UNITED STATES PATENT OFFICE.

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RECOVERING ZINC FROM ITS SOLUTIONS.

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To all whom it may concern:

Be it known that we, FREDERICK LAIST and JAMES ORR ELTON, citizens of the United States, residing at Anaconda, in the county of Deerlodge and State of Montana, have invented certain new and useful Improvements in Recovering Zinc from Its Solutions, of which the following is a specification.

This invention relates to the electrolytic recovery of zinc in reguline form from aqueous solutions of its salts.

It is known that the commercial recovery of zinc by electrodeposition presents serious technical difficulties. The deposit, even when initially satisfactory, tends to become poorer in quality as the deposition proceeds, and the current efficiency is apt to be progressively lower. In many cases moreover the deposits are not readily stripped from the cathodes.

We have found that when certain highly electropositive metals, and specifically substantially pure aluminum, are used as cathodes for the recovery of zinc from its solutions, the operation proceeds with relative smoothness and regularity, and with comparatively good current efficiencies; such cathodes will moreover take an excellent deposit of zinc for an indefinite period; that is to say, the cathode may be repeatedly used, the deposited metal being stripped at appropriate intervals in accordance with the usual metallurgical practice.

We have observed however that the presence of certain metallic or other impurities in or on the aluminum surface exerts a profound influence upon the course of the deposition. For example, an aluminum plate containing four or five per cent. of copper will often take no deposit of zinc, no matter how long it may be left in the electrolyte, or how strong a current may be used. The zinc appears to dissolve practically as rapidly as it is deposited. Similarly, an aluminum cathode containing only one or two per cent. of copper will scarcely take a deposit of zinc after it has been used a few times; whereas a substantially pure aluminum plate, for example a plate containing no copper or only a small fraction of a per cent. of this metal, will under precisely the same electrolytic conditions take an entirely satisfactory deposit for an indefinite period.

This effect is especially marked in the electrodeposition of zinc from acid solutions of its salts, and may perhaps be explained by the following considerations: The deposition of zinc as metal from acid solutions is dependent upon the relatively very slight solubility in acids of pure zinc: and anything tending to promote the solution of zinc in acids will tend equally to reduce the current efficiency of deposition and may even prevent deposition altogether. This applies for example to metallic impurities in the electrolyte; and according to our observations as above noted it applies equally to the presence of electronegative impurities in or on the aluminum cathode. It is likely that copper, for example, forms a couple with the electrodeposited zinc, thereby greatly increasing its rate of solution. Pure aluminum on the other hand, on account of its highly electropositive character, is found to be quite free from any tendency to promote the solution of zinc.

The above-described effect of pure aluminum cathodes is as might be expected dependent upon the surface conditions. For example, such alloys as aluminum bronze are incapable of receiving a good deposit of zinc. If, however, a sheet of such alloy be treated with nitric acid to dissolve the impurities or alloying metal, the resulting film of alumina being then removed, the plate will take an excellent deposit for a few days, or until the pure aluminum surface has become contaminated or has worn off, exposing a surface of impure aluminum, and rendering necessary another acid treatment.

Inasmuch as the favorable effect of aluminum upon the deposition is presumably due to its highly electropositive character, it is to be expected that other metals more electropositive than zinc, for instance magnesium, will give similar results. The essential condition for effective work appears to be that the cathode should be more electropositive than zinc, and should be either quite free as regards its exposed surface from relatively electronegative impurities, or so nearly free therefrom that their influence upon the solution of the deposited zinc becomes negligible.

We claim:—

1. The process of recovering zinc from its solutions, which consists in passing an electric current through a solution containing a zinc salt to a cathode presenting a surface

of a metal more electropositive than zinc, said surface being substantially free from impurities electronegative to zinc, until a deposit suitable for stripping has been formed.

2. The process of recovering zinc from its solutions, which consists in passing an electric current through a solution containing a zinc salt to a cathode presenting a surface of aluminum substantially free from impurities electronegative to zinc, until a deposit suitable for stripping has been formed.

3. The process of recovering zinc from its solutions, which consists in passing an electric current through a solution containing a zinc salt to a cathode presenting a surface of substantially pure aluminum, until a deposit suitable for stripping has been formed.

In testimony whereof, we affix our signatures.

FREDERICK LAIST.
JAMES ORR ELTON.