(No Model.)

A. SINDING-LARSEN.

APPARATUS FOR ELECTROLYTICAL DECOMPOSITION.

No. 525,555. Patented Sept. 4, 1894.

Fig. 2.

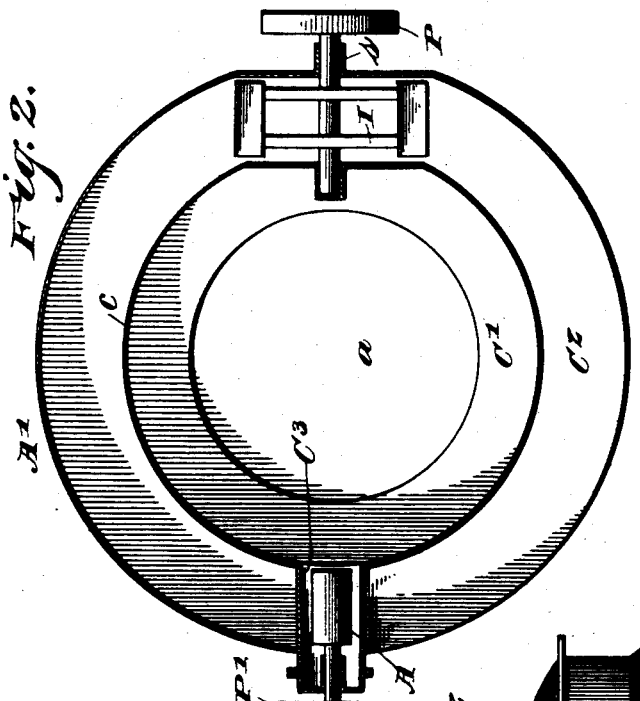


Fig. 1.

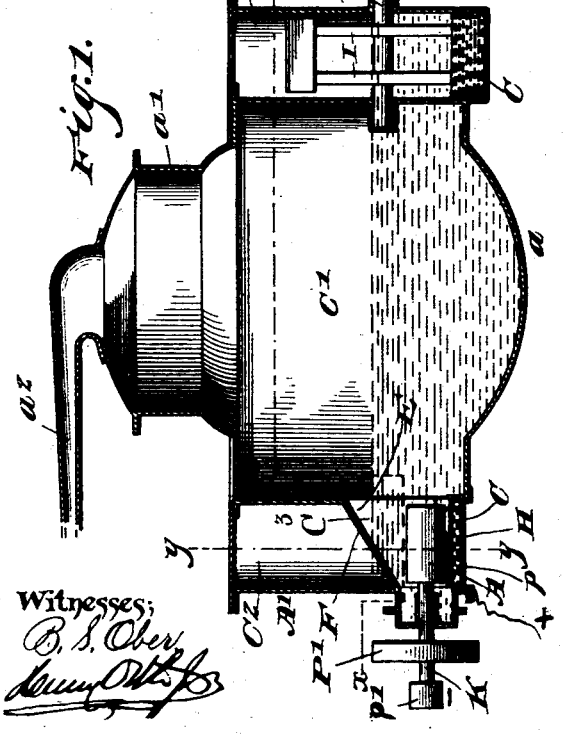
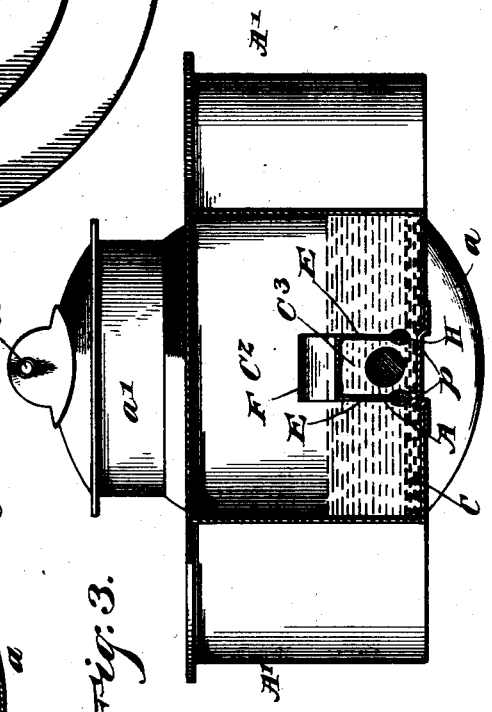


Fig. 3.



Witnesses;
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UNITED STATES PATENT OFFICE.

ALF SINDING-LARSEN, OF CHRISTIANIA, NORWAY.

APPARATUS FOR ELECTROLYTICAL DECOMPOSITION.

SPECIFICATION forming part of Letters Patent No. 525,555, dated September 4, 1894.

Application filed August 31, 1893. Serial No. 484,480. (No model.)

To all whom it may concern:

Be it known that I, ALF SINDING-LARSEN, a subject of the King of Sweden and Norway, residing at Christiania, in the Kingdom of Norway, have invented certain new and useful Improvements in Apparatus for Electrolytical Decomposition while Using Quicksilver as a Cathode; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

My invention relates to the art of electrolysis and more particularly to the electrolytical production of the salts of the metals of the alkalies and of chlorine.

Apparatuses as heretofore constructed for the purposes above referred to, in which mercury is employed as a cathode, are defective in that the water is decomposed directly on the surface of the cathode, this being due to the fact that the alkali metal amalgam exposed to the action of the water, where the current is weak will give up its metallic constituent to the water and form hydroxid and hydrogen.

In more recent constructions it has been proposed to separate the anode and cathode cells by the interposition of a porous diaphragm or partition, but this, instead of remedying the disadvantage referred to, increased the same whenever the cathode is allowed to run in contact with the partition, in view of the fact that such a partition is impervious to the cathode but pervious to the electrolyte, and this being decomposed by the action of the electric current, *i. e.*, deprived of its metallic constituent, water alone passes into the cathode cell, which is decomposed by the alkali metal amalgam, hydrogen being evolved, which, adhering to the partition, will practically form a lining, thereby reducing the area of contact between the cathode and electrolyte. Furthermore, as the hydrogen rises through the cathode it entrains more or less of the electrolyte into the solvent for the alkali metal.

This invention is designed to overcome these disadvantages, as will now be fully described, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical sectional elevation of an apparatus constructed in accordance with, and for carrying out, my invention. Fig. 2 is a transverse section on line x—x of Fig. 1, and Fig. 3 is a vertical section on line y—y of Fig. 1.

The apparatus is constructed of any suitable non-conductive material, adapted to resist the action of the electrolyte, or the ions thereof, or other products of decomposition, and, preferably of a cylindrical form. The casing or shell A′ has a concave bottom a, a dome a', and an escape pipe a^2 for the anion, and is divided interiorly into two concentric chambers, C′ C^2 by a suitable partition c, the outer chamber C^2 being of considerably less cross sectional area than the inner chamber C′. In the outer shell, and in said partition I form bearings for the spindle or shaft s of a paddle wheel I adapted to revolve in chamber C^2, said shaft receiving motion from any suitable motor through the medium of a belt pulley P, or in any other desired manner. In chamber C^2 is formed a cell C^3 that is open toward the chamber C′, so that the electrolyte in said chamber C′ may have free access to the cell. The latter is in communication with the chamber C^2 by narrow ports p formed below its side walls E E, which latter do not extend quite to the bottom of said chamber C^2, the ports being normally closed against access thereto of the electrolyte in chamber C′ by the mercury cathode C, there being just sufficient space below the side walls E to admit of the circulation of said cathode under the action of the paddle wheel I. The top of the cell C^3 is closed by a roof F inclining upwardly from the outer shell to the partition c, and said cell is of considerably less height than the chamber C^2, as shown in Figs. 1 and 3. The anode A is of cylindrical form secured to a spindle K of conductive material, said spindle receiving motion from a pulley P′ thereon, said spindle being provided with a cylindrical head or boss p' that is connected with the plus pole of a generator of electricity in any well known manner, as for instance, by a trailing contact or a brush. The minus pole of the generator is connected to a metallic conductive plate H that preferably

constitutes the bottom of the cell C^3 and is raised slightly above the bottom of chamber C^2 so as to reduce the volume of mercury flowing over the same to a thin film for purposes well understood.

By means of the construction described it will be seen that the electrolyte has free access to the electrodes but has no access to the chamber C^2 in which the dissolution of one of the ions is effected by means of a suitable solvent while the gaseous ion is free to rise through the electrolyte to the dome a' of the apparatus and is conducted off by a pipe a^2.

The operation of the apparatus is as follows: The chamber C' is, for instance, supplied with a solution of common salt in water and the chamber C^2 with water and sufficient mercury to cover the ports p, the paddle wheel I and anode A are then set in motion and current turned on, when the electrolyte will be decomposed in cell C^3, the metal of the alkali amalgamating with the mercury while the chlorine liberated at the anode rises through the electrolyte and passes out of the apparatus by pipe a^2. If the anode A were stationary the chlorine set free would collect thereon and materially interfere with the decomposition, but this is effectually avoided by maintaining the anode in motion, and inasmuch as the cathode C is caused to continuously flow from cell C^3 to chamber C^2 and back again, the amalgam formed by electrolytic action is carried along with the cathode into contact with the water in chamber C^2, where the amalgamated salt of sodium is dissolved out. In view of the fact that the anode is also in motion, the electrolyte is continuously in the presence of clean or fresh electrode surfaces, the cathode being freed from its amalgamated metal as fast as the amalgam is formed, and this is greatly facilitated by keeping the water also in continuous motion. The walls of the electrode cell C^3 are of course constructed of a non-conductive material, and to prevent all possibility of the electrolyte being carried along with the mercury under said walls into the dissolution chamber C^2, I line the lower edges thereof with a suitable amalgam, or with a metal adapted to amalgamate with the mercury, so that the latter will adhere thereto and practically form a partition that will effectually prevent the electrolyte being carried along with the mercury into said chamber C^2 without thereby interfering with the circulation of the mercury.

The apparatus is of course provided with suitable means for supplying the chamber C' with an electrolyte, the chamber C^2 with mercury and water, and for drawing off the solution from the latter chamber, as will be readily understood. I have deemed it unnecessary to show such means, owing to the fact that they are well understood and within the province of a skilled mechanic. Obviously, if the feed of the electrolyte to chamber C', and of the water to chamber C^2 and the discharge of the solution from the latter chamber are properly regulated, the electrolytical process can be made a continuous one.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. An electrolytic apparatus comprising a vessel divided into two chambers, arranged one within the other, an electrode cell in communication with both, suitable electrodes in said cell and means within one of said chambers for establishing a circulation of its contents.

2. An electrolytic apparatus comprising a vessel divided into two chambers suitable electrodes in said cell arranged one within the other, an electrode cell in the outer chamber in communication with both chambers, and means within said outer chamber for establishing a circulation of its contents, for the purpose set forth.

3. An electrolytic apparatus comprising a vessel divided into two chambers arranged one within the other, an electrode cell in the outer chamber of less height than the latter, said cell opening into the inner chamber and communicating with said outer chamber through passages below its side walls, a conductive bottom for said cell, said bottom constituting the negative electrode a positive electrode above said conductive bottom and means within the outer chamber for establishing a circulation of its contents, for the purpose set forth.

4. An electrolytic apparatus comprising a vessel divided into two chambers arranged one within the other, an electrode cell in the outer chamber of less height than the latter, said cell opening into the inner chamber and communicating with said outer chamber through passages below its side walls, the lower edge of the latter covered with an amalgam, a conductive bottom for said cell, said bottom constituting the negative electrode a positive electrode above said conductive bottom and means within the outer chamber for establishing a circulation of its contents, for the purpose set forth.

5. An electrolytic apparatus comprising a vessel divided into two chambers arranged one within the other, an electrode cell in the outer chamber of less height than the latter, said cell opening into the inner chamber and communicating with said outer chamber through passages below its side walls, a conductive bottom for said cell, said bottom constituting the negative electrode a revoluble positive electrode above said conductive bottom, and means within the outer chamber for establishing a circulation of its contents, for the purpose set forth.

6. An electrolytic apparatus comprising a vessel divided into two chambers arranged one within the other, an electrode cell in the outer chamber of less height than the latter, said cell opening into the inner chamber and communicating with the outer chamber by suitable ports at the foot of its side walls, a

conductive bottom for the cell, said bottom constituting the negative electrode, a positive electrode above said bottom, and a paddle wheel revoluble in the outer chamber, for the purpose set forth.

7. An electrolytic apparatus consisting of a cylindrical vessel divided into two concentric chambers, a gas escape in communication with the inner chamber, a cell in the outer chamber opening into said inner chamber and communicating with the outer one by ports at the foot of the side walls of the cell, said cell of less height than said outer chamber and provided with a downwardly and outwardly inclined roof, a conductive bottom for the cell, said bottom constituting the negative electrode, a revoluble positive electrode above said bottom, and a propeller for fluids within the smaller chamber, for the purpose set forth.

8. An electrolytic apparatus consisting of a cylindrical vessel divided into two concentric chambers, a gas escape in communication with the inner chamber, a cell in the outer chamber opening into said inner chamber and communicating with the outer one by ports at the foot of its side walls, said cell of less height than the inner chamber and provided with a downwardly and outwardly inclined roof, a negative electrode constituting the bottom for the cell elevated above the bottom of the outer chamber, a positive electrode above said cell bottom, and a propeller for fluids within the outer chamber, for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

ALF SINDING-LARSEN.

Witnesses:
ALFRED J. BRYN,
L. DAER.