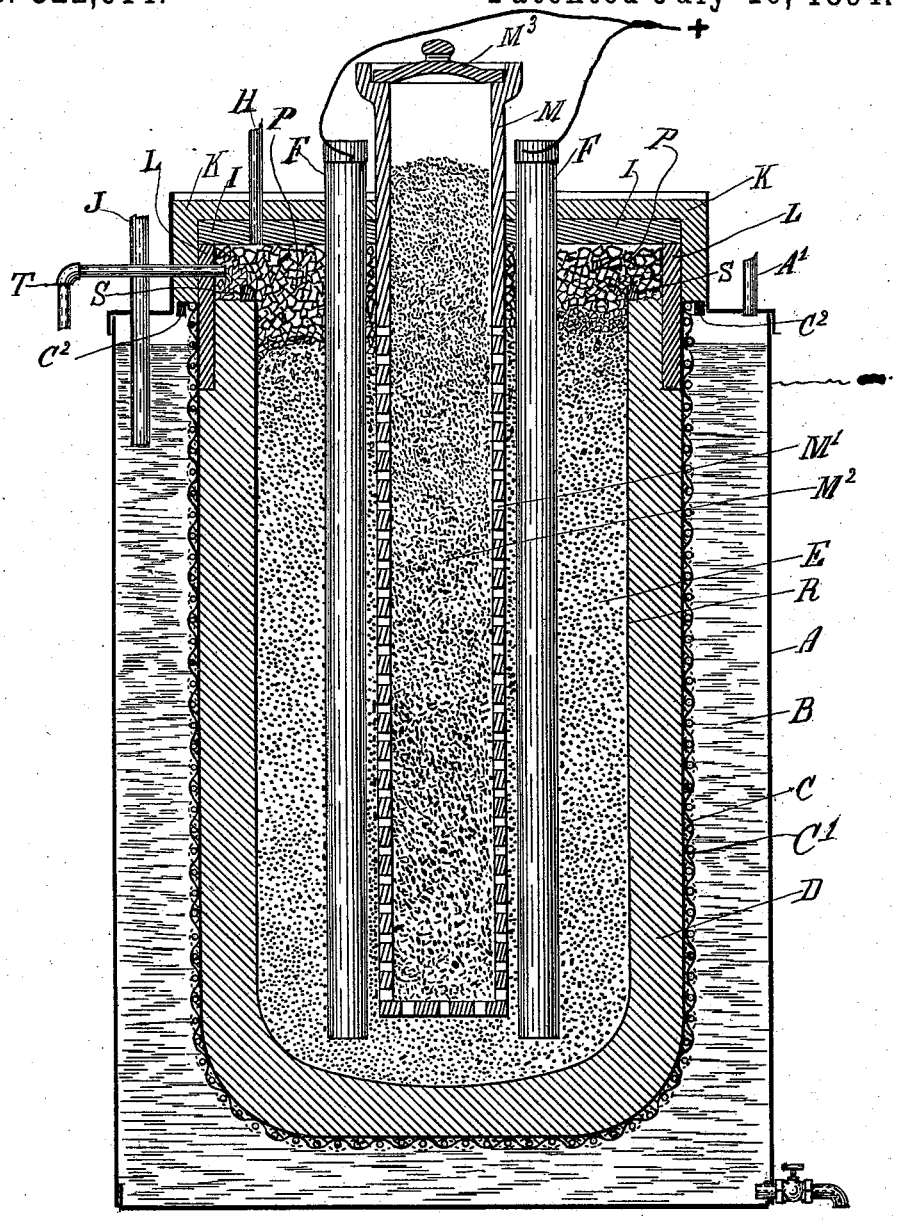
(No Model.)

I. L. ROBERTS.

ELECTROLYTIC DIAPHRAGM.

No. 522,614. Patented July 10, 1894.



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ELECTROLYTIC DIAPHRAGM.

SPECIFICATION forming part of Letters Patent No. 522,614, dated July 10, 1894.

Application filed February 10, 1893. Serial No. 461,745. (No specimens.)

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.

In a number of patents granted to me I have shown and described electrolytic diaphragms of substantially non-porous character composed of various substances in an amorphous condition, or practically so. The materials which I have heretofore employed for the production of these diaphragms were gelatinous compounds, or non-conducting substances in a very finely divided condition, and in some instances I have combined two or more substances, as for instance by employing with a gelatinous diaphragm a filamentous material such as wool, cotton, or asbestus, as a binding agent or by saturating porous earthenware with a suitable substance and then gelatinizing it in the pores of the earthenware. I have found it desirable in many cases to employ for the diaphragms certain non-conducting and insoluble pulverized substances such as, and preferably, anthracite coal reduced to an impalpable powder, but as such substances have no sensible cohesiveness their use necessitates the employment of special means of support without which the renewal of any part of the apparatus when once built up involves the destruction of the entire diaphragm.

The object of my present invention is to provide a self-supporting and permanent diaphragm of such materials, and this I accomplish by employing in the construction of the diaphragm a non-conducting substance preferably in so fine a state of mechanical subdivision as to constitute a substantially amorphous body and a liquid which is capable of gelatinization, the latter serving as the binding agent when gelatinized.

The drawing hereto annexed is a sectional view of a form of apparatus heretofore used by me and described in numerous patents and is given in illustration of the manner of carrying out the present invention.

A is an iron tank containing a solution of a salt B surrounding an insulated wire basket C and a canvas bag C′ which lines the inside of the basket. The wire basket is supported by an iron band or hoop C^2.

D is the diaphragm the composition and method of construction of which will be hereinafter described.

E are grains of coke surrounding the carbon rods F F, and the perforated earthenware cylinder N.

N^2 is a mass of the crystals of the salt to be electrolyzed.

A tube for filling the tank is shown at J. A tube for the escape of the hydrogen from the cathode which is the tank in this instance is shown at A′. The tube H is for the escape of the chlorine or other gases from the anode compartment.

M^3 shows a lid for sealing up the salt tube which permits of a tar luting O.

L shows a glass or glazed earthenware ring or cylinder filled with large broken pieces of coke P.

I is an earthenware or slate plaque covering the ring and having openings for the carbons and perforated cylinder to pass through.

K is a seal of wax or asphaltum which seals up the anode chamber air or gas tight.

T is an overflow tube which allows the water in the salt tube and anode chamber to escape when filled with a fresh supply of salt.

In making the diaphragm D, I proceed as follows: I first grind anthracite coal, or other pulverizable material which is a non-conductor of electricity and which will not be dissolved nor chemically attacked by the products of decomposition, by preference reducing the same to such a fine state of subdivision as to constitute a practically amorphous body. I also prepare a solution of silicate of soda or potash of a strength of about 25° or 30° Baumé, and about two or three per cent. of caustic soda or potash. The latter is employed to prevent the coagulation of the silicic acid by the sulphur, or any metallic salts which may be present as impurities in the powdered coal or other material, and which would tend to impair the homogeneity of the diaphragm and weaken it. I then make a stiff paste of the coal dust and said solution, and having done this I place a quantity of it in the bottom of the canvas lined suspended

basket C, said mass to be of the thickness desired for the partition D. I now construct the anode chamber which consists of the feed tube M and carbon rods F F and granulated carbon E separately; and set it in the basket on the mass or bed of paste in the bottom thereof. To construct said anode chamber I make a cloth bag R of sufficient strength to support the weight of the anode and feed tube N. I suspend it by the wooden hoop S and put in the bottom of it some granulated coke, retorted charcoal, or retorted anthracite coal, say two or three inches. I then set in the perforated feed tube or tile N which in tall tanks may be made of several tiles set end on end. I then set some carbon conductors F F around the said tile as close as convenient and lash them to it and hold the whole steady while the bag R is filled to the top around them with granulated conducting carbon E. Having filled the bag and pressed the carbon down the carbons F F and tube N will then be held firmly. The bag is then lifted into the basket C by the ring S which serves no other purpose than to support and steady it until the whole apparatus is finished which is then done by ramming or packing in the annular space D between the lining of the basket and the anode bag R, the above described paste D, until it is full to the point where the annular glazed ring L is shown; the said ring is then set in and the space between it and the anode bag R is filled. After this I place some larger sized pieces of coke P on top of the whole, filling up the annular ring and covering up the said ring with a cover I. I then seal up the whole with alphaltum K. All these steps are more fully described in other patents granted to me. I now fill the tank with water or brine as desired through the tube J and also fill the feed tube N with the salt crystals to be electrolyzed. I then pour enough of a preferably saturated solution of brine on the salt which will run through the perforations N′ and fill up the interstices in the granulated conducting carbon E. I now connect the carbons F F to a source of electricity and complete the circuit through the partition and tank in such a manner that the acid radicals will be liberated on the anode and the bases will be liberated at the tank or cathode A. On pouring the brine into the anode chamber it comes in contact with the inner surface of the anthracite partition and gelatinizes the silica which it contains and in time coagulates farther in and makes the wall permanent, as silica or anthracite is not soluble in acids. As canvas is not injured by the bases it makes the outer or cathode side permanent. The silicates may dissolve out of the surface of the cathode side but as the anthracite is not soluble the partitions remain impervious and firm.

When the current of electricity has freed some acid radicals in the anode chamber they will begin to destroy bag R and in a short time will complete its destruction and there would now be nothing left to prevent the substance of the partition from commingling with that of the anode if the silica were not present. But the firmness of silicic acid prevents the anthracite particles from moving.

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

1. A diaphragm for electrolytic cells composed of an insoluble non-conducting and non-coherent powder, and a gelatinizable binding material, as set forth.

2. A diaphragm for electrolytic cells composed of an insoluble non-conducting pulverized substance and a gelatinizable silicate, as set forth.

3. An electrolytic diaphragm composed of powdered anthracite coal and a gelatinizable silicate, as set forth.

4. The method or process herein described of producing an electrolytic diaphragm which consists in forming a paste of an insoluble non-conducting pulverized substance and a solution of silicate of soda or potash, forming said paste into the desired shape providing temporary supports for the same and gelatinizing the solution by electrolytic action, as set forth.

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