(No Model.)

# T. CRANEY.

## ELECTROLYTIC APPARATUS.

No. 507,886. Patented Oct. 31, 1893.

Fig. 2.

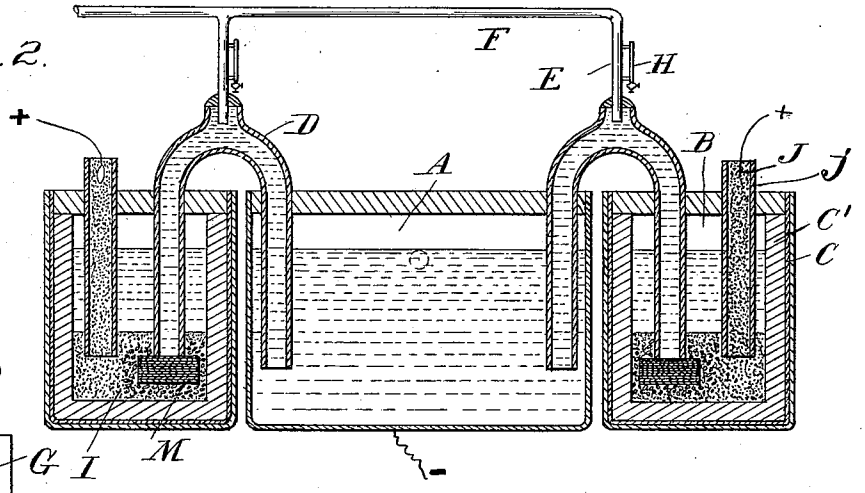
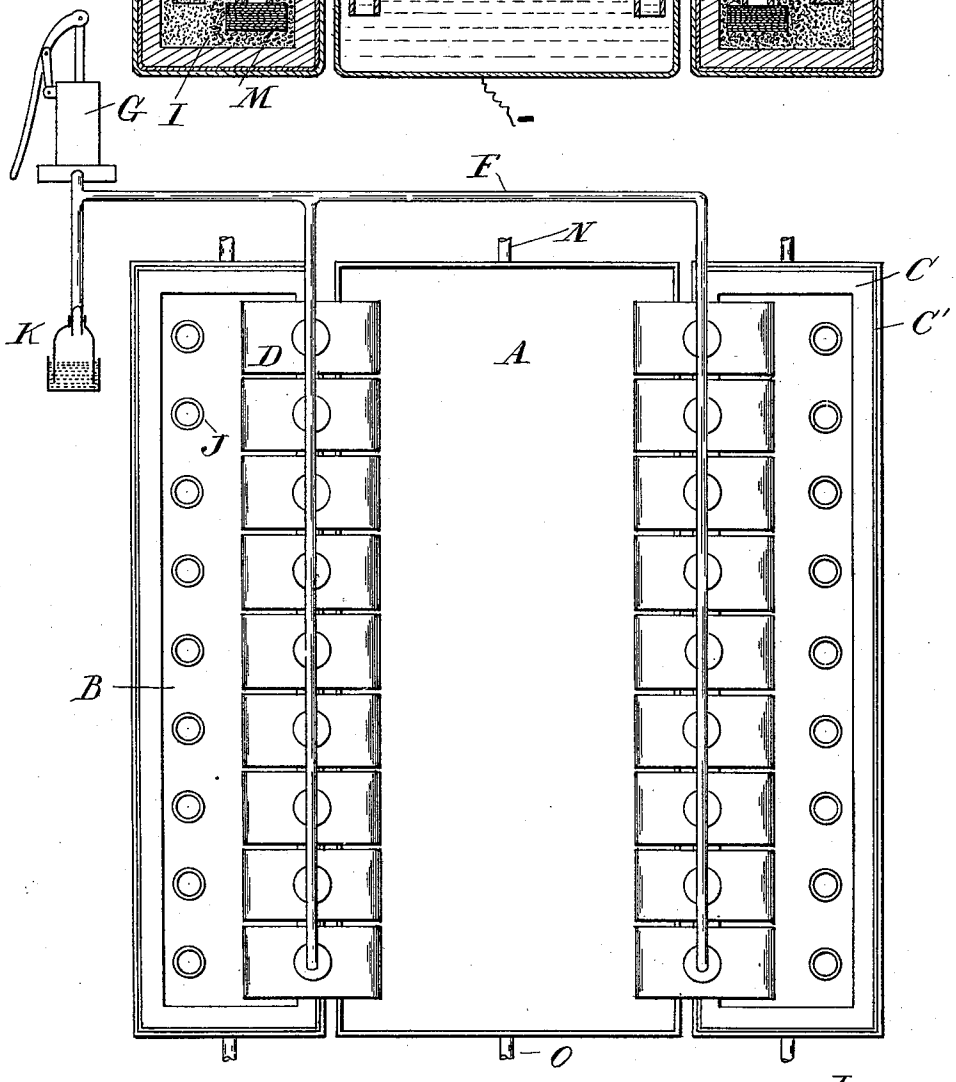



Fig. 1.




Witnesses
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# UNITED STATES PATENT OFFICE.

THOMAS CRANEY, OF BAY CITY, MICHIGAN.

## ELECTROLYTIC APPARATUS.

SPECIFICATION forming part of Letters Patent No. 507,886, dated October 31, 1893.

Application filed March 16, 1893. Serial No. 466,212. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS CRANEY, a citizen of the United States, residing at Bay City, in the county of Bay and State of Michigan, have invented certain new and useful Improvements in Electrolytic Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates more particularly to that class of electrolytic apparatus, in which electrolytic diaphragms are employed between the cathode and anode, to separate the products of electrolysis. In the present state of the art porous partitions of various materials and construction are employed for the purpose, but it has been found that they increase the electrical resistance considerably and are thereby a great obstacle to the successful exploitation of the process of electrolysis for commercial purposes; this is especially the case in the electrolysis of chlorides and metallic salts where but few materials are available for the purpose on account of the disintegration due to the products obtained.

It is the object of my invention to make a diaphragm that will produce an effective separation with a minimum of electric resistance and which at the same time is of a permanent character.

To this end my invention consists in the construction and arrangement of parts, all as more fully hereinafter described and shown in the drawings, in which—

Figure 1 is a plan view of an apparatus embodying my invention. Fig. 2 is a cross section thereof.

A represents a vessel constituting the cathode compartment of the apparatus, and B represents two vessels arranged alongside the same and forming two anode chambers. One of the two may however be omitted. The cathode vessel I preferably construct of metal, as for instance of boiler plate, whereby it may be used as the cathode. The anode vessels I make of like material, and where it is required to protect the same from corrosion by the products, such as in the electrolysis of chlorides and other salts, I line the same with a non-corrosive substance C, such as a coat of asphalt, which may be supplemented by a lining of cement C'. These three vessels are placed far enough apart to prevent any electrolytic action by their proximity. The cathode vessel A and anode vessels B are electrolytically united with each other in the following manner: D are communicating tubes arranged to project at one end into the anode compartment, and with the other end into the cathode compartment over the adjacent walls of said compartments. These tubes are open-ended and one or both ends rest upon a fibrous or porous mass M, such as a number of asbestus sheets, whereby one or both ends of such tubes are completely sealed except as far as the liquid is admitted through the pores of the material itself. These tubes may be otherwise held in place in any convenient manner, such as by supporting them in suitable openings in the covers of the vessels. I preferably use as many of these tubes as there is room alongside the contiguous walls of the vessels, and preferably form them rectangular in cross section whereby they may be placed close together. Each of these communicating tubes has a stand-pipe E connected into its top, which in turn connects it to an exhaust pipe F which leads to a suitable air pump or exhauster G, and the stand-pipe E is preferably provided with a glass gage H. These pipes I preferably construct in a manner to electrically insulate the tubes D from each other.

I is a body of granular or pulverized carbon placed in the bottom of the anode compartment, and this is electrically united with the positive terminal of the source of electricity through carbon pencils J which are preferably incased in a protective material *j*, such as earthenware or cement. I preferably place the fibrous or porous material M into the anode chambers and pack the body of carbon closely around it, using preferably coarser particles of carbon to be more readily permeated by the liquid. The cathode and anode compartments are filled with the solution of the salt to be electrolyzed to an even height and suitable feed and discharge pipes N O, are provided to introduce fresh liquid into the cathode chambers and discharge the products of electrolysis.

In practice, the parts being arranged as shown and described they are intended to

operate as follows: By means of the air pump air is exhausted from the pipe F and in consequence thereof, the liquid from the compartments will rise in the tubes D above the height of the liquid contained in the compartments, and this exhaustion of the air is continued until the liquid rises up in the standpipe to a designated point where its height can be readily observed by the gages H. The further exhaustion is then discontinued except as may be necessary from time to time during the operation to maintain the liquid at this height. The air pump, however, may be kept in constant operation and an automatic device may be used, such as the regulator K which communicates with the pipe F and which is in the nature of a mercury seal and admits air, as soon as the air is exhausted beyond the desired point; the necessary amount of vaccum is thus automatically maintained. It will be seen that by means of the body of liquid contained in the communicating tubes, the liquid in the cathode and anode compartments is vertically connected by an unbroken column, which reduces the electrical resistance to a minimum. At the same time no flow of liquid can take place through the communicating tubes, as one or both ends of the same are closed up by the fibrous or porous material acting as a diaphragm.

By this construction of the apparatus a perfect separation of the products of electrolysis in the anode and cathode compartments is obtained, with an inconsiderable portion of a diaphragm interposed between, and the electrical resistance is thereby greatly lessened.

It will be observed that the diaphragm is protected to a certain extent and held in place by being embedded in the carbon of the anode and a tight seal will be easily maintained even if the diaphragm should gradually disintegrate, by supporting the tubes D so that their weight will keep them resting upon the diaphragms.

While I have described and shown my apparatus in connection with an electrolytic diaphragm I want it distinctly understood that the spirit of my invention broadly consists in establishing liquid communication between the compartments through a bent tube in which the liquid is maintained above the hydrostatic level by means of a partial vacuum formed by extracting the air from the tube intermediate its ends. This expedient for itself accomplishes in a certain measure the separation of the products in the two compartments without the use of a diaphragm.

What I claim as my invention is—

1. In an electrolytic apparatus, the combination with separate anode and cathode compartments, of a bent tube adapted to unite the liquid in the compartments above the hydrostatic level of the same, means for producing and maintaining a partial vacuum in said tube and an electrolytic diaphragm arranged and adapted to seal one of the open ends of the bent tube, substantially as described.

2. In an electrolytic apparatus, the combination with separate anode and cathode compartments, of asbestus or other suitable substance adapted to form an electrolytic diaphragm, contained in one of the compartments, a bent tube adapted to unite the liquid in the compartments above the hydrostatic level of the same and having one of its open ends supported upon said diaphragm and means for producing and maintaining a partial vacuum in said tube, substantially as described.

3. In an electrolytic apparatus, the combination with separate anode and cathode compartments, of a bent tube through which the liquid in the two compartments is adapted to communicate above the hydrostatic level of the liquid, means for producing and maintaining a partial vacuum in said tube, an electrolytic diaphragm contained in the anode compartment and arranged and adapted to seal the open end of the said tube in said compartment and a body of carbon in the bottom of the anode compartment in which said diaphragm is embedded, said carbon forming the anode, substantially as described.

4. In an electrolytic apparatus, the combination with separate anode and cathode compartments, of a plurality of bent tubes through which the liquid in the two compartments is adapted to communicate above the hydrostatic level, an air exhausting device and connections of the same with stand pipes leading into the said tubes, whereby a partial vacuum may be produced, means for regulating said vacuum, and an electrolytic diaphragm arranged and adapted to seal the ends of the tubes in one of the compartments, substantially as described.

5. In an electrolytic apparatus, the combination with separate anode and cathode compartments, of a bent tube adapted to unite the liquid in two compartments above the hydrostatic level of the same and suction means intermediate the ends of the tube for maintaining the liquid in such tube to unite the two compartments, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

THOMAS CRANEY.

Witnesses:
M. B. O'DOGHERTY,
OTTO F. BARTHEL.