying drawing in which—

Fig. 1 is an elevation view of our flash lamp;
Fig. 2 is a fragmentary, sectional view through the base of the lamp;

Fig. 3 is an enlarged, detail view of the spark gap terminals illustrating a preferred disposition of an oxidizable substance with respect thereto;

Fig. 4 is an enlarged, detail view of a modified form of terminals for the spark gap; and

Fig. 5 is a wiring diagram of a circuit adapted for use in conjunction with our flash lamp.

In the drawing, like reference characters indicate like parts throughout the various figures.

Referring to Fig. 1, our flash lamp, which is indicated generally at 1 comprises a translucent bulb 2 having the configuration of an ordinary incandescent lamp. The neck of the bulb is sealed in a screw base 3 comprising a metallic casing 4 filled with an insulating compound 5. The conductors 6 and insulating casings 7 therefor extend from the base upwardly within the bulb 2 and terminate in spaced relationship with each other to form the terminals of a spark gap, indicated generally at 8. The lower ends of the conductors 6, indicated at 6a and 6b, are connected to terminal points of the screw base 3 in the usual manner. The bulb 2 is filled with a readily oxidizable substance 9 preferably comprising a foil which is adapted to emit light upon an oxidation thereof. Examples of suitable substances which may be used as foils are metals, metal alloys and rare earths, such as aluminum, copper, phosphor bronze, cerium and the like. To aid in the ignition of the oxidizable substance, a small amount of a fulminating substance having rapid flame propagation characteristics may be suitably disposed within ignition range of the spark gap. By way of example, we have illustrated a small amount of guncotton 10 supported by a wire 11 secured between the insulating casings 7 of the conductors (see Fig. 3). Oxidation of the light emitting substance may take place in air, but we prefer to evacuate the bulb 2 and fill with oxygen at a pressure preferably below atmospheric. The inclusion of a fulminating substance and the oxygen in our lamp aids in producing a flash lamp having the characteristics of substantially instantaneous ignition and very rapid oxidation of the foil.

In Fig. 4 we have illustrated a modified form of spark gap the terminals of which are formed of carbon or similar substance which partially disintegrates upon the passage of a spark, ejecting particles of incandescent material. The ejected particles effect a wider ignition range and generally aid in the ignition of the oxidizable materials within the bulb.

In Fig. 5, we have illustrated a wiring diagram wherein the preferred means for producing and controlling the energy for activating an oxidation of the light emitting substance in the lamp is diagrammatically illustrated. A source of electrical energy, indicated as a battery 14, is connected in series with the controls or switches B and C and the primary 15a of an induction coil 15. The connections are made through the conductors 16, 17, 18 and 19, respectively, as the circuit is traced from the battery in a clockwise

direction. An end of each of the primary and secondary coils, 15a and 15b, respectively, are connected together and the flash lamp embodying our invention may be connected through conductors 20 and 21 across the secondary of coil 15. The battery 14 may comprise a plurality of dry cells providing a source of electrical energy of the order of about 6 volts. Furthermore, a condenser 22 is preferably connected across the switch C to reduce sparking when said switch is opened.

It will be noted that the circuit, above described, may readily be adapted for use with a camera and a description of a practical manner of associating the controls thereof in cooperative relationship with a camera is fully set forth in our copending application Ser. No. 708,082, which was filed in the Patent Office on or about the 24th day of January 1934.

The operation of our flash lamp and associated circuit is as follows.

Assuming that the switch C is in closed position, when the switch B is closed, a circuit is completed through the battery 14, switches B and C and the primary 15a of the coil 15. This circuit need be maintained only during a sufficient interval of time thoroughly to saturate the magnetic circuit, whereupon the circuit may be opened through an operation of switch C. The sudden opening of the primary circuit produces a surge of high potential in the secondary coil 15b which is substantially instantaneously dissipated in the form of a spark discharge across the terminals of the spark gap indicated at 8, in the flash lamp. The spark discharge activates an oxidation of the foil or similar substance within the globe of the lamp. The fulminating substance, which may comprise a suitable amount of guncotton or the like, aids in producing a substantially instantaneous oxidation or light emission following the operation of switch C in the circuit.

It is evident that when an exposure is made through the operation of a camera shutter, the magnetic circuit may be closed and opened, as above described, in timed relation therewith, producing a light emission from the flash lamp.

It is to be understood that the flash lamp which we have illustrated and described embodies a preferred arrangement of elements collectively forming a lamp adapted to be synchronized with extreme accuracy with the shutter or automatic exposure mechanism of a camera. However, equivalent elements may be substituted for those which we have employed in our lamp and rearrangements made in the relative dispositions thereof without departing materially from the scope of our invention.

Very accurately timed high speed exposures of a falling billiard ball or a white disk attached to the hand of a synchronous clock making sixty revolutions per minute, and illuminated by a flash from the present types of flash lamp indicate three things very clearly; first, that there is a very substantial lag or interval of time between the making of the circuit which ignites the flash lamp and the actual ignition thereof; second, that this interval varies even with different flash lamps of the same manufacture and to such a substantial degree that the illumination cannot be positively synchronized with an exposure of less than 1/50th of a second; and third, that once ignition of the material in the flash lamp has actually taken place, maximum illumination is almost instantaneous.

It is obvious from the foregoing that the defects in the present type of flash lamp are due primarily to the relatively long and variable period of time which elapses between the closing of the ignition circuit and the actual ignition of the flash light material.

With modern high speed lenses and extremely fast plates or films, exposures as short as 1/1000th of a second are not unusual and exposures very much shorter than 1/50th of a second (the minimum synchronizing limit of the present flash lamp) are absolutely necessary to obtain clear pictures of an object moving even at moderate speed.

With our apparatus, using a high potential spark as a means for activating a light giving reaction between the oxidizable material and the oxygen of the air or in the bulb of the flash lamp or otherwise, the time differential between the instant of breaking the primary circuit and the ignition of the oxidizable light giving material is not only so very much shortened that it may be said to be substantially instantaneous but it is also made substantially constant. This last characteristic is of the utmost importance because it permits precise synchronization of light with shutter opening. With variations in the above time differential as small as 1/50th of a second which is quite usual in the present type of flash lamp, it is obviously impossible to photograph anything with any degree of certainty with an exposure as short as 1/100th of a second because the light, in one case may occur before the shutter has opened, and in the next case after the shutter has closed.

Without any precautions as to standardizing conditions and using ordinary flash light powder in the open air and a small piece of guncotton between carbon spark gap terminals with our apparatus one can readily synchronize the flash with exposures of much shorter duration than has been heretofore successfully accomplished even with flash lamps.

In a flash lamp containing oxygen gas and foil as described, and using carbon spark gap terminals (preferably spongy or porous carbon which will be permeated with the oxygen), and either with or without guncotton or a similar flame propagating substance, the light may be consistently synchronized with exposures of a very much higher speed. In the presence of oxygen alone, the carbon becomes almost explosive and even in the air the spark really partakes of the nature of a flaming arc, and incandescent particles of carbon are projected violently from the terminals which in either case facilitates ignition.

The word "light" as used in the specification and claims, is to be understood as meaning and including light rays both visible and invisible and by the use of which it is possible to take a photograph; and the word "translucent" is to be understood as meaning and including "transparent" and having the general property of transmitting such "light".

While we have described our invention in its preferred embodiments, it is to be understood that the words which we have used are words of description rather than of limitation. Hence, changes within the purview of the appended claims may be made without departing from the true scope and spirit of our invention in its broader aspects.

What we claim is:

1. An electric - spark - ignited photographic flash lamp having a type of construction charac-

terized by the lapse of a substantially constant interval of time between the instant of electric current application thereto and the instant of full illumination, whereby it is adapted for positive synchronization with camera shutter openings, of the order of 1/100 of a second and shorter, said lamp comprising a gas-tight translucent envelope containing a rapidly oxidizable substance adapted to emit light upon combustion thereof, electrical ignition means comprising terminals disposed in fixed, spaced relation within said envelope to form a spark gap within effective ignition range of said substance, spaced terminals on the exterior of said envelope, and electrical conductors extending between said spark-gap-forming terminals and said exterior terminals.

2. An electric-spark-ignited photographic flash lamp having a type of construction characterized by the lapse of a substantially constant interval of time between the instant of electric current application thereto and the instant of full illumination, whereby it is adapted for positive synchronization with camera shutter openings of the order of 1/100 of a second and shorter, said lamp comprising a gas-tight translucent envelope containing a rapidly oxidizable substance adapted to emit light upon combustion thereof, electrical ignition means comprising terminals disposed in fixed, spaced relation within said envelope to form a spark gap within effective ignition range of said substance, spaced terminals on the exterior of said envelope, and electrical conductors extending between said spark-gap-forming terminals and said exterior terminals; at least one of said spark-gap-forming terminals comprising an easily oxidizable material which will be ignited and disrupted by the passage of a spark across said gap.

3. An electric-spark-ignited photographic flash lamp having a type of construction characterized by the lapse of a substantially constant interval of time between the instant of electric current application thereto and the instant of full illumination, whereby it is adapted for positive synchronization with camera shutter openings of the order of 1/100 of a second and shorter, said lamp comprising a gas-tight translucent envelope containing a first rapidly oxidizable substance adapted to emit light upon combustion thereof, electrical ignition means comprising terminals disposed in fixed, spaced relation within said envelope to form a spark gap within effective ignition range of said first substance, a second, readily oxidizable substance having rapid flame propagation characteristics positioned between said terminals, whereby a spark across said gap will pass therethrough, spaced terminals on the exterior of said envelope, and electrical conductors extending between said spark-gap-forming terminals and said exterior terminals.

4. An electric-spark-ignited photographic flash lamp having a type of construction characterized by the lapse of a substantially constant interval

of time between the instant of electric current application thereto and the instant of full illumination, whereby it is adapted for positive synchronization with camera shutter openings of the order of 1/100 of a second and shorter, said lamp comprising a gas-tight translucent envelope containing a gas, a filling of foil in said envelope adapted to emit light upon combustion thereof with said gas, electrical ignition means disposed in fixed, spaced relation within said envelope to form a spark gap, a second, readily oxidizable substance having rapid flame propagation characteristics positioned between said terminals and within effective igniting range of said foil, whereby a spark across said gap will pass therethrough, spaced terminals on the exterior of said envelope, and electrical conductors extending between said spark-gap-forming terminals and said exterior terminals.

5. An electric-spark-ignited photographic flash lamp having a type of construction characterized by the lapse of a substantially constant interval of time between the instant of electric current application thereto and the instant of full illumination, whereby it is adapted for positive synchronization with camera shutter openings of the order of 1/100 of a second and shorter, said lamp comprising a gas-tight translucent envelope containing a rapidly oxidizable substance adapted to emit light upon combustion thereof, electrical ignition means comprising terminals of readily combustible material disposed in fixed, spaced relation within said envelope to form a spark gap within effective ignition range of said substance, spaced terminals on the exterior of said envelope, and electrical conductors extending between said spark-gap-forming terminals and said exterior terminals.

6. An electric-spark-ignited, photographic, flash lighting device comprising a gas-tight, translucent envelope containing a gas, a filling of foil in said envelope adapted to emit light upon combustion thereof with said gas, electrical ignition means comprising terminals disposed in fixed spaced relation within said envelope to form a spark gap within effective ignition range of said foil, a battery, a transformer having its secondary winding in circuit with said terminals, and means for forming a closed circuit through said battery and the primary winding of said transformer including means controllable by the operator for opening said last mentioned circuit to produce a spark across said gap; devices of the foregoing type being characterized by the lapse of a substantially constant interval of time between the instant of opening said primary circuit and the instant of full illumination whereby they are adapted for positive synchronization with camera shutter exposures of the order of 1/100 of a second and shorter.

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