

UNITED STATES PATENT OFFICE.

JOHN A. JEANÇON, OF NEWPORT, KENTUCKY.

PROCESS OF ELECTRO-DEPOSITING ALUMINUM.

SPECIFICATION forming part of Letters Patent No. 436,895, dated September 23, 1890.

Application filed December 30, 1889. Serial No. 335,410. (Specimens.)

To all whom it may concern:

Be it known that I, JOHN A. JEANÇON, a citizen of the United States, residing at Newport, Kentucky, have invented new and useful Improvements in the Process of Electro-Depositing of Aluminum, of which the following is a specification.

My invention relates to the electro-deposition of metals from aqueous solutions of their salts, having reference to the composition of solution, of anode, and the development of a commercially-available process involving their use for the plating of metallic and other objects with the metal aluminum.

So far as I am aware previous attempts to electroplate with aluminum have been unsuccessful for practical purposes, the reason being, in the light of my own experiments, the readiness with which aluminum in a state of fine subdivision decomposes water, forming a hydrated oxide in the deposit and preventing the deposition of a sufficiently-heavy layer for practical uses. This oxidation readily occurs even at a temperature of 100° Fahrenheit, and prevents further deposition of metal, either from the anode or from the electrolyte. The tendency to oxidize increases with the intensity of the current employed, and to the disregard of these and other conditions may be attributed, as I believe, the failure heretofore to obtain practical results.

In my improvement I employ, first of all, a saturated solution of persulphate of aluminum—that is to say, an acid sulphate of aluminum requiring a high temperature (preferably about 180° to 200° Fahrenheit)—to prevent crystallization. This high temperature is important not only in preserving the condition of supersaturation of the solution, but also in facilitating the dissolution of the molecules of the salt in the performance of the electrolytic work of the current, which in this case is of very low intensity, but of great quantity.

The anode in my present improvement is a plate composed of commercial aluminum having incorporated with it a separating substance affected neither by the current nor by the solution. I prepare it by melting the aluminum in a crucible and stirring in about thirty per cent. of carbon, kaolin, or finely-

subdivided asbestos or some other substance inert in the sense above indicated. I find carbon to be preferable, and the union, which is probably largely mechanical, is facilitated by the presence of a small quantity of hydrocarbon. The aluminum takes up an indeterminate quantity, and while agitated the mass is run out into flat molds and congealed.

The described composition of the anode modifies the action, probably, in several particulars: First, the uniform separation of the metallic molecules tends to distribute the current over the entire surface, thereby breaking up the electrolytic action into a vast number of lines of force of reduced intensity diffused throughout a wide area in relation to the cathode, while at the same time polarization is prevented; second, the separation of the metallic molecules of the anode increases by porosity the metal surface exposed to the dissolving action of the electrolyte without unduly enlarging the given field of conduction through the liquid to the cathode, thus facilitating the union of the freed oxygen with the anode molecules and in a manner protecting the deposited metal.

The other practical features and steps of the process are substantially the same as in the deposition of other metals from aqueous solutions of their salts, and need not be here specifically described.

The process indicated produces a dense and compact deposit of aluminum, which may be burnished and buffed by means and processes which I need not here describe, as they form no part of my present invention.

I may now explain that the excess of acid in the fluid electrolyte, while it facilitates the electrolysis by favoring the conduction of the current, also materially assists in preventing oxidation of the metal deposited upon the cathode by facilitating the evolution of hydrogen which passes off freely during the electrolytic action, and may be taken as a visible indication of the proper working of the process. The supersaturation and the acidity of the solution tend also to prevent the formation of a hydrated oxide in the deposit, since such is immediately converted by the free acid into the salt of the electrolyte. Under these conditions the solution is

constantly replenished from the anode, and as the process goes on it becomes more effective by the self-adjusting equilibrium of its elements, and a reguline deposit of great density and of any desired thickness is produced.

Assuming the electrolytic chain to be anode (Al) — $x(\text{Al}_2\text{O}_3, 3\text{SO}_3)$, $x\text{HO} + x\text{SO}_3$ — cathode, I suppose the electrolytic action to be as follows: (1), decomposition of HO: H, liberated at cathode, is partially lost; O, liberated at anode, recombines therewith = Al_2O_3 ; (2), decomposition of $\text{Al}_2\text{O}_3, 3\text{SO}_3$; depositing Al_2 at cathode and liberating O_3 and 3SO_3 : (a) O_3 recombines with 3H , evolved as in (1) = 3HO ; (b) 3SO_3 recombines with Al_2O_3 of anode, formed as in (1), = $\text{Al}_2\text{O}_3, 3\text{SO}_3$, which restores the electrolyte.

I claim and desire to secure by Letters Patent of the United States—

1. The process of electro-depositing aluminum, consisting in subjecting a supersaturated acid solution of an oxysalt of aluminum in water to the action of an electrolytic current passed through the electrolyte between an anode plate of aluminum in a state of division or porosity, presenting a relatively large exposure of surface within a given field

of electrolytic force, and a suitable metallic cathode to be plated, substantially as set forth.

2. The process of electro-deposition of aluminum, consisting in subjecting a highly-concentrated solution of an aluminum salt maintained at a high temperature (preferably 180° to 200° Fahrenheit) to the action of an electrolytic current passed through the electrolyte between a suitable anode plate containing aluminum and a metallic cathode to be plated, substantially as set forth.

3. The process of electro-depositing aluminum, consisting in suspending the cathode to be plated and an anode plate composed of aluminum and a separating substance not affected by the electrolyte or the electric current, in a highly-heated saturated acid solution of an aluminum salt, and passing an electric current through the solution between said electrodes, substantially as set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JOHN A. JEANÇON.

Witnesses:

L. M. HOSEA,
ELLA HOSEA.