

UNITED STATES PATENT OFFICE.

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ELECTRODEPOSITION AND REFINING OF ZINC.

1,059,233.

Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that we, URLYN CLIFTON TANTON and JOHN NORMAN PRING, subjects of the King of England, residing at Whalley Range, Manchester, Lancashire, and Sandbach, Cheshire, England, respectively, have invented certain new and useful Improvements in the Electrodeposition and Refining of Zinc, of which the following is a specification.

This invention relates to improvements in the electro-deposition of zinc upon the surface of iron and other metals and comprises an electrolyte of improved composition.

According to this invention a process for the electrolytic deposition of metallic zinc from its salts consists in adding to the solution of the salt a large proportion of acid as for example 10-30% and a small proportion of an addition agent, preferably a colloid agent such as gum tragacanth and electrolyzing the solution with a current of high density. The solution is preferably a saturated solution of zinc sulfate, the acid is preferably sulfuric acid. The addition agent or colloid agent is one which fulfils the following conditions: (1) The addition agent or colloid agent must be soluble in the electrolyte *i. e.* it must not be precipitated by the zinc salt or by the acid. (2) The addition agent or colloid agent must increase the over-voltage *i. e.* the electrical potential necessary for the separation of hydrogen thus giving preference to the electrolytic deposition of zinc.

The addition agent or colloid agent which we have found best for the purpose of this invention is gum tragacanth.

The process may conveniently be used for extracting zinc from its ores and according to this invention a process for so extracting zinc consists in forming a solution of a salt of zinc, as for example zinc sulfate, and thereafter adding a large proportion of acid and a small proportion of the addition agent or colloid agent such as gum tragacanth to the solution and electrolyzing for the deposition of the metal, with a current of high density.

As an example of this invention a solution for depositing zinc consists of zinc sulfate dissolved in water to which solution is added for example 10-11% by weight of sulfuric acid, sufficient zinc sulfate being dissolved to give the acid solution a specific

gravity of 1.38 to 1.4. Gum tragacanth is added in the proportion of 0.1 to 1.0%. Preferably a solution of the gum is prepared by first adding alcohol to form a paste and thereafter adding water. The addition of the alcohol prevents the gum forming into lumps when the water is added. If it is required to deposit the zinc on a metal article the article is placed in the solution and connected to the electrical supply as the cathode, the anode being formed of either zinc or of any substance which does not go into solution, as for example, lead peroxid or manganese dioxid.

Current is passed through the solution at a very much higher density than is usually employed in electrolytic deposition of zinc. For example 500 amperes per square foot of cathode is a suitable density. Densities of one-fifth of this amount may be used with equal success. It is found that by using this high current density a great amount of time is saved as the metal comes down much faster.

The novel features of the process according to this invention for depositing zinc and the advantages which accrue therefrom are:—

(a) The very high current density that is employed and the consequent saving of time and plant in depositing the metal.

(b) The deposits obtained are of a specially fine quality, smooth and lustrous. It is known that the metal comes down in a hard condition when high current densities are used but these high densities hitherto have been impossible owing to the small amount of acid mixed with the solution, usually about 1% or less, and its consequent high resistance. The drawback to the use of high densities however has been that the zinc comes down in non-adherent, powdery form, or in crystal form, the crystals growing between the anode and cathode and later short-circuiting the cell. The addition of the addition agent or colloid or gum prevents this crystal formation and the metal comes down firm and lustrous.

(c) Commercial materials may be used in preparing solutions as it is found that most impurities have no effect in the presence of the addition agent or colloid and the large quantity of acid. For example, the presence of iron, which is a frequent impurity in zinc refining and which also has a bad effect on the electrolytic deposition of zinc, is im-

material in a solution prepared according to this invention.

(d) The solution does not require so much attention as has hitherto been necessary and it is not necessary so frequently to regenerate it owing to the wide limits of concentration between which the deposition is successful. From 10-30% of acid may be present.

(e) The process is well adapted for plating on aluminium, which is in general a matter of extreme difficulty.

(f) In the case of zinc refining the electrolyte may be used without moving or rotating the cathodes or agitating the solution.

(g) Owing to the high concentration of the acid and the wide limits between which the concentrations may be varied it is specially easy to make up solutions, zinc and zinc oxide being very readily soluble in the solution.

The invention is found most useful for galvanizing wire electrically, a process which hitherto has been impossible owing to the low current densities which it has been necessary to use. With a low current density it is necessary to keep a length of wire in the galvanizing bath for perhaps two hours whereas with the current densities employed in the present process it is possible to galvanize the wire in a much shorter time.

The electrolyte while primarily designed for the deposition of zinc on metal surfaces may be employed as an electrolyte in accumulators and for secondary batteries in which a zinc cathode is used.

What we claim as our invention and desire to secure by Letters Patent is:—

1. The herein described process for the electrolytic deposition of metallic zinc which consists in first forming a solution of zinc and adding to the solution from 10 to 30 per cent. of acid and a small proportion of an addition agent and electrolyzing the solution with a current of high density.

2. The herein described process for the electrolytic deposition of metallic zinc which consists in first forming a solution of zinc and adding to the solution from 10 to 30 per cent. of acid and a small proportion of a colloid agent and electrolyzing the solution with a current of high density.

3. The herein described process for the electrolytic deposition of metallic zinc which consists in first forming a solution of zinc and adding to the solution from 10 to 30 per cent. of acid and a small proportion of gum tragacanth and electrolyzing the solution with a current of high density.

4. The herein described process for the electrolytic deposition of metallic zinc from its salts which consists in adding to a solution of the salt a large proportion of acid,

and a small proportion of gum tragacanth and electrolyzing the solution with a current of high density.

5. The herein described process for the electrolytic deposition of metallic zinc from zinc sulfate which consists in adding to the solution of the salt a large proportion of sulfuric acid and a small proportion of an addition agent and electrolyzing the solution with a current of high density.

6. The herein described process for the electrolytic deposition of metallic zinc from zinc sulfate which consists in adding to the solution of the salt from 10 to 30 per cent. of sulfuric acid and a small proportion of a colloid agent and electrolyzing the solution with a current of high density.

7. The herein described process for the electrolytic deposition of metallic zinc from zinc sulfate which consists in adding to the solution of the salt a large proportion of acid and a small proportion of gum tragacanth and electrolyzing the solution with a current of high density.

8. The herein described process for the electrolytic deposition of metallic zinc from zinc sulfate which consists in adding to a solution of the salt a large proportion of sulfuric acid and a small proportion of an addition agent and electrolyzing the solution with a current of high density.

9. The herein described process for the electrolytic deposition of metallic zinc from zinc sulfate which consists in adding to a solution of the salt a large proportion of sulfuric acid and a small proportion of a colloid agent and electrolyzing the solution with a current of high density.

10. The herein described process for the electrolytic deposition of metallic zinc from zinc sulfate which consists in adding to a solution of the salt a large proportion of sulfuric acid and a small proportion of gum tragacanth and electrolyzing the solution with a current of high density.

11. The herein described composition of matter for use as an electrolyte and consisting of a solution of a zinc salt, from 10 to 30 per cent. of sulfuric acid and a small proportion of a colloid agent.

12. The herein described composition of matter for use as an electrolyte and consisting of a solution of a zinc salt, a large proportion of an acid and a small proportion of gum tragacanth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

URLYN CLIFTON TAINTON,
JOHN NORMAN PRING.

Witnesses:

HAROLD CRORDALE,
DORIAN FAIRLIE.