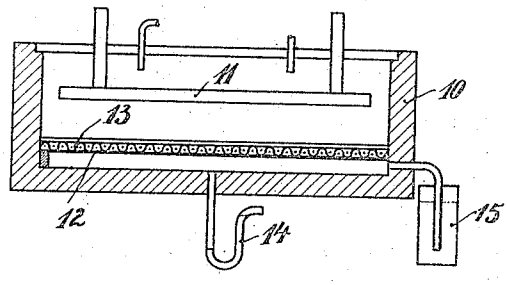
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ELECTROLYSIS OF ALKALINE HALOIDS.

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1,222,239.

Patented Apr. 10, 1917.



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UNITED STATES PATENT OFFICE.

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ELECTROLYSIS OF ALKALINE HALOIDS.

1,222,239. Specification of Letters Patent. Patented Apr. 10, 1917.

Application filed August 26, 1913. Serial No. 786,687.

To all whom it may concern:

Be it known that I, KARL OCHS, a citizen of the German Empire, and resident of Charlottenburg, near Berlin, have invented certain new and useful Improvements in the Electrolysis of Alkaline Haloids, of which the following is a specification.

My invention relates to the electrolytic decomposition of salts and particularly to the electrolysis of alkaline chlorids by means of electrolytic apparatus having horizontally arranged electrodes and diaphragms. In apparatus of the type referred to the anodes are arranged above and the cathodes below the filtering diaphragm and the salt solution by reason of its hydrostatic pressure permeates continuously and slowly the diaphragm in a manner depending upon the strength of the current applied. Since in operation several horizontal layers or zones of various composition and density are formed in the electrolyte, a certain height of the salt solution above the diaphragm and thereby a certain hydrostatic pressure is secured during the entire process of electrolysis.

Although this hydrostatic pressure is not very great in actual practice, its value varying from 100–200 mm. water column, a partial compensation of this pressure is required in order to attain a slow filtration of the electrolyte which corresponds to the current density. This has been accomplished heretofore either by a hydrostatic counter-pressure according to the principle of communicating tubes or by the provision of a relatively thick filter layer on the diaphragm. The first method has the advantage that the filter may be relatively thin and, therefore, the decomposition voltage may be taken relatively low. With this method it is, however, difficult to remove the hydrogen from the cathode space and to so arrange the compartments serving as communicating tubes that the method may be successfully carried out on a commercial scale.

The second known method requires *a priori* a relatively large thickness of the filter as the friction of the electrolyte interiorly of the filter layer will serve for compensating the hydrostatic pressure. Accordingly, a disadvantage of this method is the increase of voltage which is made necessary owing to the thickness of the filter, and further the fact, that in case of impure salts the thickness of the filter layer will gradually increase. This will necessitate either an increase in the hydrostatic pressure, or a partial vacuum to be generated underneath the filter for counteracting the decrease in the velocity of filtration.

My invention has for its object to overcome the objections named and to so control the velocity of the electrolyte in passing the diaphragm that a very thin filter cloth may be employed and only a low voltage of decomposition is required.

To this end I provide means whereby the generated hydrogen is caused to nearly fill the whole cathode space, and only after creation of a definite pressure the excess of liberated hydrogen continuously discharged into the atmosphere, whereas the hydroxid solution is at once drawn off so that it will only cover the bottom of the cathode chamber in the form of a thin film. The pressure of the hydrogen in the cathode space must be kept somewhat smaller than the hydrostatic pressure of the electrolyte, this being controlled by a valve in the discharge for the hydrogen so that the velocity of filtration of the electrolyte may be made to correspond to the conditions of the electric current at the time traversing the electrolyte.

My invention will be more fully understood by reference to the accompanying drawing which shows in a diagrammatic view one form of the apparatus for carrying my invention into effect. In the drawing, 10 represents the container or vat for the salt solution, 11 is the positive electrode or anode, 12 the negative electrode or cathode consisting preferably of a wire net, 13 is the aforesaid filter consisting preferably of a web of asbestos. In the arrangement as shown the electrolyte will permeate the asbestos filter 13 in accordance with the pressure counteracting the column of the electrolyte above the diaphragm and the conditions of the electric current applied. If no further means were employed for creating a counter-pressure of the discharging hydrogen the velocity of flow of the solution through the filter would become so large, that for the given conditions of current only a very thin hydroxid solution could be generated. Now, for controlling the velocity of filtration I provide means for impeding the discharge of the hydrogen from the cathode chamber so that the latter will nearly

be filled by the generated gas. The hydroxid solution is at once drawn off by the pipe 14 so that it will only cover the bottom of the cathode chamber in the form of a thin film. As controlling means I have shown a valve arrangement which consists of a downwardly bent tube dipped into a water vessel 15. By raising or lowering the level of the water in the vessel 15 the pressure of the hydrogen gas in the cathode chamber is correspondingly regulated.

The method described permits to employ at the start a very thin filter which therefore may be easily permeated by the electrolyte, this filter consisting, for instance of a web of asbestos so that only a small voltage of decomposition will be required. If the filter now becomes gradually denser by reason of impurities resulting into a smaller velocity of filtration, it will only be required to adjust the valve upon a smaller pressure of the hydrogen in order to attain the normal velocity of filtration.

Having thus described my invention I wish to be understood as not limiting myself to the exact mode as herein described, since modifications may be employed without departing from the principle or sacrificing any of the advantages of this invention, I claim as new and desire to secure by Letters Patent of the United States:—

1. The process for electrolyzing alkaline haloids in cells with horizontal diaphragms which consists in controlling the continuous discharge of the generated hydrogen gas so as to cause said gas to permanently fill the whole cathode space below the diaphragm with constant pressure, and drawing off the hydroxid solution from the bottom of said space so as to only form a thin layer on said bottom, thereby generating an aerostatic counter-pressure to the hydrostatic pressure of the electrolyte above the diaphragm.

2. In an apparatus for electrolyzing alkaline haloids, an anode chamber, a cathode chamber, a horizontal diaphragm between said chambers, a discharge for the hydroxid solution from the bottom of said cathode chamber, a discharge for the hydrogen from the upper portion of said cathode chamber below said diaphragm, and means for controlling the pressure in said cathode chamber so as to counteract the hydrostatic pressure of the electrolyte above said diaphragm.

3. In an apparatus for electrolyzing alkaline haloids, an anode chamber, a cathode chamber, a horizontal diaphragm between said chambers, a discharge for the hydroxid solution from the bottom of said cathode chamber, a discharge for the hydrogen from the upper portion of said cathode chamber below said diaphragm, and a valve in said discharge for the hydrogen for controlling the pressure in said cathode chamber so as to counteract the hydrostatic pressure of the electrolyte above said diaphragm.

In witness whereof I have hereunto set my signature in the presence of two subscribing witnesses.

KARL OCHS.

Witnesses:
WOLDEMAR HAUPT,
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