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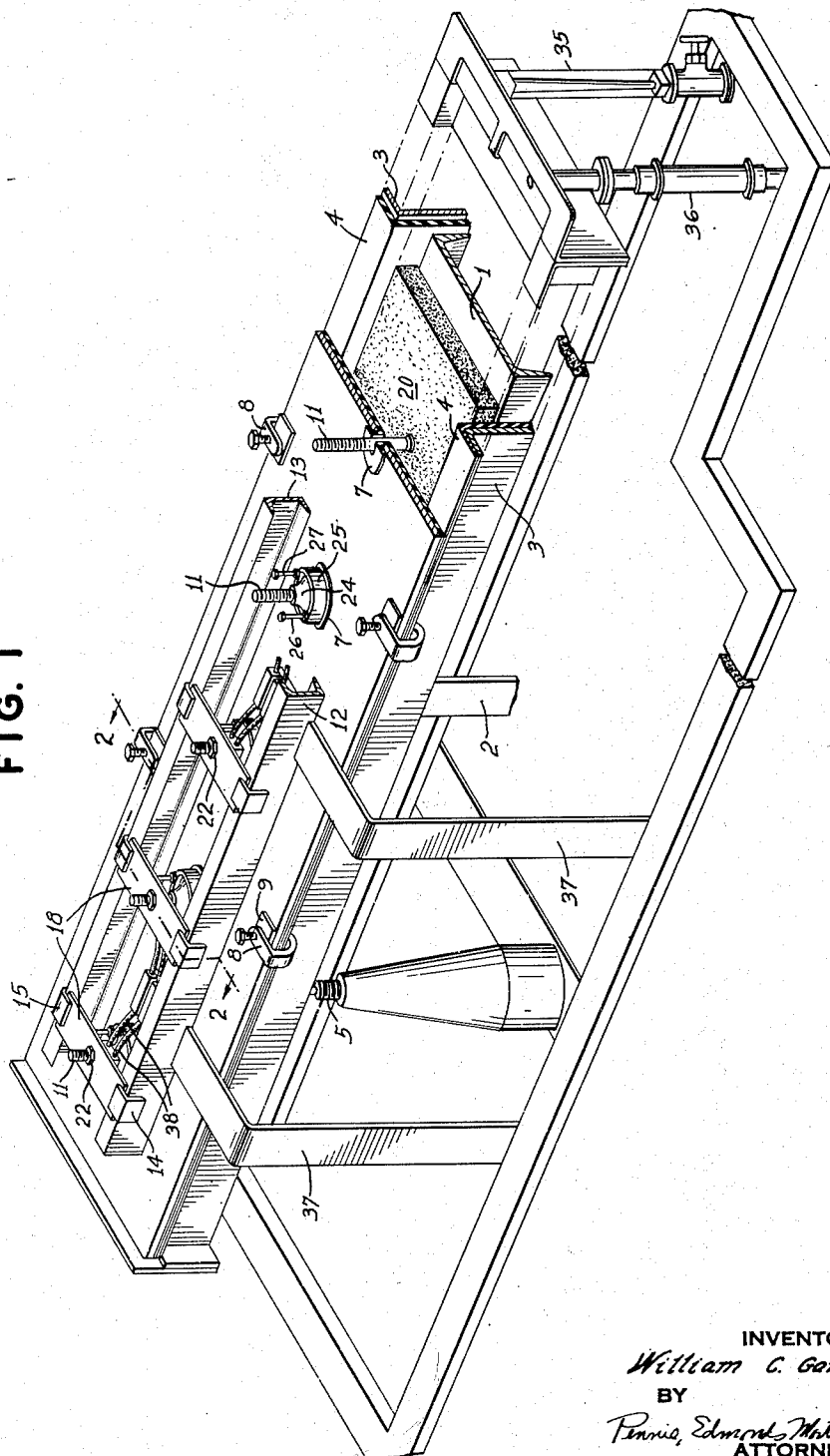
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APPARATUS FOR ELECTROLYSIS OF ALKALI METAL COMPOUNDS

Filed June 15, 1948

2 SHEETS—SHEET 1

FIG. 1



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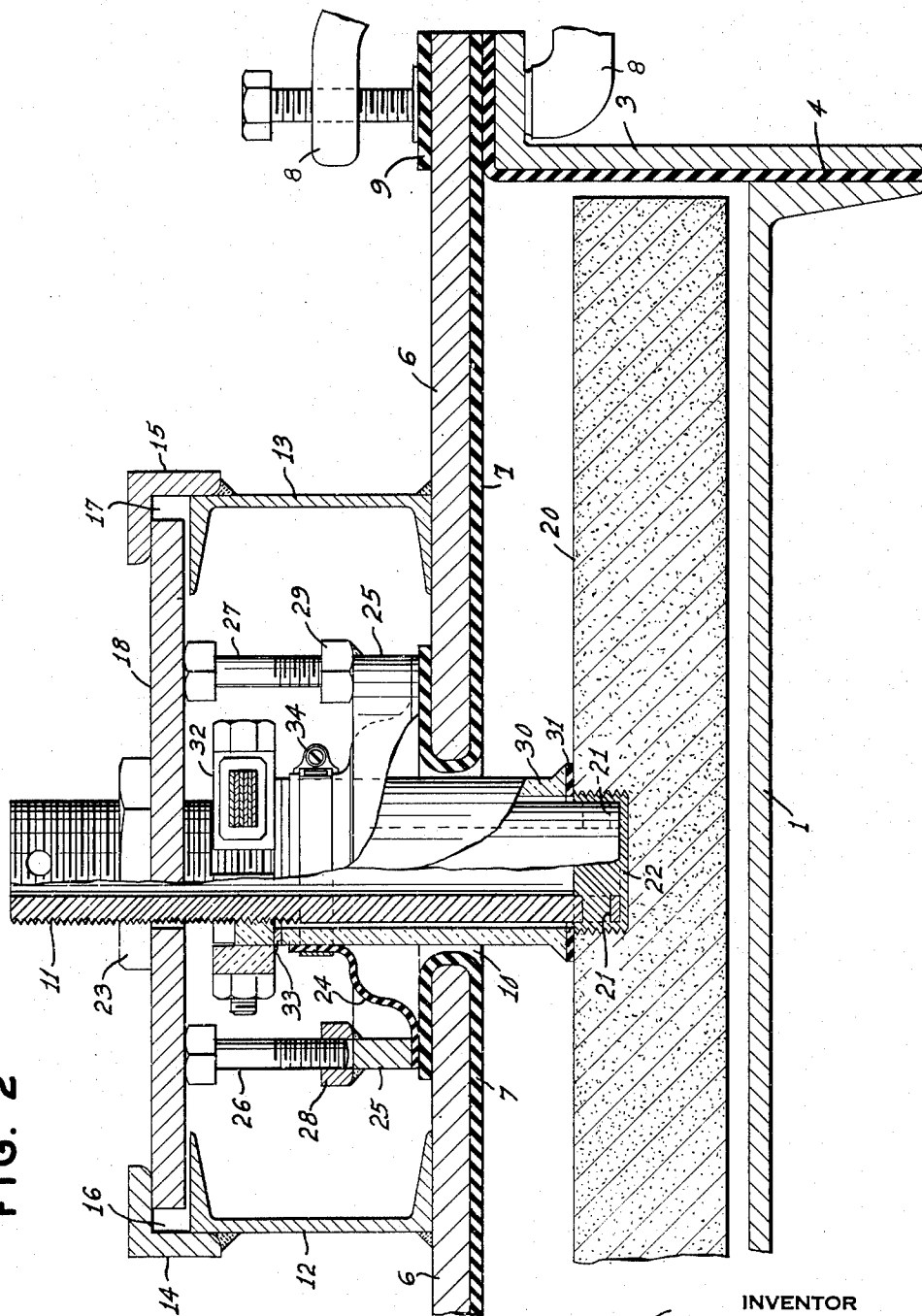
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# APPARATUS FOR ELECTROLYSIS OF ALKALI METAL COMPOUNDS

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2 SHEETS--SHEET 2



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## UNITED STATES PATENT OFFICE

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## APPARATUS FOR ELECTROLYSIS OF ALKALI METAL COMPOUNDS

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1

This invention relates to mercury cells for the electrolysis of alkali metal compounds in solution, particularly the halides, such as sodium chloride, and has for its object the provision of an improved cell of this character. My invention is concerned particularly with mercury cells having an electrolyzer which is long and narrow with an interior lined with rubber, or like material, having the anodes adjustably suspended and provides certain improvements in cells of this character.

In a preferred embodiment of my invention, I suspend the anode from an adjusting nut on a threaded metal anode lead-in and surround the lead-in with a sealed flexible rubber sleeve which permits appreciable movement of the lead-in and its attached anode without the escape of gases from the cell. I prefer to connect the lead-in to the bus bar with a flexible electrical connector to permit movement of the lead-in and anode. My improved lead-in suspension permits adjustment of the anode during operation of the cell and I utilize the anode resistance as an indicator of the adjustment. In a more complete embodiment of my invention, I provide a metal lead-in which is threaded on the upper end to receive the supporting adjusting nut, and a supporting means on which the adjusting nut bears to support the anode. A sealed porcelain or other gas impervious jacket is placed around the lead-in to protect it from anode gas and the rubber sleeve is in sealed connection with the jacket.

Advantageously I employ a cover for the electrolyzer with holes through which the lead-ins are loosely inserted and a rubber lining for the cover which is folded around the edges of the holes and placed in sealed contact with the sleeve. I may use any suitable supporting means for the adjusting nut such as a plate or a tripod arranged over the cover.

These and other objects of the invention will be better understood after considering the following discussion taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view of an improved electrolytic cell of my invention, and

Fig. 2 is a view along line 2—2 of Fig. 1.

The electrolytic cell illustrated in the drawings comprises a cell bed or bottom 1 on which the amalgam flows and which is connected to a cathode bus bar 2, flanged sides 3, and rubber side linings 4. The cell is supported on several pillars having insulators 5 on the tops which contact the under side of the bottom. The cover 6 is a flat metal plate having an inside rubber lining 7 resting upon the rubber linings 4 which extend

2

over the flanges. The cover is held by the clamps 8 which are kept out of electrical contact with the cover by the sheets of rubber 9. The inside of the cell is, accordingly, entirely enclosed in rubber except for the amalgam covered bottom. The cover has several circular holes 10, each serving for the mounting therein of an anode lead-in 11. Two longitudinally extending channel bars 12 and 13 are welded to the cover, in the form of the invention illustrated, to stiffen or reinforce the cover. At spaces opposite the holes 10, angle clips 14 and 15 are welded to the channel bars so as to leave spaces or channels 16 and 17 for receiving the anode support plates 18.

Brine is admitted through pipe 35, chlorine gas is removed through pipe 36, and the amalgam is removed at the opposite end of the cell, all by known means.

The anode for the cell comprises several, for example 18, separate anode sections 20 formed of graphite with perforations or the like (not shown) to facilitate the escape of anode gas. Each anode section is supported by its own lead-in 11. The anode suspension assembly is best shown in Fig. 2. Each lead-in is preferably formed of brass pipe, the upper portion of which has fine threads, for example 12 threads per inch, and the lower end of which has holes 21 for interlocking the lead button 22 formed by pouring molten lead into the pipe. Each anode section has a hole with threads for engaging the lead button. The threads formed on the button 22 couple the lead-in to the anode section and form a good electrical contact. Before assembly, the graphite around the hole is impregnated, for example with a drying oil, to prevent chlorine from attacking the lead threads. The adjusting nut 23 rests upon the plate 18 and thereby supports the anode.

As best shown in Fig. 2, the rubber lining 7 of the cover 6 is folded around the outside of the hole 10. The rubber sleeve 24 surrounding the lead-in is constructed so as to provide a certain amount of slack and is flanged outwardly and placed over the rubber layer 7. The pressure ring 25 rests upon the rubber sleeve 24. The pressure screws 26 and 27 are threaded into the lugs 28 and 29 and are in bearing contact with the plate 18. These screws are adjusted so that the plate 18 is forced upward into contact with the clips 14 and 15 whereby this pressure in addition to the entire weight of the anode section and its immediate assembly of supporting elements carried by ring 25 bear upon and thus seal together the rubber lining 7 and the rubber sleeve 24.

The porcelain pipe 30 fits loosely around the

3

lead-in pipe 11 and is sealed at the bottom with a rubber gasket 31. The anode bus clamp 32 is in threaded connection with the lead-in and is screwed down tight against the lead or fiber gasket 33, thereby completely sealing off the lead-in from contact with anode gases and liquids. The rubber sleeve 24 fits the porcelain pipe tightly and is held in sealing contact therewith by the clamp 34. It will be apparent from this construction that the anode can be moved upward or downward, as required, while maintaining both the inside of the cell and all of the internal elements associated with the lead-in out of contact with anode gas and liquids. Moreover, a very precise adjustment of the anode may be made with the nut while the cell is operating by measuring the resistance between the anode and the amalgam.

As best shown in Fig. 1, each adjacent pair of anode lead-ins is interconnected by two flexible cables 38, the ends of which are fixed to the anode clamps. There is a sufficient amount of slack in these flexible cables to permit the adjustment of the anodes. Each pair of cables is connected to an anode bus bar 37 which connects to the main bus bar (not shown). While I have referred to rubber as forming the lining and sleeve, and porcelain as forming the pipe surrounding the lead-in, I intend that these terms cover all equivalent materials for the purposes of the invention.

Instead of the channel bars 12 and 13, ring 25 and bolts 26, I may support the nut 23 on a tripod. For example, I may attach a plate, like plate 18, to the legs of a tripod which rest upon the cover. In this modification I use a clamp or plate to secure the rubber sleeve 24 in sealing contact with the lining 7.

I claim:

1. In an apparatus for electrolysis of alkali metal compounds, a cell having a conducting cathodic bottom, sides extending upwardly from said bottom, and a cover having a hole therein mounted on said sides; a rubber lining covering the inner surface of said cell, the rubber lining extending through said hole and covering the outer surface of said cover adjacent said hole; an anode positioned within said cell; and means for adjustably positioning said anode above said conducting cathodic bottom during operation of said cell comprising a supporting structure mounted on said cell, said supporting structure having a horizontal member above said cover with an upper surface and a lower surface, a threaded metal lead-in attached to said anode and extending upwardly through said cover hole, an adjusting nut threaded on said lead-in and engaging the upper surface of said horizontal member for the adjustable suspension of said anode above said conducting cathodic bottom, a flexible rubber sleeve having its lower portion in sealing contact with the portion of said rubber lining covering the outer surface of said cover, said rubber sleeve surrounding said lead-in upwardly of said cover, adjustable means extending between the lower portion of said sleeve and the lower surface of said horizontal member for pressing said sleeve and said rubber lining into tight sealing contact, and means in engagement with the upper portion of said rubber sleeve for forming a seal between said upper portion of said sleeve and said lead-in.

2. In apparatus according to claim 1 wherein the means in engagement with the upper portion of said rubber sleeve for forming a seal between said upper portion of said sleeve and said lead-in

4

comprises a porcelain member surrounding the lead-in and extending upwardly from the anode through the cover hole, means for sealing the lower end of said porcelain member to the anode and the upper end to the lead-in, and means for sealing the sleeve to the porcelain member.

3. In an apparatus for electrolysis of alkali metal compounds, a cell having a conducting cathodic bottom, sides extending upwardly from said bottom, and a cover having a hole therein mounted on said sides; a rubber lining covering the inner surface of said cell, the rubber lining extending through said hole and covering the outer surface of said cover adjacent said hole; an anode positioned within said cell; and means for adjustably positioning said anode above said conducting cathodic bottom during operation of said cell comprising opposing channel members extending upwardly from said cover, opposing angle clips mounted on the upper portions of said channel members to form opposing channels, a supporting plate having opposing edges engaged within said channels and extending from one of the channel members to the other, a threaded metal lead-in attached to said anode and extending upwardly through said cover hole and said supporting plate, an adjusting nut threaded on said lead-in above said supporting plate and engaging said supporting plate for the adjustable suspension of said anode above said conducting cathodic bottom, a flexible rubber sleeve having its lower portion in sealing contact with the portion of said rubber lining covering the outer surface of said cover, said rubber sleeve surrounding said lead-in upwardly of said cover, a ring positioned on top of said lower portion of the rubber sleeve, adjustable means positioned between said ring and said supporting plate for forcing the plate upwardly into engagement with said angle clips to form a fluid-tight seal between the superposed rubber lining and sleeve, and means in engagement with the upper portion of said rubber sleeve for forming a seal between said upper portion of said sleeve and said lead-in.

4. In a rubber lined mercury cell for the electrolysis of alkali metal compounds wherein the anode is supported by a lead-in brought through a hole in the cover of the cell and wherein the rubber lining of the cover is extended through the hole and is folded over the edges to the outside, a gas tight adjustable anode lead-in and supporting means which comprises a threaded metal lead-in passing through the hole in the cover plate and attached to the anode, an adjusting nut threaded on the lead-in, an anode bus clamp threaded on the lead-in, a flexible electrical connector to the bus clamp, a flexible rubber sleeve surrounding the lead-in and in sealing contact with the rubber lining of the cell which has been folded over the edge of the hole, means in engagement with the lead-in and the rubber sleeve to keep gases and liquids out of contact with the lead-in, channel members fixed to the cover provided with extensions, which receive the supporting plate, a supporting plate positioned between the extensions and the upper portion of the channel members, and a ring which rests upon the flexible rubber sleeve where the sleeve is in contact with the rubber lining of the cover, and adjustable means positioned between said ring and said supporting plate for forcing the plate into contact with the extensions on the channel members which receive said plate, whereby the weight of the anode and the downward bearing pressure of the channel members

5

against the supporting plate are applied to the ring to hold the superposed rubber lining and sleeve in tight contact.

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