May 7, 1957 G. W. CRESSMAN 2,791,114

FLASH LAMP AND IGNITION MEANS THEREFOR

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Fig. 1

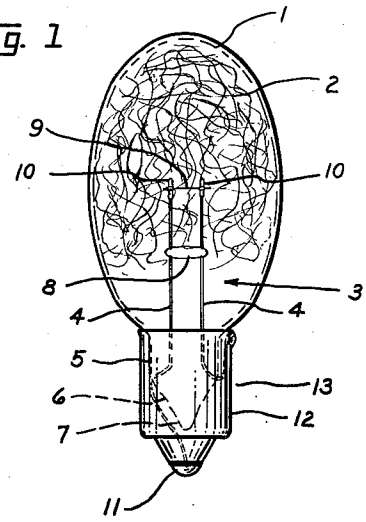
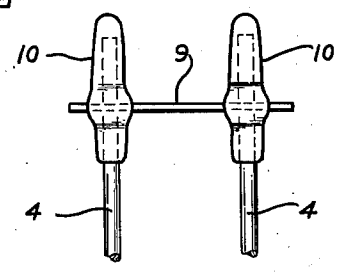


Fig. 2



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2,791,114

FLASH LAMP AND IGNITION MEANS THEREFOR

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8 Claims. (Cl. 67—31)

My invention relates in general to flash lamps of the type used for photographic purposes and comprising a sealed radiation-transmitting bulb in which is enclosed a readily combustible metallic material, together with suitable ignition means therefor, and a combustion-supporting gas filling which, upon ignition of the lamp, enters into a reaction with the combustibe material with the resulting emission of a momentary flash of actinic light of high intensity. More particularly, my invention relates to an ignition means for such flash lamps, and in particular to the composition of the fulminating or primer material thereof. The invention is especially applicable to flash lamps of the miniature type employing filamentary material of aluminum or an aluminum-magnesium alloy, in the form of wire or ribbon such as the so-called shredded foil, as the combustible light-producing material.

There has recently been introduced on the market a very small "peanut" size butt-seal flash lamp of the type disclosed and claimed in U. S. application Serial No. 421,510, Anderson et al., filed April 7, 1954, and assigned to the assignee of the present invention. It has been found that when the primer material employed for the ignition means of such miniature butt-seal flash lamps is of the conventional type heretofore commonly employed for flash lamps generally, the adherence of such type primer material to the support or lead-in wires is very poor. This is caused by the high temperatures encountered during the manufacture of this small sized butt-seal type flash lamp, which causes the binder to be partially burned out of the primer material. Good primer adherence to the support wires is, of course, necessary in order to produce the desired time-light characteristics for the lamp.

It is an object of my invention, therefore, to provide a primer composition for flash lamps possessing increased adherence to the primer support wires.

Another object of my invention is to provide a flash lamp of the miniature butt-seal type having the primer thereof composed of a material possessing good adherence to the primer support wires in the finished lamp and which will not adversely affect the flash characteristics of the lamp.

Briefly stated, in accordance with one aspect of my invention I have found that the addition of a small amount of a suitable organic resin having a decomposition temperature above 350° C. to the conventional primer material heretofore commonly used in flash lamps of the filamentary material type, will cause the primer to adhere to the lamp lead-in wires to the necessary degree in miniature butt-seal type flash lamps to assure the desired time-light flash characteristics therefor.

Further objects and advantages of my invention will appear from the following description of a species thereof and from the accompanying drawing.

In the drawing,

Fig. 1 is an elevation of the flash lamp comprising my invention; and

Fig. 2 is an enlarged view of the ignition means comprising my invention.

Referring to Fig. 1, the flash lamp according to the invention is of the miniature butt-seal type such as disclosed and claimed in the aforesaid Anderson et al. application Serial No. 421,510 and comprising a small sealed envelope or bulb 1 of glass or other suitable material capable of transmitting the radiations produced within the bulb upon flashing of the lamp. The particular bulb 1 illustrated is generally elliptical in shape and has an internal volume less than about 10 cc., preferably around 6 cc. The bulb 1 contains a loosely distributed filling of combustible material 2 in filamentary form, e. g., fine wire having a diameter of less than about 2 mils or finely cut ribbon material such as that commonly known as shredded foil and having a cross-sectional size of the order of one mil or less in width and one mil or less in thickness. The combustible material 2 is preferably made of substantially pure aluminum, although other materials, such as an aluminum-magnesium alloy containing a small percentage of magnesium, may be employed as well. The envelope or bulb 1 also contains a filling of a suitable combustion-supporting gas such as oxygen or an oxygen-containing gas at a suitable pressure for supporting the combustion of the combustible material. The pressure of this gaseous filling will vary depending upon the type of gas employed, the size of the bulb, and the quantity and type of combustible material therein. In the case of the particular miniature butt-seal type of flash lamp disclosed, and with oxygen being used as the combustion-supporting gas and substantially pure aluminum as the combustible material, the pressure of the oxygen gas filling is preferably at least of the order of 700 mm. of mercury. The bulb 1 is coated on its outer surface with a protective lacquer coating to thereby strengthen the bulb and to render it substantially shatterproof. The said lacquer coating preferably is of the type disclosed and claimed in co-pending U. S. application Serial No. 421,571, R. M. Anderson, filed April 7, 1954, and assigned to the assignee of the present invention.

Sealed into the neck end of the bulb 1, by a butt-seal such as is conventional in miniature incandescent lamps, is a lamp ignition mount 3 comprising a pair of lead-in wires 4 which, in the manufacture of the lamp, are sealed between the ends of the bulb neck 5 and the end of an exhaust tube 6 abutted thereagainst. After the evacuation of the bulb 1 and the introduction thereinto of the combustion-supporting gaseous filling 2, the exhaust tube 6 is tipped-off, as indicated at 7, to thereby hermetically seal the bulb. The lead-in wires 4 extend into the bulb 1, from the region of their seals thereinto, in a direction approximately longitudinally of the bulb and in more or less parallel relation, and are rigidly tied together and held in place interiorly of the bulb by a support bead 8 of glass or other suitable insulating material in which the lead-in wires are embedded.

Mounted on and connected across the inner ends of the lead-in wires 4, within effective ignition range of the combustible material 2 in the bulb, is a lamp ignition filament 9 preferably consisting of a short straight length of fine tungsten wire having a diameter preferably of the order of 0.7 mil. The inner ends of the lead-in wires 4, and the portions of the ignition filament 9 at the points of connection thereof to the lead-in wires 4, are coated with a layer of fulminating substance or primer material 10 to form beads of such material which become ignited when the ignition filament 9 is energized and heated. The fulminating or primer material is applied to the lead-in wires 4 and filament 9 in the form of a paste consisting of extremely sensitive metal powder and suitable powdered oxidizing material mixed with a suitable binder. Externally of the bulb 1, the lead-in wires 4 are connected to the end eyelet contact 11 and the side shell contact 12 of a base 13 suitably secured to

the neck 5 of the bulb, as by means of conventional basing cement.

The primer or fulminating material 10 which has been found to be most suitable, and has been most commonly employed for the ignition of flash lamps of the type herein disclosed employing filamentary combustible material of substantially pure aluminum, is of the general type disclosed and claimed in U. S. Patent 2,280,598, G. H. Meridith, issued April 21, 1942, and comprising an admixture of fine (i. e., of the order of 325 mesh or finer) No. 3 grade magnesium, zirconium and potassium perchlorate powders bonded together by a suitable binder such as a 2–5% solution of nitrocellulose in amyl acetate. For best results, however, and particularly where the ignition filament 9 is of a diameter of the order of 0.7 mil, it is preferred that the relative proportions by weight of the above-named powder ingredients be within the particular ranges disclosed and claimed in co-pending U. S. application Serial No. 421,509, R. M. Anderson, filed April 7, 1954, and assigned to the assignee of the present invention, such ranges being of the order of, by weight, from 60–90% zirconium, 1–8% magnesium, and 9–35% potassium perchlorate.

In the case of miniature butt-seal type flash lamps of the character with which the invention is concerned, it has been found that when the material employed for the primer beads 10 is of the composition disclosed and claimed in either the aforesaid Meridith Patent 2,280,598 or in the Anderson application Serial No. 421,571, the adherence of the primer material to the lead-in wires in the finished lamp is very poor. Such poor primer adherence adversely affects the time-light flash characteristics of such type flash lamps.

In accordance with the invention, I have found that the addition to such primer compositions of a small amount of a suitable heat-resistant organic resin as a supplementary binder, will impart to the primer composition the required amount of adherence to the lamp lead-in wires without adversely affecting the flash characteristics of the lamp. The supplementary organic resin binder may be added to the primer composition in the form of a solution, the resin being dissolved in a suitable organic solvent. For the purposes of the invention, the supplementary organic resin binder should be one which will not decompose on rapid heating to a temperature of around 350° C., this being the temperature to which the primer material is ordinarily subjected during the sealing-in of miniature butt-seal flash lamps of the type with which the invention is concerned. To this end resins such as shellac, or resins such as those commercially known as Glyptal resins which are derived from the action of polybasic acids on polyalcohols, or urea formaldehyde type resins such as those commercially known as Beetle resins, or phenolfurfural and phenol-formaldehyde type resins such as those commonly known as Durite resins, have all been found satisfactory for the purposes of the invention. However, it is preferred to employ a silicone resin dissolved in a suitable organic solvent, such as the silicone resin solutions commercially manufactured by the General Electric Company and designated as their SR–17 and SR–82 silicone resin solutions. The SR–17 silicone resin solution comprises an approximately 50% solution in toluene (i. e., approximately 50% by weight of resin solids and 50% by weight of solvent or toluene) of a methylphenyl polysiloxane resin such as described and claimed in U. S. Patent 2,258,222, Rochow, and in which there are both methyl groups and phenyl groups attached to silicon by carbon-silicon linkages. The SR–82 silicone resin solution referred to above comprises an approximately 60% solution in xylene (i. e., approximately 60% by weight of resin solids and 40% by weight of solvent or xylene) of a methyl silicone resin such as described and claimed in U. S. Patent 2,258,218, Rochow, and in which all the organic groups attached to silicon by carbon-silicon linkages are methyl groups.

The amount of the supplementary organic resin binder addition normally required for the purposes of the invention is in the general range of from approximately ¼ to 15 mgs. of resin to 1000 mgs. of the dry primer material constituents (i. e., the zirconium, magnesium and potassium perchlorate components thereof). The amount of organic resin solution, however, which must be initially added to the primer material in order to introduce the above content of supplementary organic resin binder in the final primer bead composition will, of course, be dependent upon the concentration of the organic resin solution which is employed. Thus, where the organic resin solution comprises at least a 50% solution of resin in solvent, i. e., at least 50% by weight of resin, the amount of organic resin solution which must be initially added to the primer composition, in order to produce the above specified range of supplementary organic resin binder content in the final primer composition, is in the general range of from approximately ½ to 30 mgs. of resin solution to 1000 mgs. of the dry primer material constituents. During the manufacture of the flash lamp, the solvent components of the primary nitrocellulose binder solution and the supplementary binder solution in the primer material volatilizes out, so that only the resin or solids components of the binder solutions then remain in the final primer bead composition.

The primer or fulminating material comprising my invention, and of which the ignition beads 10 of the flash lamp consist, is therefore composed of the following ingredients in the following approximate proportions, by weight:

	Percent
Zirconium powder	42–90
Magnesium powder	1–26
Potassium perchlorate powder	9–40
Dry nitrocellulose primary binder	0.15–0.40
Supplementary organic resin binder	0.025–1.5

Within the above general range of compositions, the following primer composition by weight has been found to be particularly advantageous:

	Percent
Zirconium powder	60–90
Magnesium powder	1–8
Potassium perchlorate powder	9–35
Dry nitrocellulose primary binder	0.15–0.40
Supplementary organic resin binder	0.05–0.75

The magnesium and potassium perchlorate powders employed in the primer admixture are of extremely fine character, preferably of the order of 325 mesh or finer, while the zirconium powder may have a fineness of the order of 80 mesh or finer. The zirconium metal powder preferably is that commercially known as No. 3 grade, manufactured and sold by the Foote Mineral Company of Philadelphia, Pennsylvania, the said No. 3 grade zirconium powder having a relatively high ignition point as compared to other forms of zirconium powders. The magnesium metal powder employed is preferably that manufactured by the United States Magnesium Company of Pleasant Valley, New York, and known as their 325 mesh magnesium powder. Chemically pure (C. P.) grade crystal potassium perchlorate powder is employed as the oxidizing agent in the primer composition.

The primer material is applied to the inner ends or tips of the lead-in wires 4 in the form of a paste or suspension of the powder particles in the primary and secondary binder solutions, the primary binder being one which will act to maintain the powder particles thoroughly dispersed throughout the suspension and will impart the desired workability thereto. The primary binder preferably employed for such purpose is a low percentage (i. e., around 1.5 to 4%) solution of nitrocellulose in amyl acetate, preferably one containing around 1.2 to 1.3% solids by weight and having a viscosity between 50 and 55 seconds in a No. 7 du Pont cup at 25° C. The subsequent volatilization of the solvents in the primary

and secondary binders then leaves a hardened residue or bead 10 on each lead-in wire composed almost entirely of the zirconium, magnesium, potassium perchlorate and the binder solids components of the primer paste. Enough nitrocellulose binder solution is employed to impart the desired consistency to the primer paste to produce the required size primer beads 10 on the inner lead-in wire tips for a given manufacturing application procedure. Using the above-mentioned specific nitrocellulose primary binder solution consisting of a solution of nitrocellulose in amyl acetate having a solids content of around 1.2 to 1.3% by weight, the amount of primary binder solution employed will generally amount to around 15 –30% by weight of the dry primer material constituents, i. e., the zirconium, magnesium and potassium perchlorate components thereof. A specific example of a primer paste composition according to the invention which has been found to be particularly satisfactory is as follows:

	Percent
Zirconium powder ----------grs--	496
Magnesium powder ----------grs--	58
Potassium perchlorate powder ----------grs--	223
Nitrocellulose solution in amyl acetate (1.2 to 1.3% solids) ----------ml--	200
SR82 silicone resin solution ----------grs--	8.2

The primer paste material may be prepared in the following manner: the formula quantities of magnesium powder and zirconium powder are first thoroughly mixed with enough of the formula quantity of the nitrocellulose binder to form a thin paste, the amount of binder required for such purpose being added a few milliliters at a time to the zirconium-magnesium powder admixture and being thoroughly mixed together therewith after each such addition. The remaining portion of the formula quantity of nitrocellulose binder is next added a few milliliters at a time to the formula quantity of potassium perchlorate powder and thoroughly mixed therewith after each such addition. The potassium perchlorate-binder mixture thus formed is then added to and thoroughly intermixed with the zirconium-magnesium-binder mixture, after which the formula quantity of the supplementary organic resin binder solution is added to and admixed with the resulting mixture to form the finished primer paste composition.

By my invention, a primer composition is obtained which will remain firmly adherent to the lamp lead-in wires in the finished lamp even though the primer material is subjected to elevated temperatures as high as 350° C. such as are customarily encountered during the sealing-in of miniature butt-seal type flash lamps. Such firm adherence of the primer material to the lamp lead-in wires thereby assures the desired time-light flash characteristics for the lamp. The mere substitution alone of a heat-resistant supplementary organic resin binder such as described above for the conventional nitrocellulose binder employed in primer compositions has not been found to be of itself satisfactory, since the organic resin solutions employed to introduce the supplementary organic resin binder into the primer material in accordance with the invention generally would not by themselves disperse the primer powder particles throughout the primer paste or suspension in the necessary thorough manner afforded by nitrocellulose binder solutions, nor would the required long time workability be imparted to the primer suspension by such organic resin solutions.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A primer composition comprising a powder admixture consisting essentially of magnesium, zirconium and potassium perchlorate in the approximate proportions by weight of between 1–26% of magnesium, 42–90% of zirconium, 9–40% of potassium perchlorate, and containing approximately 0.15 to 0.40% by weight of nitrocellulose and approximately 0.025 to 1.5% by weight of an organic resin which remains stable upon rapid heating to a temperature of at least approximately 350° C.

2. A primer composition of the character set forth in claim 1 wherein the said organic resin comprises a silicone resin.

3. A primer composition for flash lamps comprising a powder admixture consisting essentially of magnesium, zirconium and potassium perchlorate in the approximate proportions by weight of between 1–8% of magnesium, 60–90% of zirconium, 9–35% of potassium perchlorate, and containing approximately 0.15 to 0.40% by weight of nitrocellulose and approximately 0.05 to 0.75% by weight of an organic resin which remains stable upon rapid heating to a temperature of at least approximately 350° C.

4. A primer composition of the character set forth in claim 3 wherein the said organic resin comprises a silicone resin.

5. A primer paste composition for flash lamps consisting essentially of approximately 496 grams of zirconium powder, approximately 58 grams of magnesium powder, approximately 223 grams of potassium perchlorate powder, approximately 200 ml. of a solution of nitrocellulose in amyl acetate containing approximately 1.2 to 1.3% by weight solids, and approximately 8.2 grams of a solution of an organic silicone resin which remains stable upon rapid heating to a temperature of at least 350° C.

6. A flash lamp comprising a sealed bulb having a volume of less than about 10 cc., a mount sealed into said bulb by a butt seal, a filling of a combustion-supporting gas in said bulb, a quantity of combustible metallic filamentary material loosely distributed within said bulb, and ignition means carried by said mount and located in said bulb for igniting said combustible material, said ignition means comprising a primer composition consisting essentially of a powder admixture of magnesium, zirconium and potassium perchlorate in the approximate proportions by weight of between 1–26% of magnesium, 42–90% of zirconium, and 9–40% of potassium perchlorate, and containing approximately 0.15 to 0.40% by weight of nitrocellulose and approximately 0.025 to 1.5% by weight of an organic resin which remains stable upon rapid heating to a temperature of at least approximately 350° C.

7. A flash lamp of the character set forth in claim 6 wherein the said organic resin comprises a silicone resin.

8. A flash lamp comprising a sealed bulb having a volume of less than about 10 cc., a mount sealed into said bulb by a butt seal, a filling of a combustion-supporting gas in said bulb, a quantity of combustible metallic filamentary material loosely distributed within said bulb, and ignition means carried by said mount and located in said bulb for igniting said combustible material, said ignition means comprising a primer composition consisting essentially of a powder admixture of magnesium, zirconium and potassium perchlorate in the approximate proportions by weight of between 1–8% of magnesium, 60–90% of zirconium, 9–35% of potassium perchlorate, and containing approximately 0.15 to 0.40% by weight of nitrocellulose and approximately 0.05 to 0.75% by weight of an organic silicone resin which remains stable upon rapid heating to a temperature of at least approximately 350° C.

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