

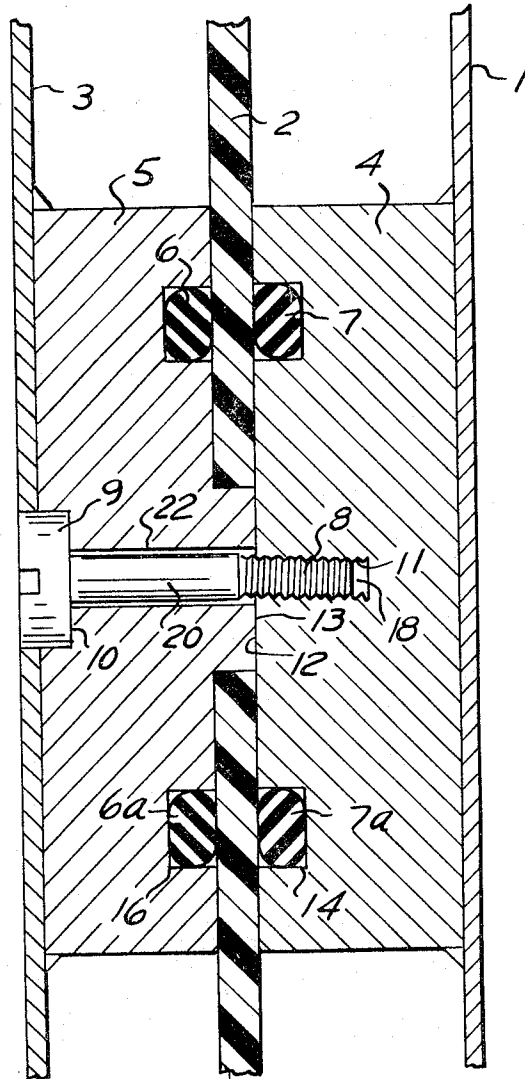
Aug. 14, 1973

O. W. STEPHENSON III, ET AL

3,752,757

BIPOLAR ELECTRODE SEAL AT BARRIER SHEET

Filed June 7, 1972



1

3,752,757

BIPOLAR ELECTRODE SEAL AT BARRIER SHEET

Orlando W. Stephenson III, Ann Arbor, and John E. Schmidt, Southgate, Mich., assignors to BASF Wyandotte Corporation, Wyandotte, Mich.

Filed June 7, 1972, Ser. No. 260,395

Int. Cl. B01k 3/10

U.S. Cl. 204—256

5 Claims

ABSTRACT OF THE DISCLOSURE

In a filter press cell for the electrolytic production of chlorine from aqueous alkali metal chloride solutions and having adjacent pairs of anodes and cathodes mechanically and electrically inter-connected, a two point sealing system is provided for bolting the anode to the cathode and sealing out the electrolyte from the hole through which the connection passes.

BACKGROUND

(1) Field of the invention

This invention relates to electrolytic cells and particularly to electrolytic cells adapted for the production of chlorine and caustic, the cells being commonly known in the art as filter press variants of the diaphragm type cells. A new two point sealing system is provided for bolting the adjacent cathode and anode through the barrier sheet while sealing out electrolyte through the bolt hole.

(2) Description of the prior art

For many years, as shown by the textbook, Chlorine, ACS Monograph 154, J. S. Sconce, editor, Reinhold Publishing Company, New York, N.Y., 1962, a diaphragm type cell has been commonly used in the production of chlorine and caustic from aqueous alkali metal chloride solutions. The filter press variant of diaphragm cells is becoming of more consequence to chlorine manufacturers. However, satisfactory electrical connections between the individual cell units which are both compact and leakproof are continued to be sought. In some cells the external wiring from one individual cell to another is objectionable. In other cells, see for instance U.S. Pat. 3,242,059, expensive titanium metal fabricated parts are used as both an individual cell divider and transfer electrical connection. In order to achieve satisfactory compactness and economy in a filter press cell arrangement, an efficient leakproof electrical connection which will permit the utilization of a plastic barrier is desired.

SUMMARY OF THE INVENTION

In accordance with this invention there is provided in a bipolar electrolytic filter press cell for the production of chlorine from aqueous alkali metal chloride solutions wherein the metal anode and metal cathode of adjoining cells are in direct electrical connection with each other by thread engaging means and said anode and cathode are maintained in spaced relationship by an electrically inactive barrier sheet between them, the improvement of independently maintaining proper electrical and mechanical connections between the anode and cathode of adjacent cells while preventing electrolyte and gas flow through the cell barrier joint between said anode and cathode comprising in combination

(1) attaching on one side of, at least one boss on each said anode and said cathode, said bosses being positioned so as to mate with each other, said bosses having a composition substantially the same as the respective electrode to which it is attached and on the side of each anode and cathode boss which is in contact with said barrier sheet and surrounding the respective

2

connecting thread engaging means of each boss an O-ring, said O-ring being retained in position by a channel cut in said boss, said channel having a depth slightly less than the cross-sectional diameter of said O-ring whereby said O-ring is placed under compression when said anode and cathode are in electrical connection with each other, and

(2) each boss having a pressure receiving shoulder which mates with the other boss and surrounds the thread engaging means, one boss having an aperture for receiving a bolt which passes through said boss into the second (other) boss, said bolt having a composition substantially the same as the boss through which it passes, said first boss also having a pressure receiving shoulder which corresponds with and mates with the pressure receiving shoulder of said bolt, said O-rings and said pressure receiving shoulders being so positioned that when said bolt is connected through said first boss with said second boss that both of said O-rings and pressure receiving shoulders are placed under compression at substantially the same time, yet the compression placed on said O-rings is independent of the compression placed on the metal to metal contact of the pressure receiving shoulder

whereby the compression of the pressure receiving shoulder of said boss is maintained independently of the changes of compression in the O-ring due to changing physical properties of said O-ring whereby said O-ring functions as a gasket rather than as an O-ring.

DESCRIPTION OF THE DRAWING

The drawing is a fragmented cutaway of the improved bipolar electrode joint and seal taken at the middle of and along the length of the bolt joining the anode and electrode together.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In this invention as shown in the drawing a typical bipolar electrolytic cell for the production of chlorine and caustic is equipped with a metal anode 1, a plastic barrier sheet 2 between adjacent cells of the filter press and the metal electrode 3 of the adjacent cell. To facilitate the bolting of the anode 1 with cathode 3 an anode boss 4 is attached to the anode 1 and a corresponding cathode boss 5 is attached to the cathode 3 in such a manner that the threaded bolt hole 18 of the anode boss 4, the cathode base bolt hole 22 and the cathode 3 are in axial alignment with one another so that bolt 20 can be inserted and engaged without difficulty. The mechanical and electrical connection is provided by inserting the bolt 20 through an electrode (for the purpose of illustration the bolt 20 is shown through cathode 3 although the other sequence through the anode 1 could also be employed) and its boss and into the other boss 4 threaded bolt hole 18 wherein threads of bolt 20 engage the anode boss engaging threads 11. The bolt 20 is turned until tight contact is exerted by (A) the bolt head pressure receiving shoulder 9 and the cathode boss receiving pressure shoulder 10 and (B) the cathode boss pressure receiving area 12 and anode boss pressure receiving area 13. It will be readily apparent to those of skill in the art that while the pressure receiving areas 9 and 10, 12 and 13 have been illustrated as flat they can also be beveled or conical, the shape being secondary to the consideration of mating engagement with firm contact to provide both a strong mechanical joint and a solid electrical contact. For the sake of completeness (though is very obvious) the plastic barrier sheet 2 has an aperture or hole through which a portion of one boss extends to meet in mating engagement with the other boss. However, the hole is substantially smaller than the

base. It is preferred that anode boss 4 and cathode boss 5 have substantially the same radial dimensions.

The second major feature of the invention is its sealing aspect. The plastic barrier sheet 2 is substantially clamped and mechanically locked together and between anode boss 4 and cathode boss 5 with the bolting process described above. To achieve the desired sealing on each boss there is cut, made or otherwise prepared an O-ring receiving chamber 14, 16 which surrounds (preferably concentrically) the bolt hole 22, 18 and on the part of the boss which faces the other boss and would otherwise be in contact with the plastic barrier sheet 2. In each O-ring receiving chamber 14, 16 there is inserted an O-ring (6 and 6a or 7 and 7a). The depth of the O-ring receiving chambers 14, 16 is about 0.5 to 0.9 of the cross-sectional diameter of the uncompressed O-ring. The pressure to the O-ring 6, 7 is substantially independent of the pressure to the pressure receiving areas 9 and 10, 12 and 13 and yet they are all placed under compression at substantially the same time. Thus, the O-ring changes in compression will be due to changing physical properties of the O-ring and it will have the operational characteristics of a gasket.

The anode 1 and anode boss can be attached by welding, including spot welding to an anode substrate of expanded titanium mesh, if desired, and are suitably made of a valve metal or an alloy thereof. By valve metals it is meant metals of tungsten, titanium, zirconium, tantalum and niobium. Preferably titanium or tantalum 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 FIG. 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.

It is also well known to coat the anode 1 with at least one platinum group metal or metal compound, e.g. oxides. The platinum group metals include platinum, ruthenium, osmium, rhodium, iridium and palladium and alloys of two or more of the foregoing metals. It has been convenient to refer to the group as platinum since platinum is the preferred metal in the group.

The cathode 3 and cathode boss 4 are also suitably joined together by welding and are suitably made from a ferrous metal as is well known in the art, iron or steel being preferred.

The bolt 20 is preferably made of the same or similar metal as the electrode through which it passes. As illustrated the bolt 20 would be made of iron or steel.

The O-rings 6, 7 and the plastic barrier sheet 2 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, polypropylene and polymers and copolymers of trifluorochloroethylene, tetrachloroethylene and tetrafluoroethylene sold under trade names such as Teflon and Kel-F. It will at once be obvious that the barrier sheet 2 can contain reinforcing filler, e.g. carbon black or asbestos to achieve certain structural and chemical resistant properties not required in an O-ring.

Many other modifications and ramifications 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 bipolar diaphragm electrolytic filter press cell for the production of chlorine from aqueous alkali metal chloride solutions wherein the metal anode and metal cathode of adjoining cells are in direct electrical connection with each other by thread engaging means and said anode and cathode are maintained in spaced relationship by an electrically inactive barrier sheet between them, the improvement of independently maintaining proper electrical and mechanical connections between the anode and cathode of adjacent cells while preventing electrolyte and gas flow through the cell barrier joint between said anode and cathode comprising in combination

(1) attaching on one side at least one boss on each said anode and said cathode, said bosses being positioned so as to mate with each other, said bosses having a composition substantially the same as the respective electrode to which it is attached and on the side of each anode and cathode boss which is in contact with said barrier sheet and surrounding the respective connecting thread engaging means of each boss an O-ring, said O-ring being retained in position by a channel cut in said boss, said channel having a depth less than the cross-sectional diameter of said O-ring whereby said O-ring is placed under compression when said anode and cathode are in electrical connection with each other, and

(2) each boss having a pressure receiving shoulder which mates with the other boss and surrounds the thread engaging means, one boss having an aperture for receiving a bolt which passes through said boss into the second (other) boss, said bolt having a composition substantially the same as the boss through which it passes, said first boss also having a pressure receiving shoulder which corresponds with and mates with the pressure receiving shoulder of said bolt, said O-rings and said pressure receiving shoulders being so positioned that when said bolt is connected through said first boss with said second boss that both of said O-rings and pressure receiving shoulders are placed under compression at substantially the same time, yet the compression placed on said O-rings is independent of the compression placed on the metal to metal contact of the pressure receiving shoulder

whereby the compression of the pressure receiving shoulder of said boss is maintained independently of the changes of compression in the O-ring due to changing physical properties of said O-ring whereby said O-ring functions as a gasket rather than as an O-ring.

2. The improvement of claim 1 wherein the depth of the O-ring receiving channel is from about 0.5 to about 0.9 of the cross-sectional diameter of the uncompressed O-ring.

3. The improvement of claim 1 wherein the mating surfaces of the bosses are flat.

4. The improvement of claim 1 wherein the mating surfaces of the bosses are conical.

5. The improvement of claim 1 wherein the anode is coated with at least one platinum group metal or metal compound.

References Cited

FOREIGN PATENTS

1,054,430 4/1959 Germany ----- 204—256

JOHN H. MACK, Primary Examiner

W. I. SOLOMON, Assistant Examiner

U.S. Cl. X.R.

204—254, 255, 268