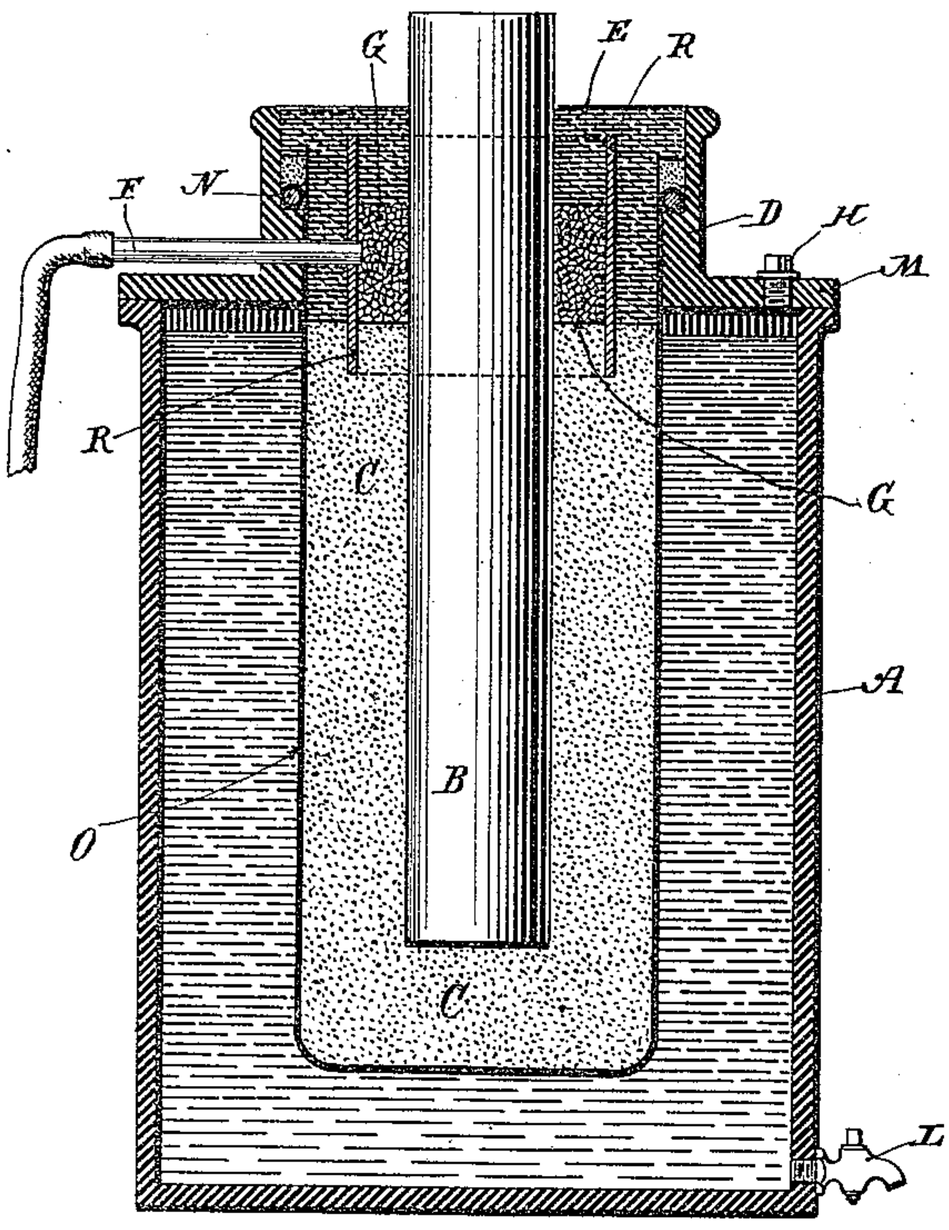
(No Model.)

I. L. ROBERTS.

ELECTROLYTIC APPARATUS.

No. 442,594. Patented Dec. 9, 1890.



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UNITED STATES PATENT OFFICE.

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ELECTROLYTIC APPARATUS.

SPECIFICATION forming part of Letters Patent No. 442,594, dated December 9, 1890.

Application filed October 22, 1890. Serial No. 368,881. (No model.)

To all whom it may concern:

Be it known that I, ISAIAH L. ROBERTS, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Electrolytic Apparatus, of which the following is a specification, reference being had to the drawing accompanying and forming a part of the same.

This invention pertains to that class of apparatus designed for the decomposition or purification of solutions of metallic salts invented by me and characterized by the presence of a diaphragm or partition between the two electrodes, which is substantially non-porous, in the sense that it does not permit the mechanical transfusion of the fluids or solutions under treatment, but which is electrolytic in character, in the sense that it permits electrolysis to take place freely through it.

The object of the present invention is, mainly, to produce an apparatus of this character designed for such uses as the manufacture of caustic alkali by the decomposition of brine or a solution of common salt.

The invention, subject of the present application, is for an improvement in the electrolytic apparatus described and shown in my application filed August 11, 1890, Serial No. 361,626.

The apparatus as shown and described in the said application is the same in the main as that illustrated in section in the accompanying drawing, and which is constructed as follows: A is a cast-iron vessel of the desired capacity, which serves as the cathode as well as the tank or vat in which the solution to be decomposed is contained. M is a cover fitting air-tight on the vessel. In said cover is a neck or contracted opening surrounded by a rim or flange D. There may be more than one of these openings, provided the tank be of sufficient dimensions to render it necessary.

To introduce the brine into the receiver A, I employ an inlet H, provided with a valve or cock, and an outlet L is used to draw off the caustic alkali after the process of decomposition has been carried on for a proper length of time.

The anode proper which I employ is a pressed or molded cylinder B, made in substantially the following manner: A quantity of carbon, preferably in the form of comminuted or finely-divided retort-carbon, is mixed with a suitable quantity of a substance such as ozocerite and heated until the same is thoroughly fused. The mixture is then molded into the desired shapes, highly compressed, and then allowed to harden and cool. This method of making the electrodes I have described in my application filed February 14, 1890, Serial No. 340,448.

To the upper rim or edge of the neck D, I secure in any proper manner, as by means of a ring or hoop N, a bag O, which when the cover M is in place reaches nearly to the bottom of the tank A. This bag may be made of some textile material, preferably of cotton, strengthened by asbestus cloth, wire-gauze, or any such material that will not be attacked by the solution or the electrolytic products. The anode B is passed down into this bag, and the space around it, up to a point slightly above the normal level of the solution in the tank A, is filled in with anthracite coal reduced to as finely a powdered condition as possible and packed in around the anode.

The anthracite coal is to be ground in such manner as to reduce it to the condition of a practically amorphous or impalpable powder. In this condition, when packed in around the anode, it forms a practically perfect barrier to the mechanical transfusion of fluid. In other words, no solution of liquid of any kind under normal conditions will strain or ooze through it, even by the action of osmose, and in this sense I call it "non-porous," as distinguished from those substances heretofore employed as diaphragms, which are, in whole or in part, distinctly porous and permit the passage or transfusion of fluids through them.

The mass of coal dust or powder, however, while it is itself practically a non-conductor of electricity, interferes to no perceptible extent with electrolytic action and the transference of the acid radical to the anode, since it is moistened throughout with the solution in the vat. I have found, however, that under the action of the current a certain quantity of water is carried through the mass

of coal-dust and accumulates in the anode-compartment around the carbon cylinder and rises above the level of the solution in the outer or cathode compartment. To avoid the very objectionable consequence of this peculiar action or property of the current of forcing or carrying along with it the water through the otherwise normally impermeable barrier of coal-dust, I adopted the expedient of packing into the bag O for a short space above the coal-dust C and within the neck D a quantity of grains of plumbago, retort-carbon, or the like. From this mass I ran a pipe F, which served the twofold purpose of a passage for the escape of the gas generated by the electrolytic action and also as an overflow to carry off the water which might appear in the anode-compartment from the cause above explained. By experience, however, I found that the chlorinated water found its way back through the bag O above the level of the solution in the cathode-chamber, rendering the solution impure and destroying or injuring the material of the bag. This proved to be a serious difficulty; but I have succeeded in entirely obviating it in the following manner: Around the carbon cylinder B, within the neck D and extending down into the mass of powdered coal C, or whatever material may be used in its stead, for a short distance below the level of the solution in the outer or cathode chamber, I place a cylinder R, of glass or other material not attacked by the products of decomposition. Within this cylinder I then pack the granulated coke or plumbago G, and the end of the gas and overflow pipe F is carried through the side of the cylinder R and into the mass of coke G. The remaining space above the coal-dust C in the bag O, both inside and outside of the cylinder R, is then sealed with a filling or luting E of tar or other suitable material. By this means any return of water through the bag O or other injurious consequences of the carrying up of water around the cylinder B is entirely avoided. The glass cylinder extends down below the level of the solution in the outer compartment, and as the water cannot return against the electrolytic action which produces it at or on the surface of the cylinder B it can only pass up into the cylinder R to the layer of coke G, from whence it runs off through the pipe F.

With regard to the operation and manner of using this apparatus it may be stated that successive charges of brine are run into the outer or cathode chamber, and when the current is applied the action, as I have observed it, is to transfer the acid radical through the packing of coal-dust to the anode B, where it is given off as chlorine gas. This gas, rising or accumulating in the stratum of granulated carbon G, is conveyed off by the pipe F. The solution of caustic alkali left in the tank A is drawn off when of sufficient strength and replaced by a fresh charge.

What I claim is—

1. In a sealed tank or vat for electrolytic decomposition, the combination, with the anode embedded in or surrounded by a substantially non-porous electrolytic body, of an impervious cylinder around the anode, extending below the level of the solution, a layer of granulated carbon between the anode and the impervious cylinder above the level of the solution, and an outlet-pipe extending from the same.

2. In a sealed tank or vat for electrolytic decomposition, the combination, with an anode and a cathode, and a substantially non-porous electrolytic diaphragm separating the same, of an impervious cylinder around the anode, extending down below the level of the solution, and an outlet-pipe for gas and water, extending therefrom above the level of the solution in the tank or vat, as set forth.

3. The combination, with the iron tank or receiver, the cover having a flanged opening or neck, the anode B, and the mass of coal-dust C, surrounding the anode, of the glass cylinder R, extending down into the coal-dust below the level of the solution, the outlet-pipe F, and the luting or seal E, as herein set forth.

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