May 7, 1957 W. E. GLEIM 2,791,111

FULMINATOR FOR PHOTOFLASH LAMPS

Filed Jan. 15, 1953

Fig. 1.

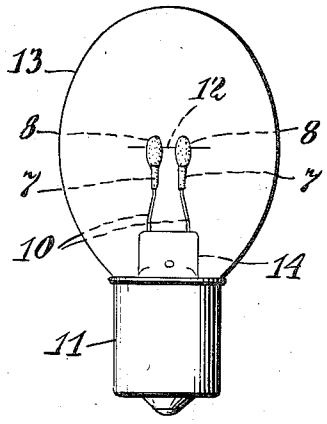


Fig. 2.

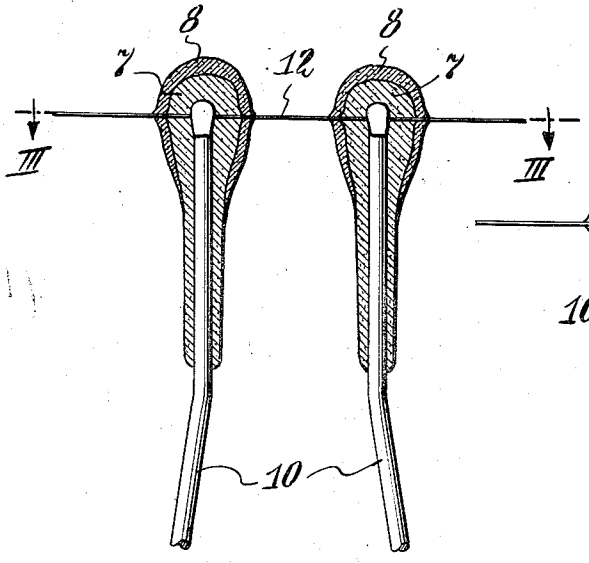
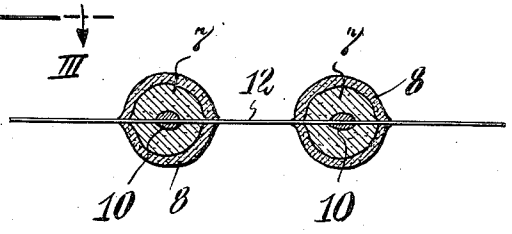


Fig. 3.



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FULMINATOR FOR PHOTOFLASH LAMPS

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8 Claims. (Cl. 67—31)

The present invention relates to photoflash lamps and, more particularly, to an improved fulminator which is reliable in ignition and which achieves good performance while maintaining excellent safety characteristics.

One of the conventional types of photoflash lamps has a metal foil therein which is ignited to produce light, while another type depends solely upon the oxidation of a fulminator applied as a paste to the leads which support the filament of the lamp. This invention is primarily concerned with the latter type of lamp, hereinafter referred to as a "paste" type, although the improved fulminator herein disclosed may also be used in conjunction wtih a "foil" type lamp.

Heretofore in paste type photoflash lamps, the fulminator applied on the leads has been of a homogeneous nature, being of approximately the same composition throughout. The disadvantages of such a homogeneous fulminator are that the oxidizer mixed with the combustible material acted as an insulator, with the result that it was difficult at times to initially ignite the fulminator from the hot filament. In addition, the oxygen atmosphere surrounding the fulminator was not efficiently used, since the combustible material tended to react more readily with the oxidizer with which it was mixed, rather than with the oxygen atmosphere. Also, the reaction of the combustible with the oxidizer and the oxygen atmosphere occurred nearly at the same time giving rise to higher instantaneous pressures because of the substantially simultaneous reaction and resultant higher temperatures.

Therefore, the principal object of my invention is to produce a photoflash lamp in which the maximum pressure encountered during firing is less than was encountered with the usual paste type photoflash lamp in which the fulminator was of a homogeneous nature.

Another object of my invention is to produce a photoflash lamp in which the combustible material in the fulminator will more readily ignite.

Another object is the more efficient utilization of the oxygen in the envelope with the attendant benefits of the use of larger amounts of combustible material resulting in a greater lumen-second output for an equivalent amount of oxidizing agent and oxygen atmosphere.

A further object of the present invention is to provide a method for applying a fulminator to photoflash lamp leads in such a manner as to deposit the fulminator in two separate layers.

The above objects, and other objects which will become apparent as the description proceeds, are achieved by applying the fulminator material in two separate coatings on the leads, the outer coating being relatively rich in combustible material as compared with the inner coating which is relatively rich in oxidizer.

The description of the present invention will be better understood by reference to the drawing which illustrates a preferred embodiment of my invention and in which:

Fig. 1 is an elevational view of a photoflash lamp embodying my fulminator coated leads;

Fig. 2 is a sectional elevation showing the fulminator coated leads;

Fig. 3 is a sectional top plan view taken along the line III—III of Fig. 2, in the direction of the arrows.

The photoflash lamp 5 of Fig. 1 is comprised generally of a light transmitting envelope 13, a mount 14 supporting and positioning leads 10, said mount including a supporting portion as is common in the art, and a filament 12 connected between the leads 10. The lamp has a standard bayonet type base 11 to provide electrical connection with a standard bayonet socket. The leads 10 are connected to the standard bayonet type socket 11. The ends of each lead 10 are coated with two separate layers of fulminator materials 7 and 8, which fulminators consist of mixtures of an oxidizer and a combustible. The inner layers 7 of the fulminator coating on each lead 10 are adjacent the leads and are relatively rich in oxidizer with respect to the outer layers 8 and these outer layers 8 are relatively rich in combustible, as compared with inner layers 7. The optimum composition of the fulminator of the inner layers 7 is about 62% zirconium metal powder and about 38% potassium perchlorate. This composition may vary within a preferred range, from 70% to 59% zirconium and from 30% to 41% potassium perchlorate. The optimum composition of the fulminator of the outer layers 8 is about 95% zirconium metal powder and about 5% potassium perchlorate. This composition may vary within a preferred range from 90% to 100% zirconium and from 10% to 0% potassium perchlorate. The zirconium in the fulminator constitutes the combustible material and the potassium perchlorate in the fulminator constitutes the oxidizer. Other materials may be substituted for the potassium perchlorate as the oxidizer, examples being sodium chlorate, potassium bichromate and lead dioxide. Other suitable materials may be substituted for zirconium as the combustible.

The inner layers 7 of fulminator material in the preferred embodiment of my invention constitute approximately 80% of the weight of the total combined weights of fulminator layers 7 and 8, although this ratio may be varied appreciably. The outer layers 8 cover the end of each lead 10, and in the preferable embodiment of my invention the outer layers 8 extend down the leads 10 for a distance of about 2 mm. below the filament 12.

The volume enclosed by the hermetically sealed lamp envelope 13 is filled with substantially pure oxygen, and in the case of the preferable proportions of combustible to oxidizer in the fulminator, as stated heretofore, the preferable oxygen gas pressure is between 115–125 mm. As the percentages of combustible to oxidizer in the fulminator are varied within the foregoing prescribed limits, the pressure of the oxygen gas within the envelope may vary from 180 mm. to 100 mm.

In the operation of the above described lamp, a potential is applied across the leads 10, causing the filament to heat. The heated filament ignites the almost pure zirconium outer layer 8 which burns rapidly with the oxygen gas surrounding it. Almost immediately, as the temperature rises due to the burning zirconium in the outer layer 8, the lower layer 7 flashes off, supplying approximately 80% of its own oxygen from the potassium perchlorate in the mixture. By the time the violent reaction of the under layer has started, the oxygen atmosphere contained within the envelope 13 has been about one-half used up by the burning of the outer layer 8 of combustible rich material, so that the pressure build-up will be less than with the usual type bulb, due to the fact that the outer and inner layers burn at slightly different time intervals. In the usual type photoflash bulb where there is only one homogeneous layer of fulminator,

the oxygen within the envelope **13** and the oxidizer react substantially simultaneously with the combustible. This substantially simultaneous reaction results in a greater instantaneous heat with greater instantaneous internal pressures, which pressures are apt to cause a violent disruption of the envelope **13**.

The two separate layers of fulminator also make possible a more efficient use of the oxygen gas within the envelope **13** than was formerly possible where only one homogeneous fulminator was used, since by making the oxygen gas available for the reaction of the high combustible content layer **8** of the fulminator at the start of the reaction, this oxygen atmosphere is about 50% exhausted when the lower layer **7** flashes off. This makes possible a more complete utilization of all oxygen contained in the oxygen atmosphere of the bulb and in the oxidizer portion of the fulminator. Because of this, it is possible to efficiently utilize about 10% more combustible material for a given amount of oxidizer and oxygen gas than was formerly possible when one single homogeneous layer of fulminator was used. The increase in weight of combustible which can be utilized results in a corresponding increase in the total lumen-second output for a given bulb, using my non-homogeneous fulminator, when compared to the same bulb utilizing a homogeneous fulminator.

It is, of course, obvious that more than two layers of fulminator may be utilized, if desired, graduating the ratio of combustible to oxidizer.

In fabricating the fulminator in two layers, the leads **10** are first inserted a predetermined amount into a dip of the material comprising the inner layer **7**. This dipping process is repeated as many times as is necessary to obtain the desired thickness of the layer **7**. The leads are now coated with a first layer only, and these coated leads are inserted a predetermined amount into a second dip consisting of the material comprising the outer layer **8**. This second dip is repeated as necessary until the desired thickness of fulminator material is obtained.

While I have described a specific embodiment of my invention, it will be understood that modifications may be made within the spirit and scope of my invention.

I claim:

1. A mount for a photoflash lamp comprising leads supporting a filament and paste fulminators on the ends of said leads, said fulminators consisting of a mixture of a combustible and an oxidizer, said fulminators each having an inner and an outer layer, said inner layer being composed of about 62% zirconium combustible material and about 38% potassium perchlorate oxidizer, and said outer layer being composed of about 95% zirconium combustible and about 5% potassium perchlorate oxidizer, and a portion of both said inner and said outer layers being in direct contact with said filament.

2. A mount for a photoflash lamp comprising leads supporting a filament and paste fulminators on the ends of said leads, said fulminators consisting of a mixture of a combustible and an oxidizer, said fulminators each having an outer and an inner layer, said inner layer preferably being composed of between 59% to 70% combustible and 41% to 30% oxidizer, said outer layer preferably being composed of between 90% to 100% combustible and 10% to 0% oxidizer, and a portion of both said inner and said outer layers being in direct contact with said filament.

3. A paste type fulminator photoflash lamp comprising a mount having leads supporting a filament and paste fulminators on the ends of said leads, said fulminators consisting of a mixture of a combustible and an oxidizer, said fulminators each having an outer and an inner layer, said outer layer being richer in combustible than said inner layer, said photoflash lamp having an hermetically sealed radiation transmitting envelope surrounding said leads and having an oxygen atmosphere therein, and a portion of both said inner and said outer layers being in direct contact with said filament, the combustible of said outer fulminator layer on being ignited by said filament reacting primarily with said oxygen atmosphere, and the combustible of said inner fulminator layer thereafter reacting primarily with the oxidizer of said inner fulminator layer.

4. A paste type fulminator photoflash lamp comprising a mount having leads supporting a filament and paste fulminators on the ends of said leads, said fulminators consisting of a mixture of a combustible and an oxidizer, said fulminators each having an inner and an outer layer, said inner layer being composed of about 62% zirconium combustible material and about 38% potassium perchlorate oxidizer, said outer layer being composed of about 95% zirconium combustible and about 5% potassium perchlorate oxidizer, and a portion of both said inner and said outer layers being in direct contact with said filament, said photoflash lamp having an hermetically sealed radiation transmitting envelope surrounding said leads and having therein an oxygen atmosphere of a pressure between 115 to 125 mm., whereby on firing the combustible of said outer layer of said fulminators is first ignited by said filament to react primarily with said oxygen atmosphere, and the combustible of said inner layer of said fulminators thereafter reacts primarily with the oxidizer of said inner layer of said fulminators.

5. A mount for a photoflash lamp comprising leads supporting a filament and paste fulminators on the ends of said leads, said fulminators consisting of a mixture of a combustible and an oxidizer, said fulminators each having an inner and an outer layer, said inner layer preferably being composed of 59% to 70% zirconium combustible and 41% to 30% potassium perchlorate oxidizer, said outer layer preferably being composed of 90% to 100% zirconium combustible and 10% to 0% potassium perchlorate oxidizer, and a portion of both said inner and said outer layers being in direct contact with said filament.

6. A paste type fulminator photoflash lamp comprising a mount having leads supporting a filament and paste fulminators on the ends of said leads, said fulminators consisting of a mixture of a combustible and an oxidizer, said fulminators each having an inner and an outer layer, said inner layer preferably being composed of between 59% to 70% combustible and 41% to 30% oxidizer, said outer layer preferably being composed of 90 to 100% combustible and 10 to 0% oxidizer, and a portion of both said inner and said outer layers being in direct contact with said filament, said photoflash lamp having an hermetically sealed radiation transmitting envelope surrounding said leads and having therein an oxygen atmosphere.

7. A paste type fulminator photoflash lamp comprising a mount having leads supporting a filament and paste fulminators on the ends of said leads, said fulminators consisting of a mixture of a combustible and an oxidizer, said fulminators each having an inner and an outer layer, said inner layer preferably being composed of between 59% to 70% zirconium combustible and 41% to 30% potassium perchlorate oxidizer, said outer layer preferably being composed of 90 to 100% zirconium combustible and 10 to 0% potassium perchlorate oxidizer, and a portion of both said inner and said outer layers being in direct contact with said filament, and said photoflash lamp having an hermetically sealed radiation transmitting envelope surrounding said leads and having therein an oxygen atmosphere at a pressure between 180 and 100 mm.

8. A paste type fulminator photoflash lamp comprising a mount having leads supporting filament and paste fulminators on the ends of said leads, said fulminators consisting of a mixture of a combustible and an oxidizer, said fulminators each having an inner and an outer layer, said inner layer preferably being composed of about 62%

zirconium combustible and about 38% potassium perchlorate oxidizer, said outer layer preferably being composed of about 95% zirconium combustible and about 5% potassium perchlorate oxidizer, a portion of both said inner and said outer layers being in direct contact with said filament, said photoflash lamp having an hermetically sealed radiation transmitting envelope surrounding said leads and having therein an oxygen atmosphere at a pressure between 115 and 125 mm, and said inner layer comprising about 80% by weight of the total weights of said inner and said outer layers.

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