Dec. 19, 1967 B. T. BUZALSKI 3,358,476

PHOTOFLASH LAMP IGNITION SYSTEM

Filed July 20, 1966

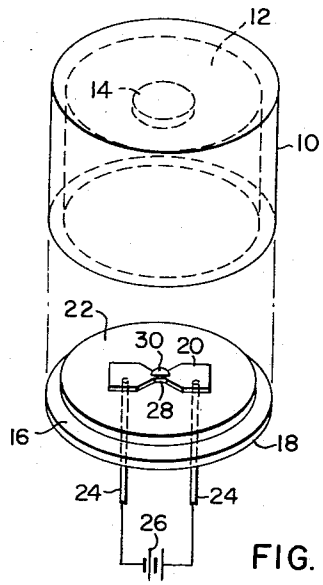


FIG. 1.

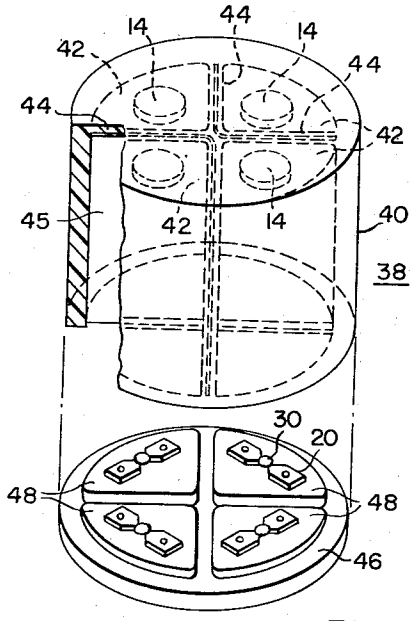


FIG. 2.

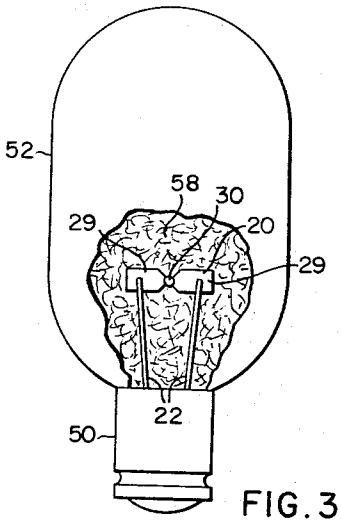


FIG. 3.

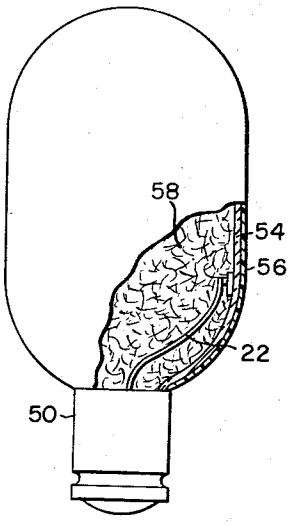


FIG. 4.

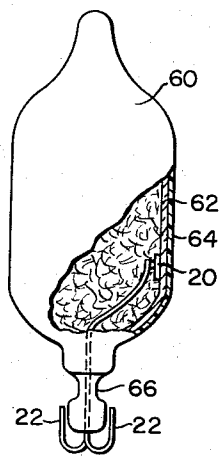


FIG. 5.

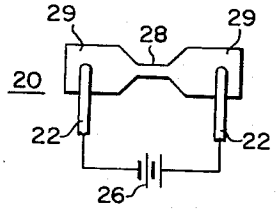


FIG. 6.

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PHOTOFLASH LAMP IGNITION SYSTEM

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10 Claims. (Cl. 67—31)

This invention relates to photoflash lamps and more particularly to a novel ignition system for use in a photoflash lamp.

In most present-day photoflash lamps or more particularly in the ignition system of such lamps, the filament is the most fragile part of the lamp. This very fine wire mounted between two lead-in conductors represents what may be called the weak link in a photoflash lamp. The weak points in this type of ignition system include both the junctions between the filament and the lead-in conductors as well as the filament itself. This very fragile part of the photoflash lamp ignition system is subject to damage from shock from rough handling during and after production as well as prior to incorporation into the bulb, and is most likely also a large contributing factor to the spontaneous static flashing of photoflash lamps. Reproducibility in this type ignition system also presents a problem due to oxidation of the wires at the point of contact between the lead-in conductors and the filament. This oxidation leads to a situation where resistance of the whole ignition system may vary severely.

Due to the electrical properties of the filament type ignition system it is necessary that photoflash systems be operated from a source of at least 3 volts. This requires camera manufacturers to supply two 1½ volt batteries with each camera. Since 1½ volt batteries have a limited shelf life, it is frequently necessary for the manufacturer to totally replace all the batteries included in his kits which have been held for too long a period by the distributor. Furthermore, during the useful life of a camera, batteries in the flash attachment must be replaced frequently and in pairs.

From the standpoint of the cost of manufacture of photoflash lamps as well as the fragility of the ignition system, the provision of a simple sturdy means for igniting the primer charge is quite desirable. Furthermore, if the primer charge can be ignited from only 1½ volts the cost of both the initial and replacement power sources can be cut in half.

It is an object of the present invention to provide an ignition system for photoflash lamps which is of sturdy construction, and not subject to failure from shock.

Another object of the present invention is to provide a photoflash lamp ignition system that is reproducible within comparatively fine tolerances.

A further object of the present invention is to provide an ignition system for photoflash lamps which can be operated from a single 1½ volt battery.

Yet another object of the present invention is to provide an ignition system for photoflash lamps which may be utilized interchangeably in the various types of photoflash lamps presently available.

These and other objects are accomplished in accordance with the present invention by employing an adherent deposit of electrically conductive material on the interior surface of the light transmitting envelope of a photoflash lamp. This deposited material defines a printed circuit having a constricted area therealong to which the primer charge is adhered. The ends of the electrically conductive deposit are connected to energy transmitting lead-in conductors which are, at their other ends, connected to a source of electrical energy of low potential.

The previously described objects and others, as well as

many of the attendant advantages of the present invention, will become more apparent as the following detailed description is considered in connection with the accompanying drawing in which:

FIGURE 1 is an exploded perspective view of one photoflash lamp embodiment employing the ignition system of the present invention;

FIG. 2 is an exploded perspective view of a compartment photoflash unit containing a multiplicity of lamps similar to the embodiment shown in FIG. 1;

FIG. 3 is a side elevational view of another type photoflash lamp employing the ignition system of the present invention with part of the outer envelope broken away;

FIG. 4 is a side elevational view partially in section of the lamp as shown in FIG. 3;

FIG. 5 is a side elevational view partially in section of yet another photoflash lamp employing the ignition system of the present invention; and

FIG. 6 is an enlarged view of the deposited printed circuit employed in each embodiment of the present invention.

Referring now in detail to the drawings, wherein like reference characters represent like parts throughout the several views, and more particularly to FIG. 1, there is shown a photoflash lamp of the type generally described in U.S. Patent No. 3,220,224 which issued November 30, 1965 to Norman F. Baird, wherein a plastic envelope of, for example, cellulose acetate propionate is employed to confine air at atmospheric pressure while having therein a flash producing mixture carried as a layer and formed of, for example, finely divided zirconium and finely divided barium nitrate or strontium nitrate with a suitable binder. In the specific embodiment of FIGURE 1 the plastic envelope is tubular in shape with one end closed and carries on the inner side thereof the layer **14** of flash producing material. This tubular envelope **10** is sealed to the annular rim **16** of the plastic base **18**. The tubular envelope **10** is sealed to the base **18** by any conventional sealing means such as for example epoxy cement, a solvent, or by heat sealing. The flash producing material **14** is preferably as indicated above in a molar ratio of 3 moles zirconium to one mole of either strontium or barium nitrate.

The ignition system employed with this invention includes a thin film of electrically conductive material **20**. This film or coating **20** is formed on the flat insulating surface **22** of the base **18** by means of printing, stamping, roller coating or any other suitable printed circuit technique known in the art. An example of a suitable composition for applying the printed circuit is silver oxide suspended in an amyl acetate vehicle which contains a small amount of nitrocellulose binder. A reducing agent, such as hydrazine sulfate, which serves to convert the silver oxide to silver when heated to relatively low temperatures is also included. Wafer thin prestamped silver sheets may also be directly adhered to the substrate surface by a suitable cement. Printed circuit coating compositions are well known in the art and other known compositions can be substituted for the examples.

The printed circuit **20** is substituted for the conventional filament and connects a pair of lead-in conductors **24** which are adapted to be connected to a source of electrical power **26** which for most flash applications represents a pair of 1½ volt batteries. The printed circuit **20** is constricted at **28** at which point a primer material **30** is adhered thereto. As indicated in U.S. Patent No. 3,220,224 a suitable primer material is formed from for example a mixture of finely divided zirconium and finely divided potassium perchlorate in such relative proportions that all of the oxygen in the perchlorate will react with all of the zirconium during firing.

With a silver deposit **20** (FIG. 6) having a width of

approximately 5 millimeters at its ends **29** and a constriction **28** of ½ millimeter in width the primer can be ignited with a potential of 1½ volts thus only requiring a single 1½ volt battery to operate the lamp. Ignition of the primer charge occurs through heating, or more particularly the heat generated by the increase in current density (amps per millimeter of cross-section) at the constriction, and is believed to be actually set off by sparking between silver particles as the continuity of the electrically conductive material is lost. The flash producing material **14** is fired by the striking thereof of burning materials from the primer.

In the FIGURE 2 emobdiment there is shown a compartmentalized flash unit generally designated **38** comprising a tubular upper portion **40** which contains four separate flash lamps of the type shown in FIGURE 1. The individual lamp compartments **42**, which are substantially equivalent to a quarter of a cylinder in shape, each carry their own reflector which, for example, may be provided for by aluminizing the interior right angle sides **44** of each compartment or by the insertion of thin aluminum foil in spaces left between each compartment wall as shown broken away at **45**. The base **46** may be sealed to the cylindrical envelope **40** in the same manner as base **18** and envelope **10** in in FIGURE 1 embodiment. A raised portion **48** defining a quarter circle fits securely into the bottom open portion of each quarter cylindrical cavity to effect the seal and has coated thereon a printed circuit **20** and primer charge **30** substantially as described heretofor. As in the FIG. 1 embodiment each of the quarter cylinder cavities has adhered thereto a layer **14** of flash producing material of the type described. FIGURES 3 and 4 illustrate the invention employed in a typical M–2 type photoflash lamp having a metallic base **50** and light transmitting envelope **52** generally constructed of a glass bulb **54** having a protective exterior lacquer coating **56**. The ignition material in this instance is generally filamentary zirconium, aluminum or magnesium **58** disposed in an oxygen atmosphere at a pressure in excess of 1 atmosphere. In this embodiment the electrically conductive material forming the printed circuit **20** is adhered to the side of the glass bulb **54** with an ignition material **30** again adhered to the constricted portion of the deposit **28** with lead-in conductors **20** secured to opposite ends **29** of the printed circuit. Of course the printed circuit **20** could alternatively be adhered to any insulating substrate within the bulb and is not limited to only the wall of the bulb **54** but, for simplification, and in order to reduce the number of parts necessary in manufacturing a lamp, adhering the printed circuit to the bulb wall is presently preferred.

The FIGURE 5 embodiment illustrates the use of the ignition system of the present invention in a conventional AG–1 type photoflash lamp. This type of photoflash lamp is generally described in U.S. Patent No. 2,982,119 issued May 2, 1961 to R. M. Anderson and includes a sealed light transmitting envelope **60** consisting of glass **62** coated with a protective exterior lacquer **64** to guard against rupture. Lead-in conductors **22** are sealed through the pinched-off base portion **66**, and at their inner ends are connected to a printed circuit ignition system **20** in the same manner as that described with respect to FIGS. 3 and 4.

In each of the FIGS. 3 and 4 and FIG. 5 embodiments the printed circuit geometry is essentially the same as that described for the FIG. 1 embodiment and may be operated with a single 1½ volt battery.

The particularly geometry of the printed circuit filament of the present invention is critical only to the extent that the constricted portion **28** be ¼ or less the width of the remainder of the printed circuit. For example, the winged portions **29** to which the lead-in conductors **22** are attached should be at least 4 times as wide as the constricted portion **28**. In the specific embodiment, a silver deposit of generally 5 millimeters in width with a constricted portion **28** of approximately ½ millimeter in width will cause a sufficient differential in current density and sufficient heating in the silver to ignite a primer charge of powdered zirconium, potassium perchlorate, and a suitable binder located centrally of the constricted area. This configuration can be ignited by a potential of only 1½ volts as opposed to the normal 3 volts required for conventional photoflash lamps. Attempts to ignite conventional photoflash lamps wherein a fine tungsten filament is secured beween a pair of lead-in conductors having primer charges located at the points of connection usually results in the burning out of the filament wire intermediate of the primer charges and hence failure of ignition. Furthermore a 1½ charge on a conventional tungsten filament flash bulb, when ignition does take place, occurs too slowly for the flash lamp to fire coincident with the exposure of the film.

Although a number of specific embodiments of the invention have been illustrated and described, numerous changes may be made thereto without departing from the spirit of the present invention. Therefore, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A photoflash lamp comprising:

(a) a sealed light transmitting enclosure having a flash producing material disposed therein;

(b) a pair of spaced energy transmitting means extending into said enclosure;

(c) a layer of electrically conductive material adhered on an insulating substrate within said enclosure, said pair of energy transmitting means electrically connected to spaced locations on said layer of conductive material, said layer of conductive material having a constricted area intermediate the connections thereto to provide for an increase in density of any current passing therethrough; and

(d) a primer charge adhered to the constricted area of said layer of conductive material and adapted to ignite in response to electrical energy of predetermined magnitude passing through said constricted area to thereby actuate said flash producing material.

2. A photoflash lamp according to claim **1** wherein said electrical energy of predetermined magnitude is less than 2.0 volts.

3. A photoflash lamp according to claim **1** wherein said sealed enclosure is formed of high strength light transmitting organic plastic enclosing a predetermined volume of air at atmospheric pressure.

4. A photoflash lamp according to claim **1** wherein said constricted area is less than 0.5 millimeter in width.

5. A photoflash lamp according to claim **1** wherein said flash producing material is filamentary zirconium, aluminum or magnesium disposed in an oxygen atmosphere, said oxygen being at a pressure in excess of one atmosphere.

6. A photoflash lamp according to claim **1** wherein said flash producing material consists essentially of finely divided zirconium, finely divided strontium nitrate and a suitable binder, said zirconium and strontium nitrate being present in a molar ratio of about 3:1.

7. A photoflash lamp according to claim **1** wherein said sealed enclosure is divided into four separate sealed compartments with separate energy transmitting means extending into each compartment, each of said compartments further having disposed therein a quantity of said flash producing material, a constricted printed circuit and a primer charge.

8. A photoflash lamp in combination with a source of electrical energy of low potential, said photoflash lamp comprising:

(a) a sealed light transmitting envelope having a flash producing material disposed therein;

(b) a pair of lead-in conductors sealed through said envelope and each connected at one of their ends to

said source of electrical energy and terminating at their other ends adjacent an interior surface of said envelope;

(c) printed circuit means connected between said other ends of said lead-in conductors and having between said connections to said lead-in conductors a constricted area of a width less than that of the remainder of said printed circuit means; and

(d) a primer charge adhered to said constricted area, said primer charge being responsive to an increase in current density within said constricted area to thereby actuate said flash producing material.

9. The combination according to claim 8 wherein said light transmitting envelope is divided into four separate

sealed compartments, with each of said compartments having a pair of lead-in conductors, separate printed circuit means, a separate primer charge and separate flush producing material.

10. The combination according to claim 8 wherein said constricted area is 0.5 millimeter or less in width and said source of electrical energy is a 1½ volt battery.

References Cited

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JAMES W. WESTHAVER, *Primary Examiner.*