Oct. 31, 1944. M. PIPKIN 2,361,495

FLASH LAMP

Filed Dec. 23, 1941

Fig. 1.

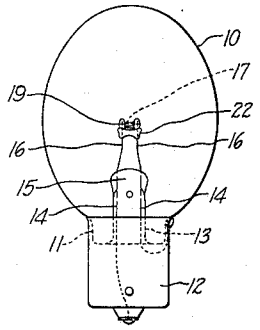
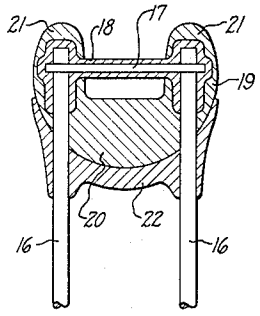


Fig. 2.



Inventor:
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UNITED STATES PATENT OFFICE

2,361,495

FLASH LAMP

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Application December 23, 1941, Serial No. 424,156

8 Claims. (Cl. 67—31)

My invention relates in general to photoflash lamps and more particularly to photoflash lamps of the type disclosed in my copending application Serial No. 328,399, filed April 8, 1940, in which the source of actinic radiation is constituted by one or more beads or compact masses of an agglutinated flashlight powder disposed within a glass bulb. The present application is a continuation-in-part of my said copending application Serial No. 328,399, now Patent No. 2,291,983, granted August 4, 1942.

Of recent date, flash lamps of the above-mentioned type have appeared on the market in which the combustible material is disposed in the form of a bead or beads on the tips of the inner portions of each of the leading-in wires, the said inner portions of the leading-in wires being disposed in a common plane extending in the direction of the length of the bulb. With such flash lamp contruction, the major portion of the burning particles of combustible material, upon ignition of the lamp, are projected laterally out toward the side walls of the bulb in a direction substantially at right angles to the plane of the said inner portions of the leading-in wires. As a consequence, the laterally projected burning particles of combustible material strike diametrically opposite portions of the relative closely adjacent side walls of the bulb before they all have had an opportunity to burn completely, thereby resulting in incomplete combustion of such particles with consequent loss in light output. In addition, the concentration of the laterally projected burning particles of combustible material against the two diametrically opposite side portions of the bulb wall causes a high heating of the bulb wall at such points and so tends to increase the danger of cracking of the glass thereat.

One object of my invention is to provide a flash lamp having a bead of combustible material which is unidirectional in action, the bead being so constructed that substantially all the burning particles thereof, upon ignition of the lamp, will be projected in substantially one direction only from the bead.

Another object of my invention is to provide a flash lamp having a bead of combustible material so constructed and arranged that substantially all the burning particles thereof, upon ignition of the lamp, will be projected from the bead substantially in the direction of the length of the bulb.

Still another object of my invention is to provide a flash lamp with a bead of combustible material, on the lamp leads, so constructed as to possess the quick and uniform ignition characteristic of a divided type of bead, as well as the mount-strengthening characteristics of a bridge-type bead.

A further object of my invention is to provide an improved combustible material composition for flash lamps.

A feature of the invention is the disposition of a bead of combustible material adjacent one end of the lamp bulb and so constructed and arranged as to project the burning particles thereof, upon ignition of the lamp, in a direction toward the opposite end of the bulb.

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

Fig. 1 is an elevation of a photoflash lamp comprising my invention; and Fig. 2 is a sectional view, on an enlarged scale, of the bead of combustible material employed in the lamp shown in Fig. 1.

Referring to the drawing, the lamp according to my invention comprises a bulb or envelope 10 of glass or other suitable light-transmitting material and provided with a relatively short neck portion 11 entirely enclosed and reenforced by a base 12 secured thereto. Preferably, the bulb is of small and extended shape, such as an ellipse, with its longitudinal or major axis coinciding with the axis of the neck portion 11. The bulb 10 is preferably sealed and filled with a combustion-supporting gaseous filling, preferably oxygen, at a suitable pressure, for instance, from 100 mm. of mercury up to 1 atmosphere or so. However, if desired, the bulb may be left open to the atmosphere. To minimize cracking of the bulb on charge flashing and to render the bulb substantially shatterproof, a suitable light-transmitting varnish or lacquer is coated on the inner and outer surfaces of the bulb. Sealed into the bulb 10 and extending thereinto from the neck portion thereof is a small and relatively short mount structure comprising a re-entrant stem 13 having a pair of leading-in wires 14, 14 sealed into the press portion 15 of the stem and extending therethrough to the terminals of the base 12. The leading-in wires 14, 14 are provided with juxtapositioned parallel inner lead portions 16, 16, the said inner leads preferably terminating at a point within the lower portion of the bulb; i. e., adjacent the lower end of the bulb. At their inner extremities the inner leads are interconnected by a filament 17 consisting of a straight

length of wire of a suitable refractory material, preferably tungsten.

In accordance with the invention, the ignition filament 17 is provided with a thin continuous film or coating 18 of a highly inflammable material of such a nature as to readily volatilize and ignite, in the oxidizing atmosphere in the bulb, at a temperature substantially below that temperature at which the filament 17 fuses. Any material having such characteristics may be employed, such as, for instance, very fine red phosphorus suspended in a suitable binder such as cellulose acetate lacquer. The inflammable material 18 may be applied to the filament 17 and the tips of the inner leads by dipping the same into the suspension of red phosphorus and allowing the coating to dry.

Disposed on the tip of each of the inner lead wires 16, 16 and bridging the said wires at a point immediately below the filament 17, is a solid bead or mass of fulminating substance or combustible material 19 of such a composition as to produce, upon ignition, a flash of actinic light of high intensity. The bridge portion of the flashlight bead 19, which is spaced a slight distance from the filament, serves to tie the leads 16 together so as to rigidify and strengthen the mount structure and so prevent breakage of the filament 17 by shock. In addition, the said bridge portion 20 of the bead causes a spreading of the inner lead wires 16, 16 upon ignition of the bead, thus causing the current applied to the lamp for ignition purposes to stop flowing therethrough more quickly, following ignition of the bead, than in the case of a divided type of primer bead. As a result, the current drain on the batteries, where such means are employed as the source of current supply, is minimized; and the need of a fuse lead, when the lamp is flashed on high voltage, is thereby eliminated. The small extensions or ear portions 21 of the bead 19, which enclose the tips of the inner leads and the immediately adjacent end portions of the filament 17, serve to insure the quick and uniform ignition of the fulminating substance.

Because of the spacing of the bridge portion 20 of the bead from the filament instead of being disposed around the filament, only a very small portion of the effective length of the filament is enclosed by the fulminating substance; i. e., only those extreme end portions of the filament enclosed by the small extensions or ear portions 21 of the bead. As a result, the bead 19 has a minimum cooling effect upon the filament and therefore allows the filament to heat up to the ignition temperature of the inflammable material 18 immediately surrounding the filament in the shortest possible period of time. From the above, therefore, it is evident that the bead construction, according to the invention, possesses the quick and uniform ignition characteristics of a divided type of bead as well as the mount-strengthening characteristics of a bridge type bead.

To control the direction of the burning particles of fulminating substance or combustible material 19, upon ignition of the same, and also to strengthen the bead 19 and therefore the mount, the lower or under surface of the bridge portion 20 of the bead is provided with a relatively thick coating 22 of a suitable tough or tenacious material; i. e., one having relatively high tensile strength, for instance, a suitable lacquer such as cellulose acetate. The thick lacquer coating 24, because of its resistance to rupture, serves as a shield and causes the greater portion of the particles of fulminating substance to be projected, upon ignition of the bead, substantially in the direction of the longitudinal axis of the bulb; i. e., upward, as shown in the drawing. As a consequence, the larger portion of the projected particles of fulminating substance are so directed as to travel a maximum distance within the bulb 10 before striking the bulb wall, with the result that they have sufficient opportunity to completely burn before reaching the bulb wall. In this manner, the complete combustion of the particles of fulminating substance, and therefore the maximum amount of light output from the fulminating substance, is more fully assured. In addition, excessive heating and consequent liability of the glass bulb cracking, by contact with the unconsumed hot particles of fulminating substance, is minimized.

As shown in Fig. 1, the filament 17 and the associated bead 19 of fulminating material are preferably disposed adjacent the lower or base end of the bulb 10 so as to space the bead 19 a maximum distance from the upper or opposite end of the bulb and so provide a maximum distance through which the upwardly projected particles of fulminating material can travel before striking the top portion of the bulb. For this purpose, it is preferable to employ as short a stem 13 and mount structure as possible so as to locate the bead 19 as close as possible to the lower end of the bulb.

The material employed as the fulminating substance 19 may be of any suitable composition which, upon ignition, will produce a flash of actinic light of high intensity. Thus, the fulminating substance may comprise a mixture of one or more sensitive metal powders and one or more oxidizing or oxygen-liberating substances bonded together by a suitable binder. The fulminating substance, however, preferably comprises an admixture of zirconium metal powder and chemically pure potassium perchlorate powder with or without chemically pure sodium chlorate powder bonded together by a nitrocellulose solution, preferably one containing from ½ to 4½ per cent of solids. The preferred proportions, by weight, of the above admixture ingredients are approximately as follows:

	Per cent
Zirconium metal powder	50–80
Potassium perchlorate powder	6–50
Sodium chlorate powder	0–34

The potassium perchlorate powder, however, in the above preferred mixtures should comprise at least ⅓ by weight of the total weight of oxidizing powder present in the mixture; that is to say, the oxidizing powder should consist from about 33⅓ to 100 per cent potassium perchlorate powder and from 0 to about 66⅔ per cent sodium chlorate powder.

A composition of fulminating substance which has been found to be particularly effective is approximately as follows:

Zirconium metal powder	grams	3–4
Potassium perchlorate powder	do	1
Sodium chlorate powder	do	1
Nitrocellulose solution	cc	2

This composition is especially effective where the zirconium content amounts to 3.5 grams.

The above admixture of the zirconium metal powder, potassium perchlorate powder and sodium chlorate powder may be otherwise expressed as consisting of about 60–67 per cent (preferably about 64 per cent) by weight of zirconium metal powder, about 16–20 per cent by weight of potassium perchlorate powder, and about 16–20 per cent by weight of sodium chlorate powder.

If desired, a part of the zirconium content in all of the above indicated admixtures, say up to about 50 per cent or so of the zirconium content, may be replaced by an equal weight of magnesium metal powder or a predominantly magnesium-containing powder such as that commercially known as "Dow Metal," which consists of an alloy of magnesium and aluminum with the magnesium present in an amount of the order of 90 per cent by weight or thereabouts.

Flash lamps according to the invention, in which the bead of combustible material is provided with a heavy lacquer coating over one side or surface thereof to thereby impart a unidirectional action thereto on ignition, produce a flash of light having a somewhat higher peak intensity (about 15 per cent or so) than that produced by a lamp containing a bead not having such a direction-imparting coating.

While I have described the invention as applied to flash lamps of the type in which the bead of fulminating material forms substantially the sole source of actinic radiation produced by the lamp, it will be obvious that if desired, the bead construction comprising my invention may also be used in flash lamps of the conventional type employing, as the principal source of actinic radiation, a quantity of foil or filamentary material of a readily ignitible metal, such as aluminum or magnesium or alloys thereof, loosely arranged within the lamp bulb, the fulminating bead in such case serving primarily as an ignition device for igniting the foil or filamentary material.

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

1. In a flash lamp comprising a bulb having a pair of leading-in wires extending thereinto and a filament bridging said wires, an agglutinated bead of finely divided fulminating material comprising a combustible and a supporter of combustion also bridging and supported by said wires adjacent said filament so as to be ignited upon heating of said filament, the main body portion of said bead being spaced a short distance away from said filament.

2. In a flash lamp comprising a bulb having a pair of leading-in wires extending thereinto and a filament bridging said wires, a thin coating of highly inflammable substance on said filament, and an agglutinated bead of finely divided fulminating material comprising a combustible and a supporter of combustion also bridging and supported by said wires adjacent said filament so as to be ignited upon heating of said filament, the main body portion of said bead being spaced a short distance away from said filament.

3. In a flash lamp comprising a bulb having a pair of leading-in wires extending thereinto and a filament bridging said wires, an agglutinated bead of finely divided fulminating material comprising a combustible and a supporter of combustion also bridging and supported by said wires and enveloping the extremities only of said filament so as to be ignited upon heating of said filament, the main body portion of said bead being spaced a short distance away from said filament.

4. In a flash lamp comprising a bulb having a pair of leading-in wires extending thereinto and a filament bridging said wires, a thin coating of highly inflammable substance on said filament, and an agglutinated bead of finely divided fulminating material comprising a combustible and a supporter of combustion also bridging and supported by said wires and enveloping the extremities only of said filament so as to be ignited upon heating of said filament, the main body portion of said bead being spaced a short distance away from said filament.

5. In a flash lamp comprising a bulb, a compact body of agglutinated finely divided material supported therein and comprising a combustible and a supporter of combustion intimately associated with each other, electrical means for developing an ignition temperature in said body, and a coating on one side only of said body sufficiently strong to cause the particles of the body, upon ignition, to be projected in a direction away from the coated side thereof.

6. In a flash lamp comprising a bulb having a pair of lead-in wires extending thereinto, a filament bridging said wires, a body of agglutinated finely divided material comprising a combustible and a supporter of combustion intimately associated with each other, said body enveloping portions of said lead-in wires and being supported thereby so as to be ignited upon heating of said filament, and a coating on one side only of said body sufficiently strong to cause the particles of the body, upon ignition, to be projected in a direction away from the coated side thereof.

7. In a flash lamp comprising a bulb having a pair of leading-in wires extending thereinto and a filament bridging said wires, an agglutinated bead of finely divided fulminating material comprising a combustible and a supporter of combustion also bridging and supported by said wires adjacent said filament so as to be ignited upon heating of said filament, the main body portion of said bead being spaced a short distance away from said filament, and a coating on one side only of said body sufficiently strong to cause the particles of the body, upon ignition, to be projected in a direction away from the coated side thereof.

8. In a flash lamp of the character described, a bulb, a pair of lead-in wires extending into said bulb, a filament bridging said wires, a continuous coating of highly inflammable material on said filament, and a body of agglutinated finely divided material comprising a combustible and a supporter of combustion, said body enveloping portions of said lead-in wires and being supported thereby so that the major portion of the body is spaced slightly from and located to one side of the coated filament but within effective ignition range thereof, and a coating on the side of said body remote from the filament sufficiently strong to cause the particles of the body, upon ignition, to be projected in a direction away from the coated side thereof.

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