(No Model.) 2 Sheets—Sheet 1.

E. B. CUTTEN.

ELECTROLYTIC CELL.

No. 480,491. Patented Aug. 9, 1892.

FIG. 1.

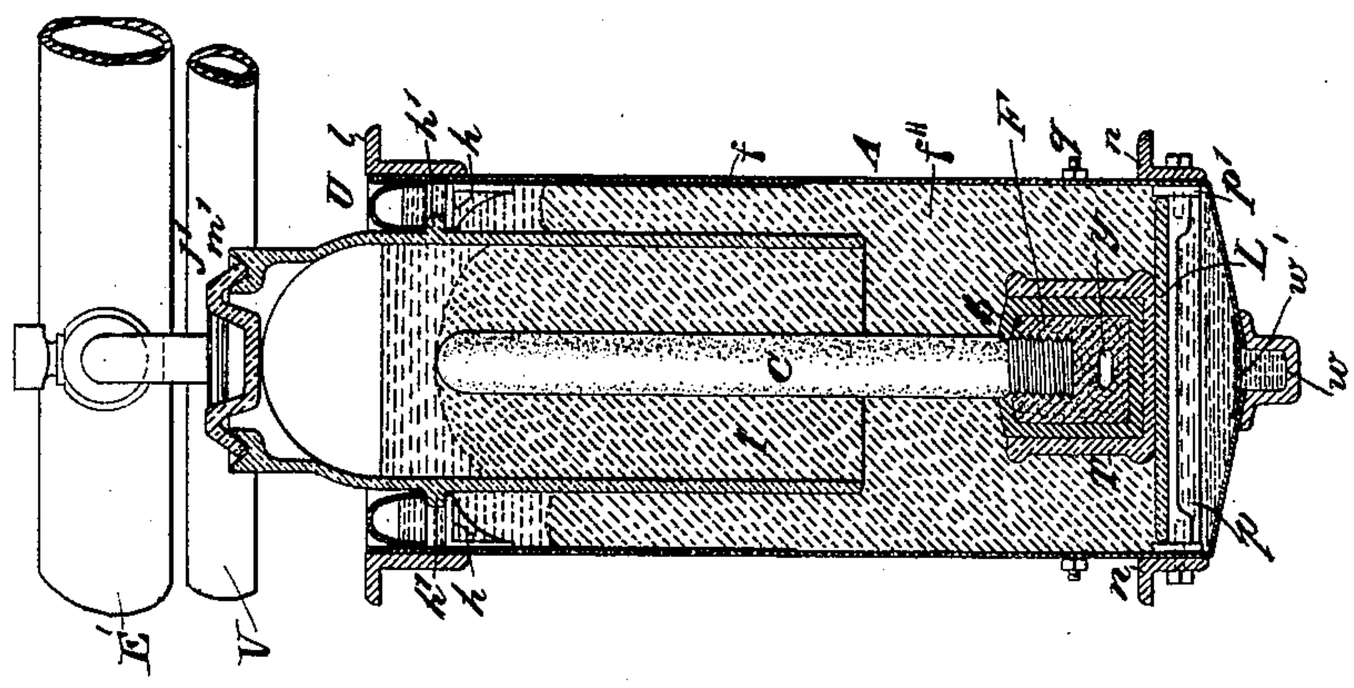
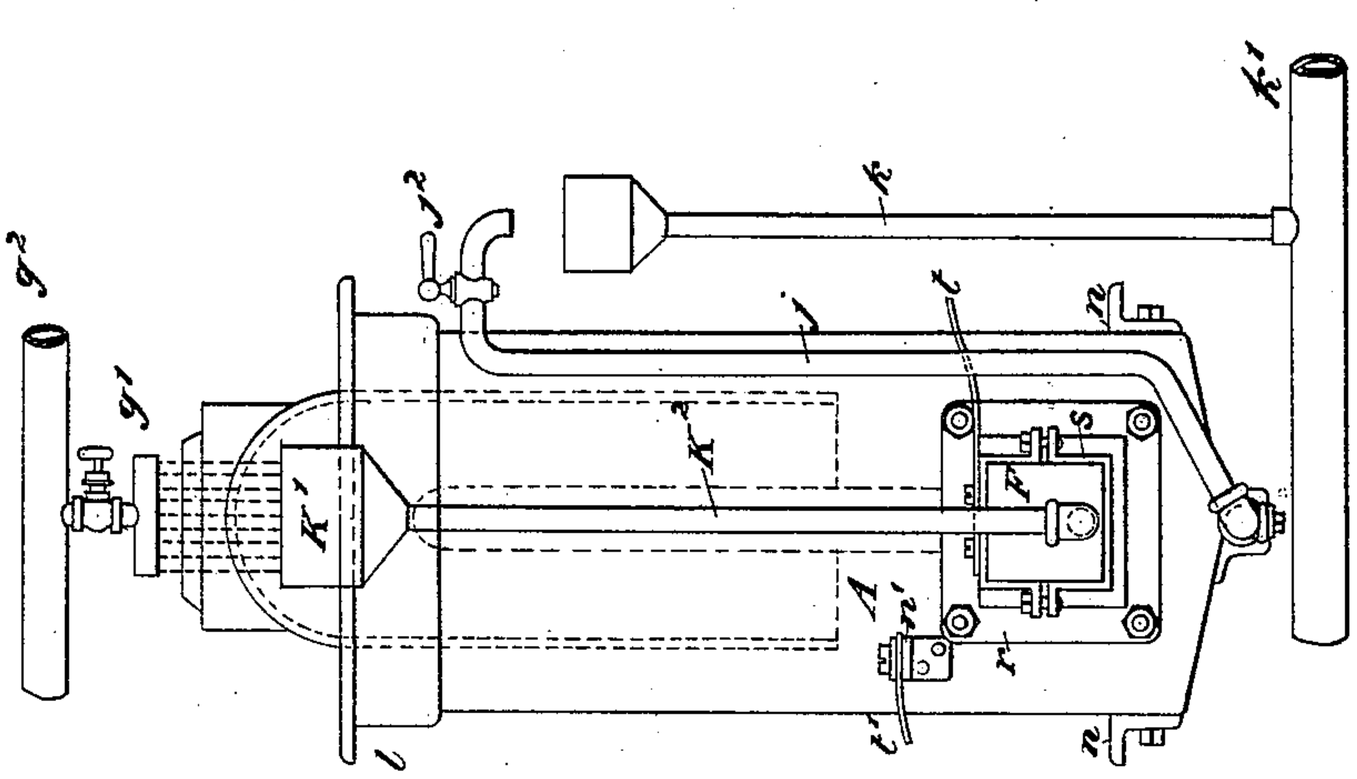


FIG. 2.



WITNESSES:
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Fred White

INVENTOR:
Elisha B. Cutten,
By his Attorneys,
Arthur G. Fraser & Co.

(No Model.) 2 Sheets—Sheet 2.

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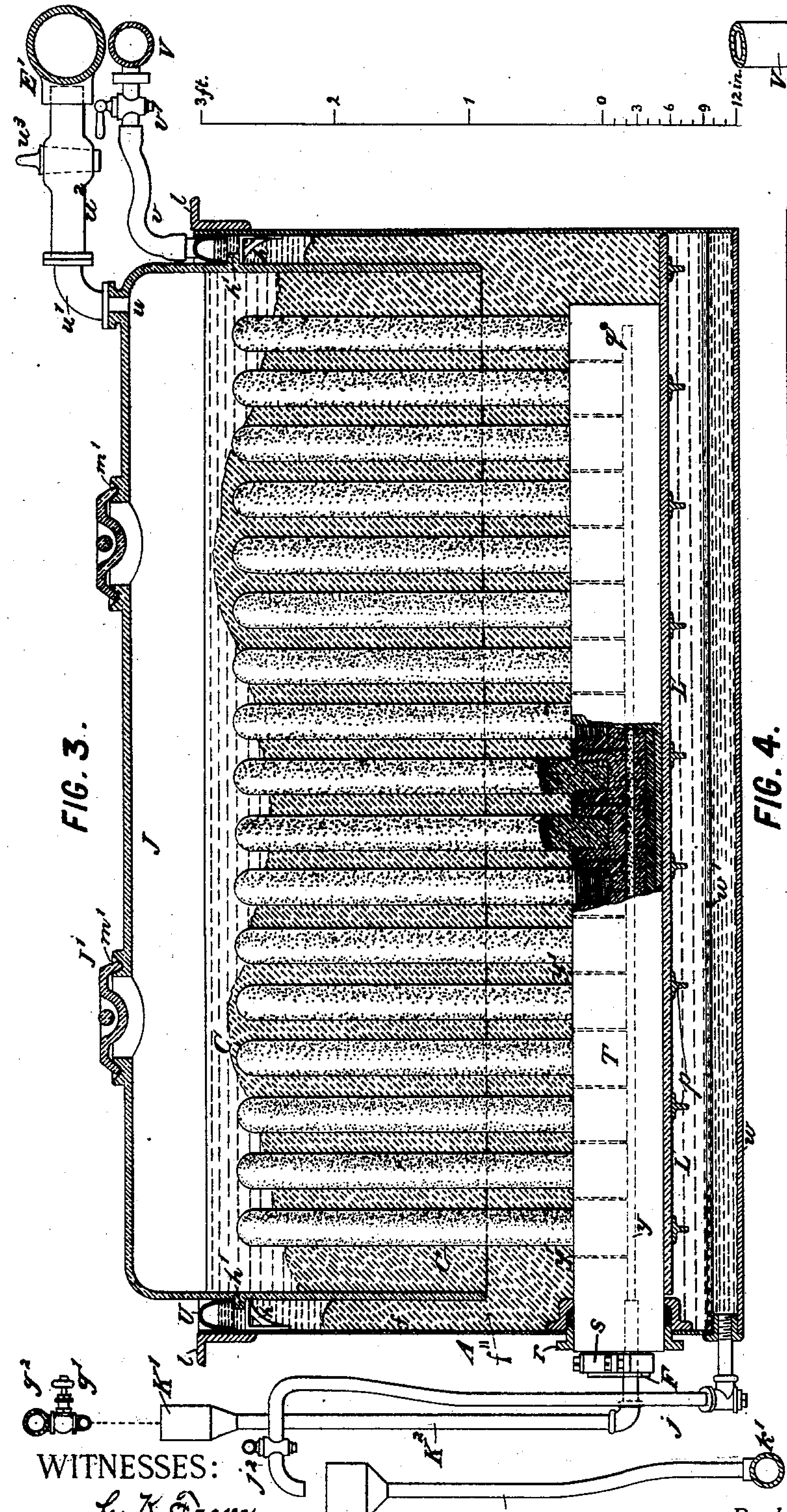

FIG. 3.

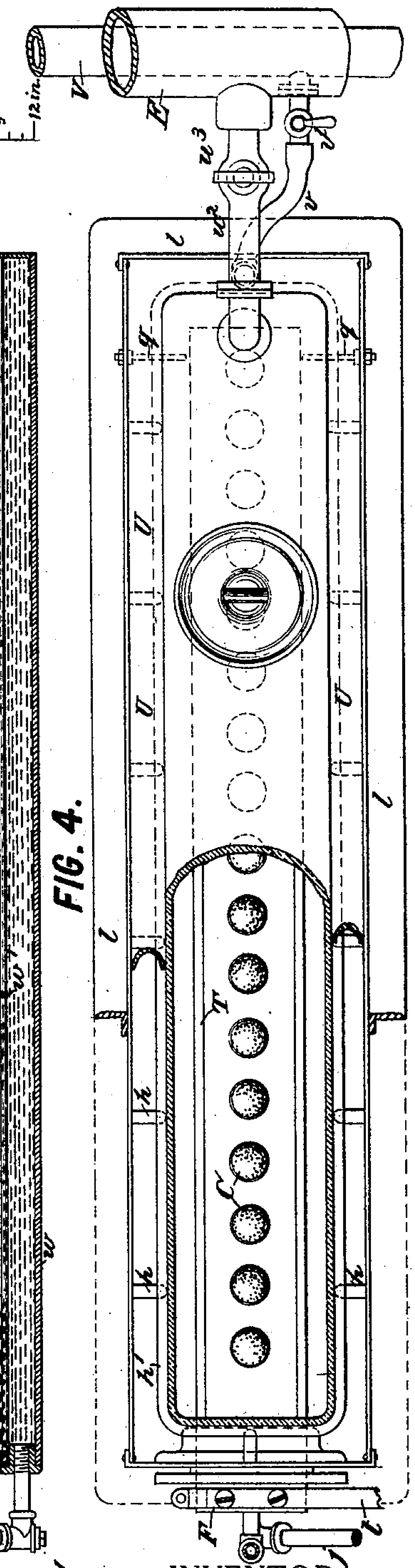

FIG. 4.

WITNESSES:

C. K. Fraser.

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UNITED STATES PATENT OFFICE.

ELISHA B. CUTTEN, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE UNION CHEMICAL COMPANY, OF NEW JERSEY.

ELECTROLYTIC CELL.

SPECIFICATION forming part of Letters Patent No. 480,491, dated August 9, 1892.

Application filed August 19, 1891. Serial No. 403,080. (No model.)

To all whom it may concern:

Be it known that I, ELISHA B. CUTTEN, of the city, county, and State of New York, have invented a certain new and useful Improvement in Electrolytic Cells, of which the following is a specification.

My invention consists in an apparatus intended for use in the electrolysis of solutions of metallic salts, and more particularly for the electrolysis of a solution of sodium chloride and the production therefrom of chlorine and caustic soda.

In another application for Letters Patent, Serial No. 416,562, filed by me December 30, 1891, I have fully described and claimed my new process for the electrolytic production of chlorine and soda, by means of which I have overcome the practical obstacles now in the way of such production, and in still another application for Letters Patent, Serial No. 416,563, filed by me December 30, 1891, I have described a simple and typical form of apparatus wherein said process may be carried into useful effect.

My present application relates, specifically, to another and larger form of apparatus for the same purpose, which, however, is intended for the practical employment of my said process on a large or commercial scale.

The principle on which my said process and also the present apparatus depends is to cause that part of the solution which, as the electrolytic process proceeds, becomes heavily charged with soda to become separated from the remaining or salt-chlorine part of the solution, preferably by its own gravity, and then to draw it off, and to reduce the affinity of the salt-chlorine solution for the salt-soda solution by reducing the quantity of chlorine present by mechanically removing said chlorine from the solution. By this means I obtain a very dense salt-soda solution, which may be drawn off and subsequently evaporated to obtain the soda therefrom, and I also separate the chlorine in gaseous form and may afterward subject it to other processes looking to its utilization.

My present invention consists in the mechanical construction and arrangement of the apparatus, as hereinafter more particularly set forth, and as pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical section, Fig. 2 is an end elevation, Fig. 3 is a longitudinal vertical section, and Fig. 4 a plan, partly in horizontal section, of my improved electrolytic cell.

Like letters of reference indicate like parts.

The outer vessel A is of iron, stiffened at the top by an angle-iron frame *l* and by the bottom bars *n* and having transverse struts *p*. On these struts the glass plate L is supported, being kept in place at its sides by washers *p'*. On this plate is placed a glass or earthenware trough T, within which extends the carbon bar F with an intervening coating of insulation *b*, surrounding the bar. The bar F is of molded carbon and extends nearly the entire length of the tank, its insulation being protected from the action of the soda solution by the trough T. The anode consists of carbon rods C C, screwed or driven into holes in the bar F and projecting upwardly to a suitable height. Near the rear end of the tank the bar is kept in position laterally by guiding-rods *q q*, while at the front end of the tank it passes through the wall thereof, a stuffing-box *r* being provided to prevent leakage around it. The carbon bar F projects beyond its insulating-trough T, and electrical connection is made with it through a metal clamp *s*, to which is attached a copper or other metal bar *t*, leading from the cathode connection of the next tank in the series. Such cathode connection is shown at *n'*, consisting of a metal bracket riveted to the end of the tank A and having fastened to it the copper conducting-bar *t'*, which leads to the anode connection of the next tank beyond. Thus the electrical connections are conveniently made at the front ends of the tanks, which are arranged side by side in a row or gang. In case any tank requires repairing or cleaning it may be easily cut out of circuit by bridging over and breaking its connections. The inner vessel or bell J is made in one piece,

preferably of molded glass formed with an internal rib h', resting on supporting-brackets h h, applied within the tank at intervals. To enable salt to be readily introduced into the inner vessel to supply the place of that consumed by the electrolysis, I provide the top of the bell with one or more covered openings J'. Salt can be readily filled in by first closing a valve in the chlorine-outlet, then removing the cover J', and immediately bringing over it a traveling hopper or bin containing the salt, which can be made to fit tightly over the opening and caused to discharge as much salt as is required, the amount being determined by looking through the transparent top of the glass bell, after which the hopper will be removed and replaced and a tight joint made by running paraffine around the top of the cover in a groove m'.

The chlorine-outlet opening u is preferably at the rear end of the bell and is joined by an elbow u', of glass, porcelain, or lead, to a branch pipe u^2, containing a stop-cock or chlorine-outlet valve u^3. The branch pipes from the several tanks lead into the main suction-pipe E', which communicates with the suction-pump. In case it is necessary to introduce salt to any tank its valve u^3 is first closed, or in case its bell J is to be removed this valve is first closed and then the elbow u' disconnected, whereupon the bell may be lifted out. In this tank provision is made for collecting and removing the hydrogen which bubbles up in the outer vessel. To this end a hood U, which may be made of sheet metal, is provided to fit into the space between the outer and inner vessels, its flanges dipping beneath the liquid-level to seal it. The hydrogen is caught in this hood and is drawn off therefrom through a pipe v and valve v' into a main hydrogen-pipe V, leading to the exhaust-blower or other suction-pump or pumping device, by which the hydrogen gas is either fed to the furnaces or is utilized in any suitable manner. This arrangement not only saves and utilizes the hydrogen, which is of some value, but also avoids risk of explosion by the formation of an explosive mixture of hydrogen and air in the tank-house. In case it is necessary to disconnect or remove any tank or to take off its hood U the hydrogen-valve should be first closed and the communicating pipe v disconnected.

Beneath the glass plate L the tank slopes to a gutter w for leading off the strongest soda solution, which passes through the space between the edge of plate L and the tank and is drawn equally from all parts of the length of the tank by having to pass first through a plate w', which is perforated at intervals with fine holes. From the gutter w at the front end of the tank the pipe j leads to the discharge-faucet j^2 before described, which drips or trickles the resulting stream of soda solution into the tank-pipe k, from which it runs off through the soda-main k'. The supply of strong salt solution to the tank is admitted from a main g^2 by a cock g' and perforated nozzle, from which it drips into the tank or hopper K', and runs through a pipe K^2, which communicates with the end of the carbon bar F, which is bored or molded with a duct y, extending through it longitudinally and having branch ducts y', formed in it vertically between the successive carbon rods C C, as clearly shown in dotted lines in Fig. 3. The liquid passes up in jets from these branches and flows upward between the anode rods. This construction is advantageous because it insures a thorough distribution of the liquid, introducing it at the points where it is most effective.

Although my apparatus is especially designed for the electrolysis of a sodium-chloride solution for the production both of chlorine and caustic soda, yet it is applicable for the electrolysis of other analogous solutions for the production of either or both the products named or other products electrolytically analogous to them. For example, I may by the electrolysis of a solution of chloride of calcium or of magnesium produce chloride of calcium or of magnesia.

The tank A is covered with an insulating-coating of varnish f from its top down to a short distance above the level of the lower edge of the bell J. The production of soda is thus limited to the portion of the iron surface below this insulating-coating, the object of which is to leave the upper portion of the salt solution as free as possible from soda. Common salt is preferably packed in the vessel A and around the carbon rods, as shown by the dotted lines and at f''. This salt operates to renew the strength of the solution and also to prevent diffusion of soda through it.

I claim as my invention the following defined improvements in the process and apparatus for the electrolytic production of caustic soda and chlorine, substantially as hereinbefore specified, namely:

1. The combination of an outer tank and an anode therein, consisting of carbon pencils projecting vertically from a carbon bar, the bar extending horizontally within said tank and passing out through the wall thereof and insulated therefrom to constitute one of the electric terminals of the tank.

2. The combination of an outer tank, an anode therein, consisting of carbon pencils projecting from a carbon bar and a protecting-trough inclosing said bar.

3. The combination of an outer tank, an anode therein, consisting of carbon pencils, a horizontal carbon bar, to which said pencils are fixed, formed with a longitudinal duct through it, and branch discharge-ducts leading therefrom to the exterior of the bar and discharging adjacent to the carbon pencils, and a liquid-inlet pipe communicating with the duct in said carbon bar.

4. The combination, with an electrolytic cell, of means for discharging a liquid there-

from, consisting of an outlet constructed to cause the liquid to fall in drops instead of a continuous stream, and a discharge-pipe to convey away the liquid, whereby the short-circuiting of the electric current through the discharge-pipe is prevented.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ELISHA B. CUTTEN.

Witnesses:
FRED WHITE,
GEORGE H. FRASER.