Oct. 18, 1966 S. A. LOPENSKI 3,279,937

METHOD AND APPARATUS FOR COATING ELECTRIC LAMP BULBS

Filed Nov. 8, 1962

FIG. 1.

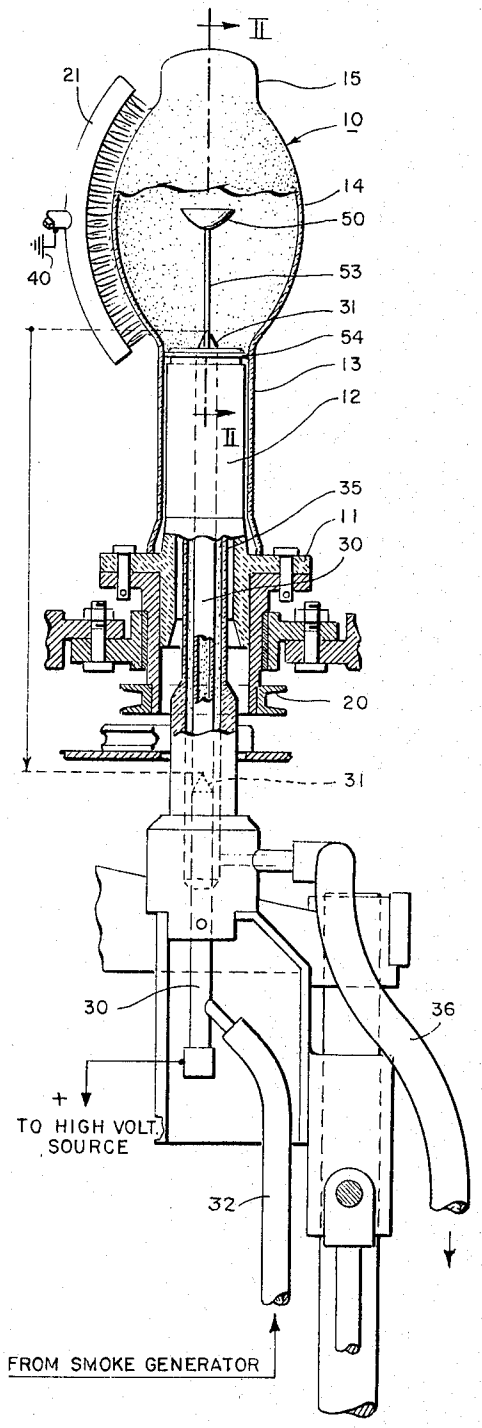


FIG. 2.

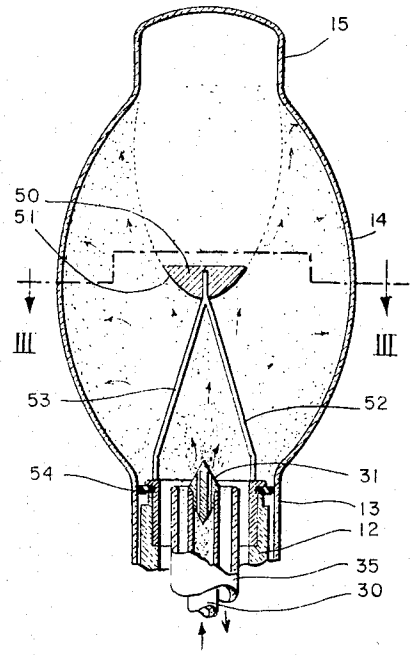
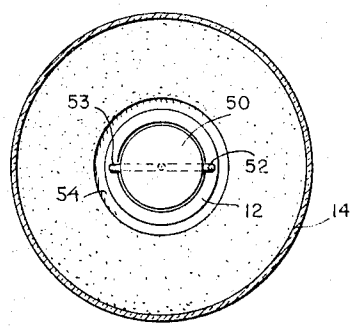


FIG. 3.



INVENTOR.
STANLEY A. LOPENSKI.

BY

Francis E. Blake

ATTORNEY.

United States Patent Office 3,279,937 Patented Oct. 18, 1966

3,279,937

METHOD AND APPARATUS FOR COATING ELECTRIC LAMP BULBS

Stanley A. Lopenski, Pompton Plains, N.J., assignor to Westinghouse Electric Corporation, Pittsburgh, Pa., a corporation of Pennsylvania

Filed Nov. 8, 1962, Ser. No. 236,347
10 Claims. (Cl. 117—17.5)

The present invention relates to the coating of the interior surfaces of glass bulbs or the like and more particularly to an improved method and apparatus for depositing finely divided coating materials on glass lamp bulbs or the like.

There are many varied forms of glass bulb shapes used for the many varieties of electric lamps being produced. Many of the lamp bulbs are provided with light diffusing coatings comprising silica on their interior surfaces or are provided with phosphor coatings on their interior surfaces to improve, enhance or modify the light generated by the lamp. For various reasons it has been found desirable to provide that selected portions or areas of the lamp bulb be uncoated with the finely divided coating material. For example, a mercury vapor fluorescent lamp may be comprised of a high pressure arc tube enclosed in a bulbous tubular outer lamp bulb having a coating of finely divided phosphor material on its inner bulb surface. It is preferable that no phosphor or other coating material be deposited on the upper tubular region of the lamp bulb since such coating is usually scratched and becomes unsightly when the arc tube and its supporting structure is placed in the lamp bulb. Furthermore, a coating on the upper tubular portion of such a form of lamp bulb usually serves no useful purpose.

One of the more successful methods for depositing the coatings of finely divided silica, phosphor or other coating materials on the interior surfaces of a glass lamp bulb or the like, involves the use of an electrostatic coating process such as described in some detail in U.S. Patent 2,988,458 to Meister et al. issued June 13, 1961. Briefly described, such method involves the introduction of a smoke of finely divided particles of coating material suspended in a gaseous medium into the lamp bulb while heating, rotating and applying an electric potential between the surface of the bulb and a region within the bulb. The method and apparatus as used and described in the foregoing and related patents provided for a generally uniform deposit of coating material all over the exposed interior surfaces of the lamp bulb and it was not possible to effectively exclude selected areas of the lamp bulb from receiving a deposit of the coating material.

Therefore, it is a principal object of the present invention to provide an improved method for electrostatically depositing a finely divided coating material on selected portions only of the interior surfaces of a glass lamp bulb or the like.

Another object of the invention is to provide an improved form of electrostatic coating apparatus for depositing a coating of finely divided silica or phosphor or mixtures of silica, phosphor or other coating materials on selected portions only of a ceramic article such as a glass lamp bulb or the like.

Yet another object of the invention is to provide an improved method and apparatus for electrostatically depositing a coating material such as finely divided phosphor material on the bulbous portions only of a bulbous tubular lamp bulb or the like so that the upper tubular interior surfaces of the bulb will remain clear and uncoated.

In accordance with the invention, a lamp bulb which may for example have a BT shape, i.e., bulbous tubular shape, is rotated about a generally vertical axis along its center line with its upper tubular region uppermost.

Simultaneously with rotation, the bulb is heated to make it uniformly electrically conductive. While the bulb is heated and rotating, a smoke of finely divided coating material suspended in a gaseous medium is injected from below the bulbous portion of the bulb and an electric potential of high voltage is applied between the surface of the bulb and a region within the bulb, preferably the smoke injection nozzle. Excess smoke containing coating material not deposited on the bulb surfaces is allowed to escape through suitable exhaust means positioned below the bulbous portion of the bulb. In order to prevent the smoke from depositing coating material on the upper tubular region of the lamp bulb, the smoke is deflected or screened within the tubular portion of the lamp above the point of smoke injection. Preferably, the deflection means may be comprised of a circular member having a lower convex surface facing and spaced from the smoke injection nozzle and the position and size of the deflector is so related to the upper tubular portion of the bulb as to effectively mask such upper tubular region from the smoke containing the coating material to be deposited.

Further objects and features and the attending advantages of the invention will be apparent with reference to the following specification and drawing, in which:

FIGURE 1 is a vertical cross-sectional view of a part of an electrostatic coating machine including the apparatus of the invention;

FIG. 2 is an enlarged fractional view of FIG. 1 showing the coating nozzle in position for coating the interior of the BT lamp bulb; and

FIG. 3 is a horizontal sectional view on the line III—III of FIG. 2 showing the deflector arrangement of the invention as it is supported over the coating nozzle.

The method of the invention and the presently preferred embodiment of the invention are adaptable for use with various ones of the known electrostatic coating machines in the art. For example, reference may be made to the patent to Lopenski et al. 2,811,131 issued October 29, 1957, which discloses one form of electrostatic coating machine which may be adapted to the method and apparatus of the invention. Referring now to the figures of the drawing, the lamp bulb or envelope which may be of the so-called BT shape is shown at **10** to be mounted temporarily on a rotating chuck **11** of the coating machine. The chuck **11** is formed of insulating material known in the art as Lava and is provided with a neck portion or manifold **12** adapted to be received within the tubular neck portion of the lamp bulb **10**. In addition to the tubular neck portion **13**, the lamp bulb **10** is provided with a bulbous portion **14** and an upper tubular portion **15**. The upper tubular portion **15** is the portion of the lamp that is to remain uncoated by the method and apparatus of the invention.

A pulley **20** is provided to rotate the chuck **11** and the lamp bulb **10** carried thereby. While the lamp is being rotated, a gas flame from the burner **21** is directed against the outer bulbous portion **14** of the lamp bulb to heat the bulb to a sufficient temperature as to make the entire bulbous surface of the lamp uniformly electrically conductive, as is well known in the art.

A hollow nozzle tube **30** having a coating discharge nozzle **31** at its upper end is adapted to be reciprocated from the lowermost position shown by the dotted lines in FIG. 1 to the uppermost position shown by FIG. 2 of the drawing. Various mechanical arrangements, not shown, may be provided to reciprocate the nozzle tube **30** to raise the tube for injection of the coating smoke into the interior of the lamp bulb as will be later described. A flexible tube **32** connects the hollow coating tube **30** to a smoke generator (not shown) which is the source of finely divided coating materials suspended in a gaseous medium under pressure. Any suitable form of

smoke generator such as shown in the aforementioned patents may be employed and no further details of the smoke generator will be given at this time.

Surrounding the smoke injection tube and nozzle is an outlet tube **35** which enables excess smoke containing the finely divided coating material not deposited on the glass bulb to be exhausted through flexible tube **36** to a container or the like to be salvaged for reuse. In addition this outlet tube **35** prevents pressure build-up in the interior of the bulb to maintain uniform smoke velocity throughout the coating period.

A source of high voltage is connected to form an electrostatic field within the lamp bulb being coated. For this purpose, one terminal of the source of high voltage which may be grounded is connected at **40** to the flame nozzle **21** which is itself formed of electrically conductive material. The other terminal of the high voltage source (not shown) is connected to the hollow nozzle tube **30** which must also be formed of electrically conductive material. Thus, a region of high potential difference is established between the nozzle **31** and the bulbous surface of the glass lamp bulb **10** which has been heated to make it uniformly electrically conductive. As is previously known to those skilled in the art, when a smoke of finely divided coating material suspended in a gaseous medium is injected through the coating nozzle **31** while the lamp bulb **10** is heated and the high voltage is applied as described, many of the coating particles contained in the smoke will be deposited on the interior surface of the lamp bulb.

In accordance with the invention it has been found that a deflector **50** may be placed in the stream of smoke at a suitable position as shown to prevent the deposit of coating material on the upper tubular portion **15** of the lamp. Basically, the deflector is a circular object having a convex lower surface **51** spaced above and preferably concentric with the coating nozzle **31**. The deflector may be formed of any suitable material and is preferably made of stainless steel since such material is non-corrosive and the coating powder in the smoke does not adhere thereto to any extent. Other materials for the deflector may be used as will be obvious to those skilled in the art. The deflector **50** is supported on any suitable supporting arrangement such as the rods **52** and **53** which are mounted and secured to the rotating manifold neck **12** as shown. It will also be noted that a rubber seal **54** is provided for the upper end of the rotating manifold neck **12** to prevent the deposit of coating material on the tubular neck of the lamp bulb below the bulbous portion **14**.

When it is realized that the coating material is essentially a smoke of finely divided materials in a gaseous medium, it will be understood that the function of the deflector **50** to prevent deposit of coating material on the upper tubular portion **15** of the lamp is not obvious. Although the exact functioning of the method and apparatus of the invention is not known, it is believed that the presence of the electrostatic field on the bulbous portion **14** only of the lamp and the injection and withdrawal of the smoke at the lower point of the bulbous portion **14** of the lamp, together with the size and positioning of the deflector **50** prevents the formation of any appreciable cloud of smoke directly above the deflector **50** and in the region of the upper tubular portion **15** of the lamp. Obviously, the position and shape of the deflector **50** would be specifically varied in accordance with the size and shape of the lamp bulb to be coated. For example, in the present form of the invention being described, the deflector is provided with a lower convex surface **51** which is generally parabolic in shape and a feather edge cutoff of coating deposit in the upper cylindrical part of the lamp bulb is thereby obtained. It will be apparent that the injection of smoke may be continued for as long as desired consistent with the thickness of coating material to be deposited. As a specific example to which the invention is in no way limited, a smoke comprising manganese activated magnesium fluorogermanate is passed at a rate of 110 milligrams per second into a BT shaped lamp bulb having a maximum bulbous diameter of 6½ inches and dome and neck diameters of 4⅝ inches, for a period of seven seconds to produce a desirable coating weight of 600 milligrams on the selected portions only of the bulb.

The method and apparatus of the invention may be used with various types of coating materials. For example, the coating material may be any of the known silicas as used for deflecting the light passing through the lamp bulb or the coating material may be any of the known phosphors such as manganese activated magnesium fluorogermanate, strontium zinc, or strontium magnesium orthophosphate activated by stannous tin, or strontium terbium orthophosphate activated by copper or copper and manganese. Also after the coating material has been deposited on the material of the lamp bulb in accordance with the method and the apparatus of the invention, additional coating treatments may be applied to the interior of the lamp bulb. For example, steam may be introduced inside of the lamp bulb to improve the adherence of the coating material previously deposited on the selected portions of the lamp surface.

Various modifications will occur to those skilled in the art. For example, although the method and the apparatus has been specifically described in connection with its use in the coating of lamp bulbs supported generally on a vertical axis in alignment with the center line of the bulb, the use of the invention is not so limited. In addition, the deflector arrangement of the invention and its method of operation may be used with various shapes of lamp bulbs other than the specific BT shape which has been described in detail. The invention provides for the deflection of a smoke of coating material in an electrostatic coating method and apparatus to thereby enable the deposit of coating material on selected surfaces only of the article to be coated.

I claim as my invention:

1. The method of electrostatically depositing finely divided coating material on all portions except the upper tubular portion of the interior surface of a bulbous tubular glass lamp bulb or the like, which method comprises, heating the bulbous portion of the bulb to be coated to a temperature sufficient to cause the heated bulbous portion to be substantially uniformly electrically conductive, effecting a rotation of said bulb about a substantially vertical axis along the center line of the bulb, forcing a gaseous smoke of finely divided particles to be coated upwards into the interior portion of said bulb from a nozzle located beneath the bulbous portion of the bulb and simultaneously applying a unidirectional high voltage potential between the surface of said bulb and the nozzle below the bulbous portion of said bulb, deflecting centrally within the bulbous portion of the bulb remote from the side walls thereof the smoke of finely divided particles to be coated so that the smoke is screened from the surface of said bulb in the upper tubular portion which is not desired to be coated, continuing to force into said bulb the smoke of finely divided particles to be deposited until a desired amount of coating material is deposited onto the selected portions of said bulb, and permitting the escape from within the bulb of the excess of smoke of finely divided materials which is not deposited on the bulb surfaces.

2. The method of electrostatically depositing finely divided coating material on all portions except the upper tubular portion of the interior surface of a bulbous tubular glass lamp bulb or the like, which method comprises, heating the bulbous portion of the bulb to be coated to a temperature sufficient to cause the heated bulbous portion to be substantially uniformly electrically conductive, effecting a rotation of said bulb about a substantially vertical axis along the center line or the bulb forc-

ing a gaseous smoke of finely divided particles to be coated upwards into the interior portion of said bulb from a nozzle located beneath the bulbous portion of the bulb and simultaneously applying a unidirectional high voltage potential between the surface of said bulb and the nozzle below the bulbous portion of said bulb, deflecting in the bulbous portion of the bulb in an area spaced from the side walls thereof the smoke or finely divided particles to be coated so that the smoke is screened from the surface of said bulb in the upper tubular portion which is not desired to be coated, continuing to force into said bulb the smoke of finely divided particles to be deposited until a desired amount of coating material is deposited onto the selected portions of said bulb, and permitting the escape below the bulbous portion of the bulb of the excess of smoke of finely divided materials which is not deposited on the bulb surfaces.

3. Apparatus for coating selected portions only of the interior of a glass lamp bulb or the like with a finely divided coating material comprising, means to rotate the bulb, means to heat the bulb to be coated, a nozzle for injecting a smoke comprising finely divided coating material suspended in a gaseous medium upward within said bulb while it is being rotated and heated, means to supply under pressure a smoke of finely divided coating material to said nozzle, outlet means to permit the escape from within the bulb of excess smoke containing coating material not adhered to the interior surface of the lamp bulb, means to apply a potential difference between the surface of the rotating bulb to be coated and said nozzle as said cloud of smoke is injected, and deflection means positioned between and spaced from said nozzle and selected areas of the interior surface of said rotating bulb to deflect the smoke from said selected areas as the smoke is injected to thereby prevent the deposit of coating material on the selected areas of the bulb.

4. The invention of claim 3 in which said deflection means is comprised of a circular member having a lower convex surface facing and concentric with said nozzle.

5. Apparatus for coating portions of the interior of a bulbous tubular glass lamp bulb or the like except the upper tubular portion with a finely divided coating material comprising, means to rotate the bulb about a generally vertical axis along its center line, means to heat the bulbous portion of the bulb to be coated, a nozzle for injecting a smoke comprising finely divided coating material suspended in a gaseous medium upward within said bulb at the lower end of its bulbous portion while it is being rotated and heated, means to supply under pressure a smoke of finely divided coating material to said nozzle, outlet means to permit the escape from beneath the bulbous portion within the bulb of excess smoke containing coating material not adhered to the interior surface of the lamp bulb, means to apply a potential difference between the surface of the bulbous portion of the rotating bulb to be coated and said nozzle as said cloud of smoke is injected, and deflection means adapted to be positioned above said nozzle in the bulbous portion of said bulb and spaced from the side walls thereof to deflect the smoke from the upper tubular portion of the interior surface of the rotating bulb to be coated as the smoke is injected to thereby prevent the deposit of coating material on the upper tubular portion of the bulb.

6. The invention of claim 5 in which said deflection means is comprised of a circular member having a lower convex surface facing and concentric with said nozzle.

7. Apparatus for coating selected portions only of the interior of a glass lamp bulb or the like with a finely divided coating material comprising, means to rotate the bulb about a generally vertical axis along its center line, means to heat the bulbous portion of the bulb to be coated, a nozzle for injecting a smoke comprising finely divided coating material suspended in a gaseous medium upward within said bulb while it is being rotated and heated, means to supply under pressure a smoke of finely divided coating material to said nozzle outlet means to permit the escape from within the bulb of excess smoke containing coating material not adhered to the interior surface of the lamp bulb, means to apply a potential difference between the surface of the bulbous portion of the rotating bulb to be coated and said nozzle as said cloud of smoke is injected, and deflection means secured to said bulb rotating means in a fixed position and spaced above said nozzle to deflect the smoke from selected areas of the interior surface of the rotating bulb to be coated as the smoke is injected to thereby prevent the deposit of coating material on the selected areas of the bulb.

8. The invention of claim 7 in which said deflection means is comprised of a circular member having a lower convex surface facing and concentric with said nozzle.

9. Apparatus for coating portions of the interior of a bulbous tubular glass lamp bulb or the like except the upper tubular portion with a finely divided coating material comprising, means to rotate the bulb about a generally vertical axis along its center line, means to heat the bulbous portion of the bulb to be coated, a nozzle for injecting a smoke comprising finely divided coating material suspended in a gaseous medium upward within said bulb at the lower end of its bulbous portion while it is being rotated and heated, means to supply under pressure a smoke of finely divided coating material to said nozzle, outlet means to permit the escape from beneath the bulbous portion within the bulb of excess smoke containing coating material not adhered to the interior surface of the lamp bulb, means to apply a potential difference between the surface of the bulbous portion of the rotating bulb to be coated and said nozzle as said cloud of smoke is injected, and deflection means having a maximum diameter less than the diameter of said tubular portion secured to said bulb rotating means and spaced above said nozzle in the bulbous portion of said bulb to deflect the smoke from the upper tubular portion of the interior surface of the rotating bulb to be coated as the smoke is injected to thereby prevent the deposit of coating material on the upper tubular portion of the bulb.

10. The invention of claim 9 in which said deflection means is comprised of a circular member having a lower convex surface facing and concentric with said nozzle.

References Cited by the Examiner

UNITED STATES PATENTS

2,336,946	12/1943	Marden et al.	117—18
2,657,150	10/1953	Hermanson	117—38
2,995,463	8/1961	Meister et al.	117—17
3,104,963	9/1963	Bonnett	55—463 X

ALFRED L. LEAVITT, *Primary Examiner.*

RICHARD D. NEVIUS, *Examiner.*

W. L. SOFFIAN, *Assistant Examiner.*