Feb. 11, 1936. O. FRITZE ET AL 2,030,440

MANUFACTURE OF FABRICATED GLASS ARTICLES

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Fig. 1.

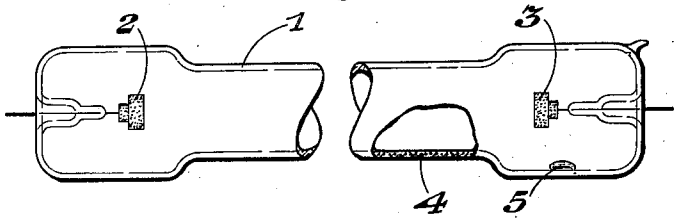


Fig. 2.



Fig. 3.

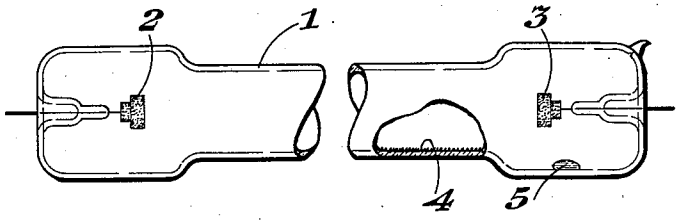
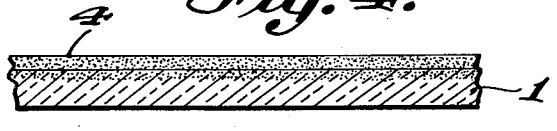


Fig. 4.



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MANUFACTURE OF FABRICATED GLASS ARTICLES

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2 Claims. (Cl. 176—122)

The present invention relates to the manufacture of fabricated glass articles, such as bulbs or tubes for electric lamps generally and more particularly the invention relates to the manufacture of luminescent bulbs or tubes for electric lamps.

Luminescent material can be applied to the inner surface of lamp bulbs or tubes, such as containers for gaseous electric discharge lamps, by applying a volatile binding material, such as glycerin or a mixture of glycerin and boric acid, to the inner surface of the container, dusting luminescent material on the binding material, heating the container to the vaporizing temperature of the binding material, such as a temperature of 200 to 250° C., and removing the vapor from the container, as by vacuum pumping, for example. A layer or coating of luminescent material remains on the inner surface of the container after the process has been completed. While the above described process is reasonably satisfactory for the manufacture of luminescent containers the coating of luminescent material is rather thin and the fluorescent effect obtained during the operation of the lamp device is not uniform. Further, it is impracticable to heat up a lamp container made by this process to the softening temperature of the glass, for the purpose of bending the container into a desired configuration or for fusing container parts or sections together, for example, since the luminescent material flakes off the container wall at such temperature.

The object of the present invention is to provide an improved method and process for applying luminescent material to the inner surface of an electric lamp container. Another object of the invention is to provide a formed container for electric lamps, said container having a smooth, glassy inner surface which is luminescent during the operation of the lamp. A further object of the invention is to provide a luminescent container for an electric lamp device which container is uniformly luminescent during the operation of the lamp device. A still further object of the invention is to provide a luminescent container for an electric lamp device which container is capable of being heated to the softening temperature thereof and then bent into desired shape without deleteriously affecting the luminescent qualities thereof. Further objects and advantages of the invention will be apparent from the following detailed description thereof and from the appended claims.

In accordance with these objects the invention comprises the steps of applying binding material, such as glycerin, to the inner surface of a formed lamp container, said binding material having a lower volatilizing temperature than the softening temperature of the glass of said container, applying particles of luminescent material on the binding material, raising the pressure in the container slightly above barometric pressure and then heating the container to the softening temperature of the glass thereof. When desired, the increase in pressure and the heating of the container takes place simultaneously. The heating of the container to the softening temperature thereof is beneficial since the binding material is completely vaporized, no residue thereof being left on the container, and the luminescent material adheres better to the wall of the container since the particles of luminescent material sink into the softened wall of the container and are completely or partially embedded therein to form a homogeneous body. The luminescent particles are fused to said container wall as well as to each other and after the heating the inner surface of the container is smooth and glassy whereas when the container is heated only to the volatilizing temperature of the binding material, as in the process first described, the inner surface of the container is rough and granular. The slightly elevated pressure in the container maintains the container in the original shape thereof during the heating period. It will be understood, of course, that the softening temperature of the container glass is below that temperature at which deleterious chemical changes in the luminescent material take place.

The strong adhesion between the luminescent material and the inner wall of the container characteristic of lamp containers manufactured in accordance with the process of the present invention has many advantages. Tubular containers are heated and then bent into desired shapes and tube sections or parts are spliced or fused together without the luminescent material flaking off. Further, a large quantity of luminescent material is embedded in the container so that uniform fluorescence is obtained over the container during the operation of the lamp and when the lamp is not operating the container has the appearance of a good opal glass container.

We have demonstrated that a matte inner surface on the container is advantageous. The binding material adheres better to such a surface and does not run off spots on the inner surface. Thus the luminescent material subsequently ap-

plied to the binding material is evenly distributed over the inner surface of said container.

The temperature to which the lamp container is heated during the process depends upon the particular glass of which the container is made. In each case however the container is heated to the softening temperature of the glass thereof. For example, a container made of the well known Thuringer glass of commerce, such as a soda glass, is heated to a temperature of 550 to 600° C. during the process. The pressure in the container during the heating thereof depends upon the dimensions of the container, particularly the thickness of the walls thereof. Generally a pressure of approximately 0.2 to 0.5 atmospheres over barometric pressure is sufficient to maintain the container in its original shape during the heating period. Such pressures are produced by connecting the container through the exhaust tube thereof to an air pressure line, when desired, or when desired, air under barometric pressure is introduced into the container which is then sealed. In this latter case the heating of the sealed container automatically increases the gas pressure therein sufficiently to prevent the container from collapsing when heated to the softening temperature of the glass thereof. In either case the vapor of the binding agent is removed, by vacuum pumping, for example, after the temperature of the container has dropped below the temperature at which the container glass is plastic. When desired, the container glass is ultra violet transmitting in which case the luminescent particles whether completely or partly embedded in the container are light emitting during the operation of the lamp device and substantially all the ultra violet light emitted by the discharge in the lamp is transformed into visible light by said luminescent material.

Any of the well known visible light transmitting luminescent materials, such as zinc sulfide, zinc silicate, cadmium tungstate, zinc cadmium sulfide, zinc borate, cadmium borate, calcium tungstate or magnesium molybdate are used in the process, when desired. The new and novel process is applicable to the containers of lamp devices having visible and ultra violet light emitting, current carrying solid bodies, such as incandescent lamps, as well as containers of gaseous electric discharge lamps.

In the drawing accompanying and forming part of this specification two gaseous, electric discharge vapor lamps each having a luminescent container made in accordance with the present invention are shown, in which

Fig. 1 is a side elevational, partly sectional view of one gaseous electric discharge lamp, and

Fig. 2 is an enlarged sectional view of the part of the lamp container shown in section in Fig. 1,

Fig. 3 is a side elevational, partly sectional view of another gaseous electric discharge lamp, and

Fig. 4 is an enlarged sectional view of the part of the lamp container shown in section in Fig. 3.

Referring to Figures 1 and 3 of the drawing the gaseous electric discharge lamp device comprises a tubular container 1 having a pair of thermionic electrodes 2 and 3 sealed into the ends thereof. Said container 1 has a rare, starting gas therein such as argon and a quantity 5 of vaporizable material, such as mercury. During the operation of the device the electrically excited mercury vapor emits visible and ultra violet light. The inner surface of said container 1 of the lamp devices illustrated in Figs. 1 and 2 has embedded therein a light transmitting, luminescent material 4, such as zinc silicate, which material is applied to said container 1 by the above described process. The luminescent material 4 (indicated by dots in the drawing) is shown completely embedded in said inner surface in Figs. 1 and 2 partly embedded in said inner surface in Figs. 3 and 4. During the operation of the lamp device the ultra violet rays striking the luminescent material are transformed thereby into visible light rays which complement the spectrum of the visible light emitted by the electrically excited gaseous atmosphere during the operation of the lamp device and supplement the intensity of the light emitted by said gaseous atmosphere.

While we have illustrated and described a particular form of lamp device it will be understood, of course, that the invention is applicable to lamp devices having different structures, for example, the invention is useful in connection with lamp devices of the type wherein the container has a single stem at one end thereof and in connection with lamp devices having a vaporizable electrode, of mercury for example, such as the well known Cooper Hewitt mercury vapor lamp of commerce.

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

1. A process for applying luminescent material to the inner surface of the container of an electric lamp device which comprises the steps of applying a binding material having a lower volatilizing temperature than the softening temperature of said container to said inner surface, applying luminescent material to the binding material, increasing the pressure in said container slightly above barometric pressure and heating the container to the softening temperature thereof to remove the binding material and to cause the said luminescent material to be fused into the container and to present a smooth glassy surface thereat.

2. A process for applying luminescent material to the inner surface of the container of a gaseous electric discharge lamp device which comprises the steps of applying a binding material having a lower volatilizing temperature than the softening temperature of said container to said inner surface, applying luminescent material to the binding material, increasing the pressure in said container slightly above barometric pressure by connecting said container to a source of gas under a pressure slightly greater than barometric pressure and heating the container to the softening temperature thereof to remove the binding material and to cause the said luminescent material to be fused into the container and to present a smooth glassy surface thereat.

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