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APPARATUS FOR THE ELECTROLYTIC DECOMPOSITION OF ALKALI CHLORID SOLUTIONS BY MEANS OF MERCURY CATHODES.

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Fig. 1

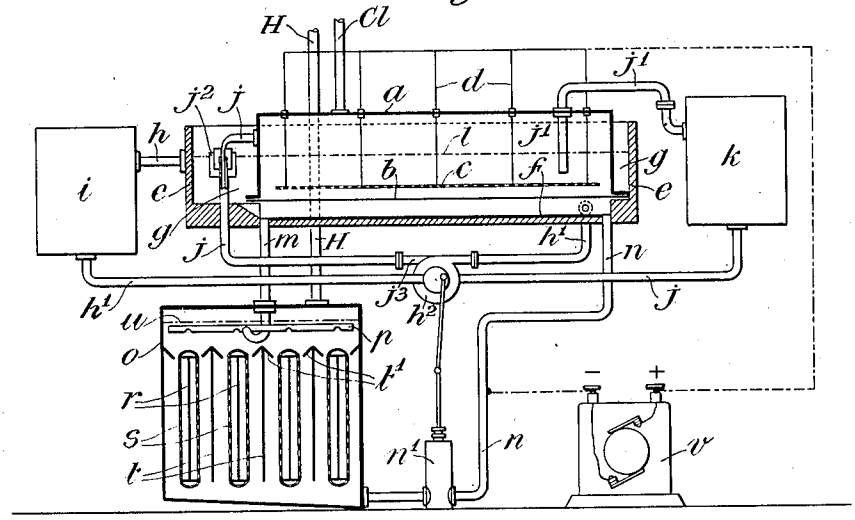
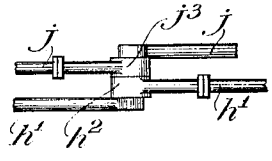


Fig. 2.



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APPARATUS FOR THE ELECTROLYTIC DECOMPOSITION OF ALKALI-CHLORID SOLUTIONS BY MEANS OF MERCURY CATHODES.

No. 918,370. Specification of Letters Patent. Patented April 13, 1909.

Application filed May 4, 1906. Serial No. 315,127.

To all whom it may concern:

Be it known that I, JOHAN JACOB RINK, a citizen of the Kingdom of Denmark, residing at Frederiksholms Kanal No. 6, in Copenhagen, in said Kingdom of Denmark, have invented certain new and useful Improvements in Apparatus for the Electrolytic Decomposition of Alkali-Chlorid Solutions by Means of Mercury Cathodes, of which the following is a specification.

This invention relates to an improved apparatus for treating alkali chlorid solutions by electrolysis, and has for its object to keep that part of the alkali chlorid solution adjacent to the cathode, on which the amalgam is placed, in as pure a condition as possible. This is obtained in such a manner that for keeping up of the constant concentration of the alkali chlorid solution in the usual manner not a single concentrating-cycle only, but two separate concentration-cycles are employed in such a manner that that portion of the chlorid solution adjacent to the cathode (the amalgam) is separated from the other portion adjacent to the anode or anodes by means of a diaphragm and that each portion is connected with a concentration-receptacle or space containing the chlorid in solid form. By this arrangement the bubbles of chlorin gas and oxids of chlorin which are formed on the anode and spread from the same toward the cathode, can exert no injurious influence on the latter.

In consequence of the provision of means by which a quick and thorough washing of the gradually formed amalgam is obtained, it is further possible that the injurious polarization and the consequent formation of alkali hydrate in the decomposition-space, that is to say, in that portion of the chlorid solution that is adjacent to the amalgam, is confined to a minimum. According to this invention, there is placed therefore a mercury-surface, practically free of alkali metal, in juxta-position to a very pure layer of the chlorid solution. This invention consists of an apparatus for carrying out the decomposition of alkali chlorid solutions electrolytically by means of mercury-cathodes, which will be fully described hereinafter and finally pointed out in the claims.

The invention is shown in the accompanying drawing, in which: Figure 1 is a vertical transverse section through one form of electrolyzer constructed according to the invention, and Fig. 2 is a detail view of the circulating pumps for the electrolyte, and their connections.

Similar letters of reference indicate corresponding parts in the figures of the drawing.

Referring to the drawing, *a*, in Fig. 1, is a vessel of essentially bell shape which is closed at its lower end by means of a porous diaphragm *b* of asbestos, glass-wool, stoneware, wood and the like. In the bell-shaped vessel *a* is located, at a short distance above the diaphragm, a net *c* of platinum-iridium which serves as the anode and which is suspended from suspension-wires *d* that are passed through the top of the vessel *a* and insulated from the same.

The receptacle *a* is surrounded by another vessel or tank *e* in such a manner that the diaphragm *b* is located at a short distance from a film or layer of mercury *f* which is spread over the bottom of the tank *e*. The space *g*, which is formed between the walls of the vessel *a* and the bottom and walls of the tank *e*, is connected by a horizontal tube *h* at its upper part and by a tube h^1 at its lower part with a concentration-vessel *i* in which the chlorid to be treated, for instance, potassium chlorid, is placed in solid form. In the tube h^1 is located a circulating-pump h^2 of any approved construction. The space in the vessel *a* is in a similar manner connected by tubes *j* and j^1 with a second concentration-vessel *k*. The tubes *j* and j^1 are each provided with a mercury-seal j^2 for permitting the easy replacement of the same. Only one mercury-seal j^2 on the tube *j* is shown in Fig. 1, the second seal for the tube j^1 being omitted. In the tube *j* is inserted a second circulating-pump j^3 which is located at the rear of the pump h^2 as shown in Fig. 2. The spaces in the bell-shaped vessel *a* and the tank *e* are filled up to a level with the line *l* with a chlorid solution.

The bottom of the tank *e* is covered with the mercury-film and connected by two tubes *m* and *n* respectively with the upper part of a washing-box *o* and a mercury-pump n^1. The tube *m* is tightly fitted into the top-part of the box *o* and connected with a perforated horizontal distributing-tube *p* in the upper part of the box *o*. In the washing-box *o* are arranged wire-nettings *s* which are stretched around vertical plates *r* that are located directly under the openings of the distribut-

ing-tube p. Between the wire-nettings s are located vertical metal plates t which are provided at their upper ends with inclined shedding-strips t^1.

The mercury-pump n^1 is connected with the lower part of the washing-box o. The piston-rod of the pump n^1 may be operated by connection with the crank-disk of the circulating-pump h^2, as shown in Fig. 2 or in any other suitable manner. The box o is filled with water or diluted lye up to a level with the line u and connected at its top-part with a pipe H for the escape of the hydrogen gases. The bell-shaped vessel a is connected at its upper end with a conducting-pipe C^1 for the escape of the chlorin gas. The positive pole of the source of electricity v is connected with the suspension-wires d and the anode c suspended from the same. The negative pole is connected at any suitable point with a circuit composed of the conducting parts f, m, o, r, n^1 and n for the mercury, and the amalgam of the same. During the electrolytic action of the current, besides the mercury-cycle, the two concentration-cycles referred to are called into action.

The solution or electrolyte which becomes gradually diluted by the deposition of alkali metal, in metallic form) on the cathode f, passes from the space g through the pipe h in the upper part of the receptacle i and permits thereby the ingress (through the tube h^1) of a fresh quantity of a concentrated and pure solution or electrolyte. The solution which is contained in the vessel a, and which is gradually diluted by the separation of free chlorin on the anode c and by the passage of alkali metal-ions through the diaphragm b, and which contains chlorin gas and some oxids of chlorin, is gradually forced out by the concentrated solution which is supplied through the tube h^1 and conducted through the pipe j into the concentrating-receptacle k. Simultaneously the amalgam, that is to say the mercury-film f is moved in the direction from n to m. The amalgam which is discharged through the perforations of the pipe p drips over the wire-nettings s and passes through the body of water or lye which fills up the space between the electro-negative plates r and t, and over the large surface of the latter, so that the quick and complete washing of the alkali metal is obtained.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. In apparatus for the electrolytic decomposition of alkali chlorid solutions, the combination of a vessel or tank, a layer of mercury forming the cathode on the bottom of said tank, a diaphragm extending across said tank above said layer of mercury, a bell-shaped vessel within said tank having its lower open end closed by said diaphragm and leaving a space within the tank surrounding said vessel, an anode suspended within said bell-shaped vessel, means for supplying the electrolyte to said anode vessel, means for supplying the electrolyte to the tank, and means for removing the mercury from the tank, washing it and then returning the same to the tank.

2. In apparatus for the electrolytic decomposition of alkali chlorid solutions, the combination of a tank having a bottom layer of mercury, a bell-shaped vessel having its open lower end closed by a diaphragm dividing said tank into upper and lower spaces, an anode suspended in said bell-shaped vessel, means for supplying the electrolyte to said vessel comprising a concentration receptacle connected with said vessel at two points, and means for supplying electrolyte to said tank comprising a concentration receptacle connected therewith by means of pipes communicating with the spaces above and below the diaphragm.

3. In apparatus for the electrolytic decomposition of alkali chlorid solutions, the combination, with a tank having a bottom layer of mercury, of a washing box connected with the bottom of said tank by means of pipes and having upright wire nettings down which the amalgam flows, and electro-negative plates between said nettings.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

JOHAN JACOB RINK.

Witnesses:
ERNEST BOUTARD,
P. HOFMAN BANGS.