Dec. 2, 1952 A. S. VAUSE 2,619,706

ELECTRODE FOR ELECTRIC DISCHARGE DEVICES

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Fig. 1.

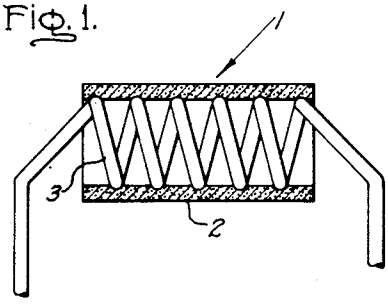
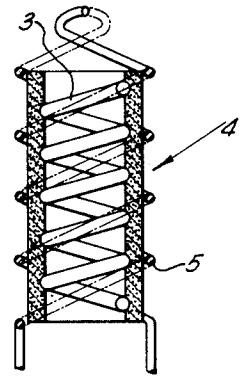


Fig. 2.



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ELECTRODE FOR ELECTRIC DISCHARGE DEVICES

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1 Claim. (Cl. 29—25.14)

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This invention relates to electrodes for electric discharge devices and more particularly to methods of applying electron emissive material thereto.

At present there are two well-known methods of manufacturing such emissive electrodes, namely, first by dipping a conductor into a solution of emissive material or by spraying the solution onto the conductor and second by inserting a solid pellet of emissive material within a containing electrical conductor. The first of these methods provides an electrode coating of low thermal inertia easily outgassed, while the second method provides an electrode having mechanical strength and controllability of the location, mass and surface area of the emissive material. Thus, an emissive electrode providing substantially all of the above advantages is desired.

An object of my invention is to provide a new and improved method of applying electron emissive material to electrodes.

Another object of my invention is to provide a new and improved method for applying electron emissive material to electrodes which will result in an electrode coating having a controlled mass and surface area of proper mechanical strength.

A further object of my invention is to provide a new and improved electrode structure having an emissive coating of low thermal inertia which is easily outgassed.

A still further object of my invention is to provide a new and improved method of coating cathodes with an emissive material which results in the material, upon the proper heat treatment, reducing in volume and shrinking tightly onto a conductor.

Further features and advantages of my invention will appear from the following description and species thereof. For a better understanding of my invention reference may be had to the following description taken in connection with the accompanying drawings and its scope will be pointed out in the appended claims. Fig. 1 is an enlarged view of a cylindrical layer of emissive material shrunk onto a tungsten wire in the form of a helix and incorporating my invention. Fig. 2 illustrates a variation of the electrode structure of Fig. 1 incorporating my invention.

In carrying my invention into effect, I provide a method wherein a mixture of barium, strontium, and calcium carbonates are mixed together with pure silica and then mixed into a paste with a solution of gum-tragacanth in distilled water and acetone. When the paste is suitably stiff it is extruded through a jet having a center pin about the diameter of a helix or electrical conductor to be coated with the material. The plastic hollow tube or cylinder thus formed is then cut into the required lengths and the conductor inserted into the hollow section thereof. The assemblies thus formed are then subjected to a suitable heat treatment wherein a chemical reaction takes place resulting in a reduction in volume of the cylinder formed of the emissive mixture. The reduction in volume effected during the chemical reaction causes the tube to shrink tightly onto the electrical conductor. This assembly may be used as part of an electric circuit, or alternatively, it may be inserted in a coiled or otherwise shaped conductor which is part of the cathode circuit.

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Referring to Fig. 1, the electrode structure or assembly 1 shown therein comprises a thin walled cylindrical layer 2 of emissive material shrunk onto a tungsten wire helix 3. The helix 3 is partially embedded in the emissive material. The thin walled cylindrical layer 2 of emissive material may, for example, have the following composition: 247 grams of barium carbonate, 50 grams of calcium and 30 grams of silica. The binder used therein may be gum-tragacanth and distilled water as heretofore mentioned. Acetone may be used in addition to the above mentioned ingredients as part of the binder. The extrusion jet diameter used may be 0.188 inch with a center pin of 0.120 inch. The tungsten wire helix 3 having an external diameter of 0.110 inch is then inserted within the emissive cylinder 2 while the latter is still moist from the extrusion. Upon heating this complete assembly 1 in a hydrogen furnace, the emissive cylindrical layer 2 is shrunk upon the helix by the chemical changes taking place therein. If the extrusion lacks the desired plasticity, a plasticiser may be added to the emissive preparation. Glycerine, in water bound mixtures, or butyl phthalate in cellulose bound mixtures, are two examples of plasticisers which have worked satisfactorily. Greater adhesion properties of the cylindrical layer 2 may be accomplished by using alternative emission compositions having greater volume contraction upon reaction or better binding properties to the tungsten helix. Rolling complete cathode assemblies between glass plates while the emitter is plastic so as to embed the wire helix in the wall of the emissive material before firing increases the adhesion of the cylindrical layer to the tungsten helix.

Fig. 2 illustrates a variation of Fig. 1 wherein an electrode or cathode assembly 4 comprises an outer containing tungsten wire helix 5 formed

around a corresponding cathode assembly. Helix 3 of the cathode assembly 1 is shortened so that it does not protrude beyond the ends of the thin walled cylindrical layer 2 which it supports. Helix 5, in turn, supports the other elements of the assembly.

In accordance with my invention, I provide a new and improved method of coating conductors with emissive materials which provide a coating having a controlled mass and surface area of proper mechanical strength. Accordingly, I provide a method which will lend itself to coating manufacture on automatic machinery.

Generally speaking, I effect these desired results by providing a method of forming or extruding emissive materials and binders into a hollow cylindrical body or tube. The hollow tube thus formed is shrunk onto an electrode conductor which, for example, may be a helix or a coiled-coil tungsten wire resulting in a cathode assembly having a low thermal inertia which is easily degassed. Furthermore, I provide a method of producing a cathode assembly having an emissive coating providing satisfactory striking voltage, low sputtering characteristics, and long life.

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

A method of forming a cathode assembly for an electric discharge device which method comprises first extruding into a hollow cylindrical body, a pasty mixture of alkaline earth metal carbonate and silica, subsequently inserting a closely fitting tungsten wire helix in the hollow interior thereof while the said body is still moist, heat treating the assembled cylindrical body and tungsten wire helix in a hydrogen furnace to effect a chemical reaction of said mixture and shrink said cylindrical body of emissive mixture onto said tungsten wire helix, and inserting said heat treated assembled cylindrical body and tungsten wire helix into the hollow interior of a second tungsten wire helix which closely fits said cylindrical body to serve as a support therefor.

ARTHUR SAMUEL VAUSE.

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