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APPARATUS FOR APPLYING EMISSION MATERIAL TO CATHODES

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Fig. 1.

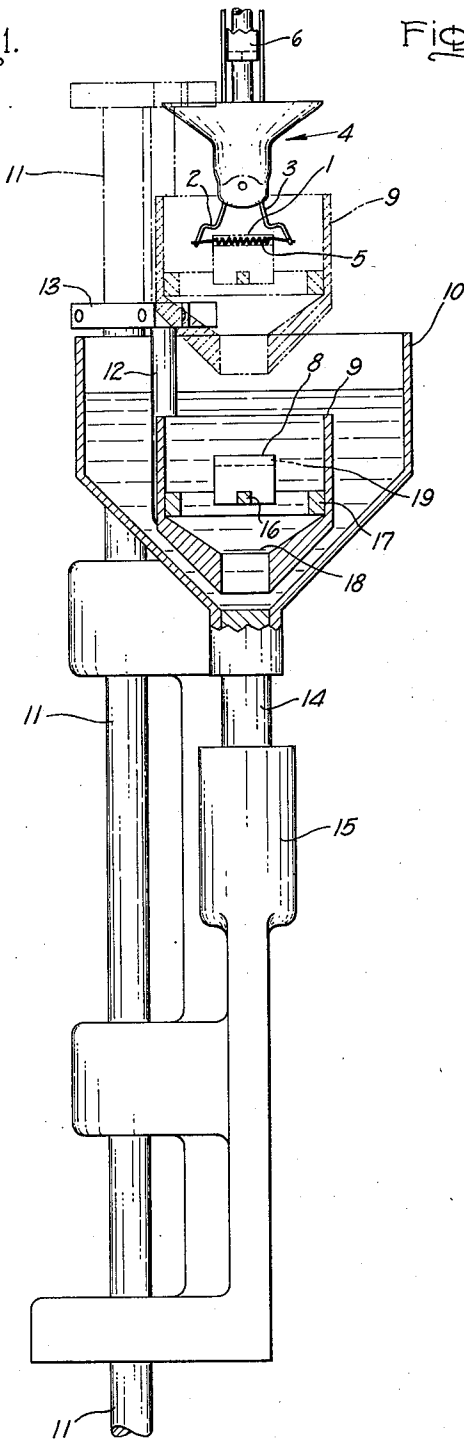


Fig. 2.

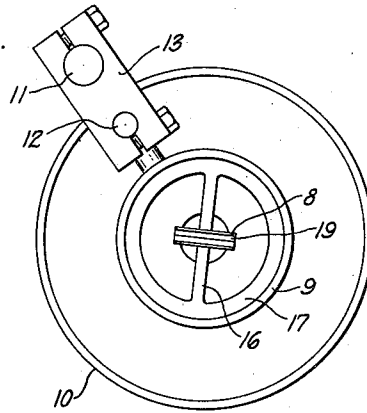
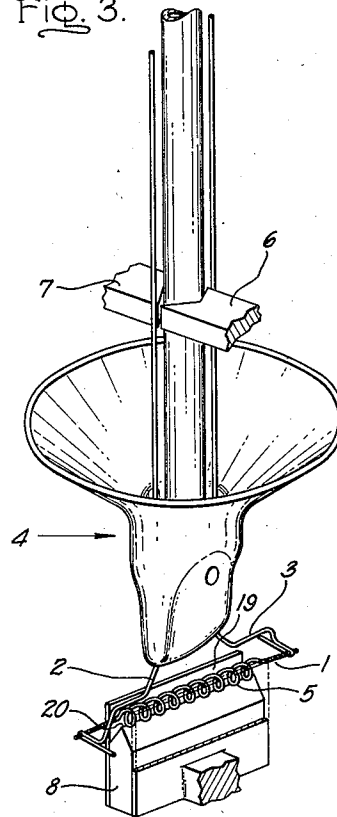


Fig. 3.



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APPARATUS FOR APPLYING EMISSION
MATERIAL TO CATHODESWilliam P. Zabel, Cleveland Heights, Ohio, as-
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2 Claims. (Cl. 91-47)

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My invention relates to the application of electron emission material to the filamentary cathodes of electric discharge lamps and similar devices. More particularly my invention relates to apparatus for flooding the complex coils of filamentary cathodes with a liquid containing the electron emission material and thereafter removing substantially all the excess liquid therefrom.

To assure the most efficient and satisfactory operation of filamentary cathodes of discharge devices, it is imperative that a relatively large quantity of the emission material be carried by the cathode and that the emission material be tenaciously retained by and uniformly distributed over said cathode. An object of my invention is accordingly to provide apparatus which will completely fill the smaller interstices of the cathode as, for instance, the primary coils of a coiled-coil cathode, and at the same time avoid the formation of heavy incrustations and bridges of emission material on the surface and more widely spaced portions of said cathode as, for instance, on the secondary coils of said coiled-coil cathode.

Other objects and advantages of my invention will appear from the following detailed description of a species thereof, and from the accompanying drawing.

In the drawing, Fig. 1 is a side elevation of one species of apparatus comprising my invention with a portion broken therefrom, and with a showing of the dipper thereof in dot-dash lines in its operative position with relation to the cathode; Fig. 2 is a plan view of the dipper, the cup and certain of the associated operating parts of the apparatus; and Fig. 3 is a perspective view on a larger scale of the applicator of the apparatus in operative arrangement to the cathode of a discharge lamp mount.

The apparatus of my invention occupies a position directly below that occupied by the cathode 1 throughout the complete cycle of operation thereof, and in said cycle carries a quantity of a liquid containing the emission material up into engagement with said cathode 1. A particular function of the apparatus is that it floods a specific portion of the cathode 1 with the liquid containing the emission material, thereby effecting the distribution thereof over a definite related portion of said cathode 1 and, in the withdrawal thereof, effects a pulling or draining of the excess liquid from said cathode 1. As shown in the drawing, the cathode 1 may be one permanently attached to the leading-in wires 2 and 3 of a mount 4 for a discharge device and is preferably, although not necessarily, stretched linearly so

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that the larger secondary coils 5 thereof are widely spaced. The apparatus can be readily combined with other apparatus, such as that disclosed in U. S. Patent 2,380,742, Flaws, for automatically manufacturing the mount 4, and in such a combination can be located at one of the work stations into which the mount 4 is advanced in its regular course of movement. The jaws 6 and 7 support the mount 4 in position and together therewith arrange the cathode at a definite position and orientation with respect to the apparatus of my invention.

At the start of the cycle of operation, the applicator 8, which is an element of the trough-shaped dipper 9, is located within the cup 10 and is completely submerged and flooded by the main supply of the liquid suspension of emission material. Subsequent operations of the apparatus raise the dipper 9 vertically out of the cup 10 to operative relation to the cathode 1 (to the position shown in dot-dash lines), and then return said dipper 9 to its original position within the cup 10 and the liquid. This manipulation of the dipper 9 accounts for the complete cycle of operation of the apparatus and is brought about by the vertical movements of the operating rod 11 in the manner of other cam-actuated operating means at other work stations of apparatus like that disclosed in U. S. Patent 2,380,742, Flaws, hereinbefore referred to.

The movement of the dipper 9, which is attached to the operating rod 11 by rod 12 and arm 13, effects a thorough agitation of the main supply of the liquid containing the emission material in its passage from and then into said liquid in said cup 10, which is mounted on the stud 14 extending from the support bracket 15. Such a manner of operation keeps the emission material, which is in the form of a finely ground solid (usually alkaline earth carbonates), in a homogeneous mixture with the other components of the liquid (usually nitrocellulose and amyl acetate) and causes said supply to thoroughly wash all portions of the dipper 9 and the applicator 8 so as to prevent the formation of incrustations and solid gatherings of the emission material upon said dipper 9 and said applicator 8 and the consequent contamination of said liquid. The advantages of the vigorous agitation are particularly realized in instances where the liquid contains a nitrocellulose vehicle which evaporates or dries very rapidly. In the upward movement of the dipper 9 from the cup 10, the liquid therein flows down over all parts of the applicator 8, which is an integral part of a par-

tion 16 bridging the ring 17, and passes through the opening in said ring 17 and the opening 18 in the bottom of said dipper 9 to the main supply within the cup 10. The reverse downward movement of the dipper 9 causes a reverse flow of the liquid and a spilling of said liquid into the top of the dipper 9 when it finally becomes submerged therein.

The application of the emission material to the cathode 1 occurs when the dipper 9 is raised sufficiently so that the larger secondary coils 5 of the said cathode 1 are located within the open-ended trough 19 running the length of the applicator 8 and almost entirely submerged within the pool of liquid contained therein. The movement is terminated when secondary coils 5 of the cathode 1 rest upon the longitudinally extending ridge 20 along the bottom of the applicator 8 and are pushed up slightly from their normal position. The restricted length of the applicator 8 confines the distribution of the emission material to the exterior surfaces of the secondary coils 5 of the cathode 1. However, the full length of the cathode 1 is comprised of small primary coils of filamentary wire into which the liquid is drawn by capillary action so as to travel therealong almost to the leading-in wires 2 and 3.

Both the design of the applicator and the viscosity of the liquid containing the emission material are responsible for the distribution of said emission material over the cathode 1 since excessively thin liquid travels farther from the applicator 8 along the primary coils than desired. To this end, it is desired that the applicator 8 and liquid be so correlated in size and viscosity as to carry the emission material only to those portions of the cathode 1 which are adapted to be adequately heated by the passage of current between the leading-in wires 2 and 3 in a subsequently occurring manufacturing operation and thereby converted to oxides of a suitable character and emissivity. The lateral proportions of the applicator 8 and viscosity of the liquid are also of major importance to the proper application of the emission material and are such that sufficient liquid is retained in the applicator 8 by adhesion and cohesion after it is completely withdrawn from the main supply of liquid to flood the full periphery of the cathode 1. It is therefore preferable that the depth of liquid within the applicator 8 be greater than the diameter of the larger secondary coils 5 of the cathode 1; however, it may be slightly less than said diameter and reliance placed upon capillary attraction to pull said liquid through the coils and up and over the top thereof. Further assurance of the proper immersion of the cathode 1 is given by the final upward movement of the applicator 8 which causes all of the secondary coils 5 to bear against the ridge 20, even though certain of said coils 5 may be slightly out of proper alignment with the others.

The subsequently occurring downward movement of the dipper 9 separates the liquid contained in the applicator 8 from the cathode 1, and in so doing pulls away from the cathode substantially all of the liquid not confined within the primary coils and wetting the surface of the

cathode 1. This forceable draining function of the applicator 8 is effected by the tendency of the liquid to cling to said applicator 8, possibly because of capillary attraction in the V-shaped channels on the sides of the ridge 20 and cohesion of the liquid therein. In this manner, substantially all of the excess liquid is withdrawn from the cathode 1 and there is substantially no creeping of liquid over the cathode 1 to the lower part thereof during the interval immediately following, thereby preventing a heavy surface incrustation of the emission material on said lower portions.

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

1. Apparatus for applying electron emission material to a coiled filamentary cathode comprising a cup for holding a pool of a liquid containing the emission material, a movable applicator in the form of a horizontally disposed open-ended trough having a ridge extending centrally and longitudinally along the bottom thereof, means for supporting the cathode in a horizontal position above said cup and with its longitudinal axis parallel to and in alignment with the longitudinal axis of said applicator, and means for supporting the applicator in a horizontal position and carrying it upward toward the cathode support means from a normal immersed position within the cup to a position surrounding the cathode and with the said ridge pressed firmly against the coils of the cathode so as to apply the emission material to the cathode before it drains out of the trough and for returning said applicator to its position within the cup so as to effect a withdrawal of the excess liquid from said cathode.

2. Apparatus for applying electron emission material to a coiled filamentary cathode comprising a cup for holding a pool of a liquid containing the emission material, a movable applicator in the form of a horizontally disposed open-ended trough having an inverted V-shaped bottom defining a longitudinally extending ridge therein, means for supporting the cathode in a horizontal position above said cup and with its longitudinal axis parallel to and in alignment with the longitudinal axis of said applicator, and means for supporting the applicator in a horizontal position and carrying it upward toward the cathode support means from a normal immersed position within the cup to a position surrounding the cathode and with the said ridge pressed firmly against the coils of the cathode so as to apply the emission material to the cathode before it drains out of the trough and for returning said applicator to its position within the cup so as to effect a withdrawal of the excess liquid from said cathode.

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The following references are of record in the file of this patent:

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