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V. ENGELHARDT.

PROCESS FOR THE ELECTROLYTIC PRODUCTION OF ZINC.

APPLICATION FILED SEPT. 14, 1904.

Fig. 2

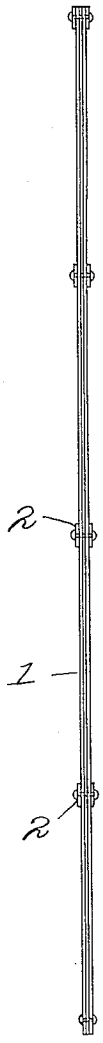
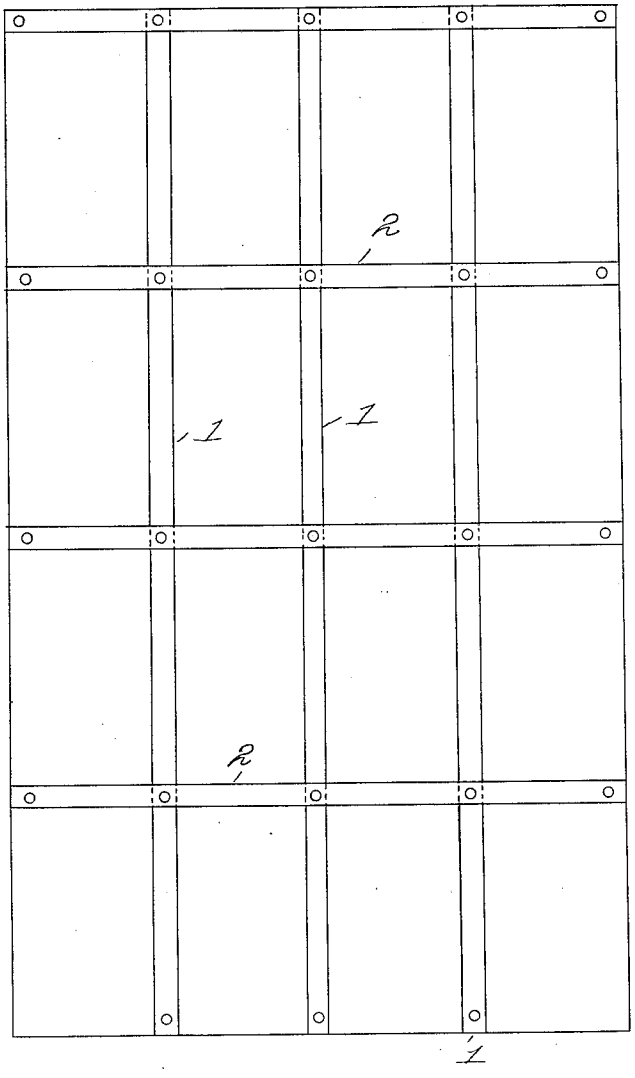


Fig. 1.



Witnesses
O. Knight Jr.
H. Currie.

Victor Engelhardt,
Inventor.
by
Knight Bros.
his Attorneys

UNITED STATES PATENT OFFICE.

VICTOR ENGELHARDT, OF VIENNA, AUSTRIA-HUNGARY, ASSIGNOR TO SIEMENS & HALSKE AKTIENGESELLSCHAFT, OF BERLIN, GERMANY.

PROCESS FOR THE ELECTROLYTIC PRODUCTION OF ZINC.

No. 831,843. Specification of Letters Patent. Patented Sept. 25, 1906.

Application filed September 14, 1904. Serial No. 224,365.

To all whom it may concern:

Be it known that I, VICTOR ENGELHARDT, a subject of the Emperor of Austria-Hungary, residing in Vienna, Austria-Hungary, have invented a new and useful Process for the Electrolytic Production of Zinc; and in order that others skilled in the art may understand and practice my invention I give the following specification.

My invention relates to the production of zinc by the electrolysis of solutions of sulfate of zinc, and has for its object the production of a crystalline dense smooth electrolytic zinc free from sponginess and roughnesses or irregularities of surface.

In the accompanying drawings I have illustrated one form of anode by which my invention may be attained.

Figure 1 of said drawings shows a face view of an anode. Fig. 2 shows a sectional view thereof.

Processes heretofore known for the electrolytic production of zinc from solutions of zinc sulfate in which insoluble anodes were employed resulted in the formation of spongy zinc, and the zinc deposit so obtained was injuriously affected by the sulfuric acid liberated at the anode.

The spongy-zinc deposits resulted, among other causes, from the influence of small quantities of impurities in the solutions which came from the raw materials used or from the anodes. These impurities (iron, manganese, lead, copper, &c.) were precipitated upon the cathode and gave rise there to secondary reactions. A further cause of the formation of spongy-zinc deposits is the formation of zinc hydrogen at the cathodes.

The sulfuric acid generated at the anode acts upon the cathode deposit by redissolving the already electrolytically-deposited zinc, particularly at the higher acid concentrations or where there is excess of acid, as where the zinc deposition has far advanced or where there is impoverishment of the bath in zinc.

My invention is directed to the elimination and overcoming of the above disadvantages.

It consists in the employment in the electrolysis of a current density for the whole surface of the insoluble anode or for separate portions thereof, which is considerably greater than that at the cathode. I have ascertained that a current density at the anode of from twenty to fifty times that at the cathode is especially advantageous. Thus for practically obtainable zinc concentrations in which a current density at the cathode of about one hundred and fifty amperes per square meter of the cathode-surface is employed the current density at the anode either for the whole surface or at single places of the same would be from three thousand to seven thousand five hundred amperes per square meter of the surface. These figures are cited as examples merely without in any way limiting the invention thereto.

The form of the anode is a matter of minor importance; but it is important that it works for its whole surface or for single places thereon with a current density considerably higher than at the cathode. For this purpose an anode-surface is selected having the necessary smaller dimensions, or an anode is selected of a surface equal to the cathode which is reinforced at several places—as, for example, by bands, ribs, or wire insertions, as indicated in the drawings—so that at these places a higher conductivity is produced, and therefore a higher current density obtained.

In the drawings an anode is shown provided with a series of strips or bands 1 1 2 2 of material of higher conductivity than the remainder of the anode, so that at the places occupied by the bands a higher current density is obtained.

A further important feature of my invention consists in the availability of the employment of platinum or its alloys as the anodes in the electrolytic production of zinc. Heretofore on account of the large size required for the anodes the employment of such materials has been out of the question on account of the expense involved. In accordance with my invention, however, the anodes are of such small size that platinum or platinum alloys can be used without materially increasing the cost of the electrolytic zinc by the loss of the anode material.

I am aware that it has been proposed in electrolytic processes to use anodes of somewhat smaller dimensions than the cathodes, the latter extending beyond the edges of the anodes. This proposition, however, is merely for the purpose of avoiding the formation of burs or knobs or roughnesses on the edges of the cathodes, and, moreover, this process

merely results in an increase of the current density at the anode of only a small percentage.

In connection with electrometallurgical processes the employment of a considerable difference of current density between the electrodes is of great advantage and importance, and particularly in the case of the electrolysis of zinc-sulfate solutions, because of the improvement in the deposit obtained. By this new process I am enabled to produce a crystalline perfectly dense smooth zinc deposit free from sponigness and roughness or irregularities and resembling in its outer appearance electrolytically-refined copper. These results may be explained as follows: By increasing the current density at the anode the formation of ozone and supersulfuric acid is materially promoted, and these have an oxidizing effect upon the cathode or zinc hydrogen. Moreover, my invention renders possible the employment of anodes of platinum or platinum alloys, and thus the tendency of the bath to become impure during the electrolysis by particles coming from the anodes is effectively prevented. The chemical purity of the deposit has the further and desirable property of resisting the dissolving action of the sulfuric acid which becomes free at the anode.

Having described my invention, what I claim, and desire to protect by Letters Patent, is—

1. The process for the electrolytic production of zinc from sulfate solutions, which consists in employing a current density at the anode which is substantially twenty or more times the current density at the cathode.

2. The process for the electrolytic production of zinc from sulfate solutions which consists in employing at the anode a current density of from twenty to fifty times that of the current density at the cathode, substantially as and for the purposes described.

3. The process for the electrolytic production of zinc from sulfate solutions, which consists in employing an insoluble anode, and a current density at said anode substantially twenty or more times the current density at the cathode.

4. The process for the electrolytic production of zinc from sulfate solutions, which consists in employing an anode of platinum or platinum alloy and a current density at said anode which is substantially twenty or more times the current density at the cathode.

5. The process for the electrolytic production of zinc from sulfate solutions which consists in employing an insoluble anode and a current density at said anode of from twenty to fifty times that of the current density at the cathode, substantially as and for the purposes described.

6. The process for the electrolytic production of zinc from sulfate solutions which consists in employing an anode of platinum or platinum alloy and a current density at said anode of from twenty to fifty times that of the current density at the cathode, substantially as and for the purposes described.

7. The process for the electrolytic production of zinc from sulfate solutions, which consists in employing at separate places on the anode a current density which is twenty or more times greater than the current density at the cathode.

VICTOR ENGELHARDT.

Witnesses:
ALVESTO S. HOGUE,
AUGUST FUGGER.