Feb. 14, 1933. R. M. HUNTER 1,897,308

APPARATUS FOR ELECTROLYSIS OF A FUSED BATH

Filed May 31, 1929

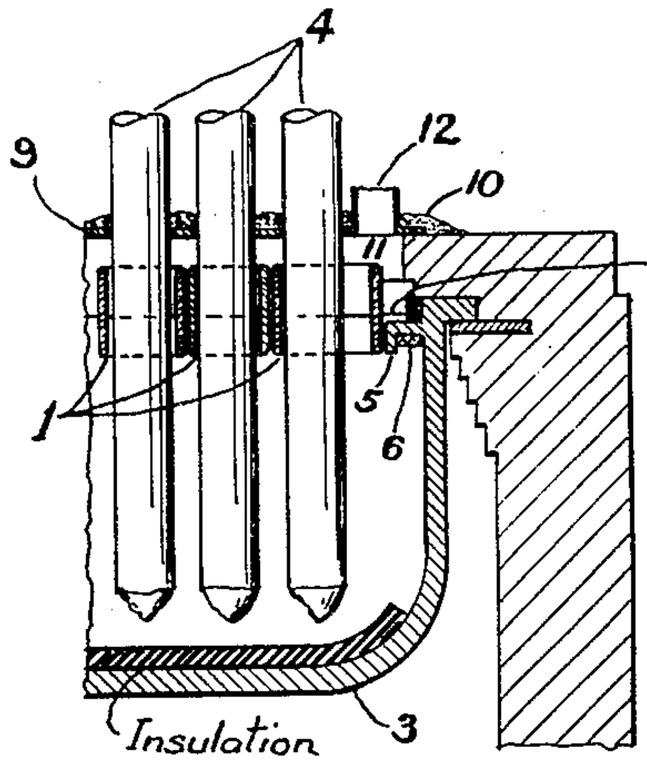

FIG. 2

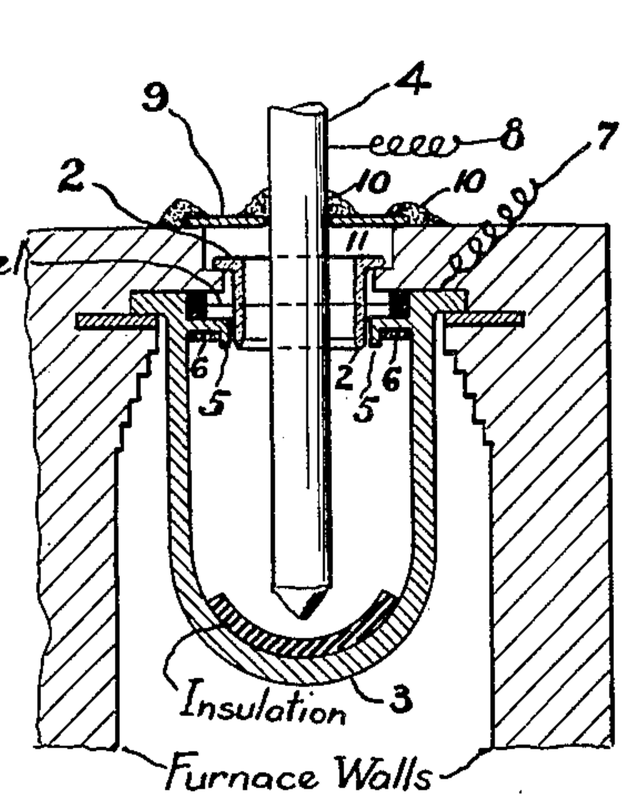

FIG. 1

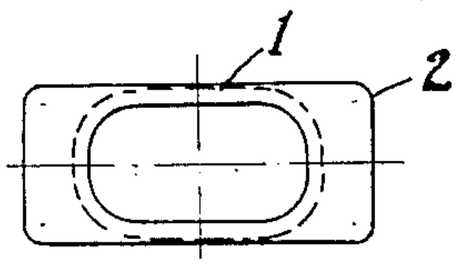

FIG. 3

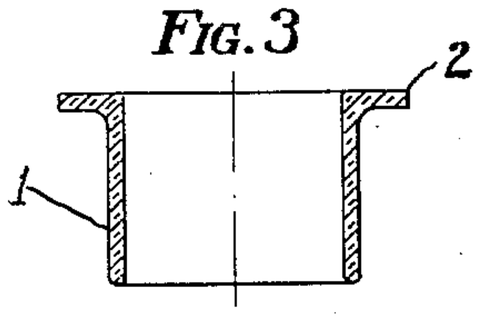

FIG. 4

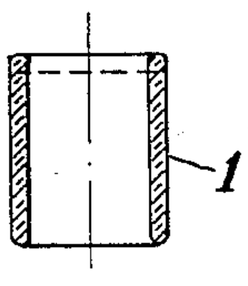

FIG. 5

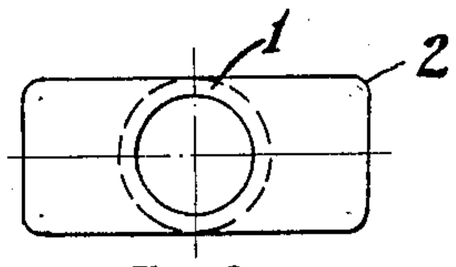

FIG. 6

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UNITED STATES PATENT OFFICE

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APPARATUS FOR ELECTROLYSIS OF A FUSED BATH

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The present invention relates to means for separating anodic and cathodic products produced by electrolysis and has particular reference to the separation of such products derived from the electrolysis of fused baths. It relates specifically to means for separating metallic magnesium floating upon the fused bath from which it has been liberated and the chlorine constituting the anode product.

When operating an electrolytic cell employing a fused bath upon which the liberated metal will float, both cathodic metal and anodic gas rise to the surface of the bath and the separation and separate disposal thereof becomes a problem. Due to the high temperature, the requirement for non-conductivity of electric current and the chemical activity to which a curtain or other means of separation must be subjected, the choice of material therefor and form thereof has required much study and experiment. The difficulties, moreover, incident to cells of small capacity are greatly magnified when it is attempted to operate large cells.

I have invented a form of curtain applicable to any and all sizes of cells employing one or more anodes, which said curtain may be withdrawn and a new one inserted without interrupting operations when a plurality of anodes are used. Other advantages will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims, the annexed drawing and the following description setting forth in detail certain means for carrying out the invention, such disclosed means illustrating, however, but two of various ways in which the principle of the invention may be used.

In said annexed drawing:—

Fig. 1 is a partial vertical cross-section through a typical fused bath cell employing my curtain. Fig. 2 is a similar cross-section at right angles to that in Fig. 1. Fig. 3 is a top plan, Fig. 4 a vertical longitudinal cross-section of one form of curtain, and Fig. 5 is a vertical section at right angles to that of Fig. 4. Fig. 6 is a plan similar to Fig. 3 of an alternative form of curtain, the other views of which would be similar to Figs. 4 and 5.

The curtain proper consists essentially of a suitable tubular sleeve which may be slipped over the anode or through which the anode may be passed when it is lowered into the cell bath. Referring to Figs. 3, 4, 5 and 6, 1 is a sleeve, which in Figs. 3, 4 and 5 is is somewhat rectangular in cross-section as shown in the plan, Fig. 3. The sleeve has rounded corners and is preferably provided with a flange 2 suited to engage with fixed members in the cell for the purpose of supporting the curtain in position. In Fig. 6 the curtain has a round or tubular form. Other forms may be employed in which the sleeve may have a corrugated or other contour and the manner of support may be varied.

The application of my curtain to a cell will be explained by referring to Figs. 1 and 2, in which 3 represents the cathode cell pot which may be of cast steel or other suitable metal. A single anode or a plurality thereof, 4, depend into the bath from above. Such anodes will preferably be carried by adjustable hangers enablng their easy removal in a vertical direction and relowering into the cell for the purpose of adjusting the submergence and for incidentally permitting the removal and replacement of the curtains. The pot 3 is provided with an inverted trough 5 adapted to form a trap for the liberated metal 6 rising from the cathode pot. The pot 3 will preferably be supported, as indicated, in a furnace for supplying initial heat or controlling the temperature during operation. Suitable electrical connections indcated at 7 and 8 will be provided to supply current for the electrolysis. The light metal caught in the traps 5 will preferably be led by said traps to a suitable collecting well or zone, not shown, enabling the later removal of the metal with ease. In Fig. 2, three anodes of a series, which may contain any convenient number, are shown depending in the bath from above, each being surrounded by a curtain 1. These curtains are shown in Fig. 1 as supported by

their flanges upon projecting portions of the brick housing or superstructure of the cell. They may be carried in that manner or in any other convenient manner adapted to the particular form of the cell, but they will have the sleeve-like construction, one such sleeve for a single anode or a group thereof, and, preferably, in large scale practice one such for each individual anode. The curtain will preferably be made of a suitable quality of fire clay or other ceramic material adapted to withstand the conditions of exposure to bath and metallic magnesium in the molten state, some of which latter may be liberated upon the inner face of the trap 5 facing the curtain. I find it best that there be a substantial clearance between such curtain and metal parts of the cell to avoid unnecessary contact of liberated metal, there entangled, with the curtain. Another object of the curtain is to cover the exposed surface of the trap 5 or other cathodic surface from which metal liberated thereon would not directly enter the trap. Such covering restricts the liberation of metal on the protected surface and to an equal extent prevents losses thereby.

It will be seen that the curtain affords a partition between that part of the bath occupied by the anode through which the chlorine or other anodic product rises and that part of the bath in which the cathodic metal is produced and collected. Cover slabs 9 may be provided and a duct 12 connected therewith for drawing off the gaseous anodic products, such as chlorine gas and the like.

When, in the course of cell operation, the curtain or one of a plurality of curtains in a cell employing a plurality of anodes, becomes damaged by cracking or erosion or the like, I provide in a handy location a separate curtain preferably gradually preheated to the temperature of the bath. I then remove such portions of the cover 9 and the sealing salt 10 thereon as will expose the damaged curtain, raise the anode therein, insert a suitable tool, such as a hook or special tongs, to engage the curtain, remove it and then immediately replace it with the fresh curtain referred to. The anode may then be again lowered into the bath and the cover replaced. During such operations the other anodes of a plurality, when used, will be in service, the metal will continue to be produced as well as the gaseous anodic products, but sufficient suction will preferably have been provided at the outlet 12 to prevent issue of gas into the room, there being preferably a draft of air drawn into the compartment 11 to wash out the gas therein.

Small pieces of ceramic material are relatively cheaper than large ones, are more easily handled without breakage and are less liable to break due to temperature changes. By employing relatively small individual curtains for each anode, or a number of such, each for a group of anodes, the limitations of ceramic material are given proper regard, and the otherwise advantageous properties made available.

I find that the use of my curtain removes a large share of heretofore very onerous and difficult procedures in the electrolysis of a fused bath, such as one containing magnesium chloride employed for the production of metallic magnesium. I find that the use of my curtain greatly simplifies procedure and contributes markedly to the reduction in cost of cell maintenance. This is particularly true in large scale operation in which it is convenient to employ a cathode pot of large size and a plurality of anodes depending therein. By supplying each individual anode with its own individual curtain, breakage or erosion losses are easily, cheaply and quickly taken care of and that without interruption of the operation of the cell or cessation of the production of valuable product. The cutting in and out of such large units is a difficult and onerous proceeding, both as to cell operation and to power control. The elimination of the necessity to so cut out a cell to remove a curtain and the application of an individual small curtain to each of a plurality of anodes constitute distinct and valuable advances in the art of electrolyzing fused baths.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the means and the steps herein disclosed, provided those stated by any of the following claims or their equivalent be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. In an apparatus for the electrolysis of a fused bath to produce a metal lighter than the electrolyte, the combination of a metallic vessel to contain such bath and constituting the cathode, an inwardly directed inverted metallic trough member connected to the upper part of the sidewall of said vessel in electrical contact therewith and adapted to entrap molten metal rising from the active cathode surface, a plurality of vertically adjustable anodes depending in said bath, and a removable one-piece sleeve-like curtain member of ceramic material circumscribing each anode in spaced relation therefrom, said curtain member being immersed in said bath to a depth sufficient to cover the surface of said trough member facing the anode and thereby to restrict the flow of current therebetween.

2. In an apparatus for the electrolysis of a fused bath to produce a metal lighter than the electrolyte, the combination of a metallic vessel to contain such bath and constituting the cathode, an inwardly directed inverted trough-shaped projection on the upper part

of the sidewall of said vessel adapted to entrap molten metal rising from the active cathode surface, a plurality of vertically adjustable anodes depending in said bath, and a removable one-piece sleeve-like curtain member of ceramic material circumscribing each anode in spaced relation therefrom, said curtain member having lateral extensions adapted to support the same upon the superstructure of said apparatus and being immersed in said bath to a depth sufficient to cover the surface of said trough member facing the anode and thereby to restrict the flow of current therebetween.

Signed by me this 28th day of May, 1929.

RALPH M. HUNTER.