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ELECTROLYTIC CELL CONSTRUCTED FOR HIGH CIRCULATION
AND UNIFORM FLOW OF ELECTROLYTE
Filed Feb. 24, 1970

3,682,809

FIG. 1.

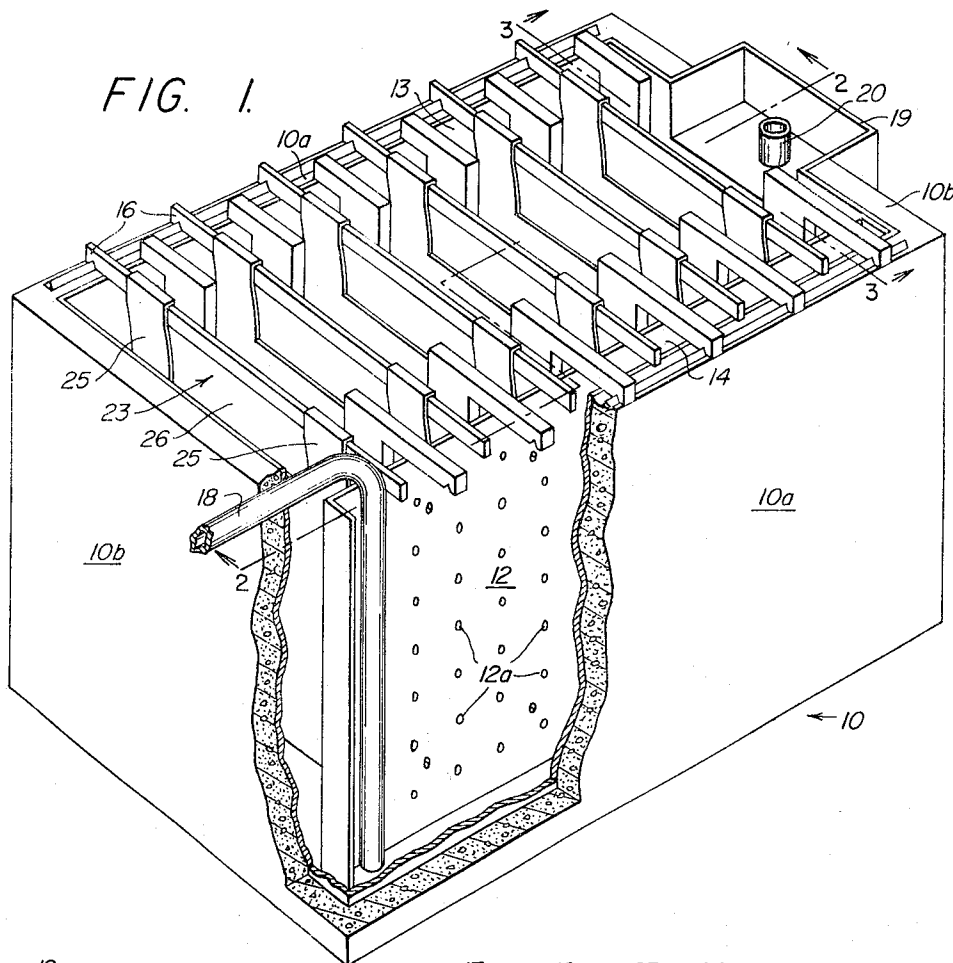


FIG. 2.

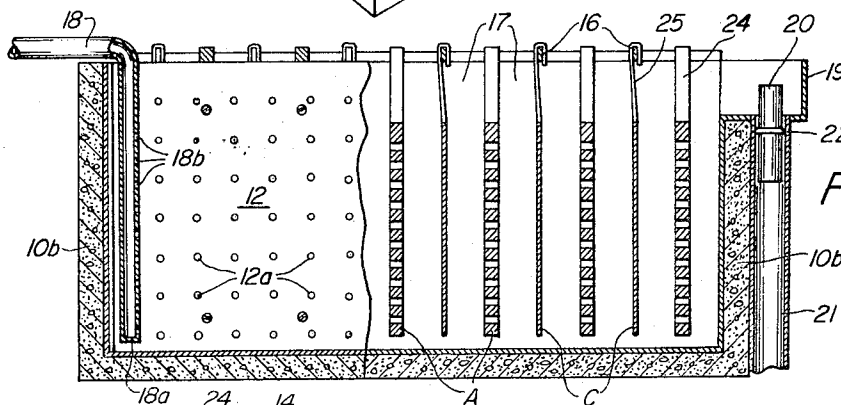


FIG. 3.

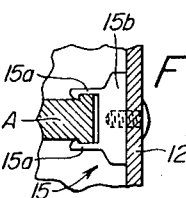
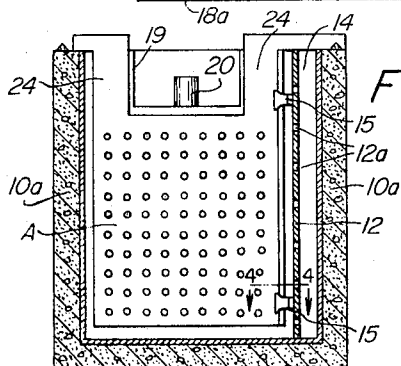


FIG. 4.

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ELECTROLYTIC CELL CONSTRUCTED FOR HIGH CIRCULATION AND UNIFORM FLOW OF ELECTROLYTE

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U.S. Cl. 204—275

6 Claims

ABSTRACT OF THE DISCLOSURE

Rapid circulation and uniform flow of electrolyte between flat plate electrodes arranged transversely of an electrolytic cell for electrorefining or electrowinning purposes are obtained by constructing the cell with a perforated baffle dividing an elongate and narrow electrolyte feed chamber along one side of the cell from the cell proper and with at least one vertical input pipe, having inflow orifices at intervals along its height and directed lengthwise of the feed chamber, for distributed input of electrolyte to such feed chamber. The electrodes are preferably deeply recessed intermediate their upper margins to provide an uninterrupted flow channel in the upper part of the cell and from end to end thereof.

BACKGROUND OF THE INVENTION

Field of the invention

The invention is in the field of electrolytic cells, particularly those utilized for electrorefining or electrowinning metals wherein flat plate or slab electrodes are arranged transversely of an elongate cell tank and electrolyte is circulated within the tank and between the electrodes.

State of the art

Electrolytic cells of the type concerned are well known, but obtaining rapid and uniform circulation of the electrolyte through such cells has long been a problem. Rapid circulation in electrowinning cells is highly desirable when the concentration of metal ions in the electrolyte is low, and is desirable in both electrowinning and electrorefining cells when high current densities are employed in order to increase the purity of the metal being deposited. Uniformity of circulation is always sought for both types of cells. Normally, however, circulation tends to be sluggish and non-uniform due to the manner of introducing electrolyte into the cell.

RELATED APPLICATIONS

This application bears a certain relationship to one filed Mar. 4, 1968 by the present applicants jointly with Joseph M. Lebrizzi, Ser. No. 710,040 now Patent No. 3,558,466. Both applications have a common assignee.

SUMMARY OF THE INVENTION

The electrolytic cell of this invention has a baffle, perforated throughout its height and breadth, dividing a feed chamber for electrolyte from the cell proper along one side of the cell and throughout the length and depth of the electrolytic bath in the cell tank. A vertical input pipe, closed at one end and having jet orifices at intervals along its height and directed along the length of the chamber, is positioned in the chamber usually at one end thereof. For extra long cells, i.e. over fifteen feet in length, one or more additional input pipes can be used. As an aid to overall circulation throughout the cell in the vicinity of the electrodes, it is advantageous that such electrodes be deeply recessed or indented intermediate their top margins to form an uninterrupted flow channel in the upper

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part of the cell from end to end thereof transversely of the electrodes.

The drawing

The best mode presently contemplated of carrying out the invention is illustrated in the accompanying drawing in which:

FIG. 1 is a view in perspective of an electrowinning cell in accordance with the invention, a portion of the cell tank being broken away to reveal details of the electrolyte feed chamber and input pipe;

FIG. 2, a longitudinal vertical section taken on the line 2—2 of FIG. 1;

FIG. 3, a transverse vertical section taken on the line 3—3 of FIG. 1; and

FIG. 4, a fragmentary horizontal section taken on the line 4—4 of FIG. 3 to show details of the clip attachment of perforated baffle to anode slabs.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

In the specific construction illustrated as representative of the best mode presently contemplated of carrying out the invention as applied to an electrowinning cell, e.g. for recovering copper ions from a leach solution, a concrete cell tank 10 of usual type is lined with a non-corrosive material 11, such as polyvinylchloride sheeting. Tank 10 is of customary elongate rectangular formation, having lateral side walls 10a extending longitudinally and adapted to support the cell electrodes, and having end walls 10b.

As in the aforesaid related application Ser. No. 710,040, a perforated wall or partition 12 is provided within cell tank 10 in narrowly spaced parallel relationship with one of the lateral side walls 10a thereof and extending throughout the length and effective height of the tank, i.e. at least as high as the maximum depth of electrolyte, to divide from the cell proper 13 an elongate and narrow feed chamber 14 for electrolyte.

In the present instance, the wall or partition 12 is formed of rigid polyvinylchloride plastic or other inert material as a baffle plate separate from the tank 10, and is held in place by special spacer clips 15, FIGS. 3 and 4, attached to several of the slab anodes A at intervals along the length of the tank. This is a particularly advantageous arrangement for electrowinning cells wherein the wall 12 should be removable. For electrorefining cells, such wall can be made an integral part of the tank if desired.

As here shown, the slab anodes A are of lead with integral hanger lugs or ears and are perforated to enhance electrolyte circulation. However, they may be of any type. Cathodes C are the usual starter sheets, e.g. of copper, looped around electrically conductive hanger bars 16. Both anodes and cathodes are closely spaced along the length of cell tank 10 within the cell proper 13 and are suspended from lateral walls 10a of the tank in customary manner. The spaces 17 between anode-cathode pairs confront perforated baffle 12 for receiving direct flows of electrolyte from the perforations 12a thereof.

The clips 15 are preferably injection molded from polyvinylchloride plastics or the like to provide anode-margin-hugging clip numbers 15a, FIG. 4, extending from a member 15b to which baffle 12 is attached as by means of stainless steel screws as shown. The anode margin is preferably recessed to receive and hold clip members 15a.

In accordance with the invention, electrolyte is introduced into the cell by means of an input pipe 18, closed at one end 18a, FIG. 2, and provided with a number of jet orifices 18b at intervals along its height and directed along the length of feed chamber 14. It has been found that, with this arrangement, the introduction of electrolyte into feed chamber 14 is effectively distributed from top to bot-

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tom of the electrolyte bath and that the flow of electrolyte through the perforations 12a of baffle 12 toward the electrodes in cell proper 13 is substantially uniform throughout the length of the cell despite the location of pipe 18 at one end of the feed chamber. The reason for this may be a Venturi action exerted by the input jet streams from pipe 18 with respect to the perforations 12a located nearest thereto, tending to draw some of the electrolyte from the cell proper into the feed chamber. Whatever the explanation, the flow of electrolyte into and through the cell proper and between the electrodes thereof is of significantly higher velocity and greater uniformity than is obtainable when electrolyte is introduced into the feed chamber in a single large and undistributed stream.

Typical inside dimensions for the cell illustrated are overall width four feet with feed chamber four inches, height four and one-half feet, length fifteen feet. Input pipe 18 is typically two inch. For longer cells, one or more additional input pipes 18 may be used to maintain maximum velocity and uniformity of electrolyte flow. These may be variously arranged, but are spaced to give most effective coverage. The jet orifices 18b are typically three-eighths of an inch in diameter, as are the perforations 12a. The number of perforations may vary considerably, but the arrangement shown is typical. For electrowinning cells, the electrolyte input rate is typically from twenty to sixty gallons per minute; for electrorefining cells such rate is typically from five to fifteen gallons per minute.

Discharge of electrolyte from the cell is preferably by way of a weir box 19 leading from cell proper 13 at the end of the cell opposite that at which pipe 18 is located. A height-adjustable weir pipe 20, also conveniently of polyvinylchloride or the like, leads from weir box 19 into a discharge pipe 21 with an O-ring 22 being interposed to prevent leakage. The usual pumping connections (not shown) between discharge pipe 21 and input pipe or pipes 18 are provided to effect recirculation of and the desired input rate for the electrolyte.

An optional feature of the invention in combination with the above is the recessing or indenting of the electrodes along and intermediate of their upper margins so as to provide a longitudinal flow channel 23 for electrolyte along the upper part of cell proper 13. As illustrated, the anode slabs A are each indented at 24 and the cathode starting sheets C are each provided with a pair of spaced suspension loops 25 to form a recess 26, FIG. 1, such indentations and recesses extending below the normal level of electrolyte in the cell collectively forming flow channel 23 leading toward weir box 19.

Whereas this invention is here illustrated and described and illustrated with respect to a certain preferred form thereof, it is to be understood that many variations are possible without departing from the inventive concepts particularly pointed out in the claims.

We claim:

1. An electrolytic cell, comprising a cell tank adapted to hold a bath of electrolyte; flat plate electrodes extend-

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ing transversely of and closely spaced along the length of the tank to provide circulation passages for electrolyte therebetween and with the walls of the tank; a baffle within and extending longitudinally of the tank throughout the depth of said bath and spaced from a longitudinal wall thereof to form a relatively narrow feed chamber for electrolyte laterally of said electrodes, said baffle being perforated throughout; a vertical input pipe for electrolyte at one end of said feed chamber and extending substantially throughout the height of said baffle, said pipe being closed at one end and having a series of jet orifices along its height directed longitudinally of said feed chamber; means for introducing electrolyte into said pipe under pressure; and means for discharging electrolyte from said cell.

2. An electrolytic cell in accordance with claim 1, wherein the baffle is a plate separate from the cell tank; and wherein removable clips secure said plate to electrodes along the length of the cell in spaced relationship to the electrodes.

3. An electrolytic cell in accordance with claim 1, wherein the electrodes are pairs of anodes and cathodes for electrowinning purposes, the anodes being perforated slabs and the cathodes being starter sheets for the metal to be won.

4. An electrolytic cell in accordance with claim 1, wherein the electrodes are recessed along an intermediate portion of their upper edges to provide an uninterrupted flow channel longitudinally of the cell in the upper part thereof.

5. An electrolytic cell in accordance with claim 4, wherein the means for discharging electrolyte comprises a weir box at the end of the cell opposite that at which the input pipe is located, and the flow channel leads toward said weir box.

6. An electrolytic cell in accordance with claim 5, wherein the weir box is provided with a height-adjustable weir pipe for establishing the level of electrolyte in the cell.

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U.S. Cl. X.R.

204-255, 257, 269, 281, 286