Nov. 15, 1960 D. S. GUSTIN ET AL 2,960,414

METHOD OF PROVIDING AN ELECTRIC LAMP ENVELOPE WITH A NON-UNIFORM LIGHT-DIFFUSING COATING

Filed Feb. 27, 1959

2 Sheets-Sheet 1

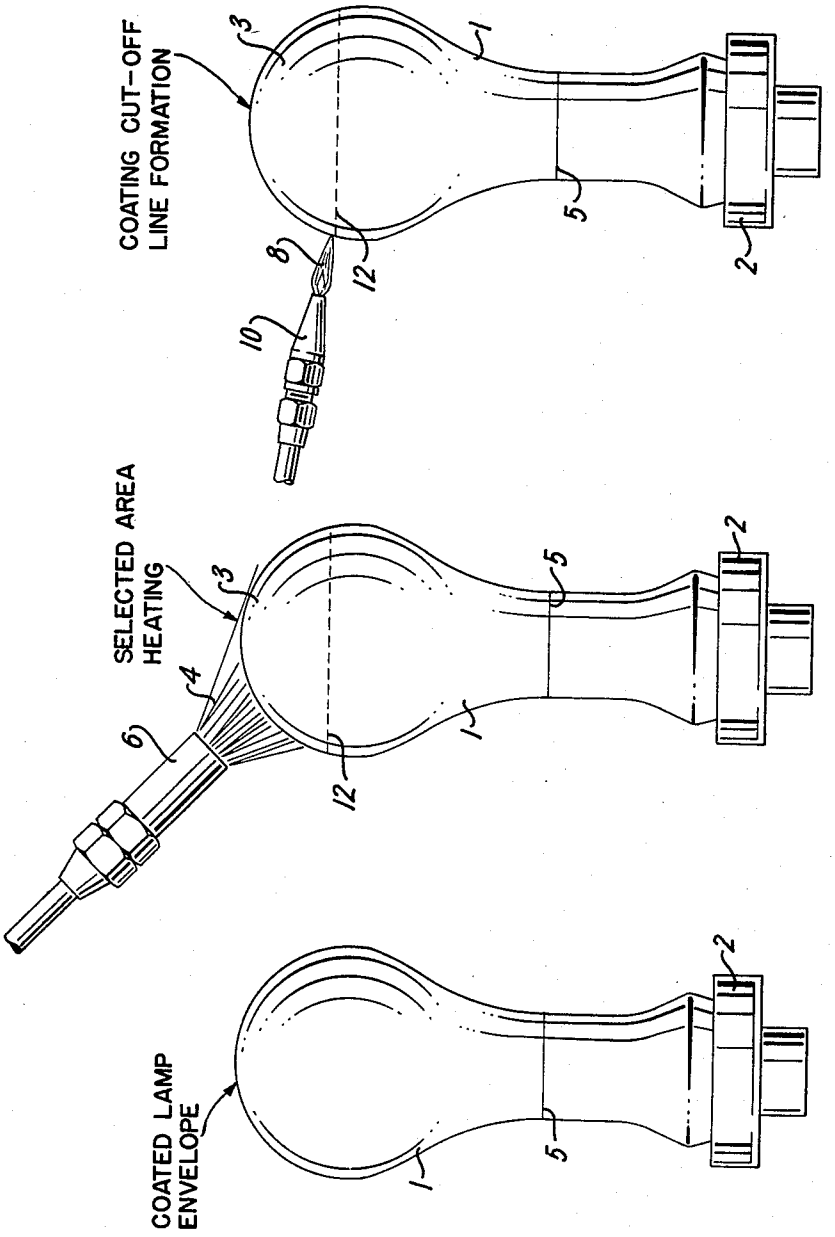


FIG-3

FIG-2

FIG-1

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2 Sheets-Sheet 2

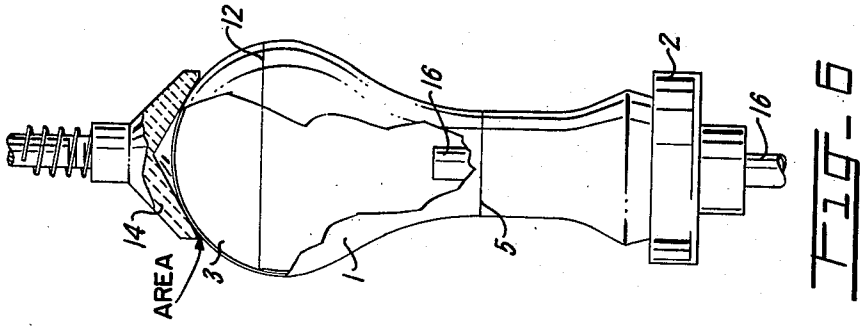


FIG-6

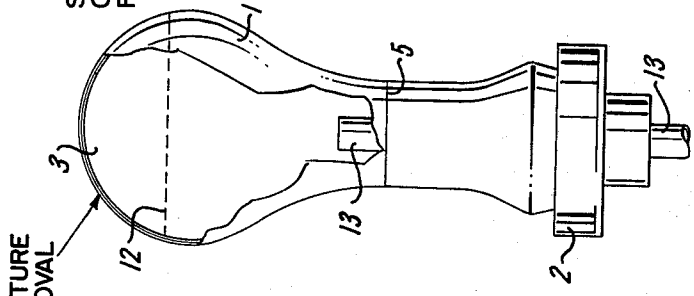


FIG-5

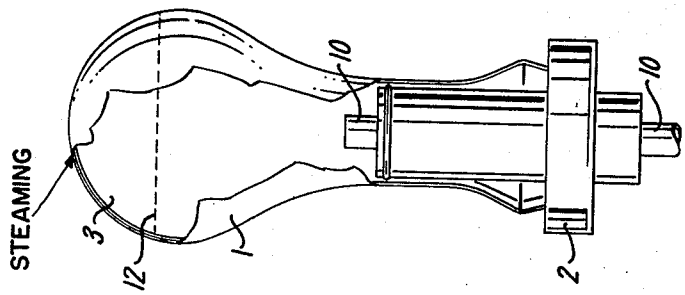


FIG-4

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METHOD OF PROVIDING AN ELECTRIC LAMP ENVELOPE WITH A NON-UNIFORM LIGHT-DIFFUSING COATING

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3 Claims. (Cl. 117—9)

This invention relates to the manufacture of electric lamps and more particularly to the manufacture of electric lamps provided with a coating of light-diffusing material on the inner wall thereof.

Over the years, various methods and techniques have been employed to provide for light diffusion in the manufacture of electric lamps. For example, in the manufacture of incandescent electric lamps, the most common light-diffusing bulb has been the "inside frost," i.e., a bulb in which the interior surface has been frosted by etching. Another approach to providing a light-diffusing bulb for an electric lamp has been the application of a coating of light-diffusing material to the inside wall of a lamp envelope. Various techniques have been employed to effect the application of this light-diffusing material. In some cases the light-diffusing material is suspended in a binder, the suspension is applied to the lamp envelope, and the binder burned off to leave the desired coating. In other cases the light-diffusing material has been smoked onto the inner wall of the lamp envelope as taught in U.S. Patent 2,545,896 to Pipkin. In still other cases, the light-diffusing material has been electrostatically precipitated onto the inner wall of the lamp envelope by some suitable means, for example, such as taught in the co-pending application of Daniel S. Gustin, Serial Number 575,111, filed March 30, 1956, entitled "Method of Coating Electric Lamp Envelopes," now U.S. Patent 2,878,136, issued March 17, 1959.

In the manufacture and sale of incandescent lamps of the types and sizes normally found in the home, and in some commercial applications, a substantial interest has been exhibited in the provision of a lamp in which certain areas of the lamp envelope are provided with a coating of light-diffusing material and other areas are uncoated. In some instances, this interest stems from utilitarian considerations and in others from aesthetic considerations.

In view thereof, a principal object of this invention is to provide an electric lamp in which some portions of the lamp envelope are coated with a light-diffusing material while other portions of the same lamp envelope are uncoated.

Another object is to provide a relatively inexpensive method providing these coated and uncoated areas on the inner wall of a lamp envelope.

A further object is to provide a coating method which readily lends itself to adaptation to conventional high-speed lamp manufacturing equipment.

The patent art is not devoid of suggestions for masking a portion of a lamp envelope while the remainder thereof is being provided with a coating. For example, U.S. Patent 2,855,326, which issued October 7, 1958, teaches a method of masking a portion of a reflector lamp envelope while a coating of reflective material is being applied to the remainder of the lamp envelope. However, the teachings of this patent and others of similar nature do not readily lend themselves to adaptation to conventional high-speed equipment employed in the manufacture of incandescent lamps of the types and sizes under consideration.

In accordance with the principles of this invention, a substantial temperature differential is effected between certain areas of a lamp envelope, the inner wall of which has been provided with a coating of light-diffusing material. The coating is then exposed to a very humid atmosphere, such as steam for example. The steam will condense on the cooler areas of the lamp envelope and effect a setting of the coating in these areas. The lamp envelope, particularly the areas on which the steam has condensed is then heated to remove this moisture. Finally a blast of air is introduced into the lamp envelope and directed against the areas which have been heated prior to steaming, thereby removing the coating of light-diffusing material from these areas. The sequence of steps in the practice of the method of this invention is illustrated in the accompanying drawings in which:

Figure 1 is an elevational view of a lamp envelope seated on a suitable support or head. The lamp envelope of Figure 1 has a coating of light-diffusing material on the interior wall thereof down to the cut-off line on the neck thereof.

Figure 2 is a view similar to Figure 1, showing a bushy fire heating the top of the bulbous portion of the lamp envelope.

Figure 3 is a view similar to Figure 2, showing a sharp fire directed onto the lamp envelope along a line which is to be the coating cut-off line.

Figure 4 is a view similar to Figure 1 but with the lamp envelope broken away to show that portion of the head assembly disposed therein. The lamp envelope is steamed at this point.

Figure 5 is a view similar to Figure 4. The lamp envelope is heated to remove the moisture at this point.

Figure 6 is a view similar to Figure 5. At this point the lamp envelope is securely held in position on the head and a blast of air is introduced to remove a portion of the light-diffusing coating.

Although, in the specific embodiment of the invention illustrated in the accompanying drawings and described below, reference is made to an electrostatic precipitation technique for applying a coating of light-diffusing material to the inner wall of an electric lamp envelope, it should be understood that the method of this invention may be practiced in cases where other techniques are employed to effect the application of the coating of light-diffusing material.

The lamp envelope **1** of Figure 1, seated on a rotatable bulb-supporting head **2**, may be provided with a coating of light-diffusing material on the inner wall thereof in the manner taught in the co-pending application of Daniel S. Gustin, Serial Number 575,111, filed March 30, 1956, now U.S. Patent 2,878,136, issued March 17, 1959. In accordance with the teaching of that application, the light-diffusing medium is electrostatically precipitated onto the inner wall of the lamp envelope from a stream of air in which the medium is suspended, the coating extending down to the neck cut-off line **5**. Further, in accordance with the teaching of that application, the light-diffusing material comprises a mechanical powdered mixture of a material selected from the group consisting of wollastonite and bone ash, and a material selected from the group consisting of silicon dioxide and aluminum oxide being between about 1% and about 15% by weight of the said first said mentioned material and having an average particle size below a micron. However, before the coating is exposed to a very humid atmosphere, such as steam for example, in order to set

the coating as taught in the referenced application, the area 3 of the lamp envelope from which the coating is to be removed is heated. As shown in Figure 2, a bushy fire 4 from burner 6 is played on the selected portion of the rotating lamp envelope. The area 3 should be heated to a temperature substantially above the boiling point of water so that when the steam is subsequently introduced water will not condense thereon. On the other hand, the area 3 should not be heated to a temperature so high that the remainder of the lamp envelope will be heated substantially by radiation. It has been found that satisfactory results are obtained when the temperature range is between about 225° F. to about 300° F. As shown in Figure 3, a sharp fire 8 from burner 10 is directed onto the rotating lamp envelope to define the cut-off line 12 if a sharp cut-off is desired.

Immediately after these heating operations have been effected, steam is introduced into the lamp envelope through tube 10 which is projected through a bore provided therefor in the head 2 (Fig. 4). The steam condenses on the cooler areas of the bulb, thereby effecting a setting of the coating as taught in the referenced Gustin application. However, the steam does not condense on the area 3 from which it is desired to remove the coating because of the heating of this area as aforesaid.

After the lamp envelope has been steamed, it is heated to bake out and remove the moisture introduced during steaming. This may be done, for example, by introducing a gentle flow of hot air into the lamp envelope through tube 13 (Fig. 5) which is projected through a bore provided therefor in the head 2. External heating means may also be employed to effect this drying. Thereafter, a suitable bulb retaining means 14 is lowered into firm, frictional engagement with the top of the lamp envelope and a stream of a gas, such as air under pressure, is introduced into the bulb through a tube 16 (Fig. 6) and directed against the area 3 to displace the coating therefrom, the line 12 defining a sharp cut-off between the coated and un-coated portions of the lamp envelope.

Although the specific example of the method of this invention has been illustrated and described in connection with the electrostatic precipitation technique for providing the inner wall of an electric lamp envelope with a coating of a light-diffusing material, as indicated above, the method may also be practiced with other coating techniques. For example, when the coating material is suspended in a binder, the suspension is applied and the binder if burned off, leaving the desired coating. In the application of the method of this invention to the suspension coating technique, the suspension coating technique is not altered in any way. Subsequent to the step of burning off of the binder in the suspension coating technique, the coating is steamed, the area from which coating is to be removed is heated, etc., as taught above.

In the specific example of the method of this invention, coating is removed from the top of the bulbous portion of the lamp envelope. It has been found that when the coating of light-diffusing material has been removed from a frosted bulb in the area illustrated in the accompanying drawings, an increase of about 15% in the downward component of light is obtained over the downward component of light from an ordinary frosted bulb. Thus lamps made in accordance with the teachings of this method possess significant practical advantages in installations where the downward light component is the primary consideration.

It will be readily apparent to those skilled in the art that areas of the lamp envelope other than or in addition to the area described above and illustrated in the accompanying drawings may be treated in accordance with the principles of this invention. For example, a sharp fire could be used to trace a design of desired configuration on the lamp envelope. Suitable external shielding means may be disposed in proximity to or in engagement with the outer wall of the lamp envelope in register with the areas from which coating is to be removed and these areas heated as described above. Multi-colored coatings may also be provided by coating with one color, removing the coating from certain areas and then applying a second coat which will be most prominent in the area from which the first coating was removed.

Although the method of this invention has been described as more particularly related to the manufacture of electric lamps provided with a coating of light-diffusing material, it will be readily understood by those skilled in the art that it may also be practiced in the manufacture of electric lamps provided with other types of light-modifying materials, such as light-reflecting and light-absorbing materials for example.

What we claim is:

1. The method of treating an electric lamp envelope provided with a coating of light-diffusing material on the inner wall thereof, said coating being of the type which adheres more tenaciously when steam is applied thereto, said method comprising: heating a selected portion of the lamp envelope to a temperature between about 225° F. to about 300° F.; introducing steam into the lamp envelope whereby the said coating is exposed thereto, the steam condensing on the cooler portions of the lamp envelope and effecting a setting of the coating thereon; heating the lamp envelope to remove the moisture introduced therein during steaming; and directing a stream of gas under pressure against the first mentioned heated selected portion of the lamp envelope whereby the coating on said selected portion is removed therefrom.

2. The method of treating an electric lamp envelope provided with a coating of light-diffusing material on the inner wall thereof, said coating being of the type which adheres more tenaciously when steam is applied thereto, said method comprising: heating a selected portion of the lamp envelope to a temperature between about 225° F. to about 300° F.; introducing steam into the lamp envelope whereby the said coating is exposed thereto, the steam condensing on the cooler portions of the lamp envelope and effecting a setting of the coating thereon; heating the lamp envelope to remove the moisture introduced therein during steaming; and directing a stream of air under pressure against the first mentioned heated selected portion of the lamp envelope whereby the coating on said selected portion is removed therefrom.

3. The method of treating an electric lamp envelope provided with a coating of light-diffusing material on the inner wall thereof, said coating being of the type which adheres more tenaciously when steam is applied thereto, said method comprising: heating a selected portion of the lamp envelope to a temperature between about 225° F. to about 300° F.; directing a sharp fire along the line of demarcation between said selected portion and the remainder of said lamp envelope; introducing steam into the lamp envelope whereby the said coating is exposed thereto, the steam condensing on the cooler portions of the lamp envelope and effecting a setting of the coating thereon; heating the lamp envelope to remove the moisture introduced therein during steaming; and directing a stream of gas under pressure against the first mentioned heated selected portion of the lamp envelope whereby the coating on said selected portion is removed therefrom.

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