

Dec. 22, 1959

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2,918,595

COATING COMPOSITION FOR ELECTRIC LAMPS

Filed April 29, 1957

FIG. 1.

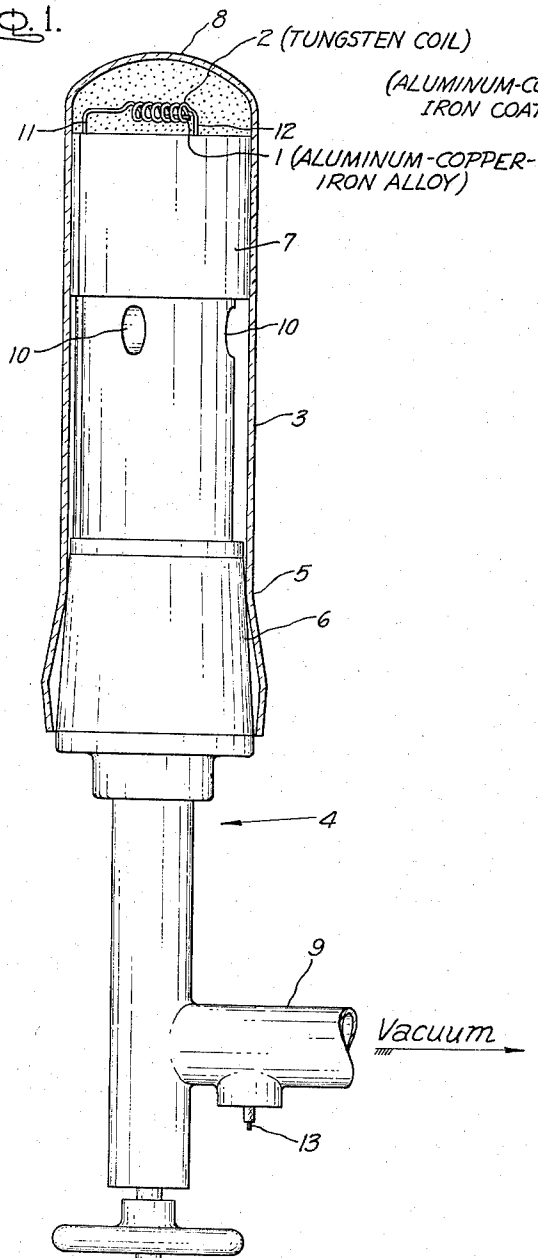
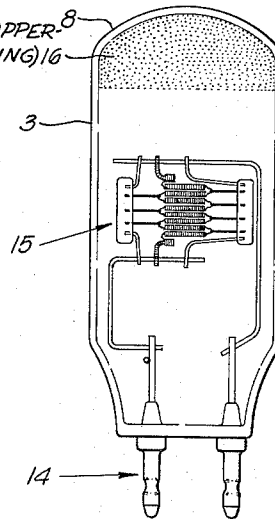


FIG. 2.



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COATING COMPOSITION FOR ELECTRIC LAMPS

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Application April 29, 1957, Serial No. 655,655

3 Claims. (Cl. 313—113)

This invention relates to an electric lamp provided with a coating to intercept part of the light rays and to an improved coating for use on the interior surface of a transparent vitreous lamp bulb and the method of applying the same.

Projection lamps, such as are in common use in connection with light projection apparatus, frequently require an opaque coating on parts of the lamp bulb, particularly the bowl end, to facilitate accurate control of the light from the lamp filament by the optical system of the apparatus. Copper, silver, aluminum and gold have all been used as lamp envelope coatings, usually on interior surfaces; however, difficulty has been experienced in the use of such materials when applied as a coating on projection lamps, largely due to the relatively high temperature at which projection lamps normally operate. For example, copper or silver when used as a coating in a projection lamp will diffuse into the vitreous material of the lamp bulb when the lamp is subsequently heated in use. Aluminum, silver, and copper will not shield the bulb sufficiently to prevent distortion of the bulb at elevated temperatures. Aluminum when used as a coating tends to flake off. Silver and copper tend to disintegrate when subjected to the elevated temperatures at which the projection lamp must operate.

Further difficulty has been experienced whenever certain of the prior art alloys have been applied by a vaporizing process. Aluminum, for example, will react with a tungsten vaporizing filament. In aluminizing, using a tungsten vaporizer, about 12 to 60 vaporizing cycles may be run before deterioration of the vaporizing coil makes it necessary to replace the coil. According to the present invention, over 900 vaporizing cycles have been run without replacement of the vaporizer coil due to deterioration. Because of its pleasing appearance, it is desirable to provide a gold-colored coating for the lamp bulb and this has the advantage in this case of providing an opaque coating. The present invention makes it possible to do this without the use of gold leaf.

It is an object of the invention to provide an electric lamp having an improved opaque coating for the inner surface of the bulb to intercept part of the light rays.

Another object of the invention is to provide an electric lamp having a metallic alloy coating on the inner surface of the lamp to form an opaque shield.

A further object is to provide an improved method of applying a highly reflective coating to the interior of a lamp bulb and which adheres well to the vitreous wall of the bulb.

According to the invention, a gold-appearing coating is produced on the inner surface of an electric lamp bulb by the vaporization of a copper-aluminum-iron alloy under suitable conditions of vacuum and temperature. The coating composition comprises an alloy containing essentially 6 to 11.2% aluminum, 1.5 to 4.5% iron and the balance substantially all copper. The coating is de-

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posited by vaporizing in a vacuum upon a glass surface which has been heated.

The nature of the invention will best be understood when described in connection with the accompanying drawings, in which Fig. 1 illustrates an apparatus adapted to pump out the air from within a projection lamp and vaporize the coating alloy; and Fig. 2 illustrates a projection lamp which has been coated in accordance with the present invention.

A coating and masking apparatus similar to that illustrated and described in copending application Serial No. 656,654 filed May 2, 1957, by Mahon et al. now Patent No. 2,879,740 dated March 31, 1959, and assigned to the same assignee as the present application may be utilized for the depositing of the metallic coating according to the present invention. An aluminum-copper-iron strip 1, of a composition having about 6 to 11.2% aluminum, 1.5 to 4.5% iron, and the balance essentially copper, is loaded onto a tungsten vaporizer coil 2. A bulb 3 to be coated is then placed over the vaporizing apparatus 4. The open end 5 of the bulb 3 fits securely against a compressible rubber gasket 6 so as to form an air-tight seal between the inside of the bulb and the atmosphere. An expendable metal mask 7 can be expanded securely against the inside of the bulb 3 so as to expose only the bowl portion 8. A vacuum line 9 communicates with the inside of the bulb 3 through openings 10. After the bulb has been assembled on the vaporizing apparatus, the air within the bulb may be pumped out to leave, for example, an absolute pressure within the bulb of approximately 20 microns. Both adherence and color of the coated alloy is dependent upon having the glass at a temperature above approximately 250° C. before vaporizing. The glass may be heated in any conventional manner, for example, by directing gas flames against the exterior of the bulb as illustrated in the above identified Mahon and Wilson application. When the bowl 8 of the bulb 3 has reached the proper temperature, the source of heat can be removed and the coating alloy can be vaporized by passing a heating current through the vaporizing coil 2. One end 11 of the vaporizing coil 2 may be grounded to the vaporizing apparatus 4 if desired and the other end 12 may be connected to an insulated lead 13 to which is supplied the heating and vaporizing current.

It is desirable to maintain the portion of the bulb to be coated at a high temperature during the coating process, while the remainder of the bulb, and the mask 7 used for shielding the bulb is kept at a lower temperature to prevent the deposit thereon of evaporated alloy. Further, it is necessary that the area of the bulb 3 which is not to be coated is well masked so as to prevent a deposit of coating material on these parts and to give smooth and well defined edges to the coating. After the coating operation is complete, cooling air may be directed against the outer portion of the bulb and an inert gas such as nitrogen may be flushed through the inside of the bulb so as to help cool the inner surfaces of the bulb 3. It is not desirable to pass cooling air to the inside of the bulb as the coating alloys react readily with the air when the alloy is at an elevated temperature.

Besides overcoming the difficulty experienced in the prior art coatings, the coating formed according to the present invention has the unique property of permanently adhering to the glass wall of the bulb in the presence of heat. It does not diffuse readily or "burn out" when the projection lamp is heated to about 800° C. for short periods of time. Further, a lime glass bulb vapor coated according to the invention may be heated above its normal softening temperature without appreciable warping or collapsing, probably due to the oxide formed between the metallic coating and glass surface. Another

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advantageous property of the coating is its high reflection of heat, which tends to keep the glass bulb at a lower temperature. The coating thus formed may be used as an opaque and decorative coating.

A further advantageous feature of the invention is that where chemical dissolving of the coated bulb is necessary say to achieve a cut-off of the coated surface, the coating may be dissolved in the usual sulphuric-chromic acid-type mixture if the bulb does not age for any appreciable time. If the coated bulb is heated in air to approximately 100° C. to 200° C., or if the coated bulb is left standing in air about twenty-four hours, the coating is extremely resistant to attack by the dissolving solution.

Fig. 2 illustrates a projection bulb having a coating therein according to the present invention. The tubular glass bulb 3 has a bowl end portion 8 and a base 14, here shown as a pin base. The lamp may have therein different types of filament structures 15; the one illustrated being particularly adapted for a bulb which is to be operated in a horizontal position. The inside bowl portion 8 of the glass envelope contains a coating 16 deposited in accordance with the present invention.

In coating a lamp aluminum-copper-iron alloys known commercially as Ampco grades 6 and 18 and produced by Ampco Metal, Inc., Milwaukee, Wisconsin, have been found satisfactory. The composition of these alloys are as follows:

	Grade 6	Grade 18
Aluminum.....	6-8%	10-11.2%
Iron.....	1.5-3%	3-4.25%
Copper.....	Substantially Balance.	Substantially Balance.
Others.....	0.5% Maximum	0.5% Maximum.

A small metal strip of either of the above alloys is placed on a vaporizing coil 2, preferably of tungsten, forming part of the aforementioned coating and masking apparatus. The air within the glass bulb 3 is evacuated and the portions of the bulb to be coated are heated to a suitable temperature. A temperature between 280° C. and 300° C. appears to be satisfactory; above 300° C. a uniform color appears from the coating but no advantage appears to be present in heating the bulb above this temperature. A current is then passed through the vaporizing filament so as to vaporize or flash the metal coating and deposit the coating on the heated exposed portion of the bulb.

As previously indicated, the alloy coating on the lamp provides a highly effective opaque shield having a bright gold color resembling that which would be obtained by the use of pure gold leaf. However, the use of the alloy makes it possible to coat the interior of the lamp bulb during manufacture by a low cost vaporizing process. The coating forms an excellent bond with the glass bulb of the lamp and will not flake off or deteriorate during subsequent burning of the lamp. In addition, the high gloss surface of the coating, which resembles a burnished reflector surface, gives the coating a very good reflective property. In so far as light rays are concerned, the

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coating reflects such rays back into the central part of the lamp and into an area to be directed by the optical system with which projection lamps are customarily assembled. In so far as heat rays are concerned, the coating also largely reflects such rays and thereby greatly reduces heating of the wall of the glass bulb underlying the coating. The result is that there is no appreciable build up of heat over the coated portion of the glass bulb such as might occur with a dark colored or black opaque coating which tends to absorb heat.

Another advantage of the coated electric lamp is that the highly reflective gold colored coating gives a very pleasing appearance. Not only is the gold colored coating highly reflective on its interior surface but it also retains such properties on that surface which adheres to the vitreous wall of the lamp bulb. This means that any light from outside sources is reflected by the coating through the glass wall of the bulb to give a sparkling and bright appearance. The interior coating is protected from scratches or other deteriorating influences such as might occur if the glass bulb were coated on its exterior and which might well interfere with the complete opacity of the shield in eliminating stray light from the filament.

It will be understood that while I have described certain preferred embodiments of my invention by way of illustration, modifications may occur to those skilled in the art. I, therefore, wish to have it understood that I intend in the appended claims to cover all such modifications as fall within the true spirit and scope of the invention.

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

1. An electric light bulb having a coating deposited by vaporization on the inside surface of its glass envelope, said coating comprising from 6-11.2% aluminum, 1.5-4.25% iron, and the balance essentially copper.

2. An electric projection light bulb having a coating deposited by vaporization on the inside surface of the bowl section of its glass envelope, said coating comprising from 6-11.2% aluminum, 1.5-4.25% iron, and the balance essentially copper.

3. An electric lamp having a filament and a bulb of vitreous material, part of the interior wall of the bulb being coated with an opaque adherent, highly reflective gold-colored material, said material comprising 6-11.2% aluminum, 1.5-4.25% iron and the balance essentially copper.

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