

UNITED STATES PATENT OFFICE.

LEO DAFT, OF RUTHERFORD, NEW JERSEY, ASSIGNOR TO ELECTRO-CHEMICAL RUBBER & MANUFACTURING COMPANY, A CORPORATION OF NEW JERSEY.

METHOD OF ELECTROPLATING.

1,042,533.

Specification of Letters Patent.

Patented Oct. 29, 1912.

No Drawing. Original application filed January 28, 1911, Serial No. 605,170. Divided and this application filed February 17, 1912. Serial No. 678,363.

To all whom it may concern:

Be it known that I, LEO DAFT, a subject of the King of Great Britain, and a resident of Rutherford, in the county of Bergen, in the State of New Jersey, have invented a new and Improved Method of Electroplating, of which the following is a specification.

My invention relates to a method of electroplating with a plurality of metals and is adapted for use in cases where the electroplating bath contains a plurality of metals in solution or where the anodes are composed of a plurality of metals preferably in the form of an alloy.

My invention is particularly useful when one of the metals to be plated is antimony and such plating is carried on for the purpose of attaching rubber to the surface thus formed by direct vulcanization, as described in my pending application Serial No. 564,840 filed June 3, 1910.

Although my invention may be practised with other metals and solutions and by the use of different steps, I shall describe it with reference to those disclosed in my pending application No. 605,170, filed January 28, 1911, of which this application is a division, since it has great utility in this connection. However, I do not wish to confine myself to the precise ingredients, proportions or steps therein disclosed, since, obviously, these ingredients have well known chemical equivalents and since the steps may be widely varied without departing from the spirit of my invention.

One method of practising my invention and that described in my herein referred to pending application, No. 605,170, is as follows: I first cast an alloy containing approximately 60 parts of copper, 38 parts of zinc and 2 parts of antimony and puddle the molten metal thoroughly to obtain a homogeneous alloy. I then dissolve this alloy in nitric acid, using approximately one ounce of alloy to 5 ounces of nitric acid at 36 Baumé. This solution is then diluted with water so that the resulting solution contains 2 oz. of alloy to $\frac{1}{2}$ gallon, and is neutralized with ammonia. When the solution is neutralized it will have assumed a clear sapphire blue color. I then add a sufficient quantity of a solution of potassium cyanid at a specific gravity of 1200, to cause the

solution to assume a clear light straw-color. I then dilute this until 1 gallon of the solution contains 1 oz. of the alloy. This completes one of the solutions used in the preparation of the electrolyte, which I shall call solution No. 1.

Another solution, which I shall call solution No. 2, is prepared in the following manner: I first cast an alloy containing 60 parts of copper and 40 parts of zinc, which I dissolve in nitric acid and dilute so that one ounce of the alloy is contained in one-half a gallon. I then add ammonia to neutralize the solution in the same manner as in solution No. 1, and add about 12 ounces of potassium cyanid solution at a specific gravity of 1.200. I then dilute until 1 oz. of the alloy is contained in 1 gallon of the solution. I then have two solutions—No. 1, which will have a specific gravity of approximately 1.032 to 1.035 and contains the antimony, and No. 2, which will have a specific gravity of 1.030 to 1.035 and is used as a diluent. During the making of these solutions some loss will occur due to evaporation of water and nitric acid, so that the quantities given above are not exact.

I find it preferable to keep the solutions at a temperature of approximately 200° Fahrenheit during the dissolution of the alloys. Solutions 1 and 2 are then mixed together in variable proportions depending upon the antimony contained of the alloy it is desired to deposit, a greater proportion of solution No. 1 being used if it is desired to obtain a deposit high in antimony and a greater proportion of solution No. 2 being used if it is desired to secure a deposit low in antimony. The electrolyte is then put in the plating tank and maintained at a temperature of 70° Fahrenheit, the article to be plated forms the cathode and the anode consists of an alloy of copper, zinc and antimony. I find that a potential of about 3.75 volts is preferable for this plating and that the distance between the cathode and anode should be approximately 10 centimeters.

I have discovered that I can vary the amounts of various metals deposited from an alloy anode by varying the proportions of the constituent metals of the alloy, the bath remaining practically constant in its proportions. Thus, if I find that I wish to deposit an alloy of a higher antimony con-

tent, I may increase the antimony content of the anode so that while an anode consisting of 30 parts copper, 38 parts zinc and 2 parts antimony is suitable for a bath such as I have described, I may, by using an anode having say $2\frac{1}{2}$ parts antimony, increase the antimony content of the alloy deposited upon the cathode. A convenient way of accomplishing this result is to have at hand a number of anodes of varying composition and make use of that best suited for the purpose. I have also discovered that the relative proportions of the metals constituting the alloy deposited may be varied by varying the potential of the current used for electroplating. Thus using the same bath and alloy anode I may increase the amount of antimony by raising the potential of the current. On the other hand, if I desire to decrease the relative amount of antimony deposited I can accomplish this result by decreasing the potential of the current. I also find that a still greater increase in the potential of the current will increase the rate of deposition of zinc in an alloy such as described above.

Having described one method in which my invention may be practised, although obviously other equivalent methods may be used, what I claim and desire to secure by Letters Patent is:

1. The method of electroplating from an electrolyte formed of a plurality of metals in solution, one of which is antimony, which consists in varying the potential of the current employed to vary the percentage of an-

timony deposited with respect to the other metals.

2. The method of electroplating from an electrolyte formed of a plurality of metals in solution, two of which are antimony and zinc, which consists in varying the potential of the current employed to vary the percentage of antimony and zinc deposited with respect to the other metals.

3. The method of electroplating from an anode of an alloy of plurality of metals, one of which is antimony, which consists in varying the potential of the current employed to vary the percentage of antimony deposited with respect to the other metals.

4. The method of electroplating from an anode of an alloy of a plurality of metals, two of which are antimony and zinc, which consists in varying the potential of the current employed to vary the percentage of antimony and zinc deposited with respect to the other metals.

5. The method of electroplating from an electrolyte formed of a plurality of metals in solution, which consists in using an anode of an alloy of metals, one of which is antimony and varying the antimony content of the anode to vary the antimony content of the metal deposited.

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

LEO DAFT.

Witnesses:

WALTER S. JONES,
MARGARET MACINTYRE.