E. ANDREOLI.

ELECTROLYTIC APPARATUS.

No. 512,266. Patented Jan. 9, 1894.

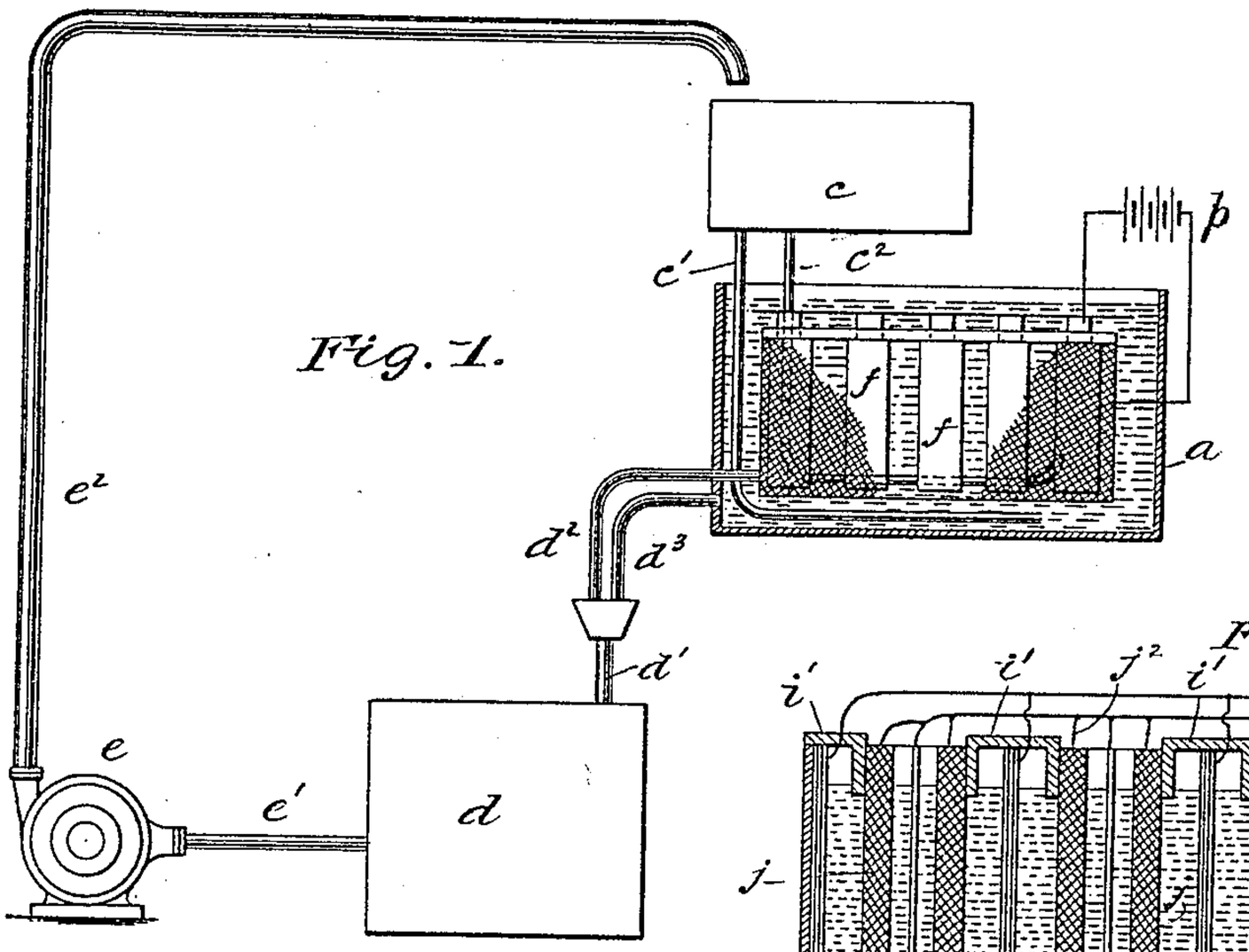


Fig. 1.

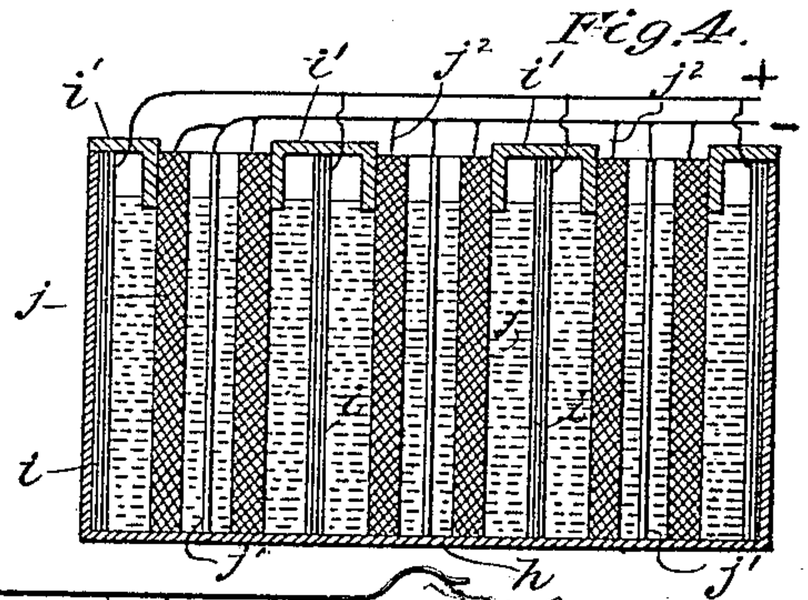


Fig. 4.

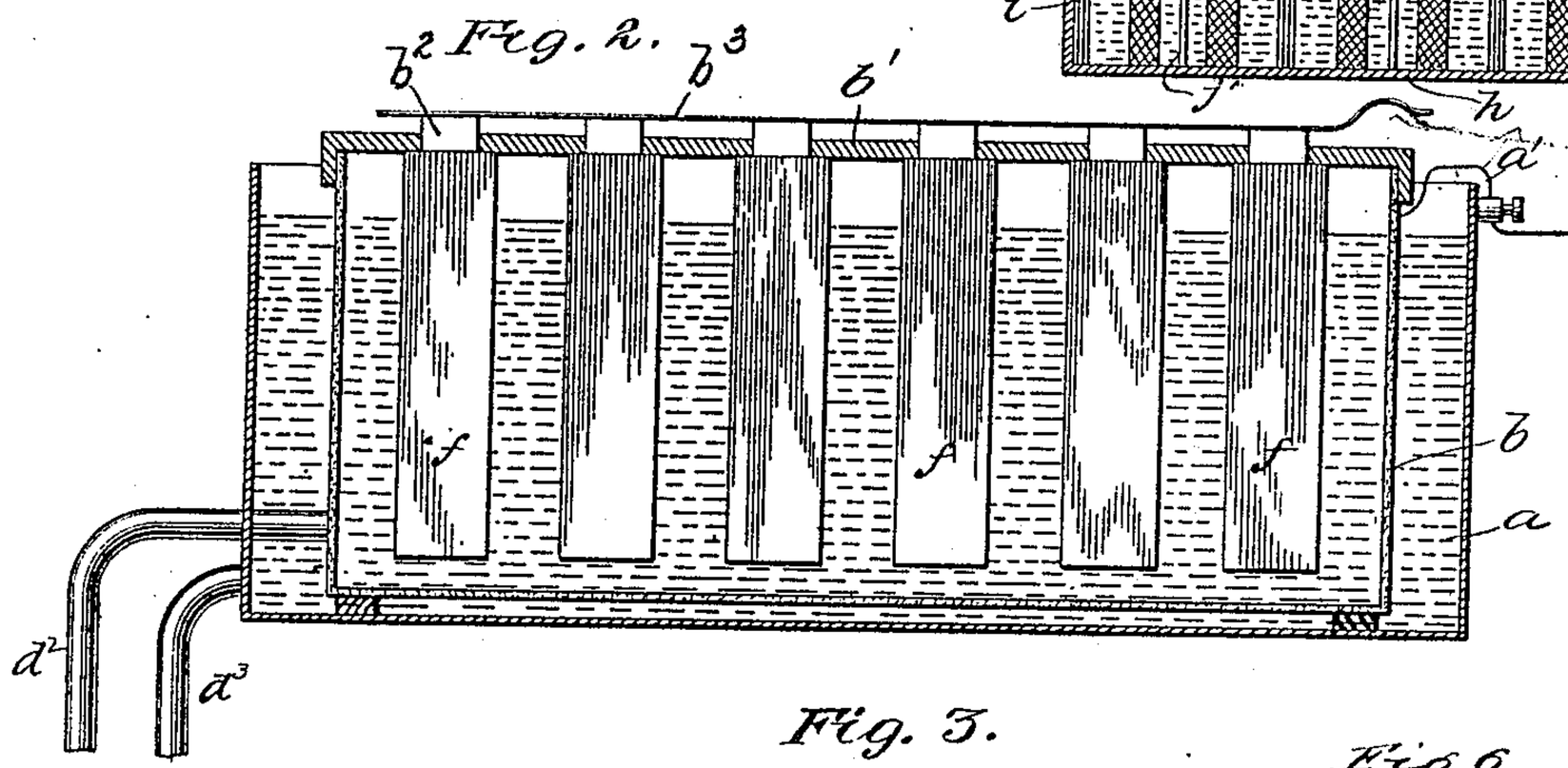


Fig. 2.

Fig. 3.

Fig. 7.

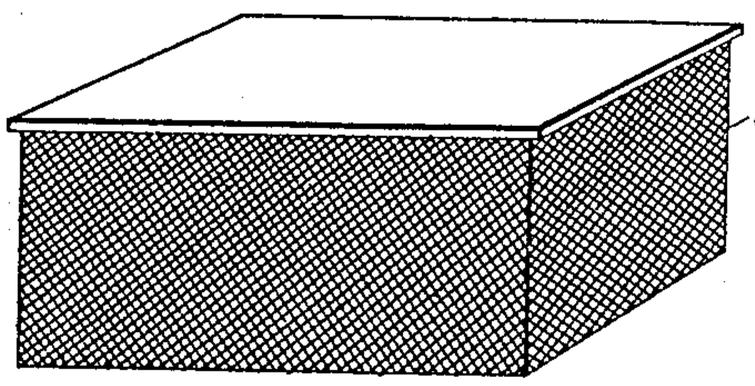
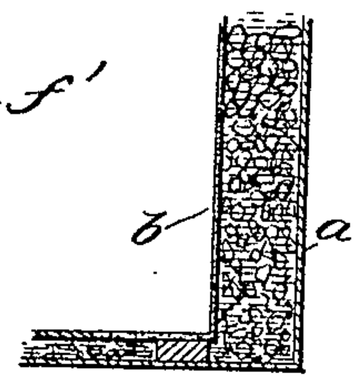


Fig. 6.



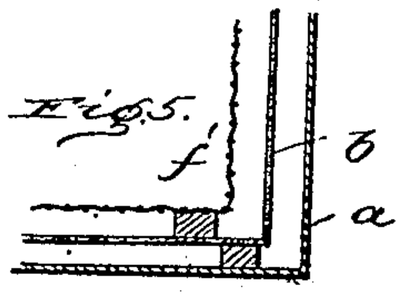


Fig. 5.

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ELECTROLYTIC APPARATUS.

SPECIFICATION forming part of Letters Patent No. 512,266, dated January 9, 1894.

Application filed February 20, 1893. Serial No. 463,037. (No model.)

To all whom it may concern:

Be it known that I, EMILE ANDREOLI, a citizen of France, residing at 18 Somerleyton Road, London, in the county of Surrey and Kingdom of Great Britain and Ireland, have invented certain new and useful Improvements in Electrolysis, of which the following is a full, clear, and exact description.

This invention has for its object to provide an improved electrolytic apparatus and is distinguished by the feature of the partitions being porous and good conductors of electricity. These partitions or diaphragms, on account of the use to which they are put, are called supplementary cathodes and are connected with the principal cathode by means of a wire of more or less resistance and in contact more or less perfect with the principal cathode.

Some of the different ways in which the invention may be utilized will be set forth, referring to, as an example, the electrolysis of a solution of chloride of sodium, although the invention can be used equally in the electrolysis of sulphates, nitrates, &c., and in other ways, such as the decomposition of a solution of potash or of caustic soda or of sulphuric acid at the anode and of hydrogen at the cathode and for all electrolytic applications, electro-deposition, &c.

Referring to the accompanying drawings in which similar letters of reference indicate like parts, Figure 1 shows a complete electrolytic apparatus, conventionally, broken away and disclosing features of the invention. Fig. 2 is an enlarged detail view in longitudinal section of so much of the apparatus in Fig. 1, as illustrates the invention. Fig. 3 is a detail view of a modified form of anode. Fig. 4 is an end elevation of a form of the invention, the end wall of the vat being removed, and illustrating features not shown in the other figures. Figs. 5, 6, and 7, are details of modifications.

Referring to Figs. 1 and 2 of the drawings, showing one form of construction for utilizing the invention, the electrolyzer is shown as consisting of an iron vat a, which serves as the principal cathode, and of a very porous carbon vat b, which serves as a supplementary cathode, that is to say, which is connected to the circuit of the principal cathode a, by means of a wire a', of less section than the conductor a^2 which connects vat a with the dynamo.

c is a feeding vat which is connected with the vats a and b, by the feed pipes c' and c^2, and by means of which the electrolyte may be supplied to the vats a and b.

d is a receiver connected by means of the pipe d', and the pipes d^2 and d^3, joined to the pipe d' with the vats a and b, so that the liquids from said vats are brought together into the receiver d.

e is a pump connected with the receiver by the pipe e' and provided with a discharge pipe e^2 communicating with the feed vat c, by means of which the liquid in the receiver is sent back to the vat c. Referring to the vat b, it may be made of fine wire gauze, instead of porous carbon, of any number of thicknesses desired, as shown in Fig. 1. This porous conducting vat b, in the operation of the apparatus, can be either completely submerged or simply immersed in the solution from the vat a. The liquid of the porous vat b is characteristically chlorureted, and that of the outside vat a is alkalined. In the vat b are suspended from the cover b', the anodes f which may be of carbon or platinum. These anodes are electrically connected together by means of the wire b^3, which is connected with the dynamo, and they are suspended from the cover by the heads b^2. The anodes when of carbon, are constructed of rectangular pieces of carbon of equal dimensions, secured together by copper rods, plated with metal or alloy which makes good contact between the carbon and the copper rods and the exposed parts insulated by enamel or other means. In this way anodes of great surface can be constructed, which in concentrated solutions, resist chlorine and oxygen for a long period.

The effect of the general arrangement shown and described in connection with Figs. 1 and 2, is that the hydrogen is produced in a more marked manner between the two cathodes and does not reduce the hypochlorite as it does in the ordinary electrolyzers.

The carbon anodes are placed parallel in the vat b, at a distance apart of between one and two inches. Instead of the carbon anodes, sheets of platinum may be used, placed parallel along the sides of the vat b. A basket

f' of wire or platinum gauze, as shown in Fig. 3, which permits circulation of the liquid in the compartment in which the hypochlorite is formed, while on the outside soda and hydrogen are produced, may be used as an anode. The apparatus in that case would then consist of three vats placed one within the other, as shown in Fig. 5; the inner one f' of platinum gauze, the sides and bottom of which are parallel to the sides and bottom of the second, which is of porous carbon or wire gauze, and the third of iron.

The space between the vats a and b can be filled with pieces of carbon, iron, or any other conducting material, as shown in Fig. 6, in order to increase the surface and the conductivity. Instead of a porous carbon vat surrounded with conducting material, a frame of wire gauze can be constructed inclosed in a second gauze frame which has the form of the carbon vat. The space between the two gauzes is filled with conducting material in such a manner as to form a diaphragm, perfect on every side and in electrical contact with the outside vat. This construction is shown in Fig. 7.

In Fig. 4 is shown a modification of an electrolyzer constructed in accordance with this invention, in which the anodes and cathodes are not in the form of vats, but are in a rectangular receptacle h of slate or other material not attacked by the liquid or gases. This form of electrolyzer is constructed on the same principle as those heretofore described.

i are carbon anodes placed vertically adjacent to the porous conducting diaphragms j, which are connected with the principal cathodes j' by fine wires j^2, the resistance of which is variable and calculated in such a way that they can serve as moderators of the current which the diaphragms should take. These diaphragms or supplementary cathodes may be formed of very porous carbon, or may be flat baskets of wire gauze as shown in Fig. 4, the basket being supplied either with carbon or crushed coke, or with metallic filings, the latter not being shown. Each of these baskets is a perfect septum which prevents the diffusion of the liquids; its good conducting qualities guarantee that the resistance resulting from the interpolation of the inert porous partitions, which hitherto has been so great an obstacle in electrolysis, is insignificant. In short, the evolution of hydrogen which has hitherto been so objectionable, especially when it is a question of the electrolysis of a solution of chloride of sodium, is produced almost entirely on the two faces of the principal cathodes j' and on the two sides of the diaphragm j, which are facing them. In the compartments formed by the anodes i and the angular covers i', which may be of glass, slate, ebonite, or other material not assailable by the liquid or the gas produced at the positive pole, chlorine is formed with very little hydrogen. The anodes are connected to the covers and the necessary precautions are taken to prevent corrosion of the metallic parts. The object of the covers is to form chambers in which the chlorine is collected and from which a pump forces or exhausts it for storage or use.

The metallic diaphragms of which I make use as supplementary cathodes are protected during the electrolytic operation by the hydrogen springing up which is produced upon the inner sides on account of their electrical contact with the principal cathode; but as soon as the work is suspended, by accident or otherwise, that protection ceases to exist and the chlorine attacks the metal. In order to avoid the destruction or even attack of the metallic parts of the diaphragm, I install in such a case, primary or secondary batteries p in which the positive pole is connected to the anodes of my apparatus, while the negative pole communicates with the diaphragms and effectually protects them.

Having thus described my invention, I claim—

1. In an electrolytic apparatus, supplementary cathodes consisting of porous conducting diaphragms arranged between, and in combination with, the main cathode and the anode.

2. In an electrolytic apparatus, supplementary cathodes consisting of porous conducting diaphragms connected with the principal cathode by a high resistance and arranged between, and in combination with, the main cathode and the anode.

3. In an electrolytic apparatus, the combination with the principal cathode of a supplementary cathode consisting of a porous diaphragm, a wire connection, connecting the supplementary cathode with the principal cathode and of higher resistance than the wire connection between the principal cathode and the source of electricity and anodes parallel with the supplementary cathode.

4. In an electrolytic apparatus, the combination with the main cathode and anode, of a supplemental cathode in the form of a vat or basket of porous conducting material.

5. In an electrolytic apparatus, the combination with the main cathode and anode, of a supplemental cathode consisting of a wire gauze frame supporting or supplied with conducting materials.

6. The combination of carbon anodes, a supplemental cathode containing the same, and a main cathode in which the supplemental cathode is immersed.

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

EMILE ANDREOLI.

Witnesses:
G. ANDREOLI,
S. F. CHAMBERLAIN.