

(No Model.)

I. L. ROBERTS.  
DIAPHRAGM FOR ELECTROLYTIC CELLS.

No. 442,204.

Patented Dec. 9, 1890.

Fig. 1

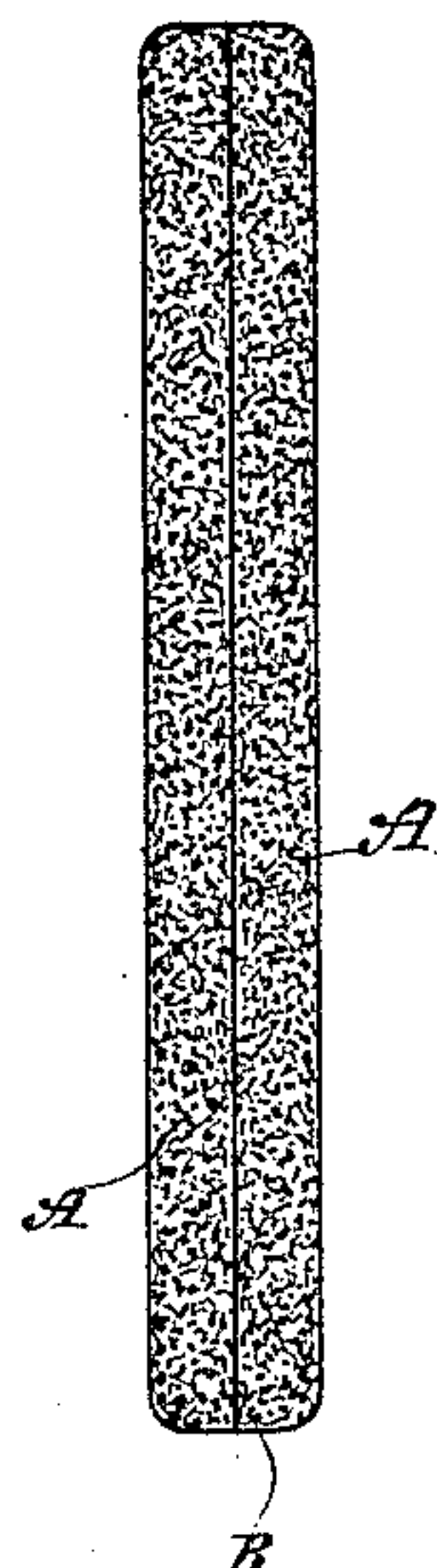


Fig. 2

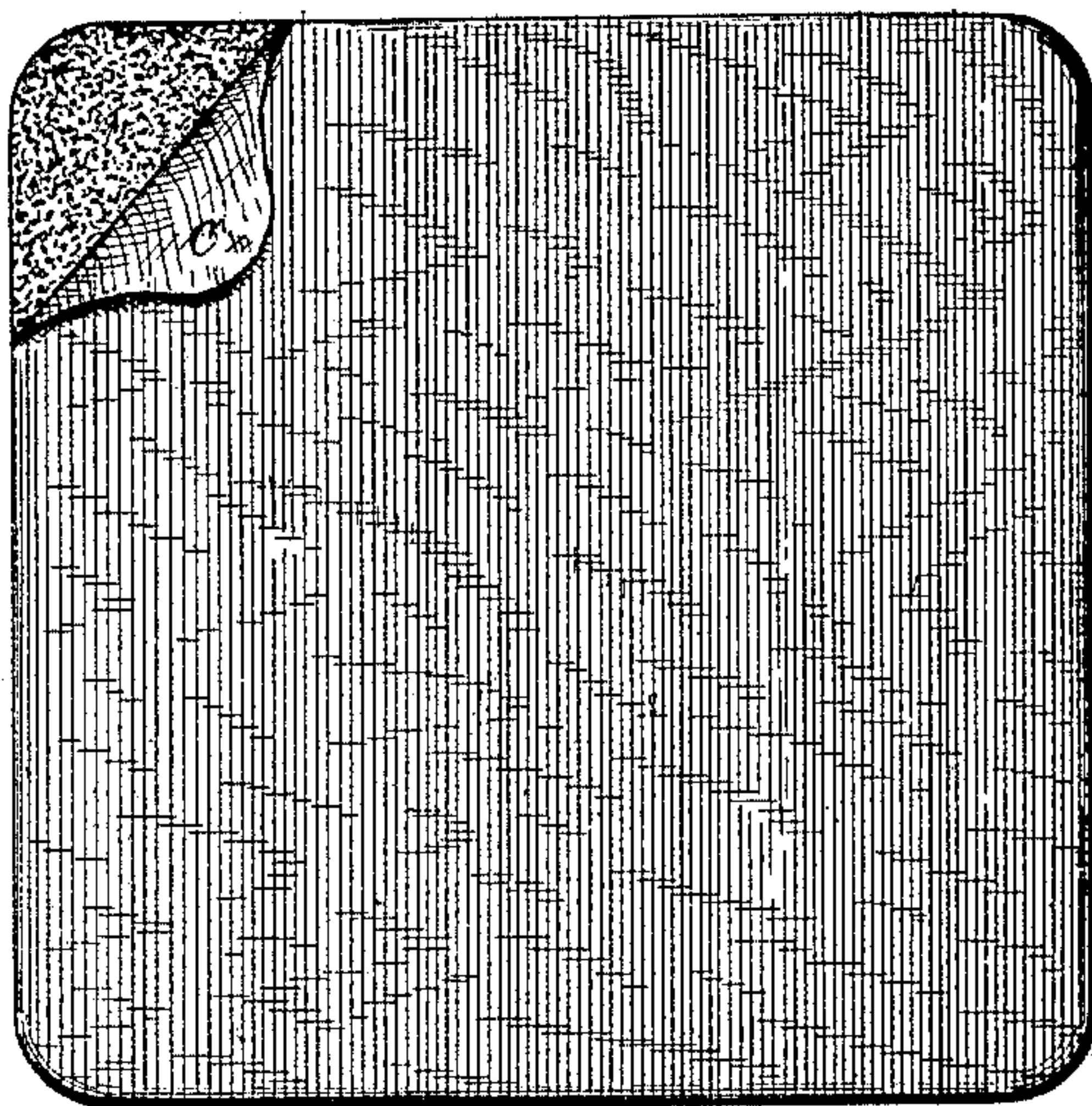
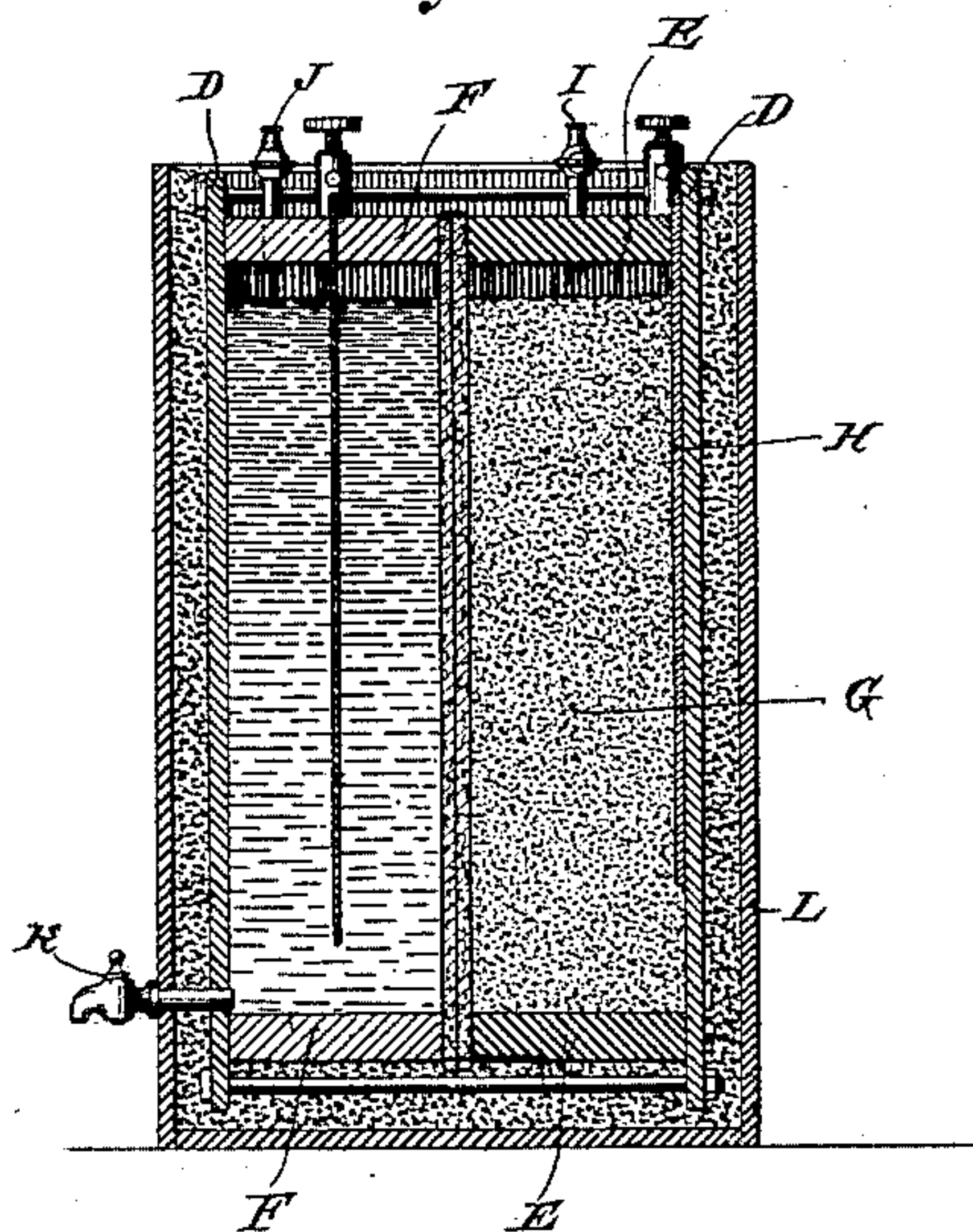


Fig. 3



Witnesses:

Raphael Netter  
Robert F. Gaylord

Inventor

Isaiah L. Roberts  
By  
Duncan, Carter & Page  
Attorneys.



# UNITED STATES PATENT OFFICE.

ISAIAH L. ROBERTS, OF BROOKLYN, ASSIGNOR OF ONE-HALF TO THOMAS H. MCGRAW, OF POUGHKEEPSIE, NEW YORK.

## DIAPHRAGM FOR ELECTROLYTIC CELLS.

SPECIFICATION forming part of Letters Patent No. 442,204, dated December 9, 1890.

Application filed March 14, 1889. Renewed May 5, 1890. Serial No. 350,580. (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 Diaphragms for Electrolytic Cells, of which the following is a specification, reference being had to the drawings accompanying and forming a part of the same.

This invention is an improvement in the diaphragms or partitions used in electrolytic cells, galvanic batteries, and the like.

The invention or discovery of the main features of the device subject of this application was the result of experiments and investigations to obtain an electrolytic partition or diaphragm non-porous in its character, as distinguished from the ordinary fibrous diaphragms and porous jars and partitions heretofore used. The special form of diaphragm in which the invention appears was designed, however, more particularly for use in decomposition cells or vats constructed for the electrolytic decomposition of metallic salts and other substances, and for this reason it has certain peculiarities of construction which render it specially adapted to this purpose.

My improved diaphragm consists in a mass of asbestos with those constituents neutralized or dissolved out which, if allowed to remain, would enter into chemical combination with the solutions or the substances set free by electrolytic action. As constructed in its most practicable form, it consists of a mass of asbestos, such as is commercially known as "asbestos board," with some form of support. The means of support which I prefer is a sheet of asbestos cloth, which is treated in the same manner as the rest.

The process of making these diaphragms which I have adopted is as follows: I cut out two pieces of asbestos board of the desired dimensions and lay them on opposite sides of a piece of asbestos cloth of about the same shape. I then sew or fasten them up in a covering or bag of cotton cloth or the like. I then expose the whole for about twenty-four hours to the action of a solution of an acid, such as muriatic acid of about 12° Baumé. I then squeeze or roll them and again treat them

with the acid. I then roll and knead the bag in fresh water until the salts or soluble portions resulting from the action of the acid are thoroughly washed out. The bag is finally subjected to pressure to free it of moisture and gas and to reduce its bulk. It is then ready for use.

So far as this invention is concerned, the process of manufacture may be considerably varied. It is known that asbestos, if used in its natural condition as a diaphragm in electrolyzing an alkaline solution, soon becomes almost a non-conductor. This I attribute to the formation throughout its entire mass of minute particles of gas and the precipitation of other non-conducting substances as the result of the chemical combination of the solutions with certain of its constituent parts. This property removed by the above or any other suitable process, the asbestos becomes a good conductor, although its particles become so densely matted together as to form a material practically impervious to fluids.

Asbestos cloth, which is a woven material composed of pure asbestos fibers, acquires the same properties of conductivity and retains its strength to a sufficient degree to constitute a support or holder for the boards, the fibers or particles of which by the above process become so intimately united with the cloth as to form a solid and compact plate. The cotton cloth serves merely to retain the asbestos while undergoing the purifying and washing process, and it may be removed after the plate or diaphragm is completed. It is usually destroyed in great measure by the chemical action.

In the drawings I have illustrated the character and the manner of using this invention.

Figure 1 is a vertical cross-section of the diaphragm. Fig. 2 is a side elevation of the same, exhibiting a portion of the asbestos fabric in its interior. Fig. 3 is a sectional view of the battery.

A A represent the asbestos boards after treatment, B the asbestos cloth, and C the cotton fabric which serves as a covering. Under ordinary circumstances I have found that the completed diaphragm should be about one inch in thickness, for which purpose the



boards should be one-quarter of an inch or over in thickness, for it will be understood that the asbestos after being exposed to the action of the acid bath swells to several times  
 5 its original bulk. The pulpy mass produced by boards of the thickness above mentioned should be compressed to a thickness of about an inch.

I prefer to use these diaphragms in the following way: D D are two pieces of wood or  
 10 other insulating material, upon which, as bottoms, two boxes are built. E E represent the sides of one, which are composed of slate or other insulating material not sensibly at-  
 15 tacked by chlorine, and F F the sides of the other, which may be of wood. The two boxes are laid together with the diaphragm between them, as shown, one being previously filled  
 20 with powdered coke or carbon G, moistened with an acidulated or saline solution. Electric conductors H, of carbon or a material which will not be attacked by chlorine, extend down into the coke, and a copper plate is supported in the other compartment. The  
 25 coke-compartment is provided with an outlet I for the gas, and the other compartment has an inlet J and an outlet K for the solution. The inlet J serves also for the escape of gas. This tank is placed in another tank L, slightly  
 30 larger, and the intervening space is filled in with tar or similar material. By this apparatus if a solution of chloride of sodium or common salt be introduced into the cathode-compartment and a current passed through the vat hy-

drogen will pass off through the opening J, chlorine gas through the outlet I, and caustic soda will be formed in the cathode-chamber. The diaphragm prevents the escape of the solution into the anode-chamber and the recombination of the products of the electrolytic action.

In this application I claim only the diaphragm herein shown and described. The process of treating the asbestos and the special form of electrolytic tank or cell here shown form the subjects of other applications  
 45 of even date herewith, and serially numbered, respectively, 303,309 and 303,307.

What I claim as my invention is—

1. A diaphragm or electrolytic partition composed of asbestos freed from soluble constituents, as herein set forth.

2. A diaphragm or electrolytic partition composed of asbestos freed from its soluble constituents and a support or holder therefor, as herein set forth.

3. A diaphragm or electrolytic partition composed of asbestos cloth and asbestos board freed from soluble constituents, as herein set forth.

4. A diaphragm or electrolytic partition composed of two pieces of asbestos board with an intermediate piece of asbestos cloth and freed from soluble constituents, as herein set forth.

ISALAH L. ROBERTS.

Witnesses:

ROBT. F. GAYLORD,  
 PARKER W. PAGE.