United States Patent

Waymouth

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[54] **XENON SLASH LAMP WITH SODIUM STARTING BAND AND METHOD OF MAKING SAME**

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[73] Assignee: **Sylvania Electric Products Inc.**

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[52] **U.S. Cl.** **313/198,** 117/93, 117/223, 313/220, 313/221, 313/224

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[58] **Field of Search**..................313/197, 198, 220, 221, 224; 204/130; 117/93, 223, 118; 316/5, 13

[56] **References Cited**

UNITED STATES PATENTS

1,925,648	9/1933	Spanner et al.	313/197 X
1,961,618	6/1934	Machlett	313/197
2,491,854	12/1949	Force	313/197
2,829,295	4/1958	Gast et al.	313/198 X
3,349,274	10/1967	Kolkman et al.	313/197 X
3,449,615	6/1969	Tucker et al.	313/226
2,897,126	7/1959	George	204/130
3,174,919	3/1965	Spremulli	204/130

FOREIGN PATENTS OR APPLICATIONS

836,551	6/1960	Great Britain	313/220

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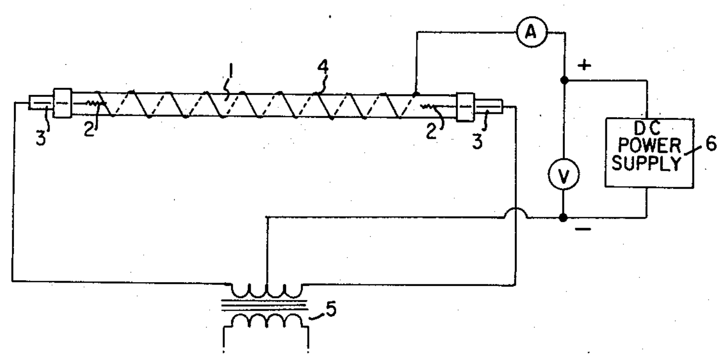
[57] **ABSTRACT**

A band of sodium metal is electrolyzed onto the inner surface of a xenon flash lamp glass envelope. The sodium band reduces the ignition voltage required to flash the lamp throughout its useful life.

5 Claims, 1 Drawing Figure



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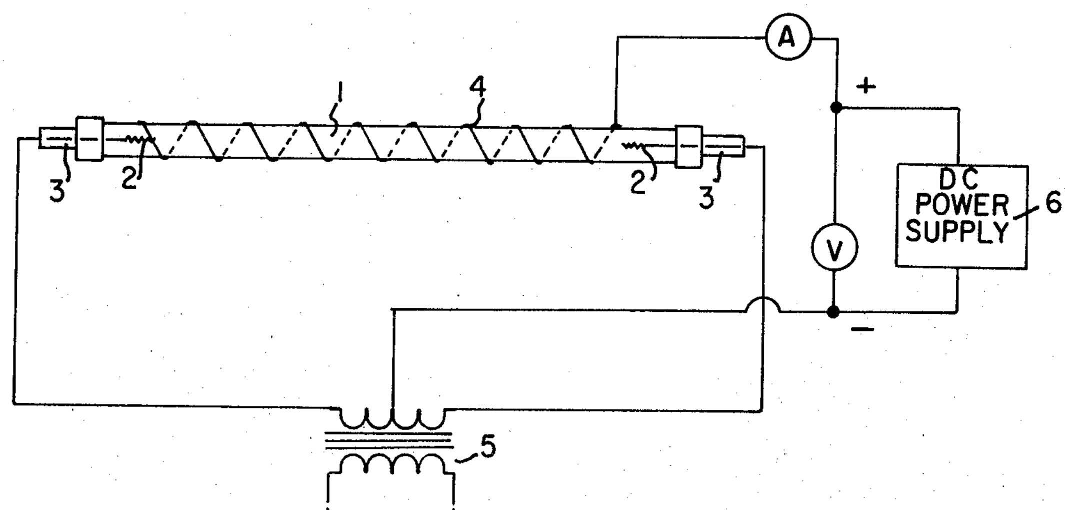

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XENON SLASH LAMP WITH SODIUM STARTING BAND AND METHOD OF MAKING SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to xenon flash lamps such as are used in photography, photocopying, laser pumping and the like. It particularly relates to internally triggered lamps, that is, those which do not have an external trigger wire to flash the lamp.

2. Description of the Prior Art

Xenon flash lamps generally comprise two spaced apart electrodes within a sealed glass envelope having a fill including xenon. Such lamps are connected across a large capacitor charged to a substantial potential, which is, however, insufficient to ionize the xenon fill gas. Upon the application of an additional pulse of sufficient voltage, the xenon is ionized, and an electric arc is formed between the two electrodes, discharging the large capacitor through the lamp, which emits a burst of intense light, usually of short duration. In some cases, the pulse voltage is applied between an external trigger wire wrapped around the envelope and the electrodes. However, in other cases an external trigger wire is not feasible since it may result in undesirable arcing between the trigger wire and a proximate lamp reflector or else the high potential applied to the external trigger wire might be hazardous to operating personnel.

In those cases, the lamp may be internally triggered by applying the pulse voltage directly across the lamp electrodes. Usually the voltage required is about 30 to 50 percent higher than that required to trigger the same lamp with an external trigger wire. This poses no particular problem in itself, since the circuit can be designed to supply sufficient pulse voltage to the lamp.

However, it has been found that in many cases, the ignition requirements of an internally triggered lamp are extremely variable. Some lamps of a particular type with 9 inch arc length may require as little as 200 volts DC input to the trigger transformer for ignition while others of the same type may require as much as 700–800 volts DC input to the trigger transformer for ignition. Even worse, though, is the tendency for the DC voltage input required for triggering to rise during life, being for instance 300 volts initially, and rising to 700–800 volts after 100,000 flashes. Such lamps would be classified as failures in some apparatus in which they are used, since only 800 volts might be available to trigger two lamps in series. These problems are particularly aggravating since they generally do not occur with externally triggered lamps.

Accordingly, it is an object of this invention to manufacture internally triggered xenon flash lamps having a more uniform ignition voltage than those of the prior art and which voltage does not rise substantially throughout the useful life of the lamp.

SUMMARY OF THE INVENTION

I have discovered that if a narrow band of sodium extends along the inner surface of a xenon flash lamp glass envelope, the internal triggering voltage of the lamp is lower and more uniform than that of the same lamp without the band. Preferably the band extends to points on the envelope that are near the electrodes at each end of the lamp.

The preferred method of forming the sodium band is electrolyzing the sodium normally present in the glass to the inner surface of the glass envelope. The outer surface of the envelope is subjected to a DC potential, positive with respect to the inner surface, while the lamp is lighted at a low current and while the lamp is heated. Under these conditions, a small DC current is drawn through the glass wall of the envelope. This conduction current is principally due to the motion of sodium ions through the glass to the inner surface of the envelope. At the inner surface they capture electrons from the arc plasma to become neutral sodium, existing as a fine deposit on the inner surface.

In order to form this deposit, say, as a fine spiral band, a suitable wire is spirally wrapped around the outside of the envelope and the aforementioned positive DC potential is applied to this wire. Thus, the transportation of sodium through the glass takes place along the wire spiral, resulting in a similar spiral of sodium on the inner surface of the envelope. The width of the sodium band is about double the wall thickness of the glass envelope and is faintly discernible as a grayish-brown deposit.

It is believed that the sodium band aids lamp ignition by providing a low resistivity path from one end of the lamp to the other and thereby concentrating the pulse voltage across a fraction of the total gaseous path and promoting more vigorous ionization thereat. At the same time, the band is not of such low resistivity as to effectively short out the main body of the envelope, which would prevent the buildup of high electric fields therein and the subsequent propagation of ionization down the envelope.

The sodium band may also furnish electrons by secondary processes, such as photoelectric emission and ion bombardment emission, to aid in the propagation of the ionization, once initiated, down the envelope to the other end. It may, in addition, serve as a getter, absorbing contaminant gases evolved during the life of the lamp.

BRIEF DESCRIPTION OF THE DRAWING

The single drawing is an illustration of electrolyzing apparatus and shows a method of depositing a spiral band of sodium on the inner surface of a xenon flash lamp envelope.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The xenon flash lamp shown in the drawing comprised a hard glass tubular envelope **1** having tungsten electrodes **2** at the ends thereof. The ends were hermetically sealed and capped with terminals **3** which were electrically connected to electrodes **2**.

Envelope **1** was 11 inches long by one quarter inch diameter and the arc length, that is, the distance between electrodes **2**, was 9 inches.

A length of 10 mil copper wire **4** was tightly spirally wrapped around the outside of envelope **1** at a spacing of two turns per inch and extended about the same distance as the arc length. The ends of the spiral were securely fastened to the glass with adhesive tape.

The secondary winding of a neon sign transformer **5** was connected to terminals **3** and a DC power supply **6** was connected to wire **4** and to the midpoint of the transformer secondary, the polarity at wire **4** being positive.

To electrolyze the sodium present in the glass, the flash lamp was heated in an oven to 200° C. A discharge was then struck between electrodes **2** by the neon sign transformer, and while a discharge current of a few milliamperes was maintained, a DC voltage of 750 volts was applied to wire **4** about 8 minutes.

The lamp was then disconnected and wire **4** was removed therefrom. A grayish-brown spiral of sodium was discernible on the inner surface of envelope **1**, the spiral closely conforming to the original spiral of wire **4**.

Before electrolyzing, the lamp had an ignition voltage of 900 volts. After electrolyzing, in which it was calculated that 30 micrograms of sodium was transported to the inner surface of envelope **1**, the ignition had been reduced to 480 volts.

I claim:

1. In the manufacture of a xenon flash lamp having an elongated sodium-containing glass envelope, the step which comprises electrolyzing a band of said sodium to the inner surface of said envelope, said band extending about the same distance as the arc length of said lamp.

2. The process of claim **1** including the steps of spirally wrapping a wire around said envelope, said wire extending about the same distance as said arc length; and electrolyzing the sodium in the immediate vicinity of said wire to the inner surface of said envelope.

3. The process of claim 2 wherein said sodium is electrolyzed by heating said lamp; striking an arc between the electrodes of said lamp; and applying a DC voltage between said wire and the interior of said envelope.

4. A xenon flash lamp comprising an elongated sodium-containing glass envelope; an electrode at each end of said envelope; and an electrolyzed band of sodium on the inner surface of said envelope, said band extending from about one electrode to the other.

5. The lamp of claim 4 wherein said band is a spiral.

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