ELECTROLYSIS CELL WITH ANODE SUPPORT MEANS

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ABSTRACT

Electrolysis cell which is a series of cathodes and anodes, the anodic arrangement being a support-plate used for current inlet, the plate being coated on the outside with a thin sheet of chemically resistant metal and with a metal anode battery fixed on the support plate by bolts, the anodes being connected by a linking device.

6 Claims, 3 Drawing Figures
ELECTROLYSIS CELL WITH ANODE SUPPORT MEANS

The present invention relates to a diaphragm or membrane cell, usable more especially in the electrolysis of alkali metal halide aqueous solutions. This cell has a new design of an anodic arrangement which gives remarkable performance in its utilization.

In the classical electrolysis membrane or diaphragm cells, anodic bottoms comprise generally anodes of graphite, the lower parts of which are surrounded with a lead layer which maintains them in a fixed position and allows their feeding in current from copper bars which are generally sealed also in this lead layer. Thus the arrangement is as follows: graphite anodes, lead, feeding bars are then placed in a concrete container on which the cathodic assembly will be supported. In order to ensure both protection and tightness of the anodic bottom, an asphalt layer is cast inside the concrete bottom having a sufficient thickness to cover the lead and the lower parts of the graphite anodes, in order to avoid the penetration of very corrosive brines during electrolysis.

The cathodic assembly comprises a battery of cathodic fingers in metal foil or a wire mesh covered with a diaphragm or membrane placed on the concrete support.

The utilization of graphite anodes has always had some disadvantages, due to the anodes own wear, giving rise on one hand to an increasing of the pressure necessary for the satisfactory operation of the cell because of an increase in the distance between anode and cathode and also due to the membrane or diaphragm plugging by the particles of disintegrating graphite. The total yield of the cell is decreased and the anodes only have a limited life.

For some years, these graphite anodes have tended to be replaced by metal anodes having a surface which is covered with a coating of precious metals, the whole then undergoing an activation treatment. Those anodes have the advantage of presenting a very good corrosion resistance with regard to the anolyte, they are stable dimensionally and do not have the hereinabove disadvantages. Consequently the lifetime of diaphragms or membranes deposited on cathodes is clearly improved.

Besides the advantages resulting from their chemical nature, the utilization of such anodes has permitted interesting improvements and simplifications in the fabrication of the anodic bottom. Indeed, graphite suppression permits elimination of the materials, such as lead and asphalt, which were required to fix and feed the graphite anode electrically and to ensure a protection against further corrosion during electrolysis.

Various possibilities have previously been described.

First, it has been proposed to connect the anodes directly to current distributors, made up of parallel bars of copper, aluminum or of another good conducting metal, which bars are cast, welded or brazed inside a pipe of titanium or of another similar metal.

On every elemental conductor made in this way, having dimensions appropriate to those of the cell, there is then fixed a number of anodes corresponding to their normal distribution in the cell. The fixing may be made by direct welding on the conductor or by previous fixing of blades on this conductor and bolting the anode on the blades. Conductors are placed in a horizontal and parallel way and extend from one side to the other side of the electrolysis cell. The anodes are placed in a parallel way between them in a vertical plan. Elemental conductors pass through the container wall and then are grouped in order to be connected to a current source (French Pat. No. 1,498,250 dated Nov. 4, 1966).

According to another technique, anode fixing has been achieved on a titanium piece, in the form of a bucket or cup, by means of titanium bolts crossing the anode, fixed on clamps conveniently welded to the base of the piece having the bucket form. A variant recommends the formation, on this plate in bucket form, of parallel ribs and the direct bolting of anodes onto those ribs. The piece in bucket form, in thin titanium sheet or a similar metal covers the whole of the container surface and is fixed by any convenient means to a relatively thick copper or aluminum stand which acts to bring in and to distribute current, this stand being made up of only a plate or by parallel bars corresponding to positioning of the anodes. (French Pat. No. 1,512,683 dated Feb. 28, 1967.)

Finally, anode bolting has been achieved on titanium plates in L form. Those plates are themselves fixed onto a titanium base which has directly below those L-shaped plates copper bars allowing current arrival. (British Pat. No. 1,125,493 dated Mar. 24, 1966).

All these previous techniques recommend the use of a tube or jacket of titanium or a similar metal, on the copper or aluminum current inlet plate or bar, with the necessity to use this tube or jacket as a relay for the passing of current between the current furnishing plate or bar and the anodes. These techniques are interesting and constitute a substantial technical advance, but they have however important disadvantages which the present invention is intended to remedy.

The object of the present invention is to provide a diaphragm or membrane electrolysis cell for alkaline metal halide aqueous solutions having an anodic arrangement comprising a support-plate used as a current inlet, coated on its exterior with a thin sheet of a metal or alloy chemically resistant to the anodic medium and a battery of metal anodes fixed to the support-plate by means of bolts, the anode fixing bolts being planted in the current inlet support-plate while the anodes are interconnected in their upper part by a connecting device.

The current inlet support-plate is of copper, aluminum or any other metal or alloy which is a good conductor of current.

The external coating on this support-plate, the anode fixing bolts, and the fixing nuts of the anodes on the bolts, are all made of a metal or alloy which is chemically resistant to the anodic medium, such as titanium, tantalum or similar metals or their alloys. The arrangement is preferably made of the same metal or alloy.

Anodes are made up of a plate or sheet of a metal resisting corrosion such as titanium, tantalum or similar metals or their alloys, covered with a coating of precious metals of the platinum group, undergoing afterwards an activation treatment. These anodes have a good resistance with regard to the anolyte and a good dimensional stability with time.

The bolts are fixed in the support-plate by any convenient means, pass through the jacket to which they are attached by welding and are used in their visible part as anode fixing elements by means of nuts. These
bolts are used as electrical current conductors and allow the direct taking into the support-plate of current intended for the anodes. The anodes may rest on the flanges or on a plate pierced with holes in order to allow passage of the bolts. The flanges or plate are set on the jacket of current inlet support-plate.

The external jacket of the support plate used for current inlet assures the chemical protection of this plate in the anodic medium. The fittings between the bolts and the jacket are made tight by welding. The direct conductance of current by anode fixing bolts, in the support-plate used as the current inlet permits the remedying of the disadvantages met by previous techniques.

In these techniques, the dilatation difference between the current inlet support-plate and the jacket sheet used as the current vehicle, involves the risk of a bad electrical contact between the plate and the support. This may give rise to bad voltage drops that it is not possible to control efficiently.

Direct taking of current into the support-plate by the bolts, in accordance with the present invention, eliminates these hazards since the voltage drop between the plate of current inlet and the anode base is limited by applying a uniform tightening couple fitted to the nuts fixing the anodes on the bolts.

According to a characteristic of the device of the invention, the anodes, after cathode installation, are connected to one another in their upper part by a connecting device. The latter, which is used for conveniently positioning the anodes, may have any form and may be made of various materials such as metals and alloys, plastic materials, ceramics, etc. It has however been found especially advantageous to effect this device in an electrically conducting and chemically inert element in order to improve the regularity of electrical distribution of the anodic arrangement and to suppress electrical imbalance which may occur between the different anodes.

The direct inlet of current into the support-plate and the linking device connecting the anodes at their upper part, are separately a great improvement, but their joint utilization gives rise to a better efficiency, so it is desirable to achieve it.

The invention will be understood better by means of the following detailed description and the attached drawings in which:

FIG. 1 is a cross sectional view of the support-plate with its jacket, bolts and anode fixing means;

FIG. 2 is a variant of FIG. 1 with respect to the fixing of the bolts; and

FIG. 3 is a cross sectional view of the electrolysis cell after installation of the cathode on the anodic bottom.

In FIGS. 1 and 2, the support-plate 1 used as the current distributor is fed by anodic current inlet plate 2, welded to plate 1 at 16.

This plate 1 is pierced with holes which are then threaded for receiving bolts 4 each provided with a flange 9.

Jacket 3 of the upper part of plate 1, which may be connected by welding to a lower jacket allowing a complete enclosure of plate 1, has been also previously pierced with holes in which are embedded the flanges 9 of anode fixing bolts 4 (as shown in FIG. 1). The flanges may also be supported on the jacket 3 (as shown in FIG. 2).

The periphery of flange 9 is welded to jacket 3, without application of metal.

In FIG. 1 welding 5 will be made again for obtaining an even surface between the flange 9 and the jacket 3 in order to obtain a good support surface for the anode base 7. When all the bolts are well positioned and welded, the anodes previously pierced by bolts are fixed on the bolts 4 by nuts 6 made of a material of the same nature as the bolts 4 and the jacket 3. Flats or washers 8 of non corrosive metal or alloy avoid direct contact between the nut 6 and anode base 7. In FIG. 3 the anode bottom as described hereinabove has been deposited in a cell container 10 in concrete or in polyester. In the case when concrete is used tightness is obtained by means of a polyester joint 11 which clamps the anodic arrangement at the periphery of support-plate 1 and of its jacket 3 and so protects the whole against anolyte corrosion. Then cathode 14 is installed; it includes a finger battery 15 of metal fabric or of perforated metal sheet on which a diaphragm has been set. Anodes 7 at the top of which grooves have been made are connected by a threaded rod 12 provided with nuts and lock-nuts 13.

The membrane or diaphragm cell for electrolysis made according to the present invention has numerous advantages.

It permits obtaining a very important weight decrease of the anodic arrangement with the same productivity because of the elimination of the lead and of the graphite.

The protection of current inlet support-plate by a jacket resisting the anolyte corrosive action eliminates asphalt use.

The metal anodes mounted according to this invention device are easily dismountable and may be regenerated very easily after wear of the active deposit. It is not necessary to dismount the whole arrangement if an anode has to be replaced.

The anodic bottom obtained in this way is achieved once and for all, contrary to the known anodic bottoms, with graphite anodes which are entirely recovered at the end of each anodic life.

The diaphragm or membrane life is greatly increased because of the absence of plugging resulting from graphite anode wear.

It will be obvious to those skilled in the art that various changes may be made without departing from the scope of the invention and the invention is not to be considered limited to what is described in the specification.

What is claimed is:

1. An electrolytic cell of the diaphragm type comprising an anode assembly therein, said anode assembly comprising an electrical conductor plate extending in the cell bottom and covered by an electrically conductive corrosion-resistant layer, a plurality of metallic anodes extending into the cell and resting on the electrically conductive corrosion-resistant layer, each of said anodes being releasably and directly attached and electrically connected to the conductor plate by a plurality of metal pins extending into the electrical conductor plate in mating engagement therewith and through apertures provided in the electrically conductive corrosion-resistant layer and in the base portion of the anodes, said pins being fixed into position, each of said anodes being releasably attached to one of said pins by a removable holding means.
2. An electrolytic cell according to claim 1 wherein the removable holding means is a nut.

3. An electrolytic cell according to claim 1 wherein the electrically conductive corrosion-resistant layer, pins and the removable holding means are made of a metal selected from the group consisting of titanium, tantalum and alloys thereof.

4. An electrolytic cell according to claim 1 wherein each pin extends through an apertured electrically conductive, corrosion resistant flange, said flange being welded to the electrically conductive corrosion-resistant layer to render said electrically conductive corrosion-resistant layer leakproof.

5. An electrolytic cell according to claim 4 wherein each flange is received in an aperture therefor in the electrically conductive corrosion-resistant layer.

6. An electrolytic cell according to claim 4 wherein the apertured flange is disposed on the electrically conductive corrosion-resistant layer, the aperture in the flange being aligned with the aperture in the layer.

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