

UNITED STATES PATENT OFFICE.

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PROCESS OF METAL-PLATING ALUMINUM.

1,256,954.

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No Drawing.

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To all whom it may concern:

Be it known that I, WILLIAM J. TRAVERS, a citizen of the United States, and a resident of Buffalo, in the county of Erie and State of New York, have invented a new and Improved Process of Metal-Plating Aluminum, of which the following is a full, clear, and exact description.

My invention relates to a process of metal-plating aluminum, and has reference more particularly to electro-plating and the subsequent treatment therefor whereby a perfect adherence is obtained between the aluminum object and the metal film deposited thereon. It is well known that when aluminum is electro-plated according to the established methods, the deposited film of metal does not adhere to the surface of the aluminum object and may be readily stripped therefrom. I have discovered that when a metal is deposited on an aluminum object by means of electro-plating and the object is subjected to uniform heat, a perfect adherence takes place between the film of metal deposited thereon by electro-plating and the aluminum object. An aluminum object which has been electro-plated and treated according to my method possesses all the qualities of electro-plated metal. The strong adherence of the film of metal on the aluminum object makes possible buffing the object to a higher luster and permits the making of soldered joints or connections with the ordinary solders.

The aluminum object to be metal plated according to my method or process is first cleaned, preferably electrolytically, as such a cleaning adapts itself better to electro-plating, particularly when it is desirable to attain a high polish in the finished article. The aluminum to be plated is made cathode in alkaline solution, which is preferably a hot solution of bicarbonate of soda and carbonate of soda containing about six ounces of bicarbonate of soda and three ounces of carbonate of soda to a gallon of water; then the aluminum object is made cathode in an acid solution, which is preferably a hot solution of oxalic acid containing about eight ounces of acid to a gallon of water. In other words, the aluminum is successively made a cathode in an alkaline bath and then in an acid bath. The object is preferably rinsed in cold water when it is transferred from the alkaline bath to the acid bath, and also when it is transferred from the acid bath to

the electrolyte to be electroplated. The aluminum object may also be electrolytically cleaned by making it successively an anode and a cathode in a metallic salt solution, e. g., sodium nitrate.

The preliminary treatment of the object can also be made as follows: The object is first treated with a grease solvent, such as alcohol, petroleum, carbon disulfid, etc., when the aluminum object is highly polished and the polish is to be retained previous to electro-plating. If the polished surface is of secondary importance, the aluminum article may be immersed in a solution of a basic salt or a base which is preferably a hot solution of strong sodium carbonate or sodium hydroxid or both together. The aluminum article should be repeatedly removed from the caustic solution and gently scrubbed. When it is evident that the action of the caustic solvent on the aluminum is sufficient the article is placed in a moderately hot solution of an acid, preferably nitric. It is preferable that previous to the immersion of the article in acid the same should be rinsed in cold water.

From the acid bath the aluminum article is transferred to the electrolyte containing the metal with which the object is to be covered. The electrolyte is preferably acidulated with a suitable acid, such as boric or citric. If the aluminum object is to be electroplated with nickel, the electrolyte will be the nickel ammonium sulfate acidulated with boric acid. The current density employed in the plating is large in order to effect a rapid deposit of the metal upon the aluminum. The electrolyte should be kept at a temperature of about 65 degrees centigrade.

The final heat treatment consists in subjecting the article to a gradually increasing temperature uniformly applied to the object. When commercial aluminum sheets are plated, and it is not desired to have the aluminum annealed, the temperature should not exceed 240 degrees centigrade. When the annealing is not material, the temperature can be raised, and the adherence of the plated metal to the aluminum increases proportionately within a certain limit, depending on the metal with which the aluminum is plated. Heat may be used under the ordinary atmospheric pressure, or, if desired, in a different atmosphere and under a pressure other than atmospheric pressure. The application of heat to the

electro-plated metal is essential to the perfect adherence of the metallic deposit to the surface of the aluminum on which it is formed.

5 The advantage of plating with nickel is that the temperature required for effecting adherence between the aluminum and the deposit is lower than the temperature at which aluminum becomes annealed. In
10 other words, it is possible to so regulate the temperature during the heat treatment that the hardness of the aluminum will remain unimpaired. It is only necessary to raise the temperature of the plated aluminum until it is a few degrees less than the critical
15 annealing temperature of the aluminum. It is of the greatest importance that the plated article have its temperature raised gradually and uniformly, owing to the different expansive capacities of the metals; the heat
20 should be allowed to soak in so that the aluminum may exert a uniform pressure upon its metallic envelop.

After electro-plating the aluminum article, it should be well rinsed in water and dried for some time at a temperature of about 100 degrees centigrade. It is essential that this drying should be complete, otherwise gases will be retained in the metals and
30 may cause subsequent blistering of the deposit, during heat treatment.

Although aluminum itself can be electro-plated with other metals than nickel by the method as described, I find it is preferable
35 to first electro-plate the object with nickel and then reelectroplate the nickel-plated aluminum object with the other metal. This second electro-plating can be made before or after the application of heat; but if the second electro-plating is made before the application of heat, the heat can be applied after the second electro-plating so as to obtain the adherence of the deposit to the surface of the aluminum object.

45 From the above description it will be seen that my process consists in cleaning the surface of the aluminum object to be electro-plated, electro-plating the same, and then heating the electro-plated object to obtain adherence between the film of metal deposited and the surface of the object.

While I have described the main and secondary steps, which I now consider to be the best embodiment thereof, I desire to have it
55 understood that the process described is merely illustrative and that such changes may be made as are within the scope of the appended claims.

I claim:

60 1. A process for nickel-plating aluminum objects, which consists in cleaning the surface of the objects electrolytically, then electro-plating the so-treated objects in an electrolyte containing nickel ammonium sulfate
65 acidulated with boric acid, then drying the

so electro-plated objects thoroughly at a temperature of about 100 degrees centigrade, then subjecting the so-dried objects to the uniform action of heat gradually increased to a temperature of not less than 70 240 degrees C.

2. A process for nickel-plating aluminum objects, which consists in making the object a cathode in an alkaline solution, then in an acid solution, then electro-plating the
75 so-cleaned object in an electrolyte containing nickel ammonium sulfate acidulated with an acid, then drying the so-electro-plated object thoroughly, and then subjecting the so-dried object to the uniform action
80 of heat gradually increased to a temperature of not less than 240 degrees centigrade.

3. A process for nickel-plating aluminum objects,—which consists in electroplating the aluminum objects in an electrolyte containing acidulated nickel ammonium sulfate,
85 and then subjecting the so-electroplated objects to the action of heat sufficient to produce the adherence of the nickel with the aluminum.

4. A process for metal plating aluminum objects which consists in cleaning the aluminum objects electrolytically, then electro-plating the so-treated objects and then submitting the electroplated aluminum objects
95 to the action of heat to a temperature sufficient to produce the adherence of the electroplated metal with the aluminum.

5. A process for metal-plating aluminum, which consists in electroplating the aluminum in an electrolyte containing a metal
100 of the iron group and then subjecting the electroplated aluminum to the action of heat sufficient to produce the adherence of the electroplated metal with the aluminum.

6. A process for metal-plating aluminum, which consists in electroplating the aluminum in an acidulated electrolyte containing metallic salts of the iron group, then subjecting the so-electroplated aluminum to
110 the action of heat sufficient to produce the adherence of the electroplated coating with the aluminum.

7. A process for metal-plating aluminum, which consists in electroplating the aluminum in an electrolyte containing metallic salts of the iron group, then drying the electroplated aluminum thoroughly at a temperature of about 100° centigrade, then subjecting the so-treated aluminum to the action of heat, gradually increasing to substantially 240° centigrade.

8. A process for metal-plating aluminum, which consists in making the aluminum a cathode in an alkaline solution, then electro-plating the so-cleaned aluminum in an electrolyte containing salts of metal of the iron group, then subjecting the electroplated aluminum to the action of heat at a temperature of not less than 240° centigrade.

9. A process for metal-plating aluminum, which consists in cleaning the aluminum electrolytically, then electroplating the so-cleaned aluminum in an electrolyte containing salts of metals of the iron group, then drying the object and then subjecting the electroplated aluminum to the action of heat sufficient to produce the adherence of the electroplated coating with the aluminum.

10. A process for nickel-plating aluminum objects, which consists in electroplating the aluminum object in an electrolyte containing salts of nickel, and then subjecting the so-electroplated aluminum to the action of heat sufficient to produce the adherence of nickel with the aluminum.

11. A process for metal-plating aluminum, which consists in cleaning the aluminum electrolytically, then electroplating the aluminum with a metal of the iron group, then electroplating the so-plated aluminum with a metal of another group, then subjecting

the so-plated aluminum to the action of heat sufficient to produce adherence of the metal of the iron group with the aluminum.

12. A process for metal plating aluminum, which consists in electroplating the aluminum with metals of the iron group, then electroplating the so-plated aluminum with metals of other groups, again electroplating the so-electroplated object with metals of the iron group, and then subjecting the so-plated object to the action of heat sufficient to produce the adherence of the initially-plated metals of the iron group to the aluminum.

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

WILLIAM JOSEPH TRAVERS.

Witnesses:

HARRY W. LAUER,
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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."