Jan. 15, 1946. T. J. RADCLIFFE 2,392,879

ELECTRODE MANUFACTURE

Filed June 29, 1942

Fig. 1.

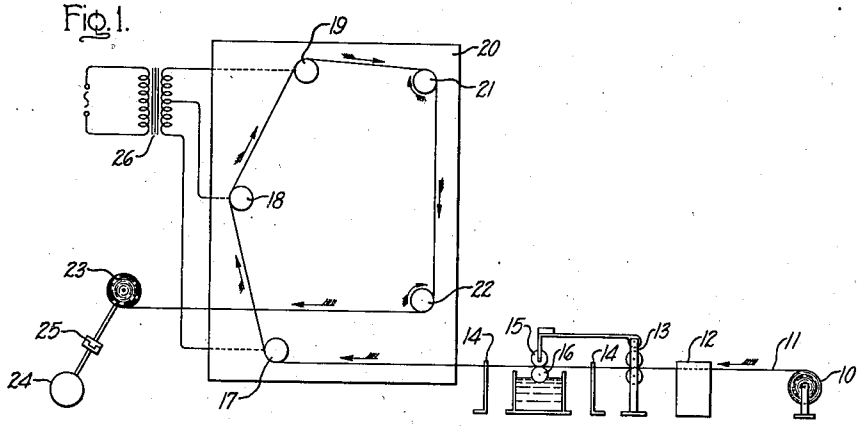


Fig. 2.

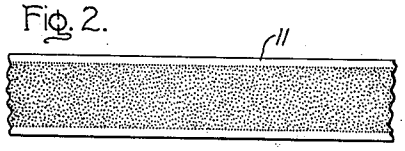


Fig. 3.



Inventor:
Thomas J. Radcliffe,
by John H. Anderson
His Attorney.

Patented Jan. 15, 1946

2,392,879

UNITED STATES PATENT OFFICE

2,392,879

ELECTRODE MANUFACTURE

Thomas J. Radcliffe, Belleville, N. J., assignor to General Electric Company, a corporation of New York

Application June 29, 1942, Serial No. 449,027

1 Claim. (Cl. 29—25.17)

My invention relates to methods of and means for applying coatings to selected portions of the electrodes of electric discharge devices. More particularly my invention relates to methods of and means for applying glow preventing material to a selected area of the electrodes of glow discharge lamps.

Glow discharge lamps comprising closely spaced electrodes are well known in commerce. A species of such lamps comprising two spaced, juxtaposed electrodes shaped as quadrants of a hollow sphere and so arranged as to jointly present a hemispherical surface is disclosed in the U. S. Patent 1,965,586, issued July 10, 1934. Such electrodes are known as "cold" type electrodes as distinguished from "hot" or incandescible electrodes which are usually made of wire or ribbon. This patent also discloses the use of aluminum or aluminum oxide, among other materials, for excluding the glow discharge from the inner surface of the electrodes and confining said discharge to the outer hemispherical surface presented thereby. Heretofore the aluminum or aluminum oxide, hereinafter called anti-glow material, has been painted on the inner surface of the electrodes by hand with a small brush. This is a slow, expensive method not suitable for mass production, and one in which complete and uniform coverage of the desired surface is not always obtained.

An object of my invention is to facilitate the manufacture of such lamps by providing an improved process of manufacturing such electrodes or cathodes including the method of and a means for applying the anti-glow material to the desired area of the electrodes. Further objects and advantages of my invention will appear from the following detailed description thereof.

A feature of my invention is the application of anti-glow material to suitable portions of the metal body out of which a plurality of electrodes may be shaped, as by punching. Another feature of my invention is a heat treatment of the applied anti-glow material and its support whereby an adherent, baked-on coating of said material is produced on the support without impairing the ductility of the support for subsequent shaping into electrodes.

In the drawing accompanying and forming part of this specification, a species of apparatus useful for the purposes of my invention is shown diagrammatically in Fig. 1; Fig. 2 is a top plan view of a portion of metal strip coated with anti-glow material by the apparatus shown in Fig. 1; and Fig. 3 is a perspective view of an electrode punched out of the strip.

Referring to Fig. 1 of the drawing, the apparatus comprises a supply reel 10 which furnishes a strip 11 of uncoated metal. The strip 11 is continuously unwound and drawn in the direction of the arrow through the guide block 12 by the motor driven feed rollers 13 which may have a soft rubber surface. A pair of centering guides 14 direct the strip 11 between the pressure roller 15 which may be of soft rubber and the applicator roller 16 which may have a steel surface. The roller 15 presses the strip 11 down on the roller 16 which runs in a bath of aluminum paint. The face of the roller 16 is narrower than the width of the strip 11 so that an even coating of aluminum paint is applied along the center portion of one side of said strip 11 as it is drawn in the direction of the arrow.

The uncoated side of the strip 11 is then passed upward over the stationary electrical contacts 17, 18 and 19 mounted on the electrically insulating support 20. Said contacts 17, 18 and 19 are connected to a source of electrical energy capable of passing sufficient energy through the ever-changing portion of the strip 11 bridging said contacts to raise it to the baking temperature of the paint. Two sheaves 21 and 22 mounted on the support 20 guide the coated strip 11 downward from the contact 19 to the collecting reel 23 which is driven by the motor 24 acting through the friction clutch 25. The portion of strip 11 passing over the contacts 17, 18 and 19 and the sheaves 21 and 22 is of loop-like shape as shown in the drawing.

The contacts 17 and 19 are each connected to a terminal of the secondary of a step-down transformer 26 and the contact 18 is connected to the mid-point thereof. The primary of said transformer 26 is connected across the terminals of an alternating current source. I have demonstrated that a current of about 50 amperes through the ever-changing painted portion of the strip 11 bridging the contacts is effective for heating said portion sufficiently to produce an adherent, uniform, baked-on coating of anti-glow material on a nickel strip having a width of approximately 5/8 inch and a thickness of approximately .010 inch when the speed of the strip 11 is such that a given point thereon is heated for approximately 5 seconds. A transformer capable of changing a 220 volt current supply of commercial frequency to 2.5 volts between the mid-point and the ends of the secondary is suitable.

While the center contact 18 and its connection to the transformer secondary may be omitted, I have found that it minimizes sparking at the contacts 17 and 19 and is therefore desirable. Further, the contact 18 avoids overheating parts and underheating other parts of the portion of the strip 11 bridging the contacts 17 and 19 at the beginning and at the end of a run. At such time the machine is stopped and current passed through that portion of the strip which would not otherwise be sufficiently heated. The contact 18 avoids such undesired temperature distribution to eliminate spoilage of material.

The feed rollers 13 are connected to and driven by the motor 24 through a reduction gear and pulley arrangement (not shown for purposes of simplicity of illustration). The rotational speed of said feed rollers 13 is substantially constant. The motor 24, acting through the friction clutch 25 tends to drive the collecting reel 23 at a higher rate of motion and to pull the strip 11 through the apparatus at a higher speed than the feed rollers 13 will allow. Sufficient tension is thus exerted on the loop-like portion of the strip 11 to hold the latter firmly against the contacts 17, 18 and 19 to avoid excessive sparking between the strip and said contacts. The strip 11 is passed between the contacts 17 and 19 at a rate such that the paint is thoroughly baked thereon without impairing the ductility of the strip 11 for the subsequent shaping of the electrodes. This rate may be determined by trial runs of the apparatus. Undue heating of the contacts, particularly contact 19, by the hot portion of the strip 11 passing over its surface may be prevented by providing sufficient heat dissipating capacity. If the heat dissipating area of the contact itself is not sufficient for this purpose then heat radiating fins or liquid cooling means may be used.

I have demonstrated that the paint sold by the Sahlin Chemical and Color Company of Camden, N. J., under the designation of No. 2056 Aluminum is eminently satisfactory for use in the above process. The composition of this paint is approximately 35 per cent aluminum, 52 per cent mineral spirit, 11 per cent China-wood oil and 2 per cent acid resin. The paint may be applied to the center portion of the strip 11 by hand and dried in air at room temperature or at an elevated temperature, such as in an oven. The coating on the strip 11 is indicated by dots in Fig. 2 of the drawing.

After the strip 11 has been coated as described above, electrodes of desired shape, such as that shown in Fig. 3, are punched out of the coated portion thereof. The electrodes then may be washed with a suitable solvent, such as carbon tetrachloride, benzol, or the like, to remove the die lubricant. The electrodes are then fired to completely remove the binder from the paint and to leave a coating of aluminum on the inner surface thereof. The firing also cleans the surface of the electrodes. I prefer to use an atmosphere of moist hydrogen to avoid the formation of complex hydrocarbons in the firing operation.

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

The method of manufacturing concave cold type electrodes having a metallic coating on their inner surfaces which comprises coating one side of an elongated metal strip with a suspension of powdered anti-glow metallic material in a volatilizable binder, baking the coating by passing the uncoated side of the strip over spaced electrical contacts connected to a source of current to heat the portion of the strip between said contacts to a temperature which is sufficiently high to bake the coating but too low to impair the ductility of the metal strip, forming and punching a multiplicity of concave electrodes from the strip with the coated side forming the inner surface of the electrode, and then firing the electrodes at a temperature sufficiently high to drive off the binder and leave an adherent coating of the metallic material on the inner surfaces of the electrodes.

THOMAS J. RADCLIFFE.