April 21, 1942. G. H. MERIDITH 2,280,598

FLASH LAMP

Filed June 9, 1939

Fig. 1.

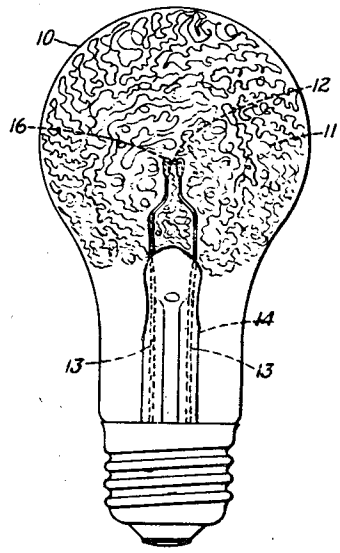
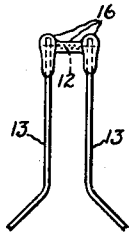


Fig. 2.



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2,280,598

FLASH LAMP

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Application June 9, 1939, Serial No. 278,288

3 Claims. (Cl. 67—31)

My invention relates to flash lamps and more particularly to that type of flash lamp used for photographic purposes. Such flash lamps usually comprise a sealed transparent bulb in which is enclosed a readily combustible material such as metal foil and/or wire, together with suitable ignition means therefor, and a substance, usually a gas filling, which, upon ignition of the lamp, enters into a reaction with the combustible material with the resulting emission of actinic light. Still more particularly, my invention relates to flash lamps employing substantially pure aluminum, in the form a wire or ribbon, as the combustible material, and to ignition means therefor.

Prior to the invention disclosed in United States patent application Serial No. 262,209, filed March 16, 1939, by Marvin Pipkin, it had been considered impossible to effectively ignite flash lamps employing pure aluminum wire as the combustible material to thereby produce a flash of light of sufficient intensity for photographic purposes. Among other things, the present invention is based upon the discovery of improved and effective ignition means for flash lamps in general, and in particular for flash lamps employing pure aluminum wire as the sole combustible material. Furthermore, for certain types of flashlight photography, commonly referred to as the "synchronized flash," it is necessary that the flash of light from the flash lamp occur simultaneously with the opening or tripping of the camera shutter. It is highly desirable, therefore, to produce uniformly performing flash lamps that have substantially the same flash characteristics in order that each lamp will function, for the same setting of the synchronizing mechanism, to produce its flash of light simultaneously with the opening of the camera shutter.

In the manufacture of flash lamps as constructed at present, in which the ignition means comprises a small filament embedded in a bead of fulminating substance, there is a considerable loss or shrinkage occasioned by the accidental flashing of the lamps, particularly during the testing thereof. The extreme sensitivity of the primer bead to external phenomenon, such as static charges of electricity, necessitates careful handling of the flash lamp in order to avoid such accidental flashing, and in addition creates a dangerous fire hazard. To reduce this extreme sensitivity of the primer bead to such external phenomenon, and also to add mechanical strength to the bead to thereby reduce the possibility of the bead cracking and breaking off the filament, it has been customary to provide a protective lacquer coating on the primer bead.

A further disadvantage of the present type of ignition means for flash lamps is the explosion hazard coincident with the flashing of the lamp. The burning particles of primer material are projected against the bulb wall with great speed, carrying with them small portions of the burning combustible material. These hot particles of combustible material in contact with the glass bulb wall may result in the cracking of the glass, so that a dangerous explosion occurs. While such explosions have been comparatively infrequent, still it is the desire of the industry to eliminate them entirely.

One object of my invention is to provide improved flash lamp ignition means having uniform ignition characteristics, and which can be manufactured at a lower cost than heretofore.

Another object of my invention is to provide a flash lamp employing drawn wire or ribbon of pure aluminum as the sole combustible material, which will produce a flash of light of sufficient speed and intensity for flashlight photographic purposes.

Still another object of my invention is to provide uniformly performing flash lamps in which the flashes of light produced thereby are uniform in character and occur at approximately the same interval of time following energization of the lamp ignition means.

A further object of my invention is to provide ignition means for flash lamps which will ignite the combustible material quickly, thoroughly and uniformly, and which will minimize the explosion hazard coincident with the flashing of the lamp.

A still further object of my invention is to provide ignition means for flash lamps which will minimize accidental flashing of the lamps during manufacture as well as reduce the fire hazard.

Further objects and advantages of my invention will appear from the following detailed description of a species thereof and from the accompanying drawing, in which Fig. 1 is an elevation of a 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 there shown comprises a vitreous transparent envelope or bulb 10 containing a loose filling of combustible material 11 consisting essentially of substantially pure drawn aluminum wire or ribbon having a fineness corresponding to a diameter of less than two mils and preferably approximately one mil or very close thereto. The envelope or bulb 10 also

contains a filling of oxygen or 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. For bulb sizes commonly in use at present, and with oxygen being used as the combustion supporting gas and pure aluminum as the combustible material, the pressure of the gaseous filling will vary up to 500 mm. of mercury or even close to one atmosphere. The bulb is coated on its inner or outer surface, preferably on both surfaces, with a coating of a suitable transparent varnish or lacquer to thereby prevent cracking of the bulb on charge flashing and to render the bulb substantially shatterproof, as disclosed and claimed in application Serial No. 269,197, H. D. Blake, filed April 21, 1939.

Mounted within the bulb 10 within effective ignition range of the combustible material 11 therein, is the lamp ignition means or mount according to the invention comprising a small filament 12, preferably of tungsten, the ends of which are connected to leading-in wires 13, 13 which extend through a stem 14 to a base 15. The filament 12 and the adjacent ends of the leading-in wires 13, 13 are covered with a thin film or layer of fulminating substance or primer material 16. The said fulminating substance is applied to the filament 12 in the form of a paste consisting of an extremely sensitive metal powder or powders and a suitable oxidizing agent mixed with a suitable binder. According to the invention, the sensitive metal powder consists of a mixture of magnesium powder, and zirconium metal powder known as No. 3 grade, manufactured and sold commercially by the Foote Mineral Company of Philadelphia, Pennsylvania, the said No. 3 zirconium powder having a relatively high ignition point as compared to other forms of zirconium powder. The oxidizing agent consists of chemically pure (C. P.) crystal potassium perchlorate powder. The binder employed preferably consists of a 4 to 5 per cent solution of nitrocellulose. The composition of the primer material is approximately as follows:

4–5 per cent nitrocellulose solution--cc--	5
Potassium perchlorate (C. P.) powder ----------grams--	5
Zirconium No. 3 metal powder----do----	6.5
Magnesium powder----------do----	1.0–4.0

In other words, the admixture of the potassium perchlorate, zirconium metal and magnesium metal powders may be expressed as consisting of from about 32 to 40 per cent by weight of potassium perchlorate powder, about 42 to 52 per cent by weight of zirconium metal powder, and about 8 to 26 per cent by weight of magnesium metal powder. The magnesium powder content, in the preferred composition, amounts to 2.4 grams, i. e., approximately 17.3 per cent by weight of the admixture of potassium perchlorate, zirconium and magnesium powders.

The primer mixture is prepared as follows: 5 grams of crystal potassium perchlorate (C. P.), which has previously been ground to a fineness of 325 mesh or finer, is added to 5 cc. of a 4 per cent solution of nitrocellulose, the powdered potassium perchlorate being stirred in thoroughly. Next, 6.5 grams of zirconium No. 3 metal powder, having a fineness of 325 mesh or finer, is added and stirred in thoroughly, after which the proper amount of magnesium powder, having a fineness of 325 mesh or finer, is added and stirred in thoroughly. To further aid in obtaining a homogeneous mixture and to thin out the same to the desired consistency, amyl acetate is added in the proper amount. The filament 12, together with its associated leading-in wires 13, 13, is then dipped into the above mixture to form, upon drying, a thin coating on the filament and the adjacent ends of the leading-in wires, as indicated at 16 in Fig. 2. If desired, the magnesium powder, instead of being mixed with the other ingredients of the primer material, may be applied thereto in the form of a coating or after-dip.

Because of the fact that the primer material 16 is applied on the filament and adjacent portions of the leading-in wires in the form of a relatively thin coating rather than a bead, only a small amount of material being employed to form the coating, the physical structure, and consequently the ignition characteristics, of the primer coating on every lamp ignition mount tends to be more uniform than in the case where the primer material is in the form of a bead of relatively large size. Flash lamps provided with such uniformly acting primers or ignition means are thus rendered more uniform in flash performance, thereby facilitating the synchronization of a camera shutter with the light peak of such flash lamps.

The potassium perchlorate powder employed in the primer mixture according to the invention provides an extremely abundant supply of oxygen for supporting the combustion of the sensitive metal powders. Because of this abundant supply of oxygen, and also because of the sensitive metal powders present in the primer material, the latter ignites very quickly and with great rapidity, the burning particles being quickly and uniformly distributed throughout the bulb, thus causing the combustible material within the bulb to ignite with great speed and with uniformity. The use of such a quick and uniformly igniting primer therefore makes it possible to employ drawn pure aluminum wire as the sole combustible material in flash lamps, for I have found that such a primer will effectively ignite the aluminum wire in the lamp. Drawn pure aluminum wire having a size corresponding to a diameter of as large as 1.0 or 1.1 mils, or even somewhat larger, can therefore be successfully employed in flash lamps for the production, upon ignition by a primer according to the invention, of a flash of light of sufficient intensity and output for flashlight photographic purposes. Furthermore, the flashes of light produced by such flash lamps successfully meet present-day requirements for satisfactory synchronized flashlight photography, i. e., they are characterized by a relatively high intensity for a prolonged period of time with their peak uniformly occurring at the desired interval of approximately 0.020 of a second following the closure of the electrical circuit through the flash lamp.

The sensitive magnesium powder employed in the primer material according to the invention imparts thereto certain beneficial ignition properties which result in a better and a more thorough and speedy ignition of the combustible material within the lamp than that heretofore obtainable. This is particularly true where the combustible material is in the form of pure aluminum wire. Then, too, by the use of such magnesium powder, the total quantity of primer material necessary to effectively ignite the combustible material is rel-

atively small as compared to the amount heretofore required. Thus, I have found that only one-fourth (approximately) as much primer material as that heretofore employed is adequate to effect proper ignition of the combustible material.

It is not known at the present time just why the presence of magnesium in the primer material facilitates the ignition of aluminum wire. It is believed, however, that the magnesium powder imparts the necessary body or strength to the chemical reaction, which takes place upon ignition of the primer material, to cause the major portion of the burning primer particles to be thrown off the filament 12 into the zone or space occupied by the combustible material, so that they can simultaneously ignite the same at a great number of points. It is also believed that the magnesium in the primer material may have some sort of a catalytic or other action either on the primer material itself or on the aluminum combustible material within the lamp, whereby the latter is caused to burn with the requisite speed for the production of a flash of light of sufficient intensity and output for flashlight photographic purposes. In any event, however, it has been discovered that the presence of magnesium in the primer material actually does impart certain advantageous ignition characteristics thereto which cause a much more effective ignition of pure aluminum wire within a flash lamp than heretofore obtainable.

An important feature of my improved ignition means is that it materially reduces the danger of explosion incident to the flashing of the lamp. This, apparently, is due to the fact that practically none of the burning primer particles are projected against the glass bulb wall so as to carry with them small portions of the hot combustible material. This condition frequently occurred with primers heretofore in use, the hot metal particles in contact with the glass of the bulb sometimes cracking the same so that an explosion resulted.

A further important feature of my invention is the substantial elimination of the static or accidental flashing of the lamp which frequently resulted when lamps provided with primers heretofore in use were subjected to static charges of electricity, such as exists during the testing of the completed flash lamp. This elimination of flashouts is partly due to the fact that the use of magnesium powder as one of the sensitive metal powders in the primer material makes it possible to use a considerably smaller quantity of primer material to form the primer on the filament and lead wires than heretofore required. Obviously, the less primer material employed, the less the possibility of an accidental ignition of the same and a consequent premature flashing of the lamp.

Because of the fact that the primer material according to the invention is in the form of a relatively thin layer 16 which firmly adheres to the filament 12 and leading-in wires 13, 13, it is not as likely to crack and break off as readily as the relatively heavy primer beads formerly employed. As a consequence, there is no need of applying a lacquer coating over the primer material 16 to strengthen the same, as required where the primer is in the form of a bead. Because of this fact, a material saving in the cost of manufacture is effected. A further saving in manufacturing cost is attained by the fact that considerably less primer material is used to form the primer covering 16 as compared to that necessary to form the conventional bead heretofore in use, and also by the fact that the primer coating can be applied onto the filament and leading-in wires by mechanical means rather than by hand, as is customary in the case of primer beads.

While I have described my improved ignition means in connection with a flash lamp having pure drawn aluminum wire or ribbon as the sole combustible material, the ignition means serving to effectively ignite such wire, it is obvious that the said means may be applied equally as well to flash lamps having other types of combustible material such as a foil of aluminum or magnesium or alloys thereof, or wire or ribbon of a composition other than pure aluminum, such as the alloys of aluminum or magnesium.

In the appended claims, the expression "filamentary wire" is used to describe either the wire or ribbon referred to hereinabove.

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

1. A primer composition for flash lamps comprising an admixture of finely divided magnesium metal, zirconium metal and potassium perchlorate powders in the approximate proportions by weight of between 8 to 26 per cent of magnesium, 42 to 52 per cent of zirconium, and 32 to 40 per cent of potassium perchlorate, said admixture ingredients being bonded together by a suitable binder.

2. A flash lamp comprising a sealed container having an oxidizing atmosphere therein, a quantity of filamentary combustible material loosely arranged throughout the space within said container, and ignition means disposed in said container within effective ignition range of said combustible material, said ignition means comprising an electric energy translation element at least a portion of which is provided with a coating of fulminating substance, said fulminating substance comprising a powder admixture consisting essentially of magnesium, zirconium and potassium perchlorate in the approximate proportions by weight of between 8 to 26 per cent of magnesium, 42 to 52 per cent of zirconium and 32 to 40 per cent of potassium perchlorate, said admixture ingredients being bonded together by a suitable binder.

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 8 to 26 per cent of magnesium, 42 to 52 per cent of zirconium, and 32 to 40 per cent of potassium perchlorate, said admixture ingredients being bonded together by a suitable binder.

GEORGE H. MERIDITH.