UNITED STATES PATENT OFFICE.

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PROCESS OF MAKING DURABLE CARBON ELECTRODES FOR ELECTROLYTICAL PURPOSES.

934,988. Specification of Letters Patent. Patented Sept. 28, 1909.

No Drawing. Application filed April 27, 1907. Serial No. 370,738.

To all whom it may concern:

Be it known that we, GUSTAV ADOLPH, of Ammendorf, doctor of philosophy, a subject of the King of Prussia, and whose post-office address is Schachtweg, Ammendorf, near Halle, Prussia, German Empire, and ALBERT PIETZSCH, of Magdeburg, a subject of the King of Saxony, and whose post-office address is No. 34 Kaiser-Otto-Ring, Magdeburg, Prussia, German Empire, have invented a new and useful Process of Making Durable Carbon Electrodes for Electrolytical Purposes; and we do hereby declare that the following is a full, clear, and exact description of our invention, which will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to the making of carbon-electrodes for use in electrolyzing watery solutions, and it has for its object to render such electrodes more durable or lasting than the carbon-electrodes now in use.

It is a well-known fact that carbon-electrodes, after having served for some time in electrolyzing aqueous solutions, manifest an increased resistance to the electric current and that, moreover, the surface of such electrodes is softened to a certain depth. Now this softened condition of the carbon-electrode, as is well-known to electrolytical experts, facilitates a rapid destruction of the electrode by both chemical and mechanical actions. This softening of the carbon-electrode results from the fact that said electrode does not constitute a perfectly homogeneous body, whereas it is composed of very minute particles which adhere together more or less closely according to the quality of the carbon or graphite used, so that more or less fine interstices are left between them. If by the action of the current the surface of the carbon becomes somewhat softened or broken up, the contact with each other of the particles forming the surface is correspondingly diminished and consequently their electrically conducting connection with each other and with the inner particles is reduced. From this it results that one side of each of the loosened particles becomes a cathode and its opposite side an anode. This condition of the surface region causes chemical decompositions with the formation of compounds which in their turn act so as to accelerate the destruction of the carbon with the effect of deepening the broken up portion of the surface thereby causing the entire electrode to become rapidly destroyed.

All that has been said about carbon-electrodes holds good for electrodes made from graphite which therefore are true equivalents of carbon electrodes in this respect also. For this reason we wish it to be understood that the term "carbon-electrode" and "carbon" as used in the following part of the specification and the annexed claims shall comprise both electrodes of carbon and electrodes of graphite.

It is the object of our present invention to prevent the formation of said softened or broken up surface-region of carbon-electrodes to be used for electrolyzing watery solutions and to give such electrodes a high degree of durability throughout their body, so as to produce carbon-electrodes that are tenacious of life.

To obtain long-lived carbon-electrodes for electrolyzing watery solutions our present invention consists in providing for in the pores of the carbon or graphite an electrical conductor of the first order so as to establish a metallic connection between all of the carbon or graphite particles composing the electrode, said conductor of the first order being of such a nature as to resist the chemical action of the product or products formed at the electrode during the electrolytic process. For instance if the said product is chlorin, as in electrolyzing aqueous solutions of alkaline chlorids, the carbon or graphite is thoroughly impregnated with a solution of platinum chlorid, and after drying the impregnated carbon or graphite is heated up to the decomposition-temperature of platinum-chlorid, whereby metallic platinum is separated out in the pores of the carbon or graphite, the chlorin set free escaping into the atmosphere. It may be observed here that the provision of metallic platinum within the pores of a carbon-electrode cannot be brought about by electrolytical decomposition for the reason that at once so much platinum is deposited upon and in the surface region of the carbon or graphite treated that no current-lines can find their way into deeper regions, as may readily be proved by experiment.

We are aware that prior to our present

invention attempts have been made to cover carbon-electrodes with conductors of the first order. For instance the pores at and in proximity of the surface of carbon-electrodes have been mechanically filled with a chemically resistant paste in order to protect a metallic rod placed within the carbon-electrode for connecting the same with the source of electricity. In another instance carbon-electrodes have been coated with an electrolytically produced deposit of platinum to serve as an accumulator for hydrogen, such deposit requiring to be of a porous condition. In all known instances the aim was to improve the surface-region of the carbon electrode or to render it suitable for specific purposes, but never has it been tried to so proceed with the carbon-electrode as to give it a high degree of durability throughout its entire body. It is obvious that, as soon as such superficial covering as applied by prior inventors, is used up or damaged, the underlying carbon or graphite will be exposed and rapid destruction will take place, whereas, with our present invention, all of the carbon particles constituting the electrode are efficaciously protected against chemical actions for the reason that throughout the entire body of the electrode its carbon particles are electrically connected with each other by metallic bridges and thereby are hindered from becoming active as separate local electrodes. It is not absolutely necessary that the pores of the electrode are closely filled up with the conductor of the first order used.

What we claim as our invention is:—

1. The herein described process of making electrolytic electrodes resistant to chemical attack which comprises impregnating the carbon throughout the entire body of the electrode with an electrical conductor of the first order, forming conducting bridges between the particles of carbon, whereby local electrolytic actions between the particles of the electrode are prevented.

2. The herein described process of making electrolytic electrodes resistant to chemical attack which consists in impregnating the carbon throughout the entire body of the electrode with a solution of a compound of an electrical conductor of the first order, and subsequently treating the impregnated carbon to cause the metallic component of said compound to become freed and form conducting bridges between the particles of carbon throughout the entire mass, whereby local electrolytic actions between the particles of the electrode are prevented.

3. The herein described process of making electrolytic electrodes resistant to chemical attack which consists in impregnating the carbon throughout the entire body of the electrode with a solution of a platinum salt and decomposing said solution to form conducting bridges of platinum between the particles of carbon throughout the entire mass, whereby local electrolytic actions between the particles of the electrode are prevented.

4. The herein described process of making electrolytic electrodes resistant to chemical attack which consists in impregnating the carbon throughout the entire body of the electrode with a solution of platinum chlorid, drying the impregnated carbon and heating the mass up to the decomposing temperature of the platinum chlorid and thereby forming conducting bridges of platinum between the particles of carbon throughout the entire mass, whereby local electrolytic actions between the particles of the electrode are prevented.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses, viz. for both inventors.

GUSTAV ADOLPH.
ALBERT PIETZSCH.

Witnesses:
CARL LINDEMANN,
GUSTAV ESCHE.