Nov. 17, 1925. 1,562,090

W. HOOPES

ELECTROLYTIC CELL

Filed Nov. 8, 1923

Fig. 1

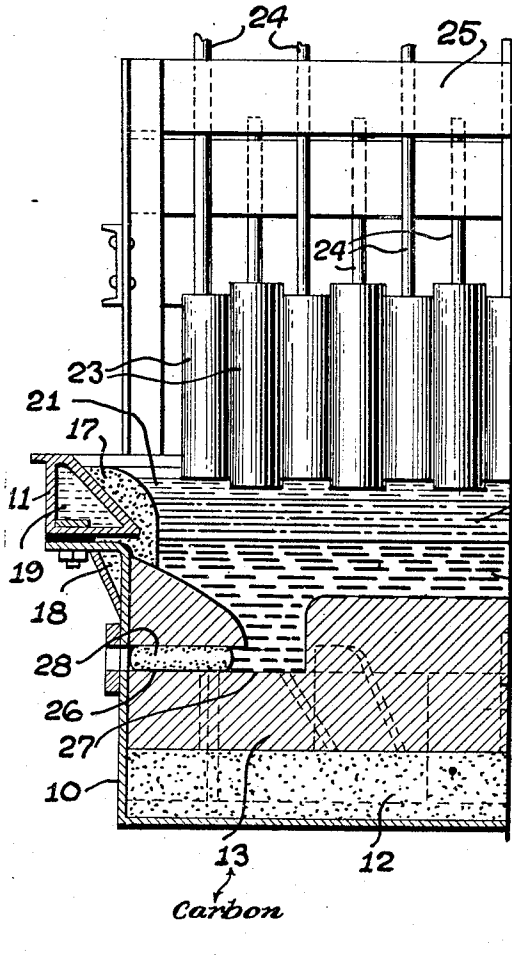
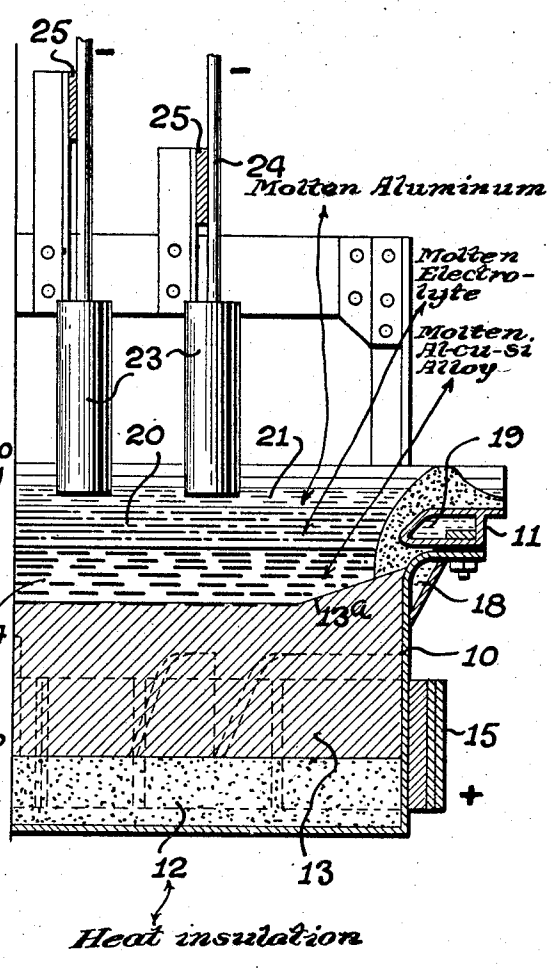


Fig. 2



INVENTOR

William Hoopes

BY

Cooper, Kerr & Dunham

ATTORNEYS

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UNITED STATES PATENT OFFICE.

WILLIAM HOOPES, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO ALUMINUM COMPANY OF AMERICA, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

ELECTROLYTIC CELL.

Application filed November 8, 1923. Serial No. 673,422.

To all whom it may concern:

Be it known that I, WILLIAM HOOPES, a citizen of the United States of America, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Electrolytic Cells, of which the following is a full, clear, and exact description.

In electrolytic methods of refining or reduction, in which a layer or body of fused electrolyte floats on a layer of molten metal, the latter is withdrawn from time to time as the refining or reducing process goes on, usually through a tap hole or the like in the bottom of the cell. In such cases difficulty is experienced in effecting a sufficiently complete removal of the metal without permitting a considerable portion of the electrolyte to escape, especially toward the end of the operation, when the body of metal in the cell has been reduced to a thin layer, say an inch or less in depth. This difficulty, which in some cases may be a source of considerable trouble in processes of the kind indicated, is obviated by the use of a certain feature of the cell disclosed in my copending application Serial No. 608,287, filed December 21, 1922. This cell is illustrated in the accompanying drawing, in which Figs. 1 and 2 are cross sections of half the cell on planes at right angles to each other. It is to be understood that the invention claimed herein is not limited to apparatus of the particular type shown, or to use in processes of the class for which such type of cell is designed, but may be embodied in other cells and used in other processes.

Referring to the drawing, the cell comprises a steel shell, preferably of cylindrical form and composed of upper and lower electrically separated sections 10, 11. In the latter, resting on a layer 12 of powdered bauxite or other refractory heat-insulating material, is a carbon bottom lining 13 formed with a bowl-like depression or cavity 13ª for the molten metal represented at 14. The carbon bottom is connected to the positive terminal of the external source of current (not shown) by means of a conductor 15 which is itself connected to steel distributor plates 16 welded to the shell and embedded in the carbon bottom.

Extending upwardly from the carbon bottom 13 and covering the joint between the shell sections is a thermally and electrically insulating refractory lining 17, which may be frozen on the shell walls, as described in the copending application of myself, Junius D. Edwards and Basil T. Horsfield, Serial No. 608,289, filed December 21, 1922, by means of the encircling water jackets 18, 19, which also aid in keeping the lining solid when the cell is in use.

The fused bath or electrolyte, which floats on the molten metal 14, is indicated at 20, and above the bath, floating thereon, is shown a layer of molten metal 21. In the electrolytic refining process for which the cell is designed the metal 14 is an alloy of aluminum, constituting the anode, and the metal 21, constituting the cathode, is pure aluminum, removed from the anode alloy by the passage of the electrolyzing current, as described, for example, in the process disclosed in my copending application Serial No. 608,282.

The cathode is connected to the negative terminal of the source of current, not shown, by means of one or more electrodes 23, preferably composed of graphite as described and claimed in the copending application of Francis C. Frary, Serial No. 672,867, connected by rods 24 to the negative busbars 25.

As the refining process goes on, the impoverishment of the anode alloy 14 by removal of its aluminum, and the resulting concentration of the impurities left behind in the alloy, make it necessary to remove the impoverished alloy and introduce fresh alloy from time to time. The removal of the spent or residual alloy is most conveniently effected through a tap hole leading out of the receptacle in the carbon bottom of the cell, but as before stated it is difficult to effect a sufficiently complete removal of the alloy without too much of the molten and therefore liquid electrolyte running out also. In accordance with the present invention this difficulty is obviated by making the tap hole, shown at 26 in the figure, lead from a shallow well 27 instead of directly from the bottom or side of the cell, as is the customary practise. Then as the metal runs out (the tap hole plug 28 being of course removed or broken out) the layer on the bottom of the receptacle 13ª becomes thinner and thinner

and can eventually drain almost completely into the well 27, leaving in the latter, however, a body of metal only a few inches deep but sufficient in amount to keep the electrolyte above the tap hole. When the first sign of the electrolyte appears a fresh plug can be shoved into the tap hole, thereby preventing further outflow of electrolyte and leaving in the well only a small amount of the metal, an amount so small that if spread over the bottom of the cell it would form scarcely more than a film. On the other hand, if the tap hole led directly from the bottom or side of the cell the electrolyte would begin to escape while a large layer of metal is still of substantial thickness and the tap hole would then have to be plugged to avoid further loss of electrolyte. The relatively large amount of residual metal thus left would in effect decrease the capacity of the cell, thereby necessitating more frequent tapping and consequently lessening the output of the cell, since the refining operation is necessarily disturbed while the removal of the impoverished alloy is going on. Moreover, as the aluminum is removed by the electrolysis the impurities are concentrated in the residual alloy and are therefore present in abnormal amount in any residual alloy left in the cell, with the result that each tapping leaves more impurities to contaminate the fresh alloy, with greater danger of transfer of impurities from the anode to the pure metal of the cathode. With my invention, however, the residual alloy left in the cell can be so small in amount, and the resulting concentration of impurities so slight, as to be practically negligible over long periods of operation.

Another advantage of my invention is that it permits the tapping hole to be horizontal, or substantially so, as indicated in Fig. 1, and hence enables the workman to drive the tapping pin or bar into the hole in the same direction, which makes the tapping operation much easier than is the case where the pin has to be driven in the upwardly inclined direction necessary when the tap hole slopes downwardly in the usual manner.

The tapping well, from which the tap hole leads, need not be large or deep, a diameter and a depth of five or six inches being ample for even a large cell. The well may, of course, be deeper, but should not be deep enough to permit the metal to freeze over the tap hole.

I claim:

1. An electrolytic cell provided with a bottom lining of carbon formed with a depression constituting a receptacle for a body of molten metal, the bottom lining having also a tapping well extending below the surface on which the molten metal rests and a tap hole leading horizontally from the bottom of the well, whereby in tapping the cell liquid floating on the said molten metal will be prevented from reaching the tap hole before the said receptacle is substantially drained of metal.

2. An electrolytic cell adapted to contain molten metal subject to withdrawal and renewal at intervals, having in its bottom a tapping well or pocket and a tap hole extending laterally from the well or pocket, the latter serving to keep liquid, floating on the molten metal, above the tap hole when the metal is being drained out therethrough, and being sufficiently shallow to prevent freezing of the metal over the tap hole when the cell is in operation.

In testimony whereof I hereto affix my signature.

WILLIAM HOOPES.