

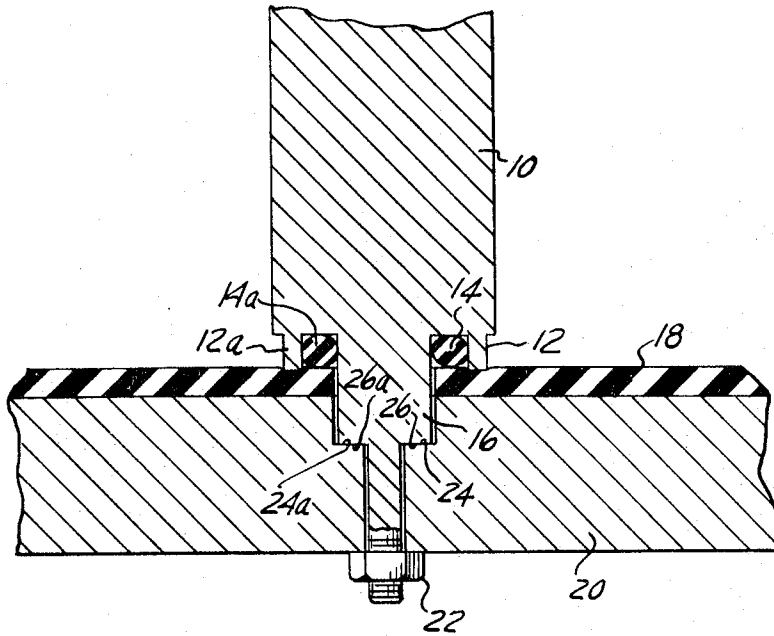
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ANODE MOUNTING FOR ELECTROLYTIC CELL

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ANODE MOUNTING FOR ELECTROLYTIC CELL
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6 Claims

ABSTRACT OF THE DISCLOSURE

In a diaphragm-type electrolytic cell for the production of chlorine and caustic alkali from alkali metal chlorine solutions wherein the cell has metal anodes, a conducting and supporting cell base which is covered with an electrically non-conductive sheet, a two-point sealing system is provided for bolting the anode to the cell base and sealing the electrolyte out of the hole through which the bolt passes.

BACKGROUND

(1) Field of the invention

This invention relates to a new means for mounting metal anodes in an electrolytic cell which has a conducting and supporting cell base.

(2) Description of the prior art

U.S. Pat. 3,591,483 granted July 6, 1971 on an application filed by R. E. Lofftfield et al. discloses a diaphragm-type electrolytic cell which is especially suited to the use of dimensionally stable (metal) anodes. The cell is characterized as having a metal base which serves as a rigid support for the anodes, as a conductor for distributing electrical current to the anodes and as a rigid support for the cell can. Furthermore, a sheet of electrically non-conductive material covers the entire cell base and serves to insulate the contact between the cell can and the cell base and also provides a hydraulic seal to prevent leakage of the electrolyte. This system is satisfactory as long as the non-conductive cover maintains its physical characteristic but these covers being organic materials are susceptible to deterioration due to the extremely adverse environmental conditions, e.g. heat and corrosiveness of electrolyte. This deterioration causes a reduction in the pressure on the electrical connection resulting in power insufficiencies plus allowing the electrolyte to seep into the electrical connection. Therefore, it is desirable to provide an improved means of mounting metal anodes in an electrolytic cell.

SUMMARY OF THE INVENTION

In accordance with this invention there is provided in a diaphragm-type electrolytic cell for the production of chlorine and caustic alkali from alkali metal chloride solutions wherein the cell has metal anodes, a conducting and supporting cell base means having holes disposed therein for receipt of anode support studs and an electrically non-conductive sheet covering the entire cell base and having holes therein in axial alignment with the holes in the cell base, the improvement comprising in combination (1) at the base of the metal anode and surrounding said anode support stud an O-ring which is retained in position by a retaining flange attached to or adjoining the base of the anode, the flange completely encircling the O-ring, the flange having a height slightly less than the diameter of of the O-ring whereby the O-ring is placed under compression when the stud is in electrical connection with the cell base and (2) the anode support stud having a pressure receiving shoulder which corresponds with and mates

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with a similar pressure receiving shoulder in the cell base, the O-ring and the pressure receiving shoulder being so positioned that when the anode supporting stud is connected to the cell base that both the O-ring and the pressure receiving shoulder are placed under compression at substantially the same time yet the compression placed on one is independent of the compression placed on the other whereby the compression of the pressure receiving shoulder of the anode support stud is maintained independent of the changes of compression in the O-ring due to the changing physical properties of the O-ring and the electrically non-conductive sheet.

BRIEF DESCRIPTION OF THE DRAWING

The drawing is a cross-sectional end view of an anode installed in an electrolytic cell with the improved mounting system of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the invention as shown in the drawings there is provided a cell bottom metal base 20 which acts as both a strength member and a bus bar member and is covered with an electrically non-conductive sheet 18. To the bottom of the anode 10 is attached anode stud (or bolt) 16 which has metal-to-metal contact shoulder 26, 26a which has the same configuration as metal-to-metal contact shoulder 24, 24a of metal base 20. These contact shoulders can be either square or conical. O-ring 14, 14a is slipped over anode stud 16 and retained in place by retaining ring (or flange) 12, 12a which is attached to the base of metal anode 10. Retaining ring 12 is concentric with and completely surrounds O-ring 14 except that retaining ring 12 has a height slightly less than the diameter of O-ring 14. Preferably this height will be about from 0.5 to 0.9 of the diameter of O-ring 14 and corresponds to the amount of original compression of O-ring 14 planned for. The metal-to-metal contact shoulders 24, 26 are so positioned that when they are mated at substantially the same time O-ring 14 is placed under compression and flange or retaining ring 12, will contact electrically non-conductive sheet 18. Anode stud 16 is maintained in mechanical and electrical connection with metal base 20 by proper tightening of stud nut 22. Metal-to-metal contact shoulders 24, 26 are also adequately prepared for good electrical contact efficiency by well known techniques to those skilled in the art. When anode stud 16 is properly installed and stud nut 22 correctly tightened retaining ring 12 initially exerts some compression on non-conductive sheet 18. During cell operation electrically non-conductive sheet 18 due to the corrosiveness of the electrolyte and temperature attained will tend to deteriorate and relax. Such relaxation is compensated for by initially having O-ring 14 under compression behind retaining ring 12. Furthermore, the mechanical and electrical connection of anode stud 16 being based on metal-to-metal contact shoulders 24, 26 and stud nut 22 is unaffected by such relaxation.

In the drawing retaining ring 12 has been shown as attached to and a part of metal anode 10. However, it is within the scope of this invention that retaining ring 12 also be separate and independent from anode 10. It will be seen that use of an independent retaining ring 12 permits the substitution of different sizes of O-rings 14 and simpler fabrication whereas an attached retaining ring 12 permits a more convenient assembly of the invention.

While it is shown in the drawing to use a flat nut 22, it is also well known in the art to use in combination with nut 22 a flat washer, or a beveled washer in connection with a chamfered opening or using a beveled nut with the chamfered opening in the metal base 20. The exact arrangement of how to obtain a good mechanical and electrically conductive connection with the metal base 20 is

well known to those skilled in the art and further elaboration need not be made at this point.

The O-ring 14 and electrically non-conductive sheet 18 can be of any of the well known materials of the prior art including but not limited to, as applicable using ordinary engineering skills, rubber, chlorinated plastics, and polymers and copolymers of trifluorochloroethylene, tetrachloroethylene and tetrafluoroethylene sold under trade names such as Teflon and Kel-F. It is readily apparent that in some instances the O-ring 14 and non-conductive sheet 18 will be made out of different materials. However, materials such as the tetrafluoroethylene polymer can be utilized in both applications. In addition, materials such as asphaltic mastics can be used for the electrically non-conductive sheet 18. As has been pointed out the anode stud 16 holes or apertures in the electrically non-conductive sheet 18 and metal base 20 are in axial alignment so that anode stud 16 plane is perpendicular to the plane of the metal base 20. Furthermore, as pointed out in discussing the stud nut 22 the edge of the aperture not covered by the electrically non-conductive sheet 18 may be chamfered to receive a beveled nut or washer in place of flat stud nut 22 shown in the drawing.

The actual configuration of metal anode 10 being beyond the scope of this invention is a matter of ordinary engineering skills. Suffice it to say that anode 10 can be either a sheet or plate metal anode or an expanded mesh anode. As is well known in the art, metal anode 10 can be coated with a platinum metal or metal oxide coating or mixture of metal and oxide to increase the efficiency of the anode.

The anode 10 and anode stud 16 are suitably made from titanium, a "restrictive valve metal" or an alloy thereof. By restrictive valve metals it is meant that the metals of titanium, tantalum and niobium. Preferably titanium is employed and it is normally a commercially pure grade such as electrolytic grade. Alloys of titanium may be employed as long as the alloy meets the criterion of passivity, metal alloys which become passivated when polarized anodically can remain passive well beyond the anodic potential needed to convert a chloride ion to chlorine. The phenomenon of passivity in this connection is discussed in an article by Greene appearing in the April 1962 issue of Corrosion, pages 136-t to 142-t wherein reference may be made to Figure 1 of the article which describes typical active-passive transition of a metal towards a corrosive medium. Titanium alloys of aluminum, vanadium, palladium, chromium or tin can be employed in which the latter metals are present as less than 10 percent of the alloy. In addition anode stud 16 may be made of copper and clad with one of the previously enumerated metals or alloys. Furthermore, it is well known that the electrical efficiency of the connection of anode stud 16 can be improved by platinizing the threads of the stud which engage stud nut 22.

Metal anode 10 and anode stud 16 of this invention have been described in terms of fabrication from titanium metal since in terms of availability and cost it is the metal of choice.

The number of anode studs 16 employed with each metal anode 10 is a matter of engineering choice and will be influenced by the size and configuration of the anode as well as electrical supply requirements. Satisfactory results are obtained by the use of 2, 3 or more anode studs.

Since the metal base 20 is protected from the corrosive

nature of the cell electrolyte the base can be made from any electricity carrying metal of choice such as steel, copper or aluminum. Additionally metal base 20 can be a composite of a strength member and a bus bar member, e.g. a steel load bearing sheet over a copper bar.

Many other modifications and ramifications of this invention will naturally suggest themselves to those skilled in the art based on this disclosure. These ramifications and modifications are intended to be comprehended as within the scope of this invention.

Having thus described the invention, what it is desired to claim and secure by Letters Patent is:

1. In a diaphragm-type electrolytic cell for the production of chlorine and caustic alkali from alkali metal chloride solutions wherein said cell has metal anodes, a conducting and supporting cell base means having holes disposed therein for the receipt of anode support studs and an electrically non-conductive sheet covering the entire cell base and having holes therein in axial alignment with said holes in the cell base, the improvement comprising in combination

(1) at the base of the metal anode and surrounding said anode support stud an O-ring which is retained in position by a retaining flange adjacent the base of said anode, said flange completely encircling said O-ring, said flange having a height less than the diameter of said O-ring whereby said O-ring is placed under compression when said stud is in electrical connection with said cell base and (2) said anode support stud having a pressure receiving shoulder which corresponds with and mates with a similar pressure receiving shoulder in said cell base, said O-ring and said pressure receiving shoulder being so positioned that when said anode support stud is connected to said cell base that both said O-ring and said pressure receiving shoulder are placed under compression at substantially the same time yet the compression placed on one is independent of the compression placed on the other whereby the compression of the pressure receiving shoulder of said anode support stud is maintained independently of the changes of compression in the O-ring due to changing physical properties of said O-ring and said electrically non-conductive sheet.

2. The anode support stud of claim 1 wherein the pressure receiving shoulder is square.

3. The anode support stud of claim 1 wherein the pressure receiving shoulder is conical.

4. The retaining flange of claim 1 wherein the flange height is 0.5 to 0.9 of the diameter of said O-ring.

5. The retaining flange of claim 1 wherein the flange is attached to the anode.

6. The retaining flange of claim 1 wherein the flange is a separate ring.

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