

# UNITED STATES PATENT OFFICE.

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## ELECTROLYTIC PROCESS.

SPECIFICATION forming part of Letters Patent No. 894,658, dated March 4, 1902.

Application filed December 11, 1900. Serial No. 39,568. (No specimens.)

*To all whom it may concern:*

Be it known that I, JULES MEURANT, a citizen of the Kingdom of Belgium, residing at Liege, Belgium, have invented certain new and useful Improvements in Electrolytic Processes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Hitherto in the electrolytic precipitation of metals there have not yet been attained the desiderata of simultaneously realizing and in an economical manner the highly-adherent deposit of metals or of their alloys while not absorbing an unduly large electromotive force for the decomposition of the salts. This double object has been attained by the present invention. These advantages are also very happily completed by the fact of being able to constitute the baths at a low price and by the property possessed by these baths of being durable and very resistant to evaporation. From all these advantages it is evident that the above-indicated process is particularly suitable to be largely utilized in industry, enabling beautiful and good products to be manufactured at low and remunerative prices. The figures, experiments, and results attained, on a large scale, in practical working (quoted below) enable this process to be appreciated at its real industrial value.

To attain the above results, the bath containing the solutions of metals or alloys and the substances used to favor the electric and chemical action is completed by the addition of the following substances, which, according to the decompositions to be obtained, will be added to the baths either singly or else mixed together and in various proportions, according to the kind of metals or alloys to be obtained. These substances are arabit, arabinose, xylose, rhamnose or isodulcite, saccharin, isosaccharin, metasaccharin, mannite, dulcite, sorbite, triose or glycerose, tetrose or erythrose, pentose, mannose, glucose, galactose, pructose, sorbinose, formose, acrose, methylenitan, glucoazone, isoglucosamine, osone, glucosone, glucosamine, the mannoses, methylexose, mannoheptose, glucoheptose, methylheptose, mannoctose, nonose, menno-

nonose, saccharose, lactose, maltose, mycose or trehalose, melibiose, raffinose or melitose, melitriose, meleotose, also, the following monoacids, the biacids, and the triabasic acids: the acids arabonic, aposorbinique, trioxylglutaric, saccharonic, trioxyadipinic, desoxalic, oxycitronic, dioxypropantricarmonic, as also the aldehydes and the ketones, hexavalents—that is to say, the acids mannitic, gluconic, dextrinic, mannonic, galactonic, &c., the saccharic, mucic, isosaccharic acids, &c. I add also all the class of gums comprising especially arabine, gum-arabic, the gums of the country obtained from plum-trees, cherry-trees, apricot-trees, &c., wood-gum, vegetable mucilage, anisie bassorin, pectic matters. I add also the classes of collagenous and chondrogenous matters containing ossein, glutine or gelatine and all the kinds of glues, as also chondrin and chitine.

The following are examples of baths prepared according to my invention, such baths being composed of the materials stated in about the proportions given.

First, for the deposit of zinc I employ (a) chlorid of zinc, one kilogram; (b) carbonate of soda, two hundred and fifty grams; (c) chlorid of ammonium, five hundred grams; (d) gum-arabic, three hundred grams. The gum-arabic may be replaced by five hundred grams of sugar or seven hundred and fifty grams of glucose or molasses. The chlorid of zinc is precipitated by the carbonate of soda. Then this precipitate is dissolved in the chlorid of ammonium and gum-arabic, and it is filtered.

Second, for the deposit of tin: (a) protochlorid of tin, one kilogram; (b) caustic potash, five hundred grams; (c) tartaric acid, two hundred grams; (d) gum-arabic, one hundred and fifty grams. The protochlorid of tin and caustic potash are dissolved together, likewise the tartaric acid and the gum-arabic. The whole is mixed together and filtered. The gum-arabic may be replaced by two hundred grams of sugar or three hundred grams of glucose or molasses.

Third, for the deposit of nickel: (a) sulfate of nickel, five hundred grams; (b) chlorid of ammonium, two hundred and fifty grams; (c) citric acid, fifty grams; (d) gum-

arabic, five hundred grams. The sulfate of nickel and the chlorid of ammonium are dissolved together and likewise the citric acid and gum-arabic. The whole is mixed together and filtered. If the bath is too acid, it is necessary to neutralize it. Seven hundred and fifty grams of sugar or one thousand grams of glucose may replace the gum-arabic.

Fourth, for the deposit of copper: (a) sulfate of copper, three hundred grams; (b) cyanid of potassium, two hundred grams; (c) ammonia, one hundred grams; (d) gum-arabic, one hundred grams. The sulfate of copper is dissolved in warm water, the ammonia is added to it, the whole is precipitated by the cyanid (b) until a deep-brown discoloration has been obtained, the gum-arabic is added, and the whole filtered. One hundred and fifty grams of sugar or two hundred grams of glucose may replace the gum-arabic.

Fifth, for the deposit of silver: (a) cyanid of potassium, five hundred grams; (b) cyanid of silver, two hundred and fifty grams; (c) gum-arabic, two hundred and fifty grams. Three hundred and fifty grams of sugar or four hundred and fifty grams of glucose. Two hundred and fifty grams of silver are dissolved in seven hundred and fifty grams of nitric acid, the nitrate obtained in four thousand five hundred cubic centimeters of distilled water, hydrocyanic acid is poured into this solution until a precipitate is no longer formed, the precipitate is collected and washed. A solution of five hundred grams of potassic cyanid in ten liters of water receives the precipitate of cyanid of silver. It is dissolved in it by a prolonged boiling during an hour. Finally, after filtration the two hundred and fifty grams of gum-arabic are added.

All these baths and others have been successively tried in the laboratory and in small commercial installations. The success of these trials has caused me and my employers to make trials on a large scale in a factory specially arranged for the purpose. These trials have succeeded completely and have shown the practical value of the process. No alteration of the baths has been found after four months of uninterrupted trials.

The voltage employed has varied according to circumstances from 0.3 to one volt without ever exceeding this latter figure, with an intensity of current from one-half to one ampere per square decimeter of surface covered.

The constancy of the bath, the non-evaporation of the bath, the feeble voltage required, the quantity of metal precipitated, one hundred and twenty-five grams of zinc per square meter, constitute so many features which give to the present invention an incontestible commercial value. With regard to the value and perfection of the products obtained these latter only confirm the excellence of the process, as may be

judged by the following trials made upon steel tubes to be used in the Dutch navy. First trial: the crushing of the tube throughout its entire length, so as to completely flatten it; second trial: the flattened tube is again taken and folded upon itself in the direction of its width; third trial: the flattening of a ferrule of the tube in the direction of its length—that is to say, that a ferrule cut in the tube is crushed following or in line with the axis of the cylinder; fourth trial: trial of the traction of a tube crushed at its two ends and held in two jaws. This tube, made of Swedish steel, has elongated twenty-seven per cent. and has shown forty kilograms of resistance to traction per square millimeter. All these trials, made after galvanization of the articles, have shown the perfect adherence of the layer of zinc upon steel, neither the flattening, bending, stretching, or tearing have shown the least alteration of the protecting layer of zinc. This latter has remained perfectly adherent. Even upon the stretched tube the layer of zinc has followed the steel in its extension without presenting the least break. All these trials of resistance demonstrate in addition that the process does not take away from the resisting properties of the steel submitted to the galvanizing process, which is sufficient to distinguish it from other electrolytic galvanizing processes. All the articles experimented upon have been in addition submitted to special trials to determine the value of adherence of the zinc after these severe tests. Even in this case the layer of zinc remains a perfect protection and prevents the action of rust. In addition, examination under a magnifying-glass of the articles submitted to tests of resistance has not shown any trace of scaling, scratching, or lifting.

The above description demonstrates beyond measure both the novelty and commercial value of the process.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. The process of coating easily-oxidizable metals with metals less oxidizable and whose chlorids are soluble in water, which consists in forming an aqueous solution of the chlorids of said metals, adding thereto a compound of a metal of the alkalies containing oxygen and adding thereto a solution of chlorid of ammonia and a carbohydrate, placing in the mixture the body to be coated as cathode with a suitable anode and passing an electric current, substantially as and for the purpose set forth.

2. The process of coating easily-oxidizable metals with metals less oxidizable as zinc and tin, which consists in forming an aqueous solution of the chlorids of said metals, adding thereto a compound of a metal of the alkalies containing oxygen, adding thereto ammonium chlorid and a solution containing a

sugar and gelatin, placing in the mixture the body to be coated as cathode with a suitable anode and passing an electric current of not over one volt, substantially as and for the purpose set forth.

3. The process of coating easily-oxidizable metals with zinc, which consists in forming a solution of a suitable salt of zinc, precipitating zinc by means of a suitable carbonate, dissolving the latter by means of ammonium chlorid and adding to the solution gelatin, placing the metallic body to be coated in said solution with a suitable electrode and passing a current of electricity, substantially as described.

4. The process of coating easily-oxidizable

metals with zinc, which consists in forming a solution of a chlorid of zinc, adding thereto carbonate of an alkali metal, chlorid of ammonia and gelatin, placing in said solution the body to be coated and a suitable electrode and passing an electric current of not over one volt, and a density of not over one ampere per square decimeter, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

JULES MEURANT.

Witnesses:

JULES MARIE HUBERT JOSEPH MONCHAMP,

HUBERT FRAINIUX.