(No Model.)

T. CRANEY.

ELECTROLYTIC APPARATUS.

No. 498,770. Patented June 6, 1893.

Fig. 2

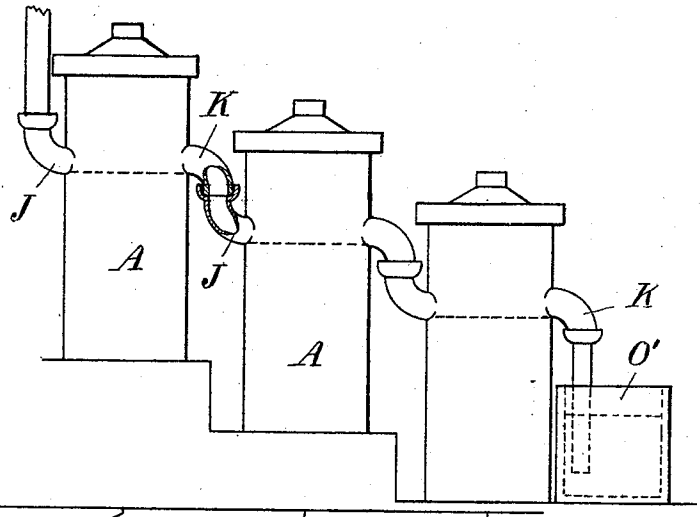


Fig. 3

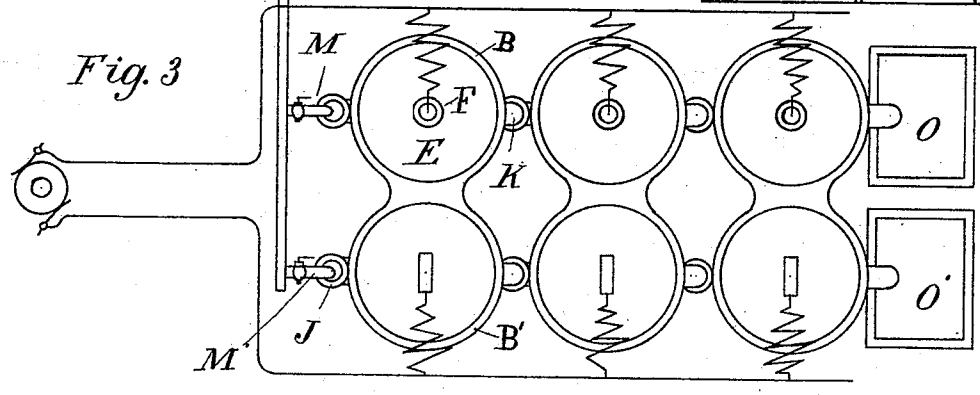
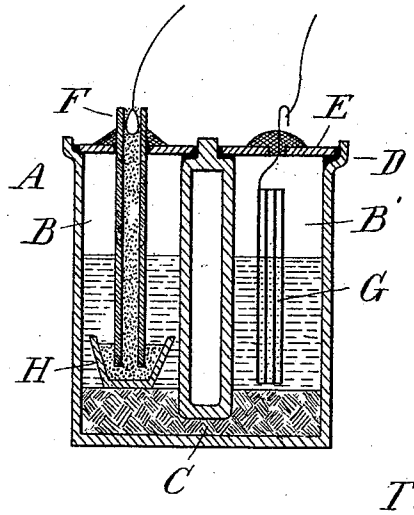


Fig. 1



Witnesses:

Otto Barthel

P. M. Hulbert

Inventor:

Thomas Craney

By Wm. G. Sprague & Son

Attys.

UNITED STATES PATENT OFFICE.

THOMAS CRANEY, OF BAY CITY, MICHIGAN.

ELECTROLYTIC APPARATUS.

SPECIFICATION forming part of Letters Patent No. 498,770, dated June 6, 1893.

Application filed August 18, 1892. Serial No. 443,416. (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 to that class of electrolytic apparatus which is designed for electrolyzing liquids.

My invention consists in the peculiar construction of an electrolytic cell, and in the combination and arrangement of a series of said cells in an apparatus whereby the process of decomposition is carried out in an accumulative manner, so as to obtain the electrolyte in a concentrated solution, all as more fully hereinafter described and shown in the drawings, in which—

Figure 1 is a vertical, longitudinal section through one of my improved cells. Fig. 2 is a side elevation showing a series of cells arranged for joint operation. Fig. 3 is a plan of Fig. 2.

In describing my invention specifically, I will suppose it to be used for manufacturing caustic soda by the electrolysis of salt brine.

My apparatus consists of a series of cells A preferably of the specific construction and arrangement shown in Fig. 1 wherein B represents the anode and B′ the cathode compartment of the cell, the two being formed preferably integral, as one vessel connected at the base through a hollow trunk C. The material from which the cell is formed may be the usual stone or glass ware, or any of the analogous substances from which such cells are usually formed to be indestructible. All of the compartments B B′ are preferably of cylindrical shape having an annular flange D around the top into which fit the covers E, which are suitably apertured to respectively receive an anode F and cathode G. The anode and cathode may be of any known construction; in the drawings the anode F is formed of a tube of indestructible material, such as stone ware and filled or packed with carbon. The lower end of this tube projects into a cup H, which is also filled with carbon. The cathode is shown as consisting of a rolled sheet of metal. The two compartments B B′ are covered at the bottom to a suitable height, which closes the trunk passage C, with a porous body adapted to form an electrolytic diaphragm. Above this to a certain height, the compartments are filled with the solution. Each compartment is provided on one side with the elbow connection J and on the opposite side with the elbow connection K, the former being turned up and the latter turned down and formed in such relation to each other that when the cells are arranged as in Fig. 2, the elbow connections will connect the anode and cathode compartments respectively through the whole series of cells. To this end it will be seen that each succeeding cell in the series is placed upon a lower plane than the preceding cell and the level of the solution in the different cells in like manner is maintained in different horizontal planes gradually descending from the highest level at the first cell to the lowest level in the lowest cell from which the product is discharged.

In operation I feed a solution to be decomposed in suitable quantity either in a continuous stream or intermittently as required into the two compartments of the first cell, the drawings showing a feed pipe L, from which valve controlled supply pipes M M′ pass into the compartments B B′. From there the solution flows from one compartment into the corresponding next one and so on through the series, being discharged from the lowest one into suitable receptacles O O′. The anodes and cathodes being suitably connected with the source of electricity and common salt brine being the electrolyte used, decomposition taking place in each vessel, caustic soda in solution will be formed in the compartments B′ containing the cathodes, and chlorine will be liberated in the compartments B, which gas will if sufficient liquid is introduced remain mostly in solution and be carried off into the receptacle O. The hydrogen gas which is also formed in the cathode chambers may be carried off through a suitable aperture or pipe in the cover of the compartment, or find its way out through the open connections of the first or last cell. The free chlorine gas produced may be allowed to escape in the same manner at the open con-

nections of the first or last anode compartment, or separately carried off from each compartment.

In explaining the advantages of my invention let us suppose an ample flow of the liquid to be electrolyzed to be taking place into the anode compartment of the first cell from which it overflows into the corresponding compartment of the next cell and so on to the last cell, from which it is discharged into the receiver O. This will maintain in the different anode compartments practically a saturated solution of the liquid to be electrolyzed. Now if the cathode compartment of the first cell only receives a limited supply of the liquid to be electrolyzed, just enough to maintain a flow of liquid from one into the next one, sufficient for the capacity of the apparatus, it will be seen that the sodic hydrate produced in the first compartment B′ will be discharged into the next corresponding compartment where the undecomposed solution is again subjected to the action of the electric current and thereby further concentrating the product. The same action will take place in the third compartment and so on through the whole series, until finally the product obtained is in concentrated form.

As the solution in the compartments B is sufficiently renewed to remain practically in a saturated condition, or to change but little from its saturation point, the electrolyte in the compartments B′ will be constantly reinforced by electrolyte transferred from the compartments B. Thus an accumulation process of decomposition is carried out, which results in the utmost concentration of the product discharged from the last compartment B′.

The porous substance at the bottom of the cells separates the products of electrolysis without interfering with the electrolytic action of the currents.

The gases arising from the decomposition may be utilized by providing the cells with suitable outlets which conduct the gas into suitable receivers. The solution of caustic soda discharged from the last cell may be further concentrated by evaporation if necessary, and the waste product from the anode compartments which contains a large percentage of chlorine in solution may be readily freed from the chlorine and used again if desired.

The advantage of connecting the cells in the manner described is that they are now so connected that the joints will not become leaky, as a result of the destructive action of the products of decomposition in the cement, as it will be seen that the joints formed by the elbows K and J are never submerged and ordinary cement can therefore be used to form a tight joint, whereas if said joint would be submerged in the liquid, the products of the electrolysis would soon destroy them no matter what substance was used and leaky joints would result therefrom, which would cause constant trouble.

The method disclosed in my invention I have described and claimed in a separate application.

What I claim as my invention is—

1. In an apparatus for electrolyzing liquids a plurality of cells, connected upon a descending plane each cell divided into separate cathode and anode compartments by means of an electrolytic diaphragm, and an upward and a downward extending elbow connection for each compartment at a point above the space to be occupied by the liquid whereby the joints formed in connecting the vessels are not submerged in the liquid substantially as described.

2. In an apparatus for electrolyzing liquids, the combination of a plurality of cells arranged upon different planes, and divided into compartments B B′ containing suitable cathodes and anodes, the porous material in the bottom of each compartment forming an electrolytic diaphragm, the elbow connections K J, uniting the like compartments of the cells in series, and the valve controlled supply pipes M M′, substantially as described.

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

THOMAS CRANEY.

Witnesses:
M. B. O'DOGHERTY,
P. M. HULBERT.