(No Model.)

I. L. ROBERTS.

ELECTROLYTIC APPARATUS.

No. 442,334. Patented Dec. 9, 1890.

Fig. 1

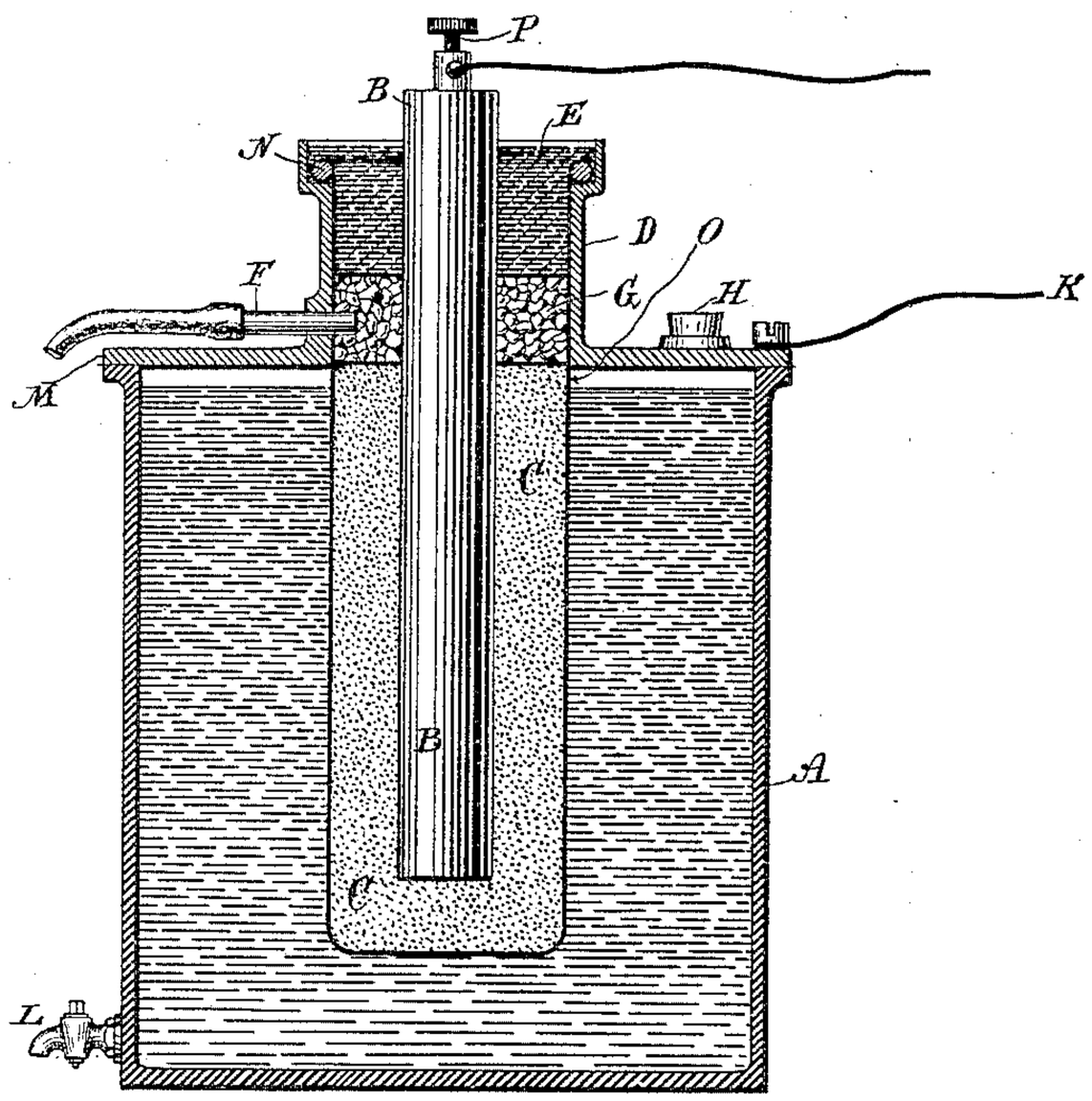
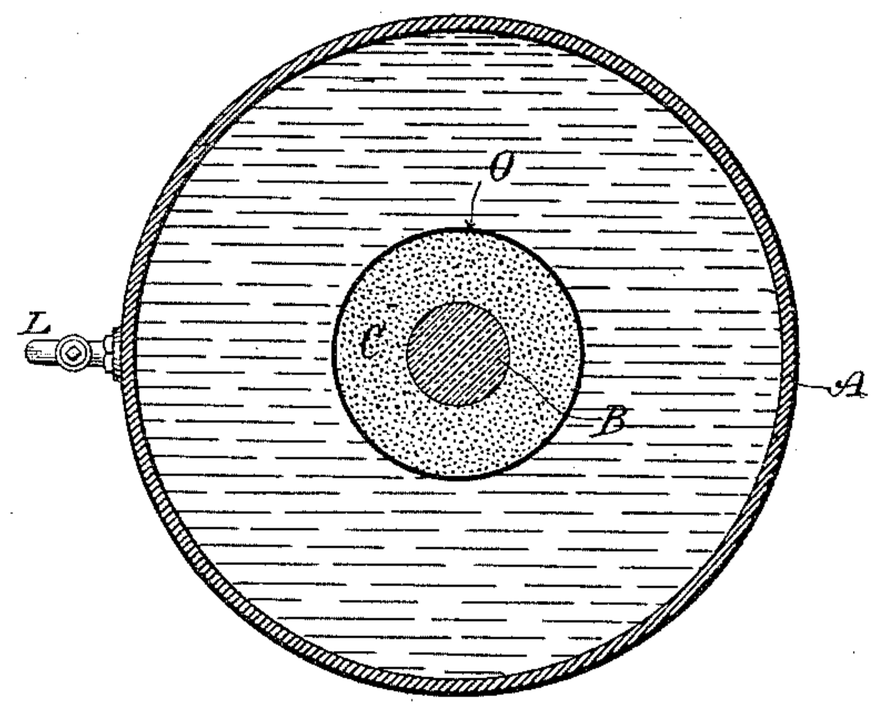


Fig. 2



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UNITED STATES PATENT OFFICE.

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ELECTROLYTIC APPARATUS.

SPECIFICATION forming part of Letters Patent No. 442,334, dated December 9, 1890.

Application filed August 11, 1890. Serial No. 361,626. (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 drawings 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 improvements which I have devised and embodied in an apparatus of this kind will be described in detail by reference to the accompanying drawings.

Figure 1 is a vertical central section of the complete apparatus for carrying out the invention. Fig. 2 is a horizontal section of the same.

I employ as a tank or receptacle for containing the solution to be treated a cast-iron vessel A, of the desired capacity, provided with a cover M, fitting air-tight. 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.

I utilize the iron receiver A as the cathode, and connect it by means of a wire K directly to the source of current.

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 or 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 heretefore 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, rising above the level of the solution in the outer or anode compartment. To avoid the very objectionable consequences 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 pack 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. Into this mass extends a pipe F, which serves 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 may appear in the anode-compartment from the cause above explained. This pipe or passage, being slightly above the level of the solution in the tank, insures the complete saturation of the coal-dust, but prevents the rise of the water to an undesirable or injurious extent. The neck above the layer of granulated carbon is filled with a luting of proper material—such as asphalt or tar—to render the tank air-tight.

I may employ in place of the coal-dust other materials, such as a paste made of flour and brine or many other substances which I have elsewhere described as adapted for use in what I term my "non-porous" diaphragm; but I have found that anthracite coal reduced to an impalpable powder possesses peculiar advantages when used in this apparatus, for, although the coal-dust itself is practically a non-conductor, the moisture which it contains permits a free electrolytic action to take place through it, while it is not affected by any chemical action and remains without change for an indefinite period. I have also found that in the manufacture of caustic alkali by this apparatus the anode exhibits a tendency to disintegrate under the action of the current, but that the consequences of such disintegration are entirely avoided by the presence of the coal-dust packed around it.

This apparatus may be used for decomposing a great many successive charges of brine. The action, as I have observed it, is to transfer the acid radical through the packing of coal-dust to the anode, 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. A binding-post P may be embedded in the upper end of the anode, which projects up through the seal or luting E.

I do not claim, broadly, in this application a diaphragm or partition non-porous in character; nor, on the other hand, do I desire to limit my claim herein to the special construction of the apparatus shown and described; but

What I claim is—

1. In an electrolytic apparatus, the combination, with a cathode, of an anode packed or embedded in a material such as anthracite coal in the condition of an impalpable powder, as set forth.

2. In an electrolytic apparatus, the combination, with a cathode, of an anode packed or embedded in powdered anthracite coal contained in a receptacle in the tank or vat, as set forth.

3. The combination, with an iron receiver constituting a cathode, of an anode contained in a receptacle within said receiver and surrounded by a substantially non-porous or impermeable mass of coal-dust, as set forth.

4. In a sealed tank or vat for electrolytic decomposition, an anode-compartment divided off from the cathode-chamber by a non-porous electrolytic partition, as described, and provided with an outlet for gas and an overflow for fluids, as set forth.

5. The combination, with a closed cathode-compartment, of a closed anode space or compartment, a gas-discharge, and an overflow-pipe for water leading from the anode-compartment and above the level of the solution in the cathode-chamber, as set forth.

6. The combination, with the closed iron vessel or receiver constituting the cathode, of the bag or receptacle extending into the same, the carbon anode contained in said bag, and the filling of coal-dust surrounding the anode, as described.

7. The combination, with the iron tank or receiver and the cover having a flanged opening or neck, of the bag or receptacle secured in the neck, the carbon anode, and the filling of coal-dust surrounding the same and contained in the bag.

8. The combination, in a closed tank or vat, of an anode surrounded by a substance such as coal-dust, a gas chamber or space above the same filled with granulated carbon, and a pipe leading therefrom for conveying off the gas, as set forth.

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