June 24, 1969 G. O. WESTERLUND 3,451,915

ELECTROLYTIC CELL WITH COVER INCLUDING FEEDING MEANS

Filed Sept. 21, 1966 Sheet 1 of 3

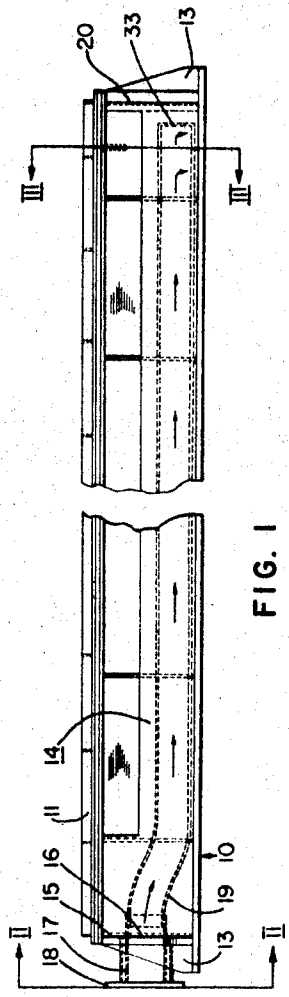


FIG. 1

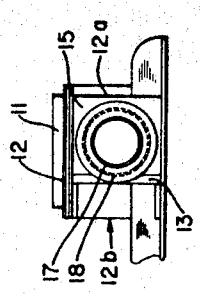


FIG. 2

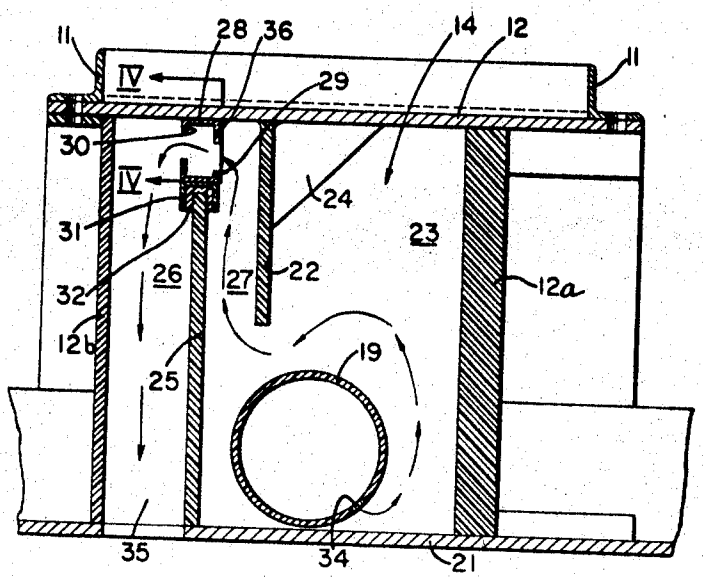

11
28
36
14
12
11
IV
29
30
IV
24
31
23
26
27
22
12a
32
12b
19
25
35
34
21

FIG. 3

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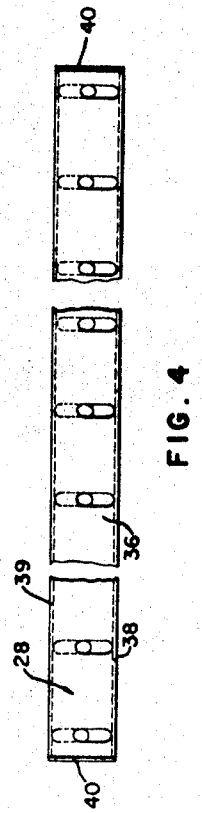


FIG. 4

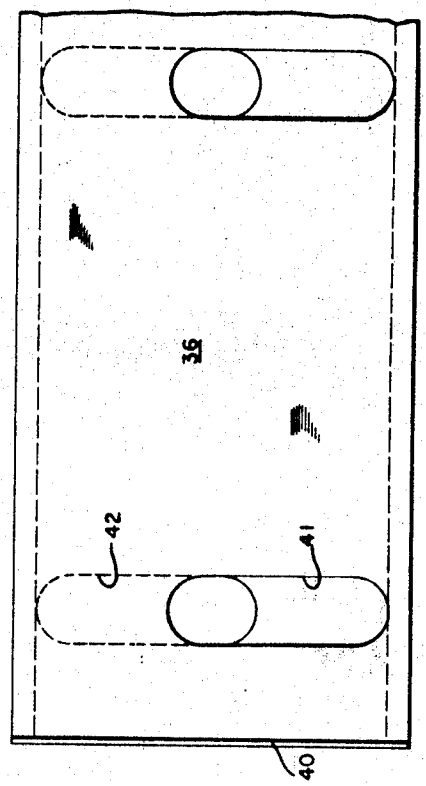


FIG. 5

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3,451,915

ELECTROLYTIC CELL WITH COVER INCLUDING FEEDING MEANS

Göthe O. Westerlund, Vancouver, British Columbia, Canada, assignor to Chemech Engineering Ltd., Vancouver, British Columbia, Canada, a corporation of Canada

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Claims priority, application Canada, July 11, 1966, 965,100
Int. Cl. B01k 3/00
U.S. Cl. 204—275 8 Claims

This invention relates to improvements in electrolysis apparatus and particularly to an improved combined cell cover and electrolyte distributor for an enclosed electrolytic cell.

There are many apparatus presently patented especially adapted to carry out electrolytic chemical reactions in a sealed apparatus. Amongst such patents are Australian Patent No. 249,105, United States Patent 2,799,643 issued July 16, 1957 to C. W. Raetzsch, United States Patent 3,030,295 issued Apr. 17, 1962 to R. F. Labarte, United States Patent 2,955,999 issued Oct. 11, 1960 to C. E. Tirrell, United States Patent 3,055,811 issued Sept. 25, 1962 to N. C. Ruff, United States Patent 3,076,754 issued Feb. 5, 1963 to D. J. Ebans, United States Patent 2,795,541 issued June 11, 1957 to J. Muller, Canadian Patent 375,433 issued July 26, 1939 to Kolbjorn Paulsen, Canadian Patent 390,568 issued May 9, 1927 to Carl Roth and Canadian Patent 714,037 issued July 30, 1965 to Sidney Forbes.

Representative of the manner in which the electrolyte is admitted to the electrolytic cell through the cover is the above mentioned Canadian Patent 714,037 which shows an electrolytic bipolar chlorate cell which is provided with a cover. Located above the upper surface of the cover member of the cell is a brine header. A plurality of feed tubes are integrally connected to the header and these feed pipes terminate in downward extensions which traverse the cell cover and end at open tubes a short distance below the liquid level contained in the cell. The header is fed from a duct which normally is connected to a retention tank which is located at a point some distance from the cell. The admission of brine to the cell is readily accomplished by suitable conventional pumping mechanism.

In order to insure proper forced circulation to each individual cell unit in a bipolar electrolytic cell which contains a plurality of such cell units, it is important that the head of liquor above the inlet to each individual cell have a substantially equal pressure. It is also important to minimize current leakage through the liquor so as to improve the efficiency of the electrolytic procedure.

Accordingly, an object of one aspect of the present invention is the provision of a combined cell cover and liquor distributor for an electrolytic cell in which the head of liquor to each inlet of the individual cell making up the electrolytic cell is substantially constant.

An object of another aspect of the present invention is the provision of a combined cell cover and liquor distributor for an enclosed electrolytic cell in which current leakage through the liquor is minimized.

By a broad aspect of the present invention there is now provided in an enclosed electrolytic cell, a combined cover and electrolyte distributor comprising: (a) an elongated manifold extending along the longitudinal axis of said cover; (b) baffles disposed within said manifold to divide said manifold into an inlet compartment, an outlet compartment and at least one intermediate compartment between said inlet compartment and said outlet compartment, said compartment being interconnected along a substantially sinusoidal pathway; (c) liquor inlet means to the inlet compartment of said manifold; and (d) outlet means from said manifold to said cell, said outlet means

extending from said outlet compartment of said manifold.

In another aspect of the present invention the liquor inlet means to the inlet compartment of the mainfold includes a liquor inlet conduit disposed within said manifold and extending the length of said cover, and including outlet means at an end thereof remote from the inlet to the conduit for discharging liquor to the inlet compartment of said manifold.

By another aspect of the present invention the manifold is divided into an inlet compartment, an outlet compartment, a single intermediate compartment therebetween.

By another aspect of the present invention at least two of the compartments within the manifold are interconnected by a hollow baffle member having inlet means and outlet means, the inlet means being connected to the outlet means along a substantially sinusoidal pathway.

By another aspect of the present invention the apertures in the above mentioned hollow baffle member are vertical slots.

By another aspect of the present invention the hollow baffle member is disposed between the outlet compartment and the intermediate compartment.

By another aspect of the present invention the baffles within the manifold extend along the length of the cell cover substantially parallel to the liquor inlet conduit.

By another aspect of the present invention the manifold and the baffles are formed of a chemically resistant material such as polyvinyl chloride.

The present invention is particularly adapted for use with the various embodiments of bipolar electrolytic cells disclosed and claimed in pending application Ser. No. 543,261 filed Apr. 18, 1966 for carrying out an alkali metal chlorate electrolysis which may be summarized as

$$MtCl + 3H_2O + 6\ \text{Faradays} \rightarrow MtClO_3 + 3H_2$$

(wherein Mt is a metal).

The main reactions in the electrolytic preparation of the metal chlorate from the metal chloride may be represented by the following primary reactions and secondary reactions, namely:

At the anode:

$$2MtCl \rightarrow 2Mt^+ + 2Cl^- \rightarrow Cl_2\ (gas) + 2e^- + 2Na^+$$

At the cathode:

$$2H_2O \rightarrow 2H^+ + 2OH^- + 2e^- \rightarrow H_2\ (gas) + 2OH^-$$

and the following secondary reactions, namely:

$$Cl_2 + OH^- \rightarrow ClOH + Cl^-$$
$$ClOH \rightarrow H^+ + OCl^-$$
$$2ClOH + ClO^- \rightarrow ClO_3^- + 2Cl^- + 2H^+$$

In the accompanying drawings,

FIGURE 1 is a central longitudinal section along the length of a cell cover according to one embodiment of the present invention,

FIGURE 2 is a view along the line 2—2 of FIGURE 1,

FIGURE 3 is an enlarged section along the line 3—3 of FIGURE 1, and

FIGURE 4 is a view along the line 4—4 of FIGURE 3, and

FIGURE 5 is an enlarged view of two of the apertures shown in FIGURE 4.

The electrolytic cell cover of one aspect of the present invention as shown in FIGURE 1 and FIGURE 2 includes a generally box-like framework **11** preferably made of steel for reinforcing purposes and provided with sheathing **12** formed of relatively chemically inert material, such as a polyvinyl chloride or rubber covered steel. Reinforcing gussets **13** are provided at each end of the box-like manifold provided by the covered framework The forward end wall **15** is provided with an aperture **16** through which projects a sleeve **17** provided with a flange

18. Connected to the sleeve 17 is a liquor conducting conduit 19 formed of relatively chemically inert material such as polyvinyl chloride. The other end 20 of the box-like manifold is unapertured.

The construction of the inlet manifold 14 will be more fully understood with reference to FIGURE 3. It is noted that the manifold 14 is in the form of a generally box-like member provided by side wall sheathing 12*a* and 12*b* and roof sheathing 12 as well as floor sheathing 21, which in turn constitutes the roof of the cell cover proper. It is noted that liquor inlet pipe 19 extends along the longitudinal axis of the manifold 14.

A first baffle 22 projects downwardly from the roof sheathing 12 to define, between side sheathing 12*a* and itself an inlet compartment 23. A plurality of triangular shaped gussets 24 serve to rigidify and strengthen baffle 22.

Upstanding from floor 21 of the manifold is a baffle 25. Baffle 25 provides, between sheathing 12*b* and itself an outlet compartment 26 and, between baffle 22 and itself an intermediate compartment 27. It is to be observed that baffles 22 and 25 and gussets 24 are formed of essentially chemically inert and resistant material such as polyvinyl chloride.

Disposed between intermediate compartment 27 and outlet compartment 26 is a hollow generally rectangular paralleleipiped baffle 28 provided with an inlet aperture 29 and an outlet aperture 30, the inlet aperture 29 and outlet aperture 30 being interconnected along a substantially sinusoidal pathway (as shown by the arrows). It is also observed that hollow baffle 28 rests upon bracket 31 which is mounted on baffle 25 by sealing means 32.

Liquor inlet pipe 19 is sealed at its terminal end 33 but it is provided with liquor discharge ports 34 near the terminal end 33, only one of such ports being shown in FIGURE 3. It is, therefore, seen that the liquor discharged through port 34 of liquor inlet conduit 19 follows the substantially sinusoidal pathway as shown by the arrows interconnecting compartment 23, intermediate compartment 27 and outlet compartment 26. Outlet compartment 26 leads to the inlet 35 to the electrolytic cell unit.

The structure and configuration of hollow baffle 28 is shown more fully in FIGURES 4 and 5. Hollow baffle 28 comprises a front wall 36, a rear wall (not shown), a floor 38, a ceiling 39 and end caps 40. Front wall 36 is provided with a plurality of spaced-apart slots 41 providing an inlet for liquor from intermediate compartment 27 to hollow baffle 28, and slots 42 are provided in wall 37 which provides an outlet from hollow baffle 28 to outlet compartment 26.

In operation then, the liquor is forced by pumping means (not shown) to sleeve 17 from whence it flows along inlet conduit 19 to the end thereof. At the end it is forced out through outlet ports 34 and follows a substantially sinusoidal pathway as indicated by the arrows in FIGURE 3 upwardly in inlet compartment 23 and then downwardly under baffle 22 and into intermediate chamber 27, then upwardly in intermediate chamber 27 through hollow baffle 28 and downwardly through outlet compartment 26 to be led to the cell inlet 35.

Since the liquor is discharged at the terminal end of the liquor inlet pipe after passing therethrough, current leakage will be minimized due to the increased resistance caused by the increased length of the liquor paths. The provision of the baffle plates within the distributing manifold creates a pressure drop which makes it possible to distribute the liquor over the full length of the manifold and thus also distribute the liquor evenly into each individual cell of the cell unit. The provision of the hollow baffle 28 which extends the full longitudinal length of the liquor distributing portion of the manifold provides that liquor from intermediate chamber 27 is caused to flow through the lower slot and overflow through the upper slot in the opposite side and then flow downwardly in outlet compartment 26 which feeds the individual cells of the cell unit. This design insures that the liquor is distributed substantially equally over the total length of the distributing manifold portion of the cell cover. This, in turn, insures that the outlet compartment has liquor therein with equal pressure over the full length of the cell unit. This insures proper forced circulation into each individual cell.

I claim:

1. An enclosed electrolytic cell including a combined cover and electrolyte distributor comprising:
   (a) an elongated manifold extending along the longitudinal axis of said cover,
   (b) baffles within said manifold to divide said manifold into an inlet compartment, an outlet compartment, and at least one intermediate compartment between said inlet compartment and said outlet compartment, said compartment being interconnected along a substantially sinusoidal pathway,
   (c) liquor inlet means to the inlet compartment of said manifold, and
   (d) outlet means from said manifold to said cell, said outlet means extending from said outlet compartment of said manifold.

2. The cell of claim 1 wherein said liquor inlet means to the inlet compartment of said manifold comprises a liquor inlet conduit disposed along the longitudinal axis of said manifold and including discharge means between said conduit and said inlet compartment of said manifold.

3. The cell of claim 1 wherein said manifold is divided into an inlet compartment, an outlet compartment and a single intermediate compartment.

4. The cell as claimed in claim 1 wherein at least two said compartments are interconnected by a hollow baffle member provided with inlet means and outlet means, the inlet means to said hollow baffle being connected to the outlet means from said hollow baffle along a substantially sinusoidal pathway.

5. The cell as claimed in claim 4 wherein the hollow baffle is disposed between the outlet compartment and the intermediate compartment.

6. The cell of claim 5 wherein the inlet means to and outlet means from said hollow baffle are vertical slots.

7. The cell of claim 1 wherein the baffles extend along the length of the cell cover.

8. The cell of claim 1 wherein the manifold is formed of polyvinyl chloride.

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ALLEN B. CURTIS, *Primary Examiner.*