UNITED STATES PATENT OFFICE.

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PROCESS FOR MANUFACTURING ANODES.

1,143,828. Specification of Letters Patent. Patented June 22, 1915.

No Drawing. Application filed May 17, 1913. Serial No. 768,377.

To all whom it may concern:

Be it known that I, PERCY CLAUDE CAMERON ISHERWOOD, Ph. D., a subject of the King of Great Britain and Ireland, residing at Moss Cottage, Bushey Heath, Herts, England, have invented certain new and useful Improvements Relating to Processes for Manufacturing Anodes, of which the following is a specification.

This invention relates to a process for the manufacture of anodes for the electrolysis of aqueous solutions of metallic salts such as zinc, copper and nickel, and it has for its object to employ natural manganese ores for the purpose.

For the electrolysis of such solutions anodes are usually employed that are not attacked by the electrolyte or the products of electrolysis. It has been proposed to employ anodes made of peroxid of manganese, and it has also been proposed to produce such anodes by heating nitrate of manganese within molds, by which anodes of peroxid of manganese are produced of a shape corresponding to the mold; but hitherto natural manganese ores have not effectively been employed.

The invention consists in the employment for the manufacture of such anodes of natural manganese ore after treatment for the removal of the impurities contained in it, and in the molding of this substance into the necessary shape in the manner hereinafter described by the use of a suitable binding agent. For the purpose of the invention I find that high-grade manganese ores are suitable, but natural ores generally contain impurities such as iron, nickel, or cobalt, which hitherto has hindered their employment for the electrolysis of zinc sulfate and other aqueous solutions.

In carrying the invention into effect I reduce natural high-grade manganese ores by grinding them into a finely divided condition, and I leach them in a solution of sulfuric acid or in a solution of nitric acid, or in the solution of any substance which does not attack manganese peroxid. By this means the impurities contained in the ore, such as, for example, iron, nickel, or cobalt, are dissolved out. I then mix the ore thus treated with a quantity of manganese nitrate (or instead I may spread over a layer of the ore a quantity of the manganese nitrate) for example, I find that a proportion equivalent to 60 per cent. of natural ore in the final product is effective; but I do not mix the ore with the full quantity of manganese nitrate. The manganese nitrate solution acts primarily as a binder for the comminuted ore. When heated and the nitrogen oxid compounds driven off, the anode becomes a mass of the treated ore held together or agglomerated by the manganese oxid produced from the nitrate. This is slightly porous in character. To diminish or remove this objection, repeated treatment with the nitrate solution is desirable. I first of all mix the ore with about one-half the necessary amount of the manganese nitrate in solution and work it into a paste on the mold or tray in which the anode is to be produced, and I distribute the paste in an even layer over the mold. I then heat this mixture on the mold or tray to a temperature of from 120 to 200 deg. C. until the water and the oxids of nitrogen are completely evolved. Upon the mass or cake thus produced I spread the remaining part of the necessary quantity of nitrate solution and the mass or cake on the mold or tray is again submitted to a temperature of from 120 to 200 deg. C. until the oxids of nitrogen are removed. A still further quantity of the manganese nitrate may then be spread over the cake for its impregnation, that is, if the necessary quantity has not already been used, or a further quantity of ore mixed with manganese nitrate. Thus the anode may be built up by repeated subjection to heat of the ore mixed or impregnated with manganese nitrate.

It will be understood that the quantity of nitrate solution may be applied in any number of stages as may be required, and that further quantities of ore mixed with nitrate may be added to build up the anode: but I prefer to apply the nitrate solution in constant proportion, that is to say, so that the final product shall contain a definite proportion of the natural ore, it being necessary to impregnate the cake or partially formed mass with the manganese nitrate so as to insure a hard and homogeneous final product.

It will thus be understood that the invention is not limited to any number of stages of heating of the mass of natural ore with the binding agent in the production of the final product. By such means the particles of the natural ore are impregnated with manganese nitrate and the mass is rendered dense and coherent by the peroxid of manganese which is produced on the heating of

the mixture. The product of such a process may, after being washed in water to remove any adherent powder, be used as an anode without any further treatment. In the use of such anodes no impurities pass into the electrolyte.

What I claim as my invention and desire to secure by Letters Patent is:—

1. A method of producing anodes which comprises comminuting natural manganese dioxid ore, subjecting said ore to treatment with sulfuric acid under conditions effective to remove all metallic compounds present other than manganese compounds, mixing the treated ore with a solution of manganese nitrate to form a paste, molding, drying, and heating to remove nitrogen compounds.

2. A method of producing anodes which comprises comminuting natural manganese dioxid ore, subjecting said ore to treatment with a solvent indifferent to manganese dioxid but capable of removing other metallic compounds present, mixing the comminuted ore so treated with a solution of manganese nitrate in quantity about one-half the necessary amount to make the anode non-porous, molding, drying, heating to drive off nitrogen oxids, charging with the remaining half of the manganese nitrate and again drying and heating.

3. The method of producing anodes which comprises comminuting natural manganese dioxid ore, subjecting said ore to treatment with sulfuric acid under conditions effective to remove all metallic compounds present other than manganese compounds, mixing the treated ore with a solution of manganese nitrate to form a paste, molding, drying, and heating to remove the nitrogen compounds from the nitrate, and saturating the anode so produced repeatedly and drying and heating to produce a dense coherent article.

4. A method of producing dense coherent electrodes of pure manganese dioxid from manganese ore, which consists in comminuting the ore, leaching with a suitable agent to secure the removal of iron, nickel and cobalt impurities, mixing the leached ore with a solution of manganese nitrate to make a paste, molding, drying, and heating to drive off nitrogen oxids, and repeatedly soaking the electrode with a solution of manganese nitrate, drying and heating, until the pores thereof become filled and it becomes dense and hard.

In testimony whereof I have hereunto signed my name to this specification in the presence of two subscribing witnesses.

PERCY CLAUDE CAMERON ISHERWOOD.

Witnesses:

ROBERT OWEN HUGHES,

HERBERT D. JAMESON.