July 29, 1952 W. R. BLOOD ET AL 2,604,870

ELECTROSTATIC COATING APPARATUS

Filed Feb. 1, 1950

Fig. 2.

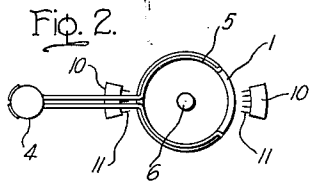


Fig. 4.

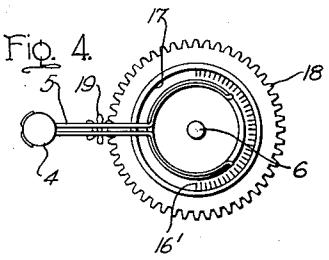


Fig. 1.

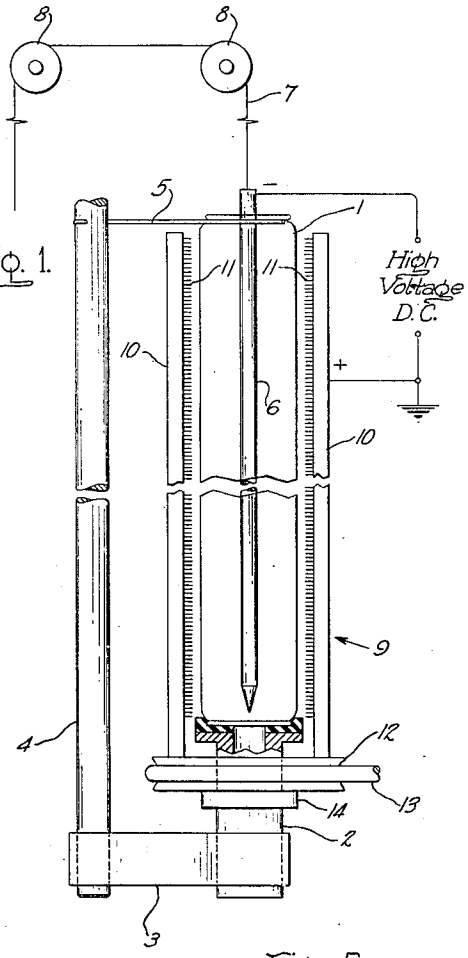


Fig. 3.

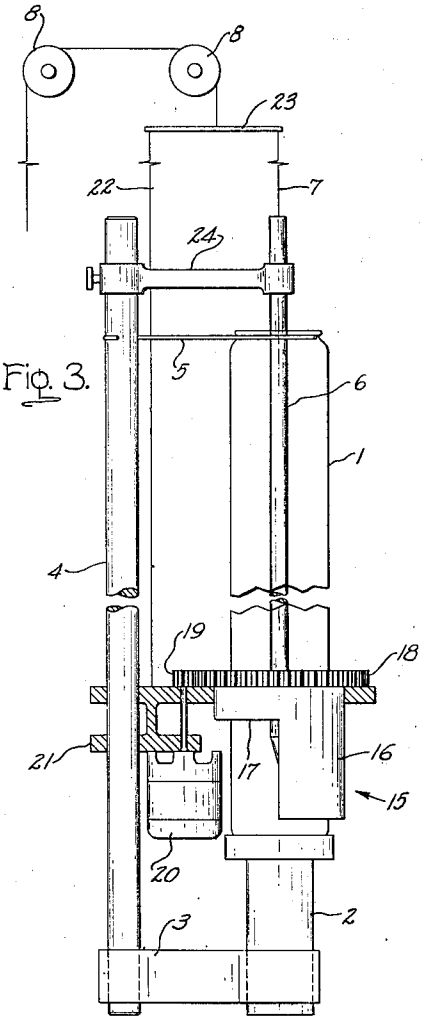
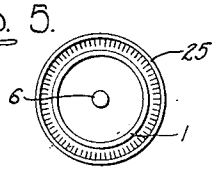


Fig. 5.



Inventors:
Walter Roy Blood,
James William Moore,
by Vernet C. Kauffman
Their Attorney.

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ELECTROSTATIC COATING APPARATUS

Walter Roy Blood and James William Moore, Rugby, England, assignors to General Electric Company, a corporation of New York

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In England February 1, 1949

1 Claim. (Cl. 118—51)

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This invention relates to the formation of the luminescent screen or layer of a fluorescent lamp by the electrostatic precipitation of powdered luminescent material onto the surface which is to sustain the screen.

In the carrying out of this process, powder is introduced into the container which is to form the envelope of the fluorescent lamp in the form of a smoke and the powder particles in the smoke are ionized by the application of a high potential between an electrode positioned within the container and the container wall.

In order that a uniform deposit of the particles be obtained, it is necessary that the part of the wall of the container which is being coated be maintained at a substantially uniform potential.

According to the invention, the substantially uniform potential is obtained by providing an electrode outside the wall of the container being coated with a plurality of point-like extensions toward said wall, the point-like extensions being uniformly distributed over the portion of the wall on which coating is being effected.

The uniform distribution of the point-like extensions over the surface of a tubular container may be obtained by employing a conducting sleeve surrounding the container wall and uniformly distributing the point-like extensions from the inner surface of the sleeve; or by employing an electrode of limited extent axially and/or transversely of the container and rapidly moving the electrode axially of and/or rotating it around the container so as to cause the point-like extensions from it to be effectively distributed over the portion of the surface being coated. We prefer to use an electrode in the form of a stirrup, the axes of which extend parallel to the axis of the container and are provided with the extensions, the stirrup being rotated rapidly around the container.

The point-like extensions may be constituted by pointed wires, e. g., phonograph needles, the tips of which are spaced a short distance from the wall.

It will be understood that in carrying out the electrostatic precipitation process smoke is introduced into the container so that it drifts along the container, which is assumed to be tubular, the production and application of the smoke being arranged to this end. An inner electrode is arranged within the container and is moved axially thereof in the path of the advancing body of smoke. A difference of potential is maintained between the inner electrode and the wall of the container by applying a high D. C. potential between the inner and outer electrodes, one of which is earthed. The outer electrode is moved with the inner electrode and the powder is uniformly electrostatically precipitated from the smoke onto the inner surface of the container.

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The tube to be coated is preferably mounted with its longitudinal axis vertical and is held in this position by means of a clip which is mounted on a standard extending alongside the tube, and can be moved along the standard to enable the tube to be inserted in position for coating, and removed after coating. The outer electrode is then rotatably mounted on a carriage movable along the standard.

For a further understanding of our invention reference may be had to the accompanying drawing wherein Fig. 1 is a somewhat diagrammatic elevation of a form of apparatus comprising our invention; Fig. 2 is a plan view of the Fig. 1 device; Figs. 3 and 4 are views, corresponding to Figs. 1 and 2, of a modification; and Fig. 5 is a plan view of a further modification.

The device shown in Figs. 1 and 2 is generally similar to that shown in Patent 2,449,655 of R. L. Keiffer and assigned to the same assignee as the present invention. The glass bulb or container 1 is supported vertically on the upper end of a hollow head or holder 2 which may be supported by a bracket 3 from a standard 4. The bulb 1 is additionally supported at its upper end by a suitable clip 5 extending from the standard 4. An inner electrode in the form of a rod 6 having a pointed lower end is suitably mounted to extend axially within the bulb 1 and to be moved vertically therethrough. The movement may be effected by means of a flexible cord or cable 7 connected to the upper end of the rod 6 and extending over pulleys 8 to a suitable winding drum or spindle.

The outer electrode 9 is shown in the form of a stirrup having axes or leg portions 10, 10 extending longitudinally along opposite sides of the bulb 1 and provided with a multiplicity of point-like extensions 11 the tips of which are spaced a short distance from the wall of the bulb 1. As here shown, the base portion of the stirrup-shaped electrode 9 is provided with a pulley 12 for rotation by a belt 13 from a suitable drive, and is supported on a suitable bearing 14 attached to the holder 2.

In carrying out the coating process, a smoke or gaseous suspension of finely divided particles of the fluorescent coating material is formed in any suitable generator such, for example, as that shown in the aforesaid patent to Keiffer. The

smoke is introduced into the lower end of the bulb 1 through the hollow head 2 so that it drifts upwardly along the bulb. The inner electrode 6 is moved axially of the bulb, from the bottom to the top thereof, in the path of the smoke. A difference of potential is maintained between the inner electrode 6 and the wall of the bulb 1 by applying a high D. C. potential (8,000–12,000 volts, for example) between the inner electrode 6 and outer electrode 9, the outer electrode being grounded. During the movement of the inner electrode 6, the outer electrode 9 is rotated and the powder is uniformly electrostatically precipitated from the smoke onto the inner surface of the bulb 1.

In the apparatus shown in Figs. 3 and 4, the supporting structure for the bulb 1 and inner electrode 6 is like that shown in Figs. 1 and 2 and corresponding parts have been similarly numbered. However, in this case the outer electrode 15 is of relatively short axial length and is arranged to move vertically along with the inner electrode 6. The electrode 15 is provided with a semi-cylindrical portion 16 having the point-like extensions 16' projecting from its inner surface, and an upper annular portion 17 to which is fixed a gear 18. The said gear 18 meshes with a gear 19 which is driven by a motor 20. The assembly of electrode 15, gears 18 and 19 and motor 20 may be suitably supported on a bracket or carriage 21 which is slidably mounted on the standard 4, and which may be moved vertically by a cord or cable 22 attached to the cord 7 by a cross member 23.

The inner electrode 6 may be guided by one or more brackets 24 mounted on and electrically insulated from the standard 4. The same arrangement may be employed in the apparatus shown in Figs. 1 and 2.

It will be understood that upon the introduction of the smoke into the head 2 of the Fig. 3 device, both the inner electrode 6 and the outer electrode 15 are moved upward and the outer electrode is simultaneously rotated about the axis of the bulb 1 while maintaining a difference of potential between the electrodes to deposit the powder progressively along the inner wall of the bulb 1.

If desired, the outer electrode in either of the

arrangements illustrated in Figs. 1 or 3 could be made cylindrical, as indicated at 25 in Fig. 5. Also, provision may be made for rotating the bulb 6 about its axis as in the apparatus shown in the aforesaid patent to Keiffer. It will be understood by those skilled in the art that the construction and arrangement of parts may be widely modified within the spirit and scope of our invention as defined by the appended claim.

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

In apparatus for electrostatically coating tubular glass containers, the combination of support means including holder means for the container, an inner electrode mounted on said support means to extend axially of the container, means including an outer electrode mounted on said support means adjacent the outer wall of the container and arranged to effectively present a multiplicity of discrete sharply pointed extensions uniformly over and projecting toward the wall of the said container, said outer electrode extending a limited distance axially of the container and being located adjacent an end of the inner electrode, means for moving said inner and outer electrodes in cooperative relation longitudinally of the container and means for simultaneously rotating said outer electrode about the axis of the container, means for conducting a gaseous suspension of finely divided coating material into the container, and means for impressing upon said electrodes a potential of sufficiently high potential to cause deposition of said coating material upon the inner wall of said envelope.

WALTER ROY BLOOD.
JAMES WILLIAM MOORE.

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