No. 738,094. PATENTED SEPT. 1, 1903.

A. BRICHAUX.

ELECTROLYTIC PROCESS.

APPLICATION FILED OCT. 4, 1898.

NO MODEL.

Fig. 1.

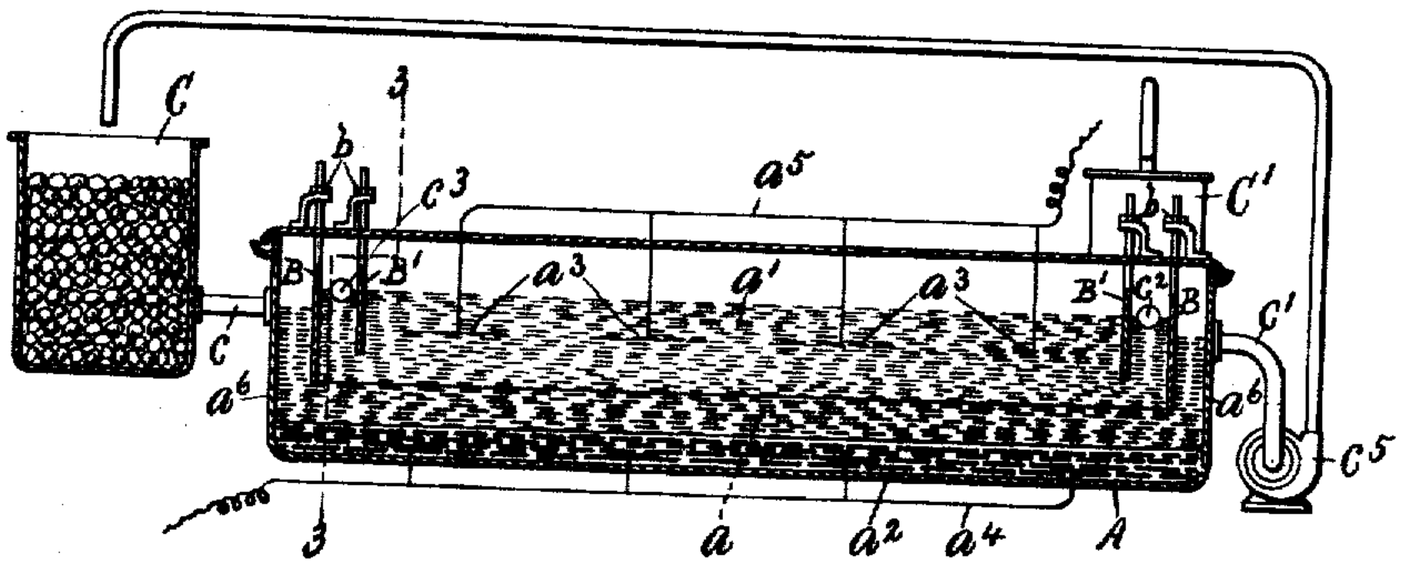


Fig. 2.

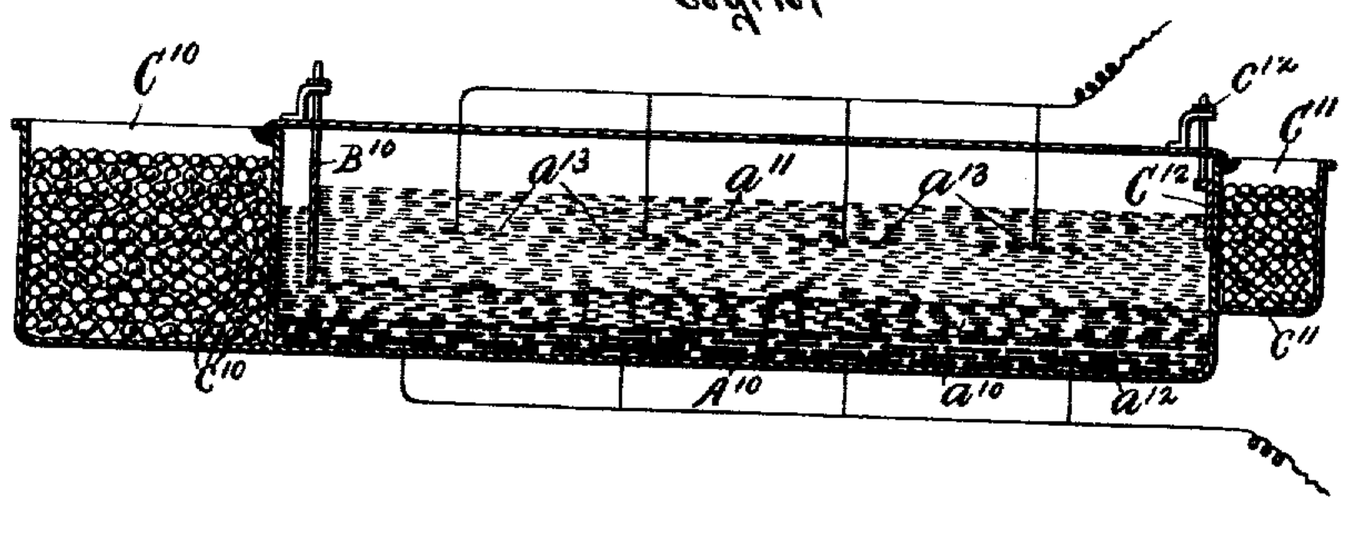
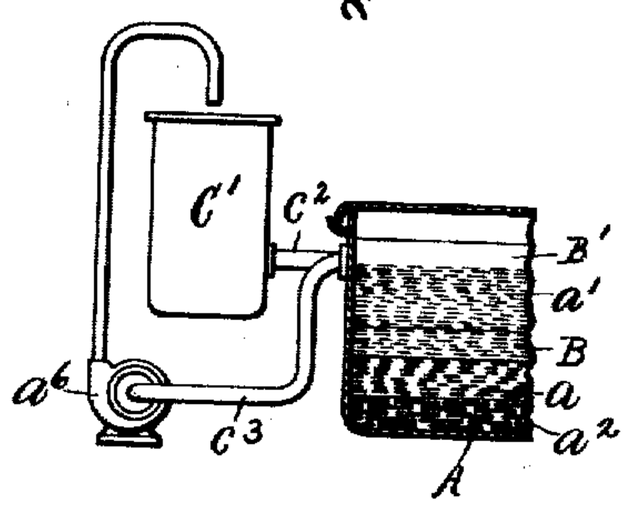


Fig. 3.



WITNESSES:

H. C. Chace,

J. A. Lowles.

INVENTOR

Arthur Brichaux

BY

Cox & Parsons.

ATTORNEYS

No. 738,094. Patented September 1, 1903.

UNITED STATES PATENT OFFICE.

ARTHUR BRICHAUX, OF BRUSSELS, BELGIUM, ASSIGNOR TO THE SOLVAY PROCESS COMPANY, OF SYRACUSE, NEW YORK, A CORPORATION OF NEW YORK.

ELECTROLYTIC PROCESS.

SPECIFICATION forming part of Letters Patent No. 738,094, dated September 1, 1903.

Application filed October 4, 1898. Serial No. 692,584. (No specimens.)

To all whom it may concern:

Be it known that I, ARTHUR BRICHAUX, a subject of the King of Belgium, residing at Brussels, Belgium, have invented a new and useful Electrolytic Process, (for which I have filed applications for foreign Letters Patent as follows: Belgium, No. 134,176, March 5, 1898; Germany, No. S, 11,224/75, March 18, 1898; Great Britain, No. 7,471, March 28, 1898; Russia, No. 4,603, May 4/16; France, No. 266,675, June 14, 1898; Switzerland, No. 18,984, July 29, 1898; Austria, August 19, 1898, and Hungary, No. 12,055, August 25, 1898,) of which the following is a specification.

My invention consists of an electrolytic process which is particularly applicable for electrolyzing alkaline chlorids and other salts and reduces to a minimum the liability of the recombination of the products separated by the current, as hereinafter specifically described, and pointed out in the claim.

In describing this invention reference is had to the accompanying drawings, in which like letters indicate corresponding parts in all the views.

Figures 1 and 2 are vertical sectional views of electrolytic apparatus particularly applicable for carrying out my process. Fig. 3 is a vertical sectional view taken on line 3 3, Fig. 1.

It is well known that the most important cause which prevents the theoretical yield being obtained in the present processes for electrolyzing alkaline chlorids and other salts is the partial recombination of the products separated by the current. For example, in the decomposition of alkaline chlorids (chlorid of sodium or chlorid of potassium) with a mercury cathode chlorin liberated at the anode dissolves in the electrolyte and recombines with sodium of potassium liberated at the cathode. This recombination is facilitated by the fact that chlorin liberated in solutions of alkaline chlorids is so readily soluble therein that the chlorin is evolved only after saturation of the solutions. The saturation of the solutions is thus constantly maintained during the evolution of the chlorin notwithstanding the continual recombinations of the products liberated by the current. The diminution of the yield of chlorin due to the recombinations referred to can be considerably obviated by the use of a diaphragm for separating the liquid in which the anode is arranged from the liquid in which the cathode is arranged; but it is a well-known fact that diaphragms afford resistance to the passage of the current and constitute a great practical complication.

By my improved process a layer of greater density of a solution of the chlorid or other salt is maintained in electrical contact with a cathode, a layer of lesser density is maintained directly upon the former layer and in electrical contact with the former layer and an anode, and an electric current is passed through said electrodes and layers.

In order that my process may be readily understood, I have shown and will briefly describe electrolytic apparatus which are particularly applicable for carrying out said process and form the subject-matter of my pending applications, Serial Nos. 692,585 and 692,586.

The apparatus seen in Figs. 1 and 3 consists of a receptacle A, partitions B B B′ B′, chambers C C′, and conduits c c' c^2 c^3. The receptacle A receives the separate layers a a' of the electrolyte and the electrodes a^2 a^3, the cathode a^2 being connected to one of the conductors a^4 of an electric circuit and supported upon the bottom of the receptacle A beneath the layer a of the electrolyte of greater density, and the anode a^3, which preferably consists of a plurality of conductors, being connected to the other conductor a^5 of said circuit and arranged above the cathode a^2 within the layer a^2 of the electrolyte of lesser density. The partitions B B B′ B′ are interposed between opposite walls of the receptacle A, and the adjacent sides of the anode a^3 are separated from each other and said walls of the receptacle and are adjusted vertically by suitable adjusters b. The chambers C C′ contain the material to be electrolyzed and are generally of unequal size. The conduits c c' communicate between the partitions B B and the adjacent walls a^6 of the receptacle at points above the lower edges of said partitions with opposite sides of the portion of the

receptacle A inclosing the lower layer a of the electrolyte, and the conduits c^2 c^3 communicate between the partitions B B B′ B′ at points above the lower edges of said partitions with opposite sides of the portion of the receptacle A inclosing the upper layer a' of the electrolyte. Said conduits c c^2 communicate, respectively, with the chambers C C′ for conducting the material to be electrolyzed from said chambers to the receptacle A, and said conduits c' c^3 are usually provided with pumps or other suction devices c^5 c^6 and discharge, respectively, into the chambers C C′ for conducting the layers of the electrolyte from the receptacle A into the chambers C C′ in order that said layers may become recharged with the material to be electrolyzed. The conduits c c' c^2 c^3 and the pumps or other suction devices connected thereto effect a positive circulation of the separate layers of the electrolyte, which facilitates the carrying out of my process.

The apparatus seen in Fig. 2 consists of a receptacle A^{10}, a partition B^{10}, chambers C^{10} C^{11}, and a regulator C^{12}. The receptacle A^{10} receives the separate layers a^{10} a^{11} of the electrolyte and electrodes a^{12} a^{13}, arranged in substantially the same manner as the electrodes a^2 a^3, previously described. The partition B^{10} is supported within the receptacle A^{10} between one of its side walls and the anode a^{13} and above the bottom of said receptacle and the lower layer a^{10} of the electrolyte. The chambers C^{10} C^{11} contain the material to be electrolyzed and are so connected to the receptacle A^{10} that unequal areas thereof communicate, respectively, with the portions of the receptacle A^{10} inclosing the layers a^{10} a^{11} of the electrolyte for supplying to the respective layers unequal amounts of the material to be electrolyzed. The chamber C^{10} is arranged in proximity to the side of the receptacle A^{10} adjacent to the partition B^{10} and communicates with said receptacle by suitable conduits c^{10} c^{10} c^{10}, opening into the receptacle A^{10} at one side of the partition B^{10} and at points above and below the lower edge of said partition. The chamber C^{11} is arranged in proximity to the opposite side of the receptacle A^{10}, is of less size than the chamber C^{10}, and communicates with the receptacle A^{10} by a single conduit c^{11}, opening into the receptacle A^{10} at the opposite side of the partition B^{10} and at a point above the lower edge of said partition. The regulator C^{12} consists of a plate which is movable across the conduit c^{11} for controlling the passage therethrough of the material to be electrolyzed and may be raised and lowered by a suitable adjuster, as a nut c^{12}. The material to be electrolyzed passes through the conduits c^{10} c^{11} of the apparatus seen in Fig. 2 without circulation of the electrolyte except by diffusion.

The described electrolytic apparatus are particularly applicable for carrying out my process; but I do not limit my invention thereto, as any other suitable means may be employed in carrying out said process.

My process is carried out as follows: The electrolyte is divided into upper and lower layers of unequal density and of uniform thickness from end to end, the lower layer resting upon the mercury or other cathode and being almost or entirely saturated with the material to be electrolyzed, as an alkaline chlorid, and the upper layer resting upon the lower layer and being in contact with the lower layer and the anode and impregnated with a less amount of said material. The electric current is then passed through the electrodes and the layers of the electrolyte. The dense lower layer serves the purpose of a diaphragm without occasioning the inconvenience attending the use of an ordinary solid diaphragm and remains practically free from the material, such as chlorin, being liberated at the anode, since said lower layer in contact with the mercury or other cathode is saturated with the material to be electrolyzed, such as an alkaline chlorid, and cannot readily absorb any liberated chlorin, and since the upper layer of lesser density which surrounds the anode readily absorbs the liberated chlorin, owing to the comparatively small amount of material to be electrolyzed, as an alkaline chlorid, in solution therein. The layers of the electrolyte do not materially mix with each other during the passage of the current, especially when said layers are circulated within the receptacle containing the same, as in the apparatus for carrying out my process seen in Figs. 1 and 3.

My electrolytic process will now be readily understood upon reference to the foregoing description and the accompanying drawings.

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

The herein-described electrolytic process for the decomposition of chlorids and other salts, the same consisting in introducing into two layers of a solution of the chlorids or other salts respectively, a quantity of salt which will serve to maintain the lower layer of said solution in a condition of greater density and the upper layer in a condition of lesser density, the lower layer being in electrical contact with a cathode and the upper layer in electrical contact with the lower layer and an anode, and in passing an electric current through said electrodes and layers, substantially as and for the purpose described.

In testimony whereof I have hereunto signed my name, in the presence of two attesting witnesses, at Brussels, Belgium, this 1st day of September, 1898.

ARTHUR BRICHAUX.

Witnesses:
J. F. FURSTENHOFT,
GREGORY PHELAN.

Corrections in Letters Patent No. 738,094.

It is hereby certified that in Letters Patent No. 738,094, granted September 1, 1903, upon the application of Arthur Brichaux, of Brussels, Belgium, for an improvement in "Electrolytic Processes," errors appear in the printed specification requiring correction, as follows: In line 41, page 1, the word "of" should read *or*, and same page, line 88, the reference-letter "a^2" should read a'; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 16th day of October, A. D., 1906.

[SEAL.]

F. I. ALLEN,

Commissioner of Patents.