

UNITED STATES PATENT OFFICE

2,330,202

METHOD OF MAKING ELECTRODES

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This invention relates to electrolytic devices such as electrolytic condensers, rectifiers, storage batteries and the like, and more particularly to a method of making electrodes for such devices.

As disclosed, for example, in my Patents Nos. 2,104,018 and 2,104,019, and in my pending application Serial No. 199,396, filed April 1, 1938, electrodes having porous or permeable surfaces composed of finely divided cohering particles of metal have many advantages in the construction of various types of electrolytic devices, one of the principal advantages flowing from the fact that such electrodes have a very extended surface area exposed to the action of the electrolyte. Such electrodes are preferably produced by spraying finely divided particles of molten metal onto a suitable base, as by the Schoop metallizing process. In carrying out such spraying operation, and as described in my prior Patent No. 2,104,018 referred to above, the spraying apparatus is preferably adjusted in such manner that the minute deposited particles cohere to each other without forming a solid surface structure, thus producing porous or honeycombed layer having the desired extended surface area.

I have found that the effective surface area of the spray deposited material can be further increased, and the capacity of an electrode having such a surface correspondingly increased if the spraying operation is carried out in such manner as to prevent the formation of an impervious film of spray deposited particles even in the region immediately adjacent the base. In ordinary spraying operations it is the usual practice to carry out the operation in such manner that the base upon which the material is deposited becomes very hot. Under such circumstances the molten particles projected against the base are not cooled with sufficient rapidity to prevent them from forming a substantially impervious, relatively smooth layer, and such a layer immediately adjacent the base does not greatly increase the effective area of the electrode.

According to my present invention I further increase the effective area of electrodes having spray deposited surfaces, and improve the efficiency and capacity of such electrodes, by spraying the molten metal upon the base in such a manner that the particles which adhere directly to and are immediately adjacent the base only adhere thereto and to each other at spaced points, thus insuring that the entire deposit of particles, including those adhering directly to the base as well as those superposed thereon, while electrically conductive throughout, will be in the

form of a permeable, reticular layer which is porous and honeycombed throughout. This result is preferably accomplished by preventing the surface of base upon which the particles are deposited from reaching a temperature equal to or closely approaching the melting point of the metal being deposited. Thus the particles striking the base under such circumstances that its surface temperature is maintained at less than the melting temperature of the metal being deposited are chilled and solidified to an extent sufficient that they retain their general spherical shape, being only partially flattened by their impact against the base and contact with each other and thereby leaving cracks, crevices or interstices between the adjacent particles and between the deposited particles and the base.

The base material can be prevented from reaching an elevated temperature by various methods. For example, in spraying on a thin aluminum sheet the surface opposite that being sprayed may be cooled by a blast of air or by a stream of water or other cooling fluid. If such a cooling operation is impractical, a blast of air may be discharged in a direction parallel to the metal spray to cool the base or the spray or both. The spray may be cooled or discharged in such manner that by the time the particles reach the base they are no longer in a truly liquid condition, but merely in a plastic condition, and only contain sufficient heat that they will adhere to the base and cohere to each other without forming a continuous film. The method is particularly useful in the spraying of metals having relatively low melting points, such as aluminum, but is also advantageous in conjunction with the manufacture of electrodes of various other metals. The method may be applied in conjunction with spraying on any suitable base materials, for example, on metallic sheets, wires, rods or castings, on a porous material, for example, cloth such as open-mesh gauze, or on an insulating material such as porcelain or glass.

Various other methods of preventing the base material from reaching such temperature that the sprayed particles form an impervious film thereon will doubtless be apparent to those skilled in the art. It is therefore to be understood that my invention is not limited to the specific method steps outlined above, or in any manner other than by the scope of the appended claims when given the range of equivalents to which my patent may be entitled.

I claim:

1. Method of making physically reticular and

electrically conductive layers for electrolytic condenser electrodes which comprises spraying finely divided molten aluminum upon a base, and simultaneously directing a current of fluid to maintain the surface of the base upon which the metal is deposited at a temperature lower than the melting point of the metal so sprayed, to thereby produce a spray deposited layer which is conductive and porous throughout.

2. The method of making electrodes for electrolytic devices which comprises spraying finely divided molten metal upon an open mesh gauge base, and simultaneously directing a current of fluid to maintain the surface of the base upon which the molten metal is sprayed at a temperature below the melting point of the metal being sprayed, thereby to insure the production of a spray-deposited layer which is porous and permeable throughout, on said base.

3. The method of making electrodes for electrolytic devices which comprises spraying finely divided molten metal from a discharge nozzle upon a suitable base, and during the spraying operation, cooling the material of the base by directing a cooling fluid thereagainst to maintain the base at a temperature below the melting point of the metal being sprayed, thereby to insure the production of a spray-deposited layer which is porous and permeable throughout, on said base.

4. The method of making electrodes for electrolytic devices which comprises spraying finely divided molten aluminum from a discharge nozzle upon an aluminum sheet, and during the spraying operation, cooling the sheet by directing a cooling fluid thereagainst to maintain the base at a temperature below the melting point of the metal being sprayed, thereby to insure the production of a spray-deposited layer which is porous and permeable throughout, on said base.

5. The method of making electrodes for electrolytic devices which comprises spraying finely divided molten metal from a discharge nozzle upon an open-mesh fabric base and during the spraying operation, cooling the material of the base by directing a cooling fluid there-against to maintain the base at a temperature below the melting point of the metal being sprayed, thereby to insure the production of a spray-deposited

layer which is porous and permeable throughout, on said base.

6. The method of making electrodes for electrolytic devices which comprises spraying finely divided molten metal from a discharge nozzle upon a base composed of insulating material, and during the spraying operation, cooling the material of the base by directing a cooling fluid there-against to maintain the base at a temperature below the melting point of the metal being sprayed, thereby to insure the production of spray-deposited layer which is porous and permeable throughout, on said base.

7. The method of making electrodes for electrolytic devices which comprises spraying finely divided molten metal from a discharge nozzle upon an open-mesh fabric base, and during the spraying operation directing a current of gas to cool the sprayed metallic particles during their passage from the spray nozzle to the base to maintain the base at a temperature below the melting point of the metal being sprayed, thereby to insure the production of a spray-deposited layer which is porous and permeable throughout, on said base.

8. The method of making electrodes for electrolytic devices which comprises spraying finely divided molten metal upon a metallic base, and simultaneously directing a current of fluid to maintain the surface of the base upon which the molten metal is sprayed at a temperature below the melting point of the metal being sprayed, thereby to insure the production of a spray-deposited layer which is porous and permeable throughout, on said base.

9. The method of making electrodes for electrolytic devices which comprises spraying finely divided molten metal from a discharge nozzle upon a suitable base, and during the spraying operation directing a current of gas to cool the sprayed metallic particles during their passage from the spray nozzle to the base to maintain the base at a temperature below the melting point of the metal being sprayed, thereby to insure the production of a spray-deposited layer which is porous and permeable throughout, on said base.

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