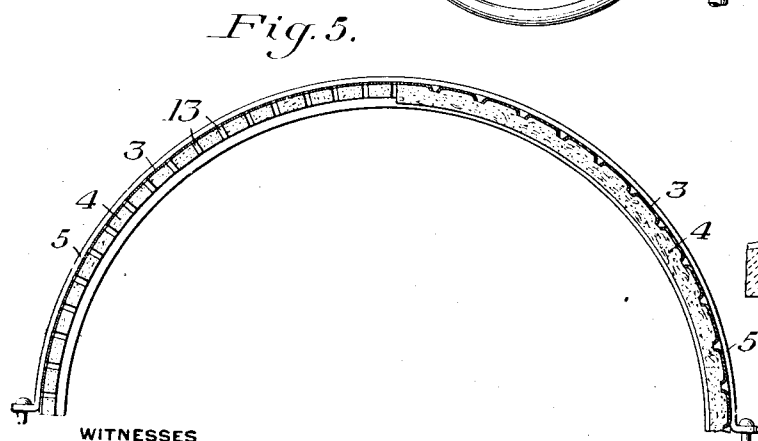
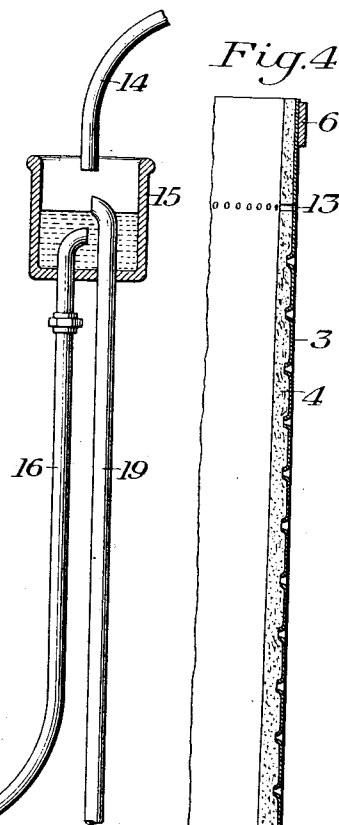
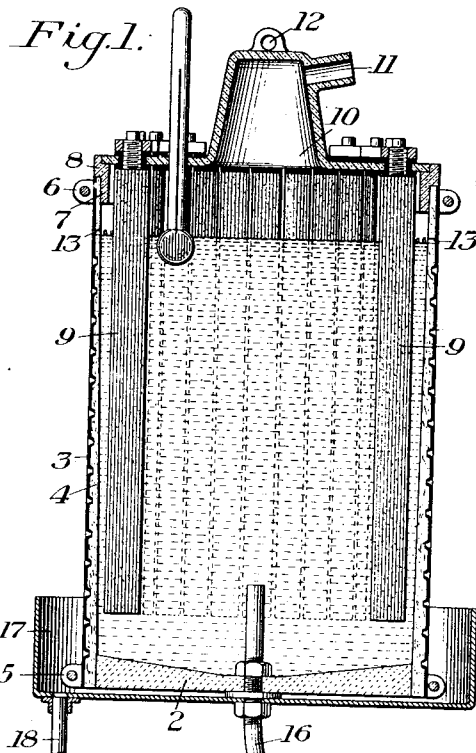


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Patented Mar. 21, 1916.
2 SHEETS—SHEET 1.



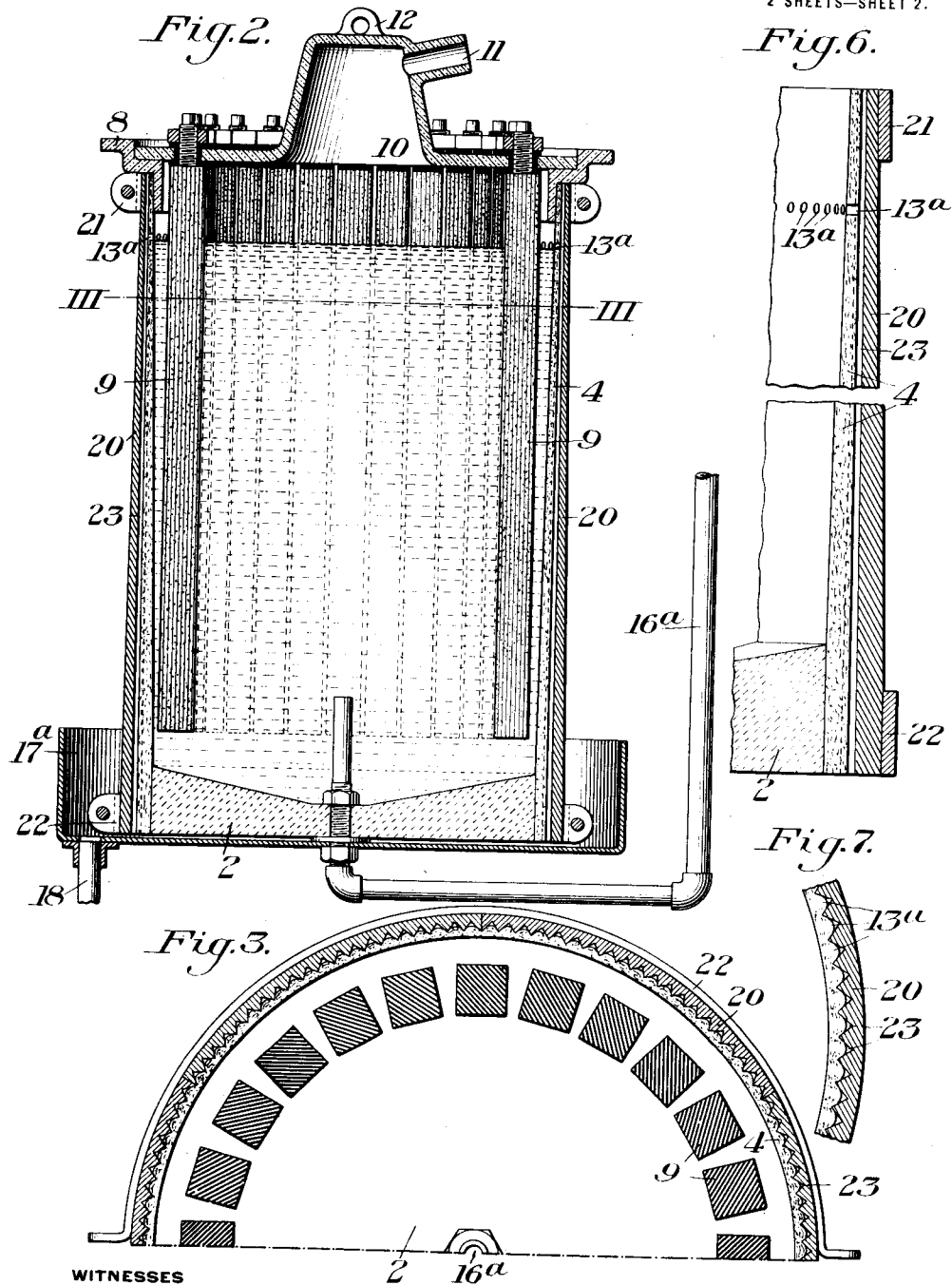
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UNITED STATES PATENT OFFICE.

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PROCESS OF ELECTROLYSIS.

1,176,541.

Specification of Letters Patent.

Patented Mar. 21, 1916.

Application filed October 25, 1913. Serial No. 797,259.

To all whom it may concern:

Be it known that I, ARTHUR E. GIBBS, a subject of the King of Great Britain, and a resident of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in the Process of Electrolysis, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figures 1 and 2 are vertical sections of two different forms of electrolytic cell embodying the features of my invention; Fig. 3 is a partial section on the line III—III of Fig. 2, but on a larger scale; and Figs. 4, 5, 6 and 7 are detail sectional views hereinafter more fully described.

My invention relates to an improved process of electrolysis, which has heretofore been carried out by the use of cells of the type shown in my Patent No. 874,064 of December 17th, 1907. In cells of this type, which are arranged for wet electrolysis, such as the electrolysis of alkaline chlorids, there is employed a metallic cathode, together with a diaphragm of permeable material, the cathode having projections embedded or partially embedded in said diaphragm.

One object of my present invention is to provide an improved process of electrolysis, which will permit the flow of the electrolyte from the interior of the cell into contact with a surface of the cathode, upon which caustic soda is formed in the action of the cell. This flow is independent and additional to that permeating the diaphragm, and provides for washing the surface of the cathode over which it flows to remove the products of electrolysis. The permeable diaphragm of these cells in the course of time tends to become choked or clogged, thereby restricting the permeation therethrough, and interfering with the proper action of the cell. In such cases this impermeability can be in part overcome by the provision of the passages above referred to and which provide for flow of the electrolyte independently of and additional to that through the interstices of the diaphragm.

Referring first to the form of apparatus for carrying out my invention which is shown in Figs. 1, 4 and 5, the numeral 2

designates a bottom member of resistant material; 3 designates the cathode member, and 4 the permeable diaphragm within the cathode member. In these figures, I have shown a cathode member and diaphragm, which are in general similar to that shown in Figs. 1 and 2 of my said patent, the cathode member being provided with a plurality of holes or perforations formed by punching. These punched or inset portions of the cathode which surround the holes are embedded in the material of the diaphragm. The cathode member and diaphragm are held at the bottom by an annular clamping band 5 placed around the bottom member 2; and at the upper end by a similar clamping member 6 surrounding a depending flange 7 of a top ring 8, which seats upon the upper end of the cathode and diaphragm and upon the clamping band 6. The anode preferably consists of a series of carbon rods 9 arranged in annular form and projecting through the dome 10, which may rest upon an annular recess in the top ring 8. The positive wire of the connections leads to this anode, while the negative wire leads to the cathode. The dome is shown as provided with a gas outlet 11, and also with a ring or suspending device 12, which may be engaged by a crane or hoisting device to lift out the anode. Through the upper portion of the diaphragm I form a series of holes or passages 13, these being located at about the highest level of the electrolyte at which the cell can be operated. 14 designates an inlet pipe for feeding the solution into a vertically adjustable feeding cup 15. 16 is a pipe for conveying the solution from the cup 15 into the anode chamber. 17 designates a suitable pan or vessel within which the lower portion of the cell is placed and which serves to catch the cathode products. This pan is provided with an outlet pipe 18. The feeding cup 15 is provided with an overflow pipe 19, which serves to maintain a substantially constant level in the cup and also in the cell.

In carrying out the process, the solution to be treated is fed into the cup 15 at a faster rate than it is passed through the cell. The overflow feeds out through the pipe 19, and the solution feeds into the anode compartment of the cell through the

pipe 16. By adjusting the height of the cup 15 I can adjust the feed so as to give the best efficiency at different stages of the life of the cell. As the solution passes outwardly through the permeable diaphragm, in the treatment of alkaline chlorids, the caustic forms upon the projections or points of the cathode, the bulk of electrolysis taking place at these points or projections. As the caustic is formed, the flow of electrolyte carries it outwardly through the holes in the cathode and out of the region of electrolytic action. As above stated, however, in use the diaphragm tends to become clogged or choked, so that the proper quantity of the electrolyte does not permeate through the same. In such cases the caustic is not carried away as rapidly as it is formed and becomes decomposed, thus lowering the efficiency of the cell. My present invention overcomes this defect, in that the provision of the perforations 13 in the upper portion of the diaphragm forms a means for conducting electrolyte to the outer surface of the cathode over which it flows, thus constantly washing away any deposit of the caustic.

In the form of my invention shown in Figs. 2, 3, 6 and 7, the cathode is composed of the series of segments 20 fitted together to form a complete cylinder and held in place by the top and bottom clamping rings 21 and 22. The segments 20 may be in the form of castings, thus giving a strong and durable construction. The inner faces of the segments are vertically corrugated as indicated at 23, thus forming a multiplicity of vertical channels between the cathode and the diaphragm, these channels being partially filled by the embedding of the corrugations in the diaphragm. Vertical channels are left, however, through which a flow of the products of electrolysis can take place downwardly into the pan or receptacle 17^a. In this form of apparatus, the perforations 13^a in the upper portion of the diaphragm communicate with vertical channels or passages on the inner surface of the cathode so as to maintain a sufficient flow of the electrolyte therethrough to remove the caustic as it is formed.

It will be obvious that various changes can be made in the details of construction and arrangement of the various parts within the scope of the appended claims. Thus, instead of forming perforations through the diaphragm to lead the electrolyte to a surface of the cathode, I may provide any

other suitable passage or passages for that purpose.

The advantages of my invention result from the provision of a process of electrolysis in which the life and efficiency of the cell are increased by constantly permitting some of the electrolyte to flow from the anode compartment to the cathode compartment, to wash the products of electrolysis from the surface of the cathode.

I claim:

1. The process of electrolysis, which comprises maintaining constant freedom of communication between the anode and cathode compartments, and a constant flow of liquid across the electrolytic field within a space between the cathode and the porous diaphragm.

2. The process of electrolysis, which comprises maintaining a constant pressure on the electrolyte in the anode compartment, and a flow of liquid across the electrolytic field within a space between the porous diaphragm and the cathode, with a constant discharge of the cathode liquor.

3. The process of electrolysis, which comprises constantly feeding in electrolyte into the anode compartment, in by-passing a portion of the electrolyte around the porous diaphragm, and in maintaining a flow of the liquid across the electrolytic field from the point of said bypass with a constant discharge of the cathode liquor.

4. The process of electrolysis, which comprises flowing the liquid across the electrolytic field within a space between the diaphragm and the cathode.

5. The process of electrolysis, which comprises flowing the liquid across the electrolytic field in thin sheets within a space between the diaphragm and the cathode.

6. The process of electrolysis, which comprises flowing the liquid across the electrolytic field downward within a space between the diaphragm and the cathode.

7. The process of electrolysis, which consists in maintaining a flow of the electrolyte from the anode compartment of the cell to a surface of the cathode, independent of the permeation through the diaphragm, thereby removing the products of electrolysis from such surface.

In testimony whereof, I have hereunto set my hand.

ARTHUR E. GIBBS.

Witnesses:

G. E. GOLLOP,
E. A. WILSON.