(No Model.)

T. CRANEY.

METHOD OF ELECTROLYZING SALTS.

No. 498,769. Patented June 6, 1893.

Fig. 2.

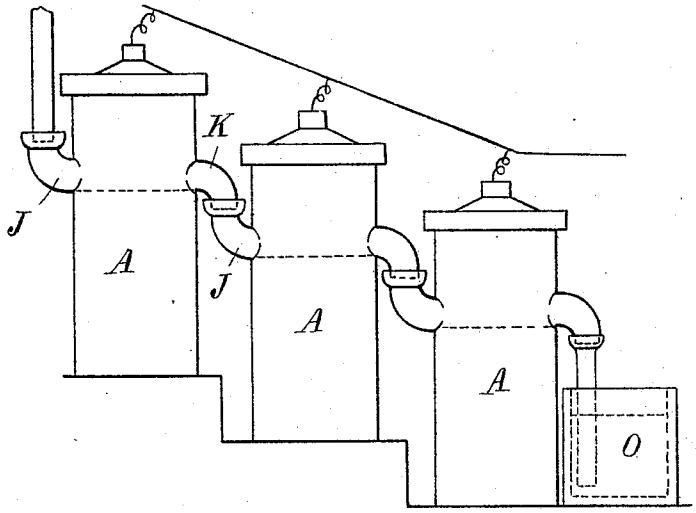


Fig. 3.

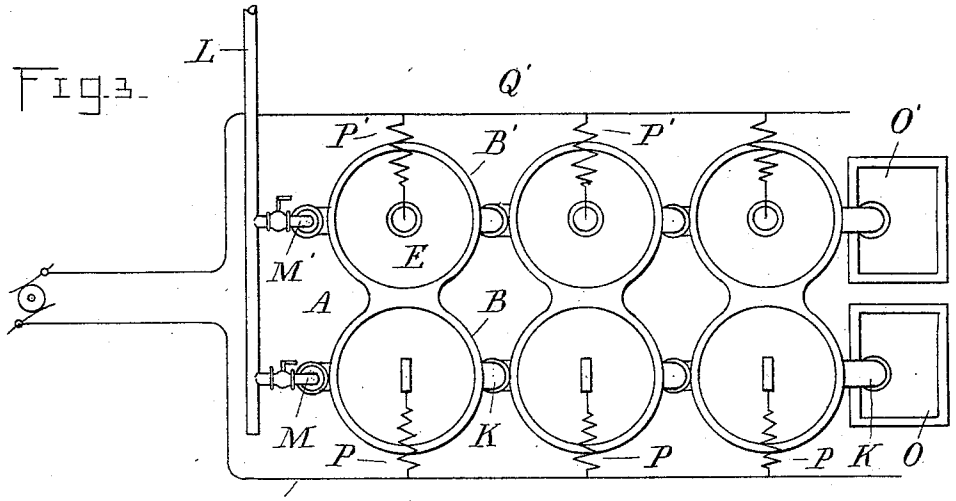
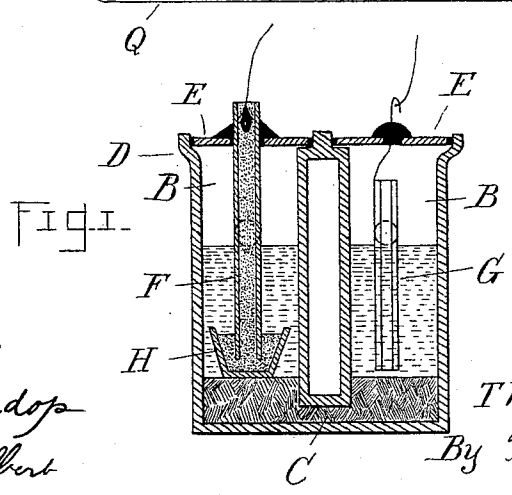


Fig. 1.



Witnesses:
N. L. Lindop
S. M. Hulbert

Inventor:
Thomas Craney
By Thos. L. Sprague & Co.
Attys.

UNITED STATES PATENT OFFICE.

THOMAS CRANEY, OF BAY CITY, MICHIGAN.

METHOD OF ELECTROLYZING SALTS.

SPECIFICATION forming part of Letters Patent No. 498,769, dated June 6, 1893.

Application filed August 10, 1892. Serial No. 442,648. (No specimens.)

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 Methods of Electrolyzing Salts, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates more specifically to that class of electrolytic apparatus designed for the electrolysis of salts in solution.

My invention consists in a novel method, whereby the desired product of electrolysis is obtained in a high state of concentration, and it further consists in an apparatus for carrying out such method.

In the following description I will describe and show my invention as applied to the manufacture of sodic hydrate from salt brine, and the apparatus which I have devised for the purpose of carrying out my method is specifically designed for the commercial manufacture of such sodic hydrate in concentrated form, so that the product may be used commercially, as for instance in manufacturing soap.

In the accompanying drawings, Figure 1 shows a vertical central section of one of the electrolytic cells of which my apparatus is composed. Fig. 2 shows my apparatus in elevation. Fig. 3 is a plan view of Fig. 2.

My apparatus consists of a series of cells A each containing two communicating compartments as shown in Fig. 1, B representing the anode compartment, and B′ the cathode compartment of the cell, the two being formed preferably integral in one piece connected at the base through a hollow trunk C. The cell may be formed of stone or glassware or any other of the different materials found suitable for the purpose. Each of the chambers B B′ is preferably of cylindrical shape with an annular flange D around the top into which fits the cover E, which cover is suitably apertured to respectively receive an anode F and cathode G. The anodes and cathodes may be of any known construction; in the drawings the anode F consists of an open ended tube of glass or stoneware or other like indestructible material, and is filled or packed with carbon with which the terminal of the circuit is in electrical connection. The lower end of this tube projects into a cup H, which is also filled with carbon exposed on the surface to contact with the solution to be electrolyzed. The cathode G to which the other terminal of the electric circuit is secured is shown as consisting of a sheet of metal loosely rolled so as to present a large surface in contact with the solution.

The two compartments B B′ are covered at the bottom to a suitable height above the trunk passage C, with an inert porous substance such as asbestus, sand, &c., or preferably with a body of the solid substance to be electrolyzed, which in the case of the decomposition of brine would be a body of common salt. Above this to a certain height the compartments are filled with the salt brine. Each compartment has inlet and outlet connections J, K, on opposite sides. The inlet connection J extends upwardly and the outlet connection K extends downwardly, and the two connections are adapted to form a joint when the cells are arranged in a descending level as shown in Figs. 2 and 3. As each succeeding cell in the series is placed upon a lower plane than the preceding cell the level of the solution in the different cells is in like manner maintained in different horizontal planes gradually descending from the first cell to the last cell from which the product is discharged.

The solution of the salt to be decomposed is fed either in a continuous stream or intermittently 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 overflows from one compartment into the corresponding next one and so on through the series of cells, being discharged from the compartments of the last cell into separate receptacles O O′.

In the manufacture of sodic hydrate the common salt brine as taken from the salt wells may be used, and this is decomposed by the electrolytic action of the current which is made to pass through all the cells by means of suitable feeders P P′ arranged in multiple between the main conductors Q Q′ of the generator. The product of decomposition is then sodic hydrate which is formed in the compartments B′ accompanied by the formation of

hydrogen gas, while chlorine gas is evolved in the compartments B. The chlorine gas in a measure will be carried off in solution with the overflow into the receptacle O and may be recovered therefrom, if desired, for instance, by heating the solution or it may be allowed to escape through suitable openings formed in the cover of the compartments B. The gaseous chlorine being heavier than atmospheric air will, if no other escape is provided, flow from one cell into the next and escape at the discharge of the last cell where it may be separately connected. The hydrogen gas may also be allowed to escape from each compartment B′ separately through suitable openings or pipes or as it is lighter than atmospheric air it may be allowed to rise into the highest compartment and from there allowed to escape.

In explaining my invention let us now 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. This will maintain in the different anode compartments through the whole series practically a saturated solution of the salt to be electrolyzed. The supply of solution into the cathode side of the apparatus is regulated according to the capacity of the apparatus to decompose most or all the salt by the time it overflowed from the last compartment B′ of the series.

It will be seen that the amount of solution fed into the cathode side of the apparatus is subjected to decomposition in each compartment and thus the quantity of sodic hydrate will increase from cell to cell, but the gradual concentration of the sodic hydrate will not arise only from this cause, but as the anode compartments contain practically a saturated solution of the salt maintained by an abundant feed, the anode chambers will actively continue to transfer sodic hydrate into the cathode chamber, and thereby constantly add to the quantity of sodic hydrate. By this accumulative method of electrolyzing I have succeeded in obtaining sodic hydrate in any desired state of concentration by merely regulating the feed into the cathode chamber.

My method is altogether different from the ordinary process of subjecting a certain quantity of a solution of salt to electrolysis, as even if the decomposition of the salt shall be carried to its utmost possible limit (which is practically too expensive) the product would not be concentrated, while with my method I can produce sodic hydrate having the consistency of sirup as regards concentration.

The solution of salt of the cathode side need not be concentrated as even if water alone would be introduced, the process would not be very materially altered as the liquid is mainly necessary to discharge the sodic hydrate from the apparatus. Up to a certain point however, the amount of sodic hydrate discharged from the apparatus is increased by feeding a solution of the salt into the cathode side of the apparatus, but if more is fed than can be decomposed the final product of sodic hydrate would of course contain some of the undecomposed salt.

To obtain the product in a concentrated form it is necessary that the contents of each cathode chamber should be as much separated as possible from any other chamber, both for the purpose of preventing the reuniting of the different products as well as to prevent the sodic hydrate in one compartment from mixing with that in another compartment. The first object is obtained by separating the compartments in each cell by a porous diaphragm, and the second is obtained by means of the different levels maintained by the solutions in the different cells. The arrangement by which this is carried out is also of great importance as it is about the only way in which a series of cells can be joined together. In my mode the joint between two cells is never submerged by the liquid in the cell for if this were the case it would be practically impossible to prevent leakage, as sodic hydrate would attack and soon destroy any of the known cements that could be used for a packing between the connections J and K.

With my construction there is no difficulty from leakage and if desired gas tight joints may be readily made and maintained by the use of cement.

In the case of manufacturing sodic hydrate from common salt, the solution going to waste on the anode side by overflowing is not of much account as it ordinarily costs merely the price of pumping, but if desired it can be freed from chlorine and used again.

What I claim as my invention is—

The herein described method of electrolyzing salts in solution, the same consisting in subjecting the solution to electrolytic action in anode and cathode compartments separated by an electrolytic diaphragm, in supplying during the operation fresh solution of the salt into the anode compartment in quantity to maintain the solution in concentration in supplying the cathode chamber with a limited amount of the solution, and in regulating such supply to produce a discharge of the product in a uniform state of concentration, substantially as described.

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

THOMAS CRANEY.

Witnesses:
N. L. LINDOP,
JAMES WHITTEMORE.