No. 713,277. Patented Nov. 11, 1902.

A. G. BETTS.

ELECTROLYTIC REFINING OF LEAD AND LEAD ALLOYS.

(Application filed Jan. 9, 1902.)

(No Model.)

Fig. 1,

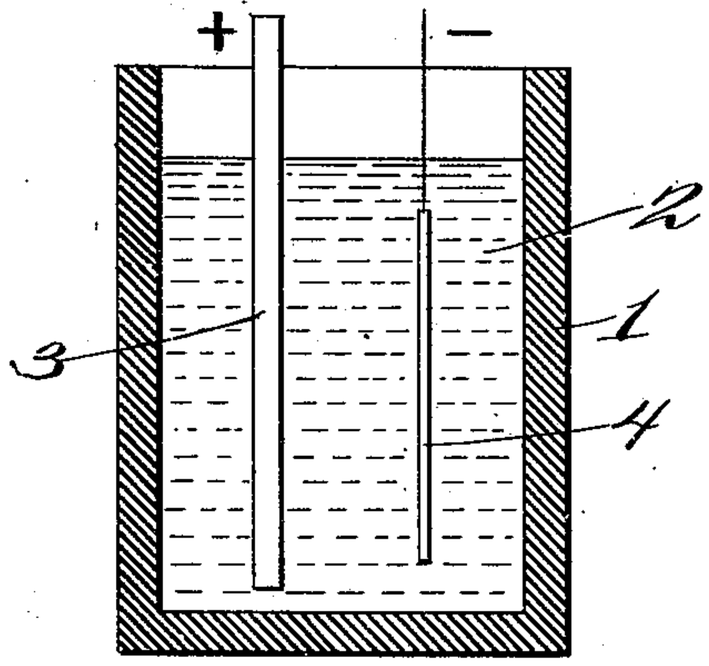


Fig. 2,

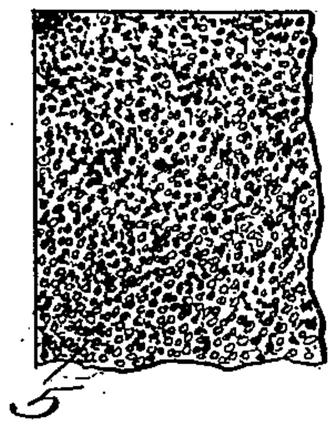
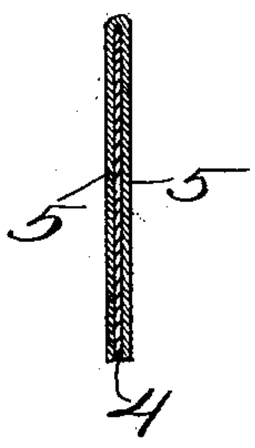


Fig. 3,



WITNESSES:

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ANSON G. BETTS, OF LANSINGBURG, NEW YORK.

ELECTROLYTIC REFINING OF LEAD AND LEAD ALLOYS.

SPECIFICATION forming part of Letters Patent No. 713,277, dated November 11, 1902.

Application filed January 9, 1902. Serial No. 89,074. (No specimens.)

To all whom it may concern:

Be it known that I, ANSON G. BETTS, a citizen of the United States, residing at Lansingburg, county of Rensselaer, and State of New York, have invented a certain new and useful Process for the Electrolytic Refining of Lead and Lead Alloys and the Product Resulting Therefrom, of which the following is a specification.

The present invention relates to the art or process of electrolytic refining of lead and lead alloys.

The lead resulting from electrolysis by methods heretofore commonly employed is characterized by lack of density, incoherency, and by a crystalline spongy formation, rendering the electrodeposit unsuitable for fusion.

The object of my invention is to produce by electrolytic treatment substantially pure lead having substantially the density and homogeneity of cast lead. Such object is attained by the employment, in connection with a suitable electrolyte, of an agent capable of restraining the crystallization of the deposit.

To carry out my invention, I employ any suitable electrolyte—such as, for example, a solution of a lead salt of a fluorin acid, as described in United States Letters Patent No. 679,824, granted to me August 6, 1901. To the electrolyte is added a quantity of a reducing agent, which I have found materially improves the deposited lead. Among the substances which I have found available for such purpose are gelatin, pyrogallol, resorcinol, saligenin, ortho-amido-phenol, hydroquinone, and sulfurous acid. Phenols of the aromatic series are well adapted for use in the present process by reason of their being easily oxidizable. The improvement in the electrodeposit is believed to be due to the reducing action of the agent employed.

The agent contained in the electrolyte, as above stated, serves to restrain the crystallization of the electrodeposited lead and causes the same to form at or upon the cathode in a solid coherent body of substantially uniform structure throughout, having substantially the density and homogeneity of cast lead, constituting a product which by reason of its physical properties facilitates the practical electrolytic refining operations and which may be fused without the formation of an undue amount of dross. By the present process I am able to produce without mechanical treatment a deposit that can be made of considerable thickness and which is non-porous, as shown by the specific gravity of a mass of it. A product is easily made with a specific gravity of 11.36, the same metal remelted and cast having the same density. I have observed with some of the more active of these agents, as gelatin and pyrogallol, the projections that always occur on thick electrodeposits are nodular, while with some of the weaker agents, as ortho-amido-phenol and saligenin, the projections are apt to be crystals. When the projections are nodular, they swell into lumps on the surface during electrolysis, reducing the liability of short-circuiting during practical working of the process. With the crystalline form of projection short-circuiting occurs, rendering such deposits less desirable or suitable for electrolytic refining or electroplating, although the deposit is superior to that obtained by prior electrolytic processes. There appears to be a very slight increase in the weight of the lead deposit in connection with the use of the above agents. These agents also affect to some extent the solution of lead at the anode by preserving the mass of solid lead underneath the anode slime with a somewhat-smoother surface.

In practicing my present invention I prefer a current strength of ten to twenty amperes per square foot of cathode surface and a corresponding tension of .15 to .35 volts for each element. With higher currents the lead becomes harder and more brittle and takes on a whitish color and silvery luster. A sample deposited with a current of forty amperes per square foot showed a specific gravity of 11.276. In general, the deposited lead is apt to be slightly stiffer than ordinary lead; but this stiffness may be regulated at will by varying the current density and the quantity of agent in the solution.

Of the above-named agents I have found gelatin the cheapest and to give the best results and prefer its use in the proportion of one part of gelatin, by weight, to five thousand

parts of solution. The current efficiency does not appear to be affected by the presence of gelatin or of any of the other-named agents in the electrolyte. The agent may be applied to the electrolyte in such quantities as desired from time to time. If gelatin is used, it is dissolved in hot water and a sufficient quantity of this solution added to the electrolyte, so as to make the desired proportion.

My improved method is well adapted for electroplating metal bodies with lead, as the electrodeposit forms thereon a firmly-adherent dense coating of lead. The body to be electroplated may be of any desired form.

The present process for directly producing lead of a quality for remelting is of great importance in the electrolytic refining of lead as well as in the art of electroplating, as it removes one of the obstacles in the electrolytic refining of lead—namely, the unsuitability of lead products of prior processes for remelting and for maintaining without attention the proper conditions of work in the refining-tanks—that is, without short-circuiting. As the electrodeposit is not mechanically treated while being formed by the present process, it retains undisturbed the normal structural characteristics due to electrolysis. The appearance of the surface of the deposit changes as the electrolysis proceeds, beginning with a frosty appearance and becoming coarser until it has a pebbly or botryoidal appearance.

Any suitable electrolytic apparatus may be employed to carry out the present process. I have shown one form of apparatus in the accompanying drawings, in which—

Figure 1 is a vertical cross-section of the apparatus employed in treating lead by my improved process. Fig. 2 is a plan view of a metallic plate electroplated with lead by my improved process, the plate being partly broken away. Fig. 3 is a vertical cross-section of the same.

1 is the electrolytic vat, containing the electrolyte 2, with a restraining agent, as above described.

3 is the anode, and 4 the cathode, suspended in the electrolyte and connected with the respective poles of an electric energizer. (Not shown.) The anode consists of lead or lead alloy to be refined. The cathode is shown of a metallic plate suspended in position to be electroplated with lead by my improved method.

5 represents the electrodeposited lead having the characteristics above described.

What I claim, and desire to secure by Letters Patent, is—

1. The process of electrodepositing lead consisting in subjecting to electrolysis an electrolyte containing in solution a lead compound and a reducing agent capable of restraining the crystallization of the lead deposit.

2. The process of electrodepositing lead consisting in subjecting to eloctrolysis an electrolyte containing in solution a lead salt of a fluorin acid and a reducing agent.

3. The process of electrodepositing lead consisting in subjecting to electrolysis an electrolyte, containing in solution a lead salt of a fluorin acid and gelatin.

4. The process of electrodepositing lead consisting in subjecting to electrolysis an electrolyte containing in solution lead fluosilicate and gelatin.

5. The process of electrodepositing lead consisting in subjecting to electrolysis an electrolyte containing in solution an agent capable of restraining the crystallization of the electrodeposited lead.

6. The process of electrodepositing lead, consisting in subjecting to electrolysis an electrolyte containing in solution a reducing agent capable of restraining the crystallization of the lead deposit, and a lead salt of an acid, forming a readily-soluble salt of lead.

7. The process of electrodepositing lead, which consists in subjecting to electrolysis an electrolyte containing in solution a lead salt of an acid forming a readily-soluble salt of lead, and an agent capable of restraining the crystallization of the electrodeposited lead.

8. An electrolyte consisting of a solution of a lead salt of a non-oxidizing acid which forms readily-soluble salts with lead, and a reducing agent.

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

ANSON G. BETTS.

Witnesses:

GEO. E. CRUSE,

ALMA E. JOHNSON.