June 18, 1963 L. E. DUVAL 3,094,642

COATED LAMP

Filed June 17, 1960

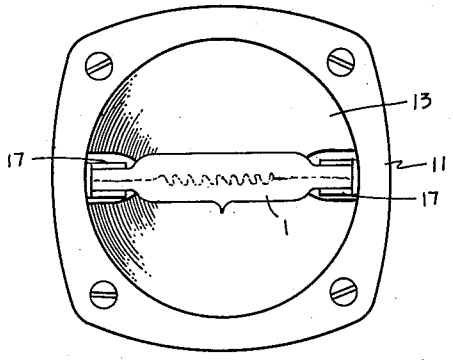

fig. 1

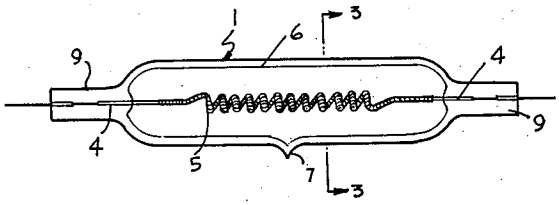

fig. 2

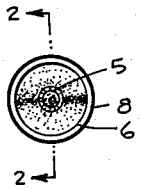

fig. 3

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United States Patent Office 3,094,642 Patented June 18, 1963

3,094,642

COATED LAMP

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Filed June 17, 1960, Ser. No. 36,801
4 Claims. (Cl. 313—223)

This invention relates to a protective coating for use on the exterior surface of an incandescent lamp. More specifically, this invention relates to a coating to be applied to a high silica content glass envelope, which finds particular use in an incandescent lamp having high luminous efficiency. In particular, this coating finds application in an iodinetype incandescent lamp.

An iodine lamp is an incandescent lamp having high luminous efficiency and a long useful life. Lamps of this type have an efficiency often greater than 20 lumens per watt and a substantially better maintenance than the prior incandescent lamp. The length of service is in the order of hundreds of hours and possibly in excess of 2000 hours before any appreciable darkening on the interior surface of the bulb takes place.

It has been determined that high efficiency for a long useful life can be obtained by departing from the conventional aspects of comparatively large bulb size for a given energy dissipation and deliberately employing a small compact glass envelope which contains an atmosphere of iodine vapor. The iodine functions as a regenerative getter in association with the tungsten filament by combining with the evaporated metallic tungsten at the wall of the glass envelope to form tungsten iodide. This tungsten iodide then migrates to the vicinity of the hot tungsten filament where it is dissociated and the tungsten is returned to the filament. It has been determined that this small compact bulb size with high energy loading is necessary to maintain a comparatively short path for travel of the iodine vapor from the filament to the bulb wall to thereby minimize the possibility of recombination of the dissociated iodine before it migrates back to the bulb wall. Further, the compact size is also necessary to maintain the bulb wall at temperatures above a critical value to effect a reaction of the iodine with the vaporized tungsten particles. It has been determined that for iodine to properly perform this function the inside bulb wall temperature should be maintained at approximately 250° C. minimum and a maximum of about 1200° C. to assure at the lower limit that the reaction which forms the tungsten iodide precedes at a proper rate and at the upper limit to avoid dissociation of the tungsten iodide. It is thus apparent that to obtain high efficiency in the lamp, relatively high temperatures must be maintained at the bulb wall surface. Therefore, ordinary glasses such as those conventionally used in incandescent lamps are not suitable for use in this glass envelope. It is therefore general practice in the art to use a quartz glass or one having above about 96% fused silica.

Although each of these high silica content glasses are quite suitable for use at the high temperatures, it has been determined that substantial devitrification of the glass takes place when the lamps are handled. This handling usually takes place either in the factory, in the packaging operation or by the consumer when inserting the lamp into the fixture.

Devitrification of glass is a change of the vitreous substance to a crystalline condition. That is, the formation of crystals in the glass. Devitrification tends to make the glass translucent and brittle. It is apparent that to produce a marketable lamp, no devitrification should be allowed to occur in the envelope.

The devitrification of the lamp envelope has been found to be due to its handling prior to use. It would appear that sweat and oil present on the hands diffuse into the glass when the lamp is placed in operation at the high temperatures and causes the devitrification. In the packaging operation now being used extreme care must be taken to avoid handling of the lamp. After the lamp has been purchased by consumers, they will insert it into fixtures. These fixtures are designed to reflect the maximum amount of light very often to a fairly small area, and often the insertion of the lamp may be rather difficult due to the positioning of the electrical connections. Examples of such fixtures are shown in the copending application of David R. Dayton and David N. Brooks, entitled Movie Light, Serial No. 26,228, filed May 2, 1960.

I have now discovered that if the lamp is coated with an evanescent barrier layer of plastic organic compound prior to packaging, the devitrification will not take place in the envelope upon use even if it is handled. For purposes of this invention, an evanescent barrier layer includes organic compounds which will be completely combusted when the lamp is placed in use. Also, the evanescent layer includes those compounds which will be vaporized from the surface of the lamp without combustion such as by depolymerization and volitization of the monomer. It is apparent in all of these coatings that it is critical that there be no carbonaceous deposits or residues remain on the surface of the envelope after it has been placed in operation for a while, since such residues would readily reduce the luminous efficiency of the lamp.

It is an object of this invention to provide a means whereby a high luminous efficiency lamp will not devitrify in use even if handled.

It is a further object of this invention to fabricate a lamp having a silica glass envelope and generating substantial heat which will not be subjected to devitrification even if handled.

Another object of this invention is to provide a coating of an evanescent barrier layer of an organic compound on the exterior surface of the bulb wall which will be gasified after the initial use by the consumer.

A feature of this invention is that a lamp is produced which will not be subject to devitrification due to handling.

Other objects, features and advantages of this invention become apparent to those skilled in the art upon reading the following specification and the accompanying drawings.

FIGURE 1 is a showing of the iodine lamp prepared according to this invention, inserted in an appropriate fixture.

FIGURE 2 is a cross sectional view taken along the lines 2—2 of FIGURE 3 which shows in greater detail the iodine lamp.

FIGURE 3 is a showing along the lines 3—3 of FIGURE 2 of the incandescent lamp prepared according to this invention.

Referring now to FIGURE 1 of the drawing, the fixture comprises the support member **11** and the reflecting surface **13**. Positioned within the reflecting surface **13** is the incandescent lamp **1**. The reflecting surface **13** is a concave, mirror-like surface. On either side of the reflecting surfaces **13**, small passages are provided so that the electrical contact **17** may be attached to the incandescent lamp. In practice, it has been found advisable to make the support surface **11** and the reflective surface **13** a unitary body. Screws may be affixed in appropriate positions to support members so that the reflector may be secured thereto.

Referring now to FIGURE 2, the sealed ends **9** of the glass tube **6** support the support members **4** which in turn support the tungsten filament **5** at either end. The support element **4** may be suitable metal such as molybdenum, tungsten or platium, and is sealed in the glass envelope **6** so that the interior of the lamp **1** is isolated from the atmosphere. The inside of the glass tube **6** is filled with suitable inert gases such as neon, krypton or argon. Also included within the glass tube is a small quantity of iodine. This quantity of iodine should be sufficient to effect the regenerative getter action required for the operation of the lamp but it should be insufficient to materially affect the light transmission. These gases are added through an evacuation tube, the residue of which is shown at **7**.

As will be noted on FIGURE 3 the coating **8** surrounds the entire glass surface of the envelope. This coating can be effectively laid down by dipping, spraying, bench painting or other appropriate means; however, dipping is preferred due to the insured uniform coat.

Suitable for use as the barrier layer of the organic composition is a coating of an organic lacquer which may be, for example, acrylic acid esters, cellulose esters, or vinyl resins. Suitable solvents for these organic lacquers may be, for example, ethyl alcohol or acetone. Other materials suitable for use include polyvinyl resins such as polyvinyl acetate, polyacrylate and polymethacrylates. Of these polymethacrylates, I have found that methyl, butyl and isobutyl-methacrylates, copolymers and mixtures thereof are quite suitable. Cellulose acetate is highly suitable for use as this barrier layer. Acetone is the principal solvent of cellulose acetate since it possesses a high evaporation rate. Substituted cellulose acetate and organic compounds are also suitable for use such as cellulose acetate butyrate. A combination of cellulose acetate and cellulose acetate butyrate are also suitable for the desired purpose. Also suitable for use are the styrenes such as polystyrene, the appropriate ratio would be a 90/10% by weight solution of xylene and polystyrene). Epoxy resins are quite suitable as the barrier layer. The reaction product of epichlorohydrin and bisphenol in a 95/5% by weight xylene-resin solution is satisfactory. The polyamids such as nylon are also useful. Adequate devitrification inhibitation can also be given by cellulose nitrate in amylaceate. In all of these possible organic compounds the layer must be relatively thin and transparent. Also suitable for use are the urethane plastics, such as polyurethane, in a suitable solvent.

As specific examples of this invention the following are offered. These examples are merely preferred embodiments of the invention and are not intended to be limitative upon the claims.

Exemple 1

A batch of ethyl cellulose was prepared according to these specifications. An 80/20% mixture by weight of xylol and normal butanol was mixed with 16.6% by weight of solids. The lamps were dipped into the batch of coating composition and were air dried at room temperature, resulting in a clear transparent lacquer coating; after drying the lamps were freely handled. Within a few minutes after the lamps were illuminated the coating was burned off leaving the lamps clean with no apparent residue. After continued use of the lamp, no devitrification appeared.

Example 2

A batch of methylmethacrylate in acetone was prepared. The mixture was composed of 20% solids and 80% solvents by weight. The lamps were dipped into the batch of coating composition and were then air dried. The clear transparent film of the evanescent barrier layer of methylmethacrylate was formed on the lamp surface. After the coating operation, the lamps were freely handled. They were then inserted into the fixtures and within a few minutes the barrier layer was completely burned off. No devitrification had appeared on the surface.

Example 3

A batch of isobutylmethacrylate was prepared according to the following specifications: 37% by weight resin in about 62½% by weight of acetone. The lamps were air dried after dipping into this batch and were freely handled. After drying, a clear transparent layer of lacquer is left on the lamp. Within a few minutes after the lamps are turned on, the lacquer is burned off and the lamps are clean and with no apparent residue of carbonaceous material and also no apparent devitrification.

Example 4

A 75/25% mixture by weight of xylol and cellulose acetate buytrate is prepared. The lamps are dipped into the batch of this mixture and air dried. No precautions are taken as to handling. After the initial illumination, the evanescent barrier layer is gasified and the envelope of the lamp is free of divitrification.

Example 5

A batch of 80% by weight of acetone and 20% by weight of polyvinyl acetate is prepared. The lamps are dipped into the batch of coating material and air dried at room temperature. A clear layer of the resin is produced after air drying. The lamps are handled freely and, after the initial illumination, no devitrification appears.

It is apparent that modifications may be made by those skilled in the art, my intent being only to be limited by the scope of the appended claims.

As my invention I claim:

1. An incandescent lamp having a glass envelope containing fused silica, said envelope being sealed from the atmosphere at the ends thereof, lead-in conductors sealed in said ends, a tungsten filament in said envelope, the ends of said filament connected to said lead-in conductors, a filling of an inert gas and a quantity of iodine in said envelope, said iodine being in quantities less than that which results in appreciable adsorption of light, but sufficient to effect a regeneration getter action, a layer of an evanescent organic compound on the exterior surface of said lamp, whereby devitrification of the glass envelope, when placed in service, is inhibited.

2. An incandescent lamp having an envelope prepared of a glass selected from the group consisting of quartz and one having greater than 96% fused silica, said envelope being sealed from the atmosphere at its ends, lead-in conductors sealed in each of said ends, a tungsten filament in said envelope and being connected at its respective ends to said lead-in conductors, a filling of an inert gas and a quantity of iodine in said envelope, said iodine being in quantities less than that which results in appreciable adsorption of light, but sufficient to effect a regeneration getter action, and a barrier layer of an evanescent organic compound on the exterior surface of said glass whereby devitrification of the glass is inhibited.

3. An incandescent lamp having an envelope prepared of a glass selected from the group consisting of quartz and one having greater than about 96% fused silica, said envelope being sealed from the atmosphere at its ends, lead-in conductors sealed in each of said ends, a tung-

sten filament positioned in said envelope and connected at its respective ends to the lead-in conductors, a filling of an inert gas and a quantity of iodine in said envelope, said iodine being in quantities less than that which results in appreciable adsorption of light, but sufficient to effiect a regeneration getter action, and an evanescent barrier layer of an organic compound consisting of carbon, hydrogen and oxygen on said glass, whereby devitrification of the glass is inhibited.

4. An incandescent lamp adapted to be heated to high temperatures and having a glass envelope containing high quantities of silica, said envelope being sealed from the atmosphere at each of its ends, lead-in conductors sealed

in said ends, a tungsten filament axially positioned in said envelope and connected at its respective ends to the lead-in conductors, and an evanescent barrier layer of an organic compound on said envelope whereby devitrification is inhibited.

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