Jan. 15, 1946. K. E. STUART 2,392,868

ELECTROLYTIC ALKALI HALOGEN CELLS

Filed May 4, 1942 3 Sheets-Sheet 1

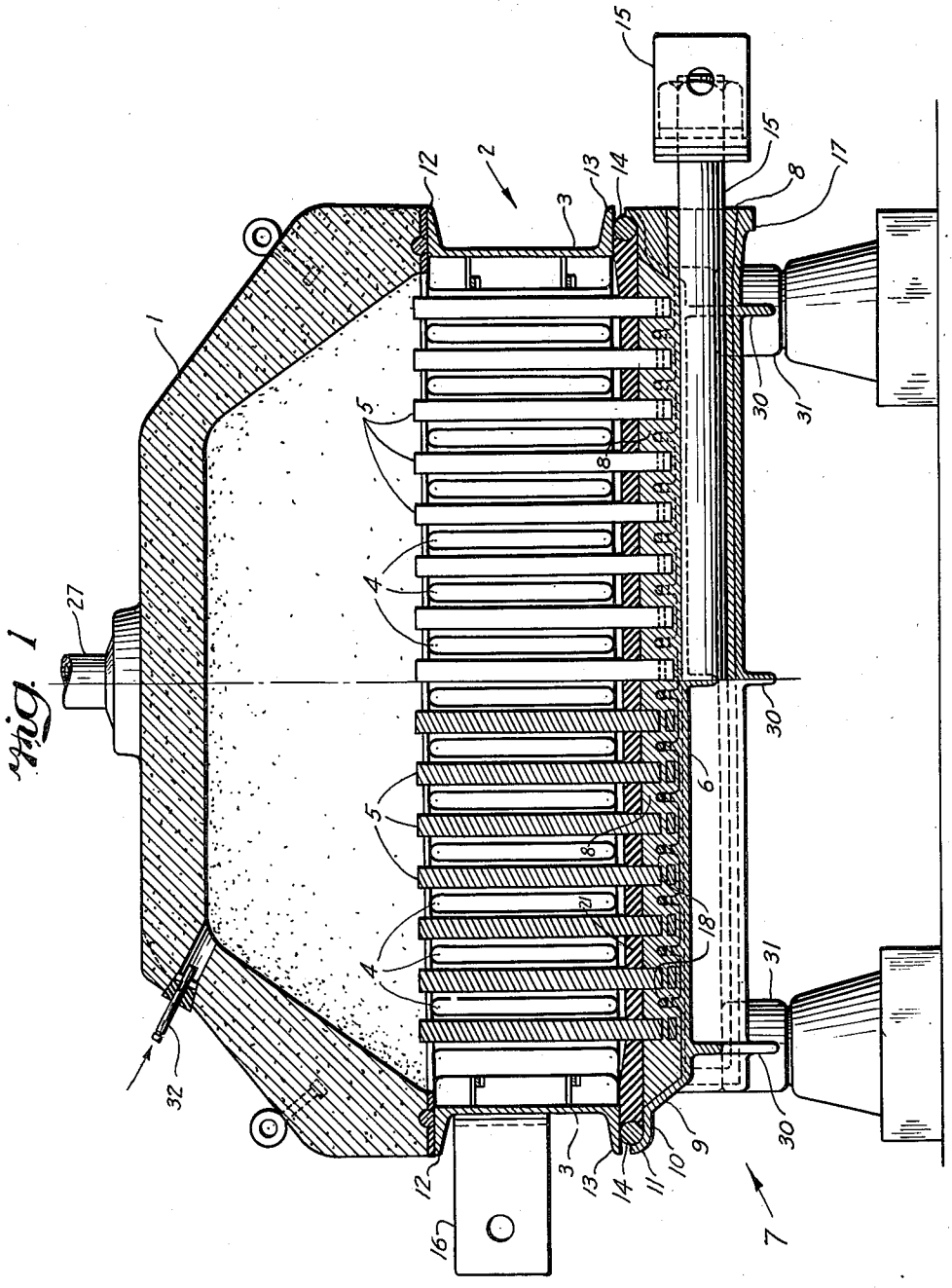


Fig. 1

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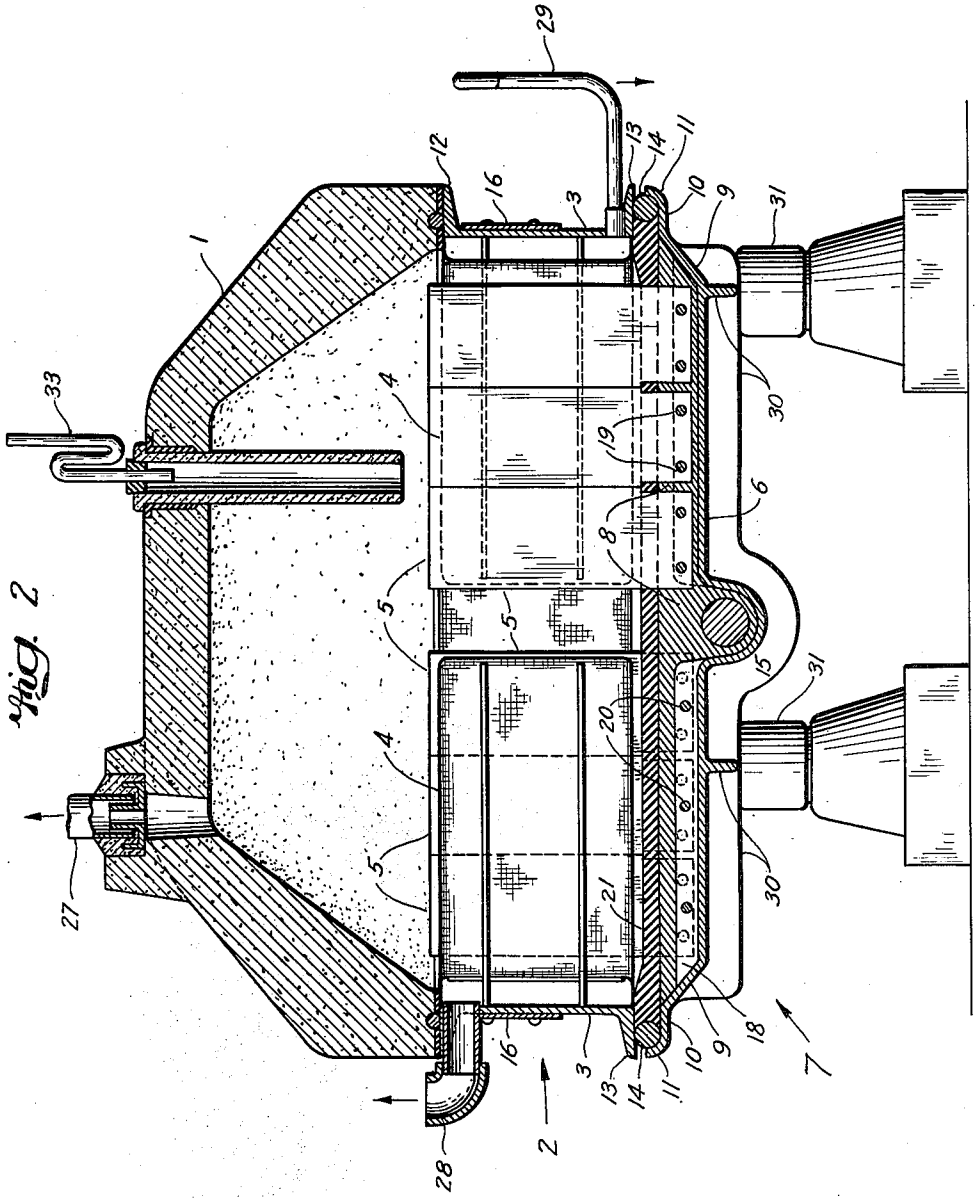


Fig. 2

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Fig. 3

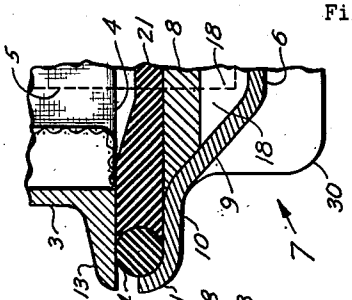


Fig. 6

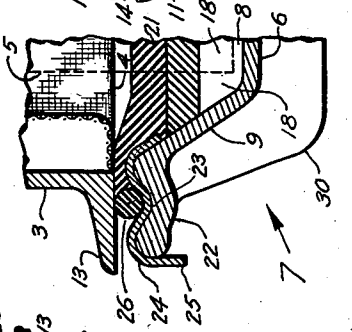


Fig. 5

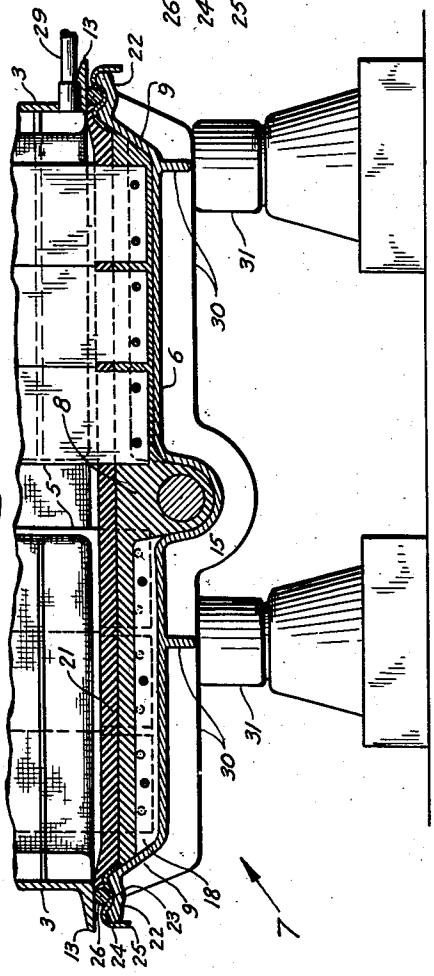
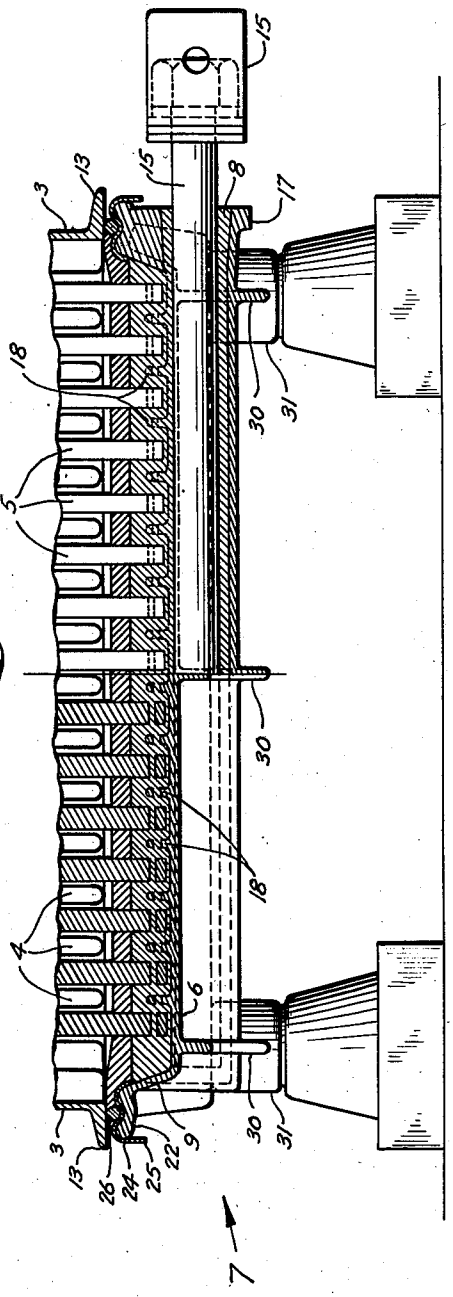


Fig. 4



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Patented Jan. 15, 1946

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UNITED STATES PATENT OFFICE

2,392,868

ELECTROLYTIC ALKALI HALOGEN CELLS

Kenneth E. Stuart, Niagara Falls, N. Y., assignor to Hooker Electrochemical Company, Niagara Falls, N. Y., a corporation of New York

Application May 4, 1942, Serial No. 441,663

2 Claims. (Cl. 204—252)

My invention relates more particularly to an improvement upon the cell disclosed in Patent No. 1,866,065, granted to me July 5, 1932. One object of my invention is to provide an anode assembly, including a metal plate to which the anodic electrodes may be conductively affixed, suitable for construction of cast metal, such as cast iron, when this plate constitutes the bottom closure member for the liquid-retaining enclosing wall of the cathode assembly. Another object of my invention is to provide means for forming an electrically insulating, liquid-tight joint between the plate and the enclosing wall. Another object of my invention is to protect this plate against electrolysis which would otherwise be liable to result from accidental minor leaks through said joint. Still another object of my invention is to provide for mechanically and conductively anchoring the anodic electrodes to the cast metal plate constituting the bottom wall of said closure member. A further object of the invention is to provide good conductive contact between the anodic bus bar and the cast metal plate to which the anodic electrodes are conductively affixed.

Referring to the drawings:

Fig. 1 is a longitudinal sectional elevation of a cell of the type disclosed in the patent referred to, taken in part through the electrodes and in part along the center line of the cell through the clearance between the two banks of electrodes, showing the construction of the cathode assembly and bottom closure member and means for forming an electrically insulating liquid-tight joint between the two.

Fig. 2 is an end elevation of the cell, mostly in section along its center line.

Fig. 3 is a sectional detail of a portion of the bottom closure member of Figs. 1 and 2, to an enlarged scale.

Fig. 4 is a longitudinal elevation corresponding to Fig. 1, showing the lower portion only of a cell of similar type provided with a bottom closure member generally similar to that of Fig. 1, but modified in some of its details.

Fig. 5 is a cross sectional end elevation of the lower portion of the cell and bottom closure member of Fig. 4.

Fig. 6 is a sectional detail of a portion of the bottom closure member of Figs. 4 and 5, to an enlarged scale.

In Figs. 1, 2, 4 and 5, the foraminous screen of which the cathodic electrodes are composed and the diaphragm covering it are indicated conventionally by a single heavy line.

Referring to Figs. 1 and 2:

1 is a gas collecting cover member of halogen resistant, non-conducting material, such as concrete, provided with exit 27 for the halogen gas. 2 is the cathode assembly, comprising vertical, flanged, liquid-retaining enclosing wall 3, provided with exit 28 for the hydrogen and effluent pipe 29 for caustic alkali solution, and foraminous cathodic electrodes 4, 4, adapted to be covered with asbestos diaphragm material and to alternate with anodic electrodes 5, 5, which are in the form of flat blades of halogen resistant conducting material, such as graphite. Anodic electrodes 5 project upwardly from conductive contact with plate 6, which constitutes the bottom wall of closure member 7, the lower ends of electrodes 5 being preferably embedded in a slab of lead 8, bonded to plate 6. Plate 6 is stiffened by ribs 30 integral therewith, which in turn rest upon insulators 31.

Brine is supplied to the inner compartment of the cell to serve as electrolyte therein, by means of a tubular controlling device 32 in accordance with U. S. Patent No. 2,183,299, granted me December 12, 1939. 33 is an electrolyte level indicating device which is fully described in copending application Serial No. 304,813, filed November 16, 1939.

Direct electric current is supplied to the cell from a source not shown, through bus bars 15 and 16.

Closure member 7 is formed with enclosing rim 9, integral therewith, extending around its four sides, to provide a support for the cathodic assembly. Preferably rim 9 slopes outward, then bends downward to form horizontal flange 10. Flange 10, in turn, is provided with reacting fin 11.

Wall 3 of the cathode assembly is flanged at 12 and 13. Flange 10 parallels these flanges, and the joint between rim 9 and flange 13 is rendered liquid-tight by resilient gasket 14, preferably of circular cross section, which I shall refer to as a "rope-type" gasket. Gasket 14 presents a rounded surface to flange 13, which surface becomes flattened by pressure of the flange, as illustrated in the figures. Retaining fin 11 of flange 10 preferably conforms in plan to the exterior dimensions of flange 13. Gasket 14 rests upon flange 10 and is retained in position by fin 11, which should preferably be curved to the same radius. Gasket 14 may be of rubber, natural or synthetic, or any suitable resilient, halogen-resistant rubber substitute, and is fixed in position preferably by cementing by means of the type of cement that has a softening effect upon the

material of the gasket itself or has some of the material in solution. This type of gasket requires that the frame in which it is housed be well filleted at the corners.

In order to secure good conductive contact between anodic bus bars 15 and anodic electrodes 5, this bus bar is introduced through an opening in one of the sides 9, reinforced by boss 17, and the anodic electrodes are supported perpendicularly with respect to plate 6, preferably with a slight clearance between. Molten lead is then poured in, forming lead slab 8, embedding both the inner portion of bus bar 15 and the lower ends of anodic electrodes 5. The inner surface of closure member 7, which is preferably of cast iron, may if desired, be tinned, in order to assure a perfect bond with lead slab 8. The anchorage of lead slab 8 may be further improved by providing fins 18, integral with closure member 7, one between each pair of rows of anodic electrodes. Holes 19 are preferably drilled through the ends of electrodes 5, below the level to which the lead is to be poured, and holes 20 are preferably formed in fins 18. As the lead flows through these holes 19 and 20, slab 8 is firmly anchored to both electrodes 5 and fins 18, in the manner disclosed in copending application Serial No. 355,317, filed September 4, 1940. After anodic electrodes 5 have been mounted in position with their ends embedded in lead slab 8, as just described, the upper surface of the lead and all the surrounding metallic surfaces, including those of flange 10, are protected against electrolysis by a coating of impervious, non-conducting material, such as bitumen. Coating 21 may be formed by pouring in the bitumen while molten or while rendered fluid by a solvent. It should be carried outward around its edges so as to bond with gasket 14 and upward flush with the upper surface of gasket 14. Coating 21, being plastic, will not prevent the proper sealing of flange 13 against gasket 14.

Referring to Figs. 4 to 6:

In these figures there is illustrated a modified construction in which the flange 22 of enclosing rim 9 is formed with a shallow groove 23, and its edge, instead of forming a retaining fin, is rounded to facilitate the formation of a drip edge, to be described. Groove 23 and the adjacent portions of flange 22 and rim 9 are covered and protected by a sheet of flexible, impervious, non-conducting, halogen-resistant material 24, which, as before, may be of natural or synthetic rubber or of any suitable rubber substitute. Sheet 24 is cemented to the metallic surfaces with which it comes in contact. It is pressed into groove 23 and carried downward over the fillet between flange 22 and rim 9 and over the fillet of the outer edge of flange 22 and cemented thereto. Preferably it is of such a width that it extends downward beyond the edge of flange 22 so as to form a drip edge 25. Groove 23 is of such a radius and sheet 24 of such a thickness that after the sheet has been pressed into the groove and cemented therein, the radius of the groove inside the lining shall be sufficient to house a rope-type gasket 26, of suitable diameter to form a liquid-tight joint with flange 13. Gasket 26, of material which may be the same as that of which sheet 24 is composed, is then pressed into the lined groove and preferably cemented to sheet 24. Gasket 26 may be of considerably smaller diameter than gasket 14. After the anodic electrodes 5 have been mounted in position and embedded in lead slab 8, the surface of the lead and surrounding metallic surfaces are protected against electrolysis, as before, by a coating 21, preferably of bituminous material. This should preferably be carried up around its edges to overlap sheet 24, and even come into contact with gasket 26. If sheet 24 and gasket 26 are of material incapable of withstanding the temperature of molten bitumen, the bitumen may be applied in a solvent.

The purposes of drip edge 25 is as follows: In an alkali halogen cell, the metal parts of the cathode assembly, if of iron, are unaffected by electrolysis. However, plate 6, rim 9, and flange 22 are anodic. There is no known metal but platinum that will withstand nascent halogens. If iron be exposed to anodic conditions in an electrolytic chlorine cell the chlorine combines with the iron as fast as it is withdrawn from the electrolyte. No chlorine whatever appears as such, but all the chlorine appears as ferrous or ferric chloride. Since these are very soluble, under these conditions the iron itself melts away almost as if it were itself soluble. Any accidental minor leak past gasket 26 will therefore have a very destructive effect upon the edge of flange 22, and in a very short time. However, in the construction of Figs. 4 to 6 electrolyte leaking past gasket 26 flows over the outer surface of drip edge 25, without any possibility of its contacting the edge of flange 22. The metal of flange 22 is therefore completely protected against the destructive effect of electrolysis.

I claim as my invention:

1. In an electrolytic alkali chlorine cell comprising a cathode assembly including a foraminous structure and cathodic electrodes enclosed in an upright liquid-retaining wall provided with a normally horizontal flat flange all around its lower edge and an anode assembly co-operative with said cathode assembly including upright anodic electrodes having their lower ends embedded in a slab of low melting metal; the improved support for said cathode and anode assemblies and bottom closure for the retaining wall comprising a metal bottom plate extending beneath said retaining wall completely across from side to side thereof and conductively affixed to said slab, said bottom plate being also provided with an upturned border and said upturned border being provided with an outwardly extending normally horizontal flat flange around its upper edge conforming with the retaining wall flange in plan view and having its outer edge filleted; and a gasket between said flanges supporting the weight of the cathode assembly, including a sheet of impervious electrically non-conducting resilient material cemented against the upper surface of the flange of said upturned border and extending outwardly and downwardly around the fillet thereof to form a drip rim, protecting the border flange against anodic electrolysis in case of leakage of electrolytic past the gasket, said slab and said bottom plate and its upturned border and flange being protected against anodic electrolysis by a layer of impervious electrically non-conducting pressure-plastic material extending around and between the lower ends of said anodic electrodes to said gasket and making a sealing bond therewith.

2. In an electrolytic alkali chlorine cell comprising a cathode assembly including a foraminous structure and cathodic electrodes enclosed in an upright liquid-retaining wall provided with a normally horizontal flat flange all around its lower edge and an anode assembly co-operative with said cathode assembly including upright

anodic electrodes having their lower ends embedded in a slab of low melting metal; the improved support for said cathode and anode assemblies and bottom closure for said retaining wall comprising a metal bottom plate extending beneath said retaining wall completely across from side to side thereof and conductively affixed to said slab, said bottom plate being also provided with an upturned border and said upturned border being provided with an outwardly extending normally horizontal flat flange around its upper edge conforming with the wall flange in plan view and having its upper surface provided with a shallow groove and its outer edge filleted; and a gasket between said flanges supporting the weight of the cathode assembly, including a sheet of impervious electrically non-conducting resilient material cemented against the upper surface of the flange of said upturned border, pressed into said groove and extending outwardly and downwardly around the fillet thereof, to form a drip rim, and a resilient rope-type gasket of convex curvilinear cross-section likewise pressed into said groove and supporting said cathode assembly; said slab and said bottom plate and its upturned border and flange being protected against anodic electrolysis by a layer of impervious electrically non-conducting pressure-plastic material extending around and between the lower ends of said anodic electrodes to said gasket and making a sealing bond therewith.

KENNETH E. STUART.