

Nov. 11, 1969

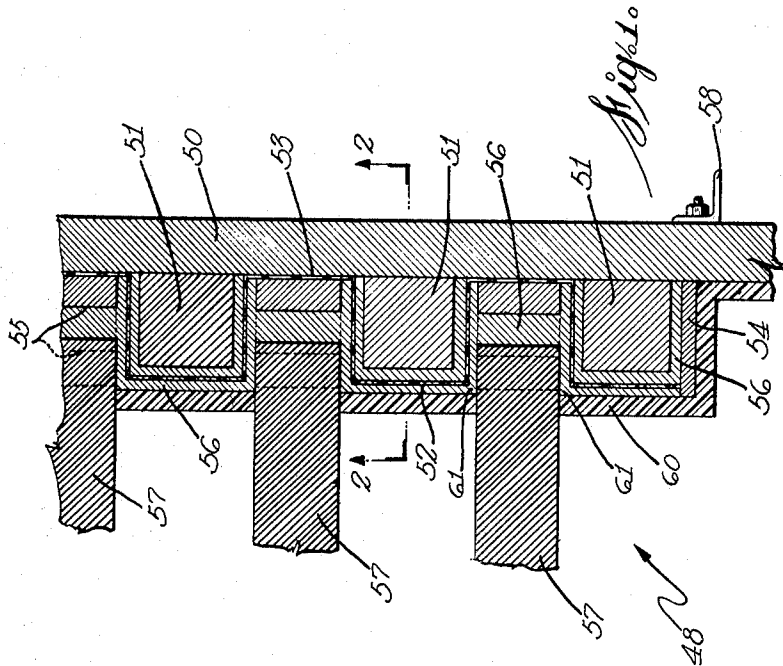
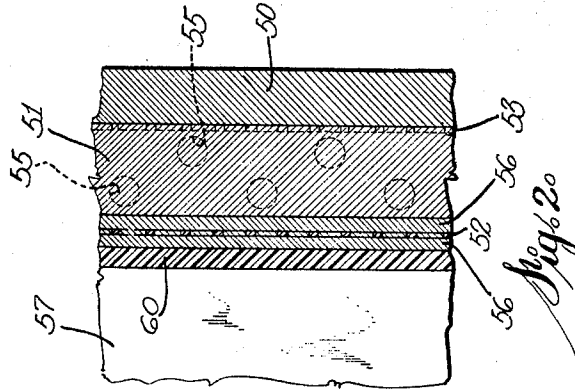
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ANODE STRUCTURE FOR ELECTROLYTIC CELL

Filed Oct. 6, 1967

2 Sheets-Sheet 1



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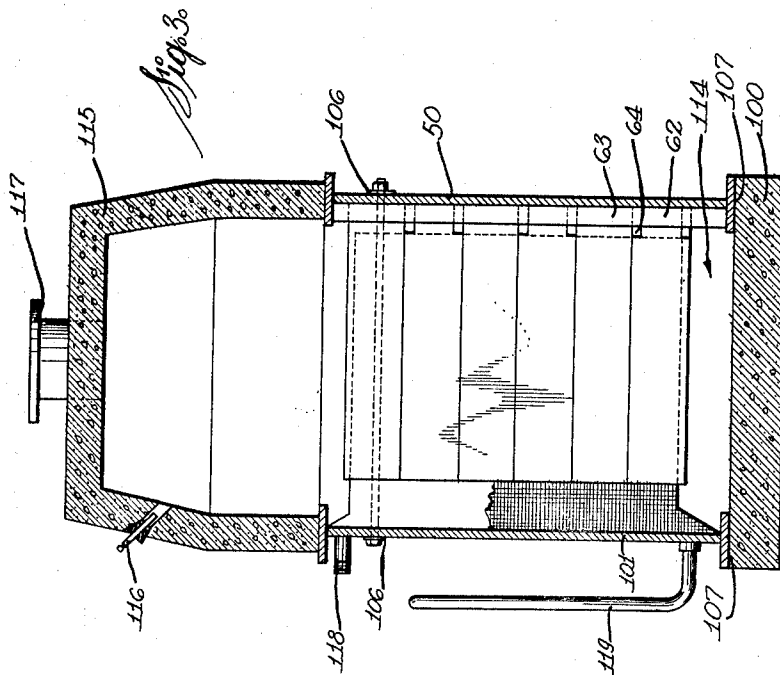
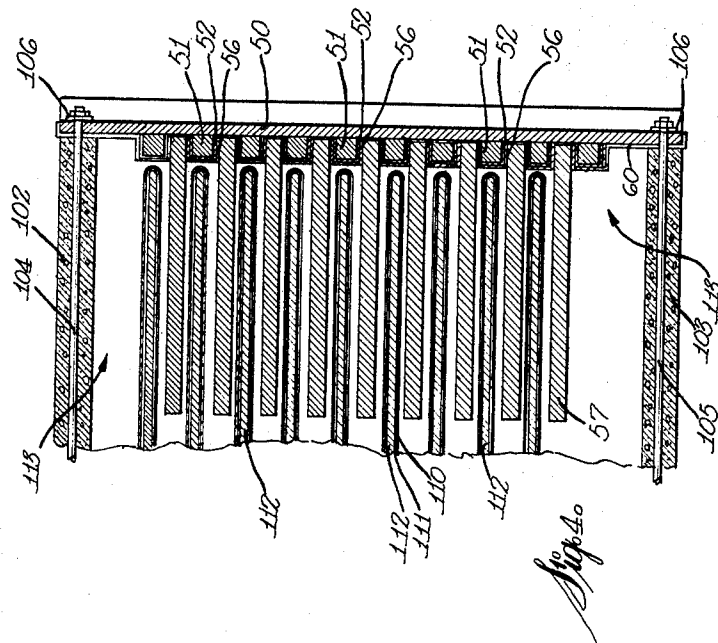
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ANODE STRUCTURE FOR ELECTROLYTIC CELL
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Filed Oct. 6, 1967, Ser. No. 673,516

Int. Cl. B01k 3/10; C22d 1/02

U.S. Cl. 204—266

7 Claims

ABSTRACT OF THE DISCLOSURE

In a cell for the production of chlorine and alkali by electrolysis of alkali halide brine, a normally vertically extending wall structure is provided to which anodes have been attached by the method of covering the wall section with a layer of copper mesh arranged in corrugated fashion and providing a thin cast section of lead extending through the interstices of the copper mesh and transverse holes in the anodes.

Background of the invention

This invention relates to an anode wall structure for electrolytic cells and to a method of producing such wall structure.

In conventional chlorine-alkali cells the most satisfactory method of both supporting and providing conductive contact to graphite anodes has been by the use of cast lead. In such cells the graphite anodes are supported in a vertical position on the base or bottom member of the cell box. A series of transverse holes is formed along the lower end of each anode. The anodes are secured in position with their lower ends gripped in a relatively thick cast lead block. The lead fills the holes in the anodes to provide a more rigid support. The cathodes are supported from one or more of the sides of the cell box in a vertically extending configuration interleaved with the anodes. The lead surface is separated from the electrolyte by a layer of electrolytically inert material such as bitumen.

Several disadvantages exist in this prior art structure attributable mainly to the use of the relatively thick lead block as the supporting structure. In large capacity units the weight of lead is such that handling and support of the base section is difficult and expensive. Similarly, in large capacity units the supporting section cannot economically be used in a vertically extending configuration because of the limitation of lead as structural and conductive material. Using this configuration the anodes can be supported only from the base, thus setting a limit to the vertical height of the cell. Since lead is a relatively poor conductor, it is necessary to use a copper bus bar embedded in the lead to reduce power losses thereby adding significantly to the cost of the apparatus.

In casting lead there is a volume contraction of around 4% and, when the molten lead surrounding the ends of the anodes solidifies, there is a tendency for the blades to be drawn together. Prior attempts to obtain a high conductivity bond between a steel backing plate and cast lead of sufficient thickness to adequately bond graphite anode blades have been unsuccessful since the shrinkage of solidifying lead tends to either deform the steel or to pull away from contact with the steel.

Summary of the invention

In the method of this invention for forming an anode supporting wall assembly a series of spacer blocks are positioned on a plane wall section which is positioned horizontally during the assembly process. Wire mesh is then laid over the spacer blocks and bonded to the wall member between the spacer blocks to assume a corrugated shape of, approximately, rectangular cross-section. A series of transverse holes are formed in one end of each anode and such ends of the anodes are positioned in the recesses of the corrugated wire mesh. Molten lead is poured over the assembly to form a thin layer filling the interstices in the mesh and extending through the holes in the anodes. The exposed surface of the lead around the anodes is covered with an inert plastic material.

Due to shrinkage of lead as it solidifies, the bridges of lead extending through the holes in the anodes exert a force causing the lead to grip the sides of the anodes. Also the layers of lead over the top of the spacer blocks exert forces gripping the top edge of the spacer blocks. However, the cross section of lead is sufficiently thin so that there is no damaging deformation of the steel plate or copper mesh.

Thus, the resulting anode wall assembly consists of a plane wall section formed from a conductive material having spacer blocks arranged thereon and covered by a corrugated arrangement of wire mesh. The wire mesh is bonded to the wall section, as by welding, at points intermediate the spacer blocks. A series of anodes are arranged with one end gripped in the recesses between the spacer blocks by means of a thin layer of lead penetrating both the interstices in the wire mesh and transverse holes formed in the gripped ends of the anodes. The exposed surface of the lead layer is preferably covered by a layer of an inert plastic material.

The anode wall assembly of this invention permits an economical form of cell construction in which the height of the cell can be increased as much as desired, limited only by the necessity of providing collector means for the evolved gas. The anode assembly of this invention is designed to be used with the wall section arranged vertically and forming one side of an electrolytic cell. However, the anode wall assembly may be used in any plane, horizontal or vertical or inclined and is suitable for top, bottom or side entry. The number of individual cell units and, hence, the capacity of the cell may be increased to any desired amount by extending the wall section in a horizontal direction.

A further advantage of this invention is that the anode assembly may be manufactured at a position remote from the eventual position of the electrolytic cell. This allows the anode assembly to be accurately aligned during manufacture with the remaining steps in assembling the electrolytic cell being less critical.

Brief description of the drawings

FIGURE 1 is a view, in section, of the anode wall assembly,

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

FIGURE 3 is a side elevation, in section, of an electrolytic cell using the anode wall assembly of this invention, and

FIGURE 4 is a plan view, in section, of a portion of the cell shown in FIGURE 3.

Description of the preferred embodiment

The anode wall assembly, indicated generally at 48 in FIGURE 1, is constructed by the following method. A wall member 50 is placed in a horizontal position for assembly and spacer blocks 51 are supported on the wall member. A wire mesh 52 is arranged in corrugated fashion over the spacer blocks, touching the wall member between the spacer blocks at points such as 53. The wire mesh 52 is joined to the wall member 51 at their points of contact by suitable means, such as brazing. A plate 54 is provided at each end of the wall member to anchor the wire mesh, plate 54, in turn, being attached to wall member 50 by suitable means, such as welding.

Wall member 50 is formed of electrically conductive material, preferably steel. The spacer blocks 51 are formed from a heat resistant material, such as asbestos, magnesite, graphite or carbon. Plate 54 is of similar material to the wall member, preferably steel. The preferred material for wire mesh 52 is copper.

In the next step, graphite anodes 57 are positioned with one end in the recesses of the wire mesh between the spacer blocks 51. In each anode the end placed adjacent to wall member 50 is provided with a series of transverse holes 55. Molten lead is then poured over the wire mesh and solidifies as a thin layer filling the interstices in the mesh and the holes 55 in the anodes. Prior to pouring the lead, the wire mesh can be coated with a tinning compound to ensure bonding between the lead and wire mesh. Typically, the thickness of the lead layer will be of the order of 1/4". A layer 60 of an inert plastic material is added to cover the exposed surface of the lead and protect it from attack by the electrolyte.

Thus, the completed anode wall assembly consists of wall member 50 supporting spacer blocks 51 and anodes 57 alternately positioned along one surface. A wire mesh 52 extends in corrugated fashion over the spacer blocks and under the ends of the anodes. Where the wire mesh is in contact with the wall member, that is under the ends of the anodes, it is bonded to it, for example by brazing. A thin layer of lead 56 extends around the wire mesh and into the holes in the anodes. The force exerted by the shrinkage of the lead in the portions of wire mesh extending parallel to the anodes is transferred to the bridge of lead extending through holes 55 and holds the anodes firmly in position against wall member 50. The reduction of lead volume on solidification may result in corners 61, shown in FIGURE 1 as right-angled corners, being slightly rounded. This does not, however, affect the rigidity of the assembly. The exposed surface of the lead is covered with a layer of inert plastic material 60. The necessary electrical connection to the anodes is made to the outer surface of wall member 50 as shown at 58.

An electrolytic cell using the anode wall assembly of this invention is shown in FIGURES 3 and 4. A base member 100 is provided, preferably of concrete. The base member supports the anode wall member 50 and a cathode supporting wall member 101. To avoid leakage of electrolyte, a sealing compound, such as putty, is inserted between the bottom flange of wall members 50 and 101 and base 100, as shown at 107. The box structure of the electrolytic cell is completed by two side walls 102 and 103, shown in FIGURE 4, also of concrete. The cell box is given rigidity by tie-bars 104 and 105 extending through side walls 102 and 103 between wall members 50 and 101. Insulating washers 106 are used at the ends of the tie-bars to avoid short circuiting the anode and cathode assemblies.

The anode wall assembly is identical to that previously disclosed and the same reference numerals are used to denote features previously described. Each anode is formed from an array of flat bars 62, 63. Alternate bars, 75

such as 62 may have recesses formed at the ends gripped by the wall assembly, such as are shown at 64, to permit sealing the entire surface with a plastic protective sealer. The cathode wall assembly is of the type disclosed in U.S. Patent 1,866,065, issued July 5, 1932 to K. E. Stuart. Briefly, the cathodes consist of a permeable diaphragm 110 supported on a foraminous conducting surface such as woven wire screen 111 which in turn is reinforced by supporting members 112 attached to wall member 101.

The cathodes and anodes are arranged alternately as shown in FIGURE 4, spaces being left at the sides of the cell as shown at 113 and near the base as shown at 114 to promote circulation of the electrolyte. The cell is completed with a top cover 115 preferably made of concrete.

Such a cell is suitable for the electrolysis of sodium chloride brine situated in the anode compartment. For this use an inlet 116 is provided for brine, an exit opening 117 for chlorine, an opening 118 for removing hydrogen and an effluent pipe 119 for removing the caustic alkali solution.

As previously mentioned, the anode and cathode wall assemblies can be constructed remotely from the final location and the final assembly performed on site. Due to the use of the anode wall assembly of this invention, very large current capacity cells, e.g., 100,000-200,000 amps. can be constructed by extending the anode and cathode supporting walls sideways. Due to the thin layer of lead employed, the current paths from the graphite anodes, via the lead and the copper mesh, to the anode wall member are of low resistance, thus avoiding significant electrical power loss. While, in FIGURES 3 and 4, the anode wall assembly is positioned in the cell unit with the wall member extending vertically and the anodes projecting horizontally, it will be clear that the assembly can be used with the anodes projecting in any desired direction.

I claim:

1. In a cell for the production of chlorine and alkali by the electrolysis of alkali halide brine, an electrode wall assembly comprising:

an electrically conductive wall member,
a plurality of spacer members arranged at substantially regular intervals on one surface of said wall member,

wire mesh arranged in corrugated fashion against said spacer members and wall member and bonded to said wall member at points intermediate said spacer members, and

a plurality of electrodes having transverse holes at one end held in position with said one end between said spacer members by a layer of lead filling said holes and the interstices in said wire mesh.

2. Apparatus as set forth in claim 1 wherein said electrode wall assembly further comprises a layer of inert plastic material covering the surface of said lead.

3. Apparatus as set forth in claim 1 wherein said spacer members are elongated blocks of substantially rectangular cross-section arranged parallel to one another on said one surface of said wall member.

4. Apparatus as set forth in claim 1 wherein said wall member is formed from steel, said wire mesh is formed from copper and the bond between said wall member and wire mesh is formed by brazing.

5. Apparatus as set forth in claim 1 wherein spacer members are formed from asbestos, magnesite, graphite or carbon.

6. A method of securing electrodes having a flat wall portion with transversely extending holes at one edge thereof to a plane member comprising the steps of:

positioning spacer members at spaced apart locations on one side of said plane member,

applying wire mesh to follow the contour of said spacer members and plane member forming a corrugated pattern,

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bonding said wire mesh to said plane member at some of their points of contact,
positioning said anodes each with said one end in a recess of said corrugated pattern between said spacer members,
flowing molten lead into said recesses to form a thin layer of lead occupying the interstices of said mesh and extending into the holes in said anodes.
7. A method as set forth in claim 6 further comprising the step of applying a coating of inert plastic material to the surface of said lead layer.

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U.S. Cl. X.R.

204—286