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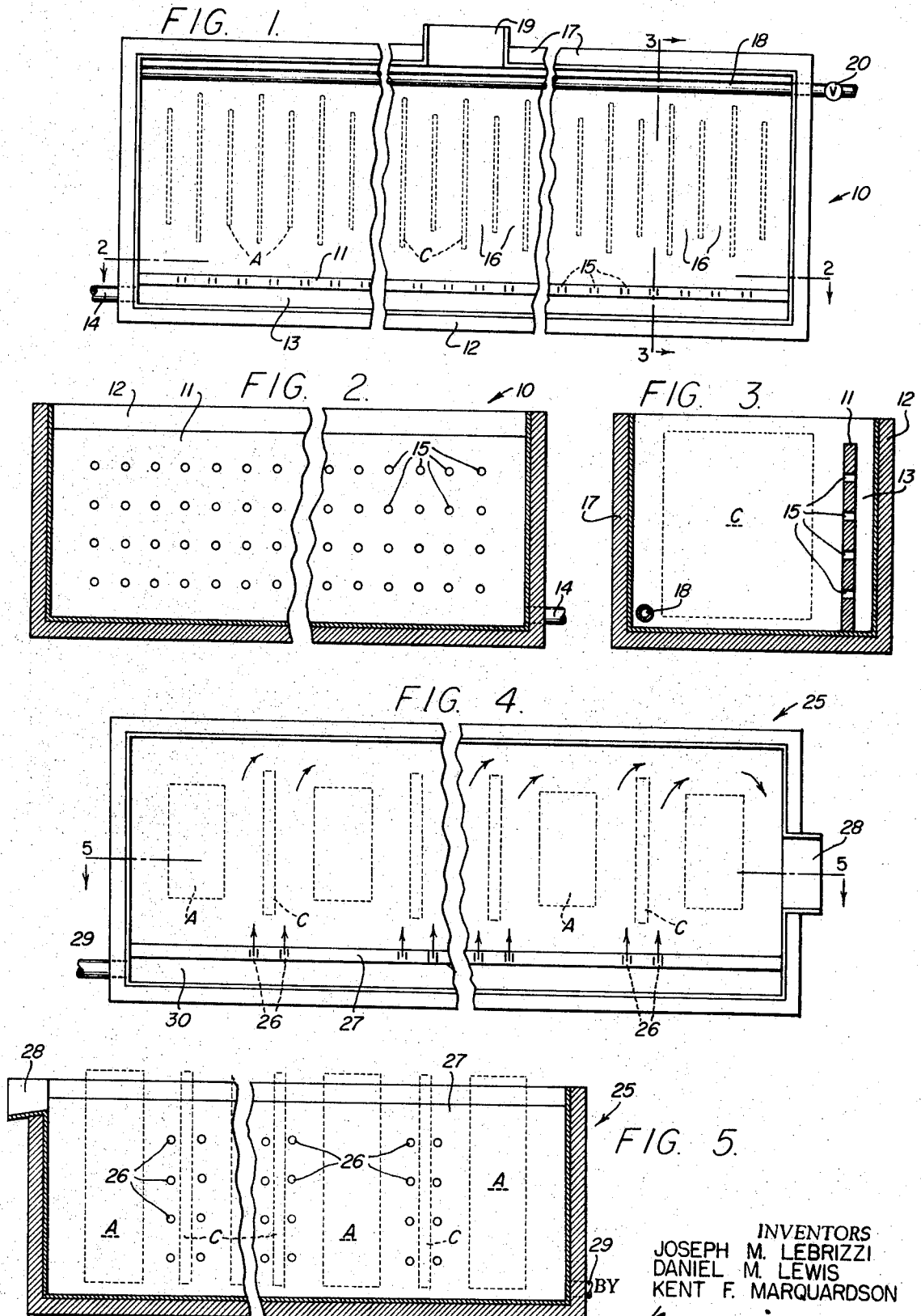
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ELECTROLYTIC CELL

Filed March 4, 1968

2 Sheets-Sheet 1



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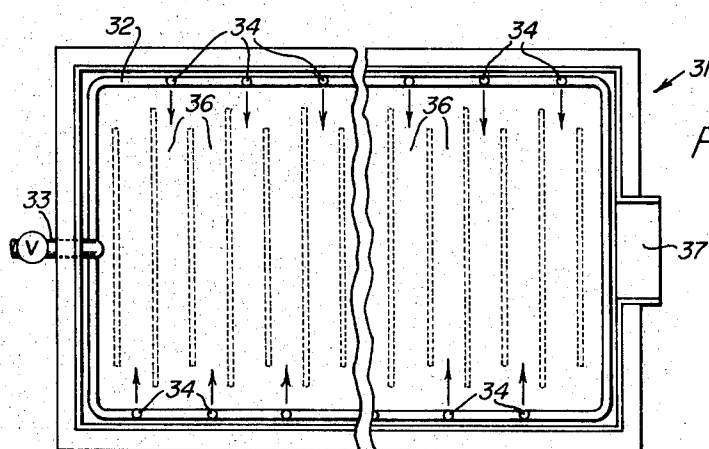
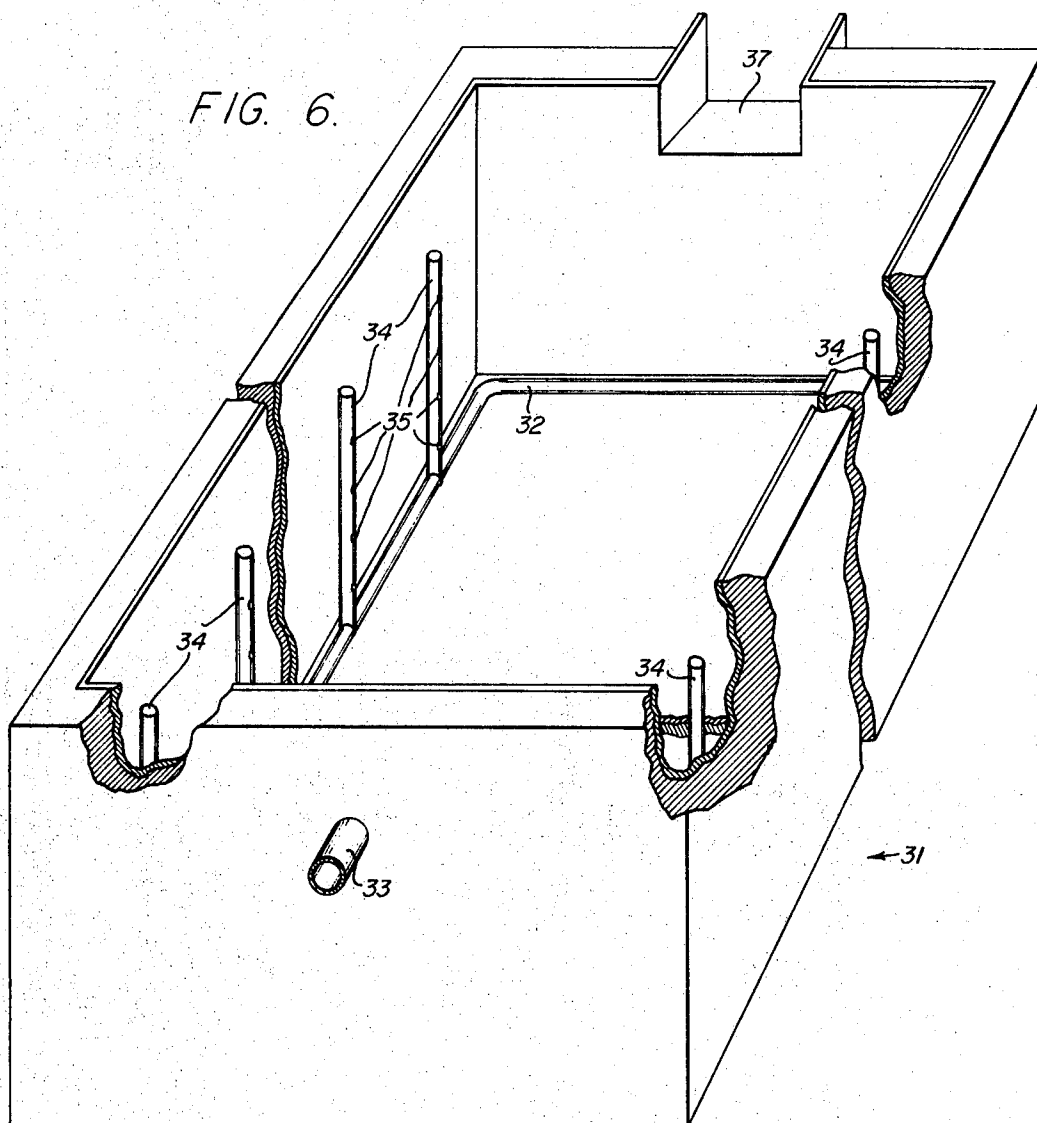
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ELECTROLYTIC CELL

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11 Claims

ABSTRACT OF THE DISCLOSURE

An electrolytic cell intended primarily for the electrorefining and electrowinning of metals, notably copper. In order to enable the use of high current densities, while still obtaining satisfactory deposits of metal on the cathode electrodes of the cell, there is provided an electrolyte-inflow system which directs feed of electrolyte into the cell between mutually adjacent anode and cathode electrodes along the length and the effective height of the cell tank, with discharge of electrolyte either along the length of the cell tank in opposition to the feed or at an end of the cell tank, so that flow of electrolyte through the cell takes place at high velocity and minimum turbulence between the electrodes and substantially parallel with the broad faces thereof.

BACKGROUND OF THE INVENTION

Field.—The invention pertains broadly to the art of the electro-deposition of metals from an electrolyte solution, wherein the metallic ions are either placed in solution in the cell by the action of an electric current on anodes of metal to be refined, such as previously fire-refined, blister copper, or are already in the solution, e.g. by reason of the previous leaching of ore with the solution. In either instance, the metallic ions are deposited from the solution on cathode electrodes of broad sheet formation extending in spaced, alternating, series relationship with anode electrodes interleaved therebetween.

State of the art.—The art is highly developed, but those skilled therein have long sought ways of enabling the use of higher than normal current densities in order to produce metallic deposits of maximum purity. It has been recognized heretofore that difficulties which normally arise in the use of high current densities can be minimized by increasing relative motion of the electrolyte and the electrodes. Various ways of doing this have been proposed prior to this invention, but there has been considerable room left for improvement in both increased current densities and character of the metallic deposits on the cathodes.

SUMMARY OF THE INVENTION

A principal purpose in the making of the invention was to attain high velocity flow of electrolyte relative to the electrodes, so as to enable use of high current densities, without undue turbulence or other disadvantages that would outweigh the advantage otherwise attained.

This was achieved by introducing the electrolyte into the cell tank through orifices located in or adjacent to either one or both lateral walls of the cell tank, distributed along the lengths and effective heights of such walls, and directed toward the spaces between mutually adjacent electrodes of the series. When introduction of the electrolyte is from only one lateral wall of the cell tank, discharge from the tank can be advantageously arranged at the opposite lateral wall of the tank; when feed is from both lateral walls of the cell tank, discharge is normally arranged at an end of the cell tank.

THE DRAWINGS

The accompanying drawings illustrate the best mode and certain variations thereof presently contemplated for carrying out the invention.

In the drawings:

FIG. 1 represents a schematic top plan view, with intermediate portions broken out for convenience of illustration, of an electrowinning cell conforming to the invention and having feed and discharge of electrolyte along respective, opposite lateral sides of the cell tank, the anode and cathode electrodes being indicated by broken lines;

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

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

FIG. 4, a view corresponding to that of FIG. 1 but showing an electrorefining cell conforming to the invention and having feed along one lateral side of the cell tank and discharge at one end thereof;

FIG. 5, a view corresponding to that of FIG. 2, but taken along the line 5—5 of FIG. 4;

FIG. 6, a pictorial view, looking from one end and above, of a somewhat different form of electrowinning cell conforming to the invention; an intermediate portion and parts of the cell tank walls being broken out for convenience of illustration;

FIG. 7, a top plan view of the cell of FIG. 6 with anode and cathode electrodes being indicated by broken lines.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

In the embodiment of the invention illustrated in FIGS. 1—3, the electrolytic cell is in the form of an electrowinning cell used for the winning of metal values from a metallurgical leach solution or the like and is arranged with means for the introduction, i.e. feed, of electrolyte along the length and effective height of one lateral side of the cell tank 10 and with means for the discharge of electrolyte from the opposite lateral side of such tank after it has passed between the anode and cathode electrodes indicated A and C, respectively.

By "effective height" is meant that portion of the height of the tank that measures the normal depth of electrolyte in the tank during operation of the cell.

The cell tank 10 is preferably of the standard elongate rectangular formation, with reinforced concrete walls protectively lined internally of the tank.

The feed means for electrolyte, which is recirculated through the system in customary manner, comprises in this instance an inner lateral wall 11 in the form of a perforate panel of corrosion-resistant material, such as a suitable plastic, spaced from a lateral wall 12 of the cell tank to provide a header space or passage 13 for the flow of incoming electrolyte from a supply pipe 14 to the perforation or inlet passages 15 distributed along both the length and the height of such inner wall 11. Such inner wall 11 comprehends in its extent the normal depth of electrolyte in the cell during operation. The inlet passages 15 are arranged between mutually adjacent anode and cathode electrodes, so as to direct the flow of the electrolyte feed into the spaces 16 between such electrodes in parallel relationship with the opposite broad faces of each cathode C, it being understood that the electrodes are suspended in the cell tank in the usual manner and have the usual electrical connections.

Discharge means for electrolyte is arranged at the opposite lateral wall 17 of the cell tank, and, in the form shown, comprises a pipe 18 perforated along its length and extending longitudinally of the tank at a low level

therein, preferably adjacent to the level of the lower ends of the cathode electrodes, as indicated in FIG. 3. The discharge means also preferably includes a conventional weir 19 disposed centrally of the lateral wall 17 as a positive control for the level of electrolyte in the cell tank.

In the operation of the cell, electrolyte is introduced into the header space or passage 13 from the electrolyte recirculating system by way of supply pipe 14, and is returned to the system by way of discharge pipe 18 after traversing the width of the cell tank in parallel flow relationship with the electrodes A and C. A valve 20 is desirably interposed in the discharge line from pipe 18 in order to regulate the amount of electrolyte discharging from the cell tank by way of pipe 18 and weir 19, respectively.

The embodiment of FIGS. 4 and 5 illustrates an advantageous arrangement for an electrorefining cell in accordance with the invention. There, feed means for the electrolyte to cell tank 25 is similar to that of the foregoing embodiment, with suitable modifications in the placement of the perforations or inlet passage 26 in inner wall 27 to accommodate the different anode and cathode electrodes, A and C, respectively, involved for electrorefining.

The discharge means in this embodiment is provided solely by a weir 28 leading from one end of the cell tank 25. In operation, electrolyte from supply pipe 29 flows into header space or passage 30 and thence into the interior of the tank from one lateral side thereof in parallel flow relationship with the electrodes, by way of the inlet passages 26. Circulation of the electrolyte through the interior of the cell tank tends to be as indicated by the arrows, with longitudinal flow along the opposite lateral side of the tank toward the discharge end thereof.

In the embodiment of FIGS. 6 and 7, shown as an electrowinning cell, introduction of electrolyte to the cell tank 31 is along both lateral sides of the tank by way of a header loop of piping 32 set into the interior of the tank and connected to a valved supply pipe 33 leading from a pressure source of electrolyte. Series of spaced riser pipes 34, extending along opposite lateral sides of the tank, are drilled transversely to provide respective series of inlet passages 35 along their lengths and directed interiorly of the tank, and are capped at their upper ends to provide a closed system except for the inlet passages 35.

Such riser pipes 34 are located so as to face directly toward the spaces 36 between the mutually adjacent anode and cathode electrodes, A and C, respectively, whereby pressurized electrolyte from both lateral sides of the tank is directed in parallel flow relationship with the broad faces of such electrodes. By placing such riser pipes at alternate lateral sides of the tank and at the ends of alternate spaces 36, as illustrated by FIG. 7, directed flow of electrolyte is unidirectional through such spaces.

The means for discharging electrolyte from the cell tank is, again, solely a weir 37 at one end of the tank.

Reference herein and in certain of the claims to inventive details of specific embodiments is not intended to limit the scope of the generic claims, which particularly point out and distinctly claim the broader subject matter which is regarded as the essence of the invention. Thus, the present disclosure will suggest many modifications which do not essentially depart from the invention described and claimed hereby.

We claim:

1. An electrolytic cell, comprising a tank having end walls and mutually opposed lateral walls, said tank being adapted to hold electrolyte and a plurality of substantially vertical and transversely disposed, mutually spaced and interleaved, anode and cathode electrodes; feed means for electrolyte comprising inlet passages distributed along the length and effective height of said tank at one lateral side thereof, said inlet passages being directed toward spaces between said anode and cathode electrodes as installed in said tank so as to discharge electrolyte therebetween in substantially parallel flow relationship therewith; and means for discharging electrolyte from the tank.

2. An electrolytic cell according to claim 1, wherein the feed means for electrolyte comprises a header extending along the length and effective height of the tank interiorly thereof and at the lateral wall of the tank that is at the one lateral side thereof; and wherein the inlet passages extend through a wall of said header.

3. An electrolytic cell according to claim 2, wherein the header is formed by an inner wall of the tank that is coextensive with and spaced from the lateral wall of the tank at the one lateral side thereof.

4. An electrolytic cell according to claim 3, wherein the discharge means is located at the opposite lateral side of the cell tank in opposition to the inlet means.

5. An electrolytic cell according to claim 4, wherein the discharge means comprises a perforate conduit extending longitudinally along the opposite lateral wall of the cell tank.

6. An electrolytic cell according to claim 5, wherein the discharge means additionally comprises an overflow weir.

7. An electrolytic cell according to claim 6, wherein the discharge means additionally comprises valve means for controlling flow from the perforate conduit.

8. An electrolytic cell according to claim 1, wherein the discharge means is solely an overflow weir at one end wall of the cell tank.

9. An electrolytic cell according to claim 1, wherein the feed means for electrolyte comprises a liquid-flow system that is closed except for the inlet passages, and means for introducing electrolyte into said system under pressure.

10. An electrolytic cell according to claim 9, wherein the liquid flow system is a closed loop of piping having a series of spaced risers extending therefrom, the inlet passages being formed through said risers.

11. An electrolytic cell according to claim 10, wherein the loop of piping has portions extending along both lateral sides of the cell tank at the lateral walls thereof, and wherein there is a series of risers along each of said portions.

References Cited

UNITED STATES PATENTS

541,147	6/1895	Blackman	204—275X
686,395	11/1901	Dessolle	204—275X
1,136,483	4/1915	Porter	204—263X
3,350,286	10/1967	Crane	204—95
3,451,906	6/1969	Weed	204—82

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204—269, 263