W. S. HELTZEN.

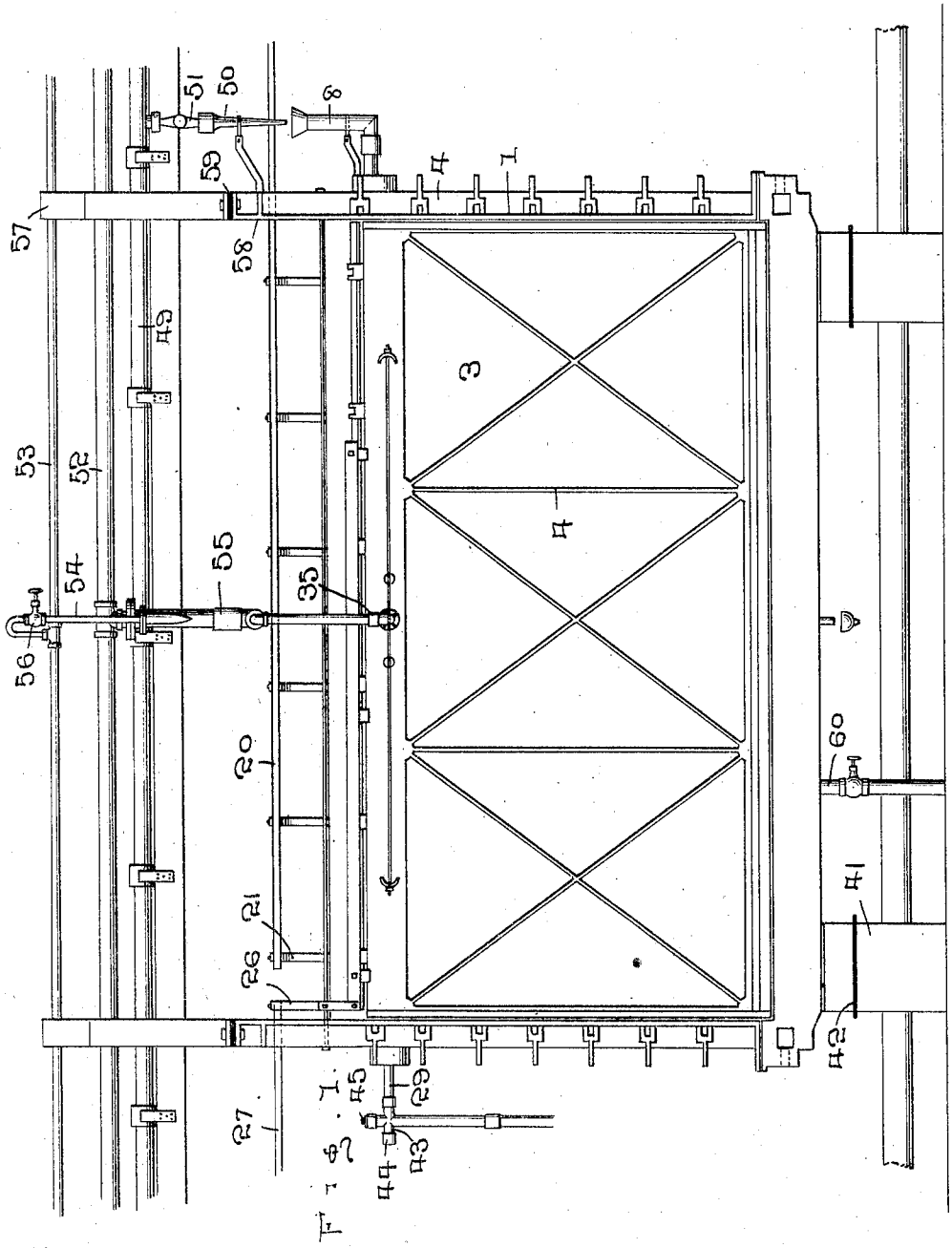
ELECTROLYTIC CELL.

APPLICATION FILED MAY 25, 1910.

1,002,989.

Patented Sept. 12, 1911.

3 SHEETS—SHEET 1.



WITNESSES:

Thos. W. Riley

M. Newcomb.

INVENTOR

W. S. Heltzen

BY

W. J. FitzGerald & Co

Attorneys

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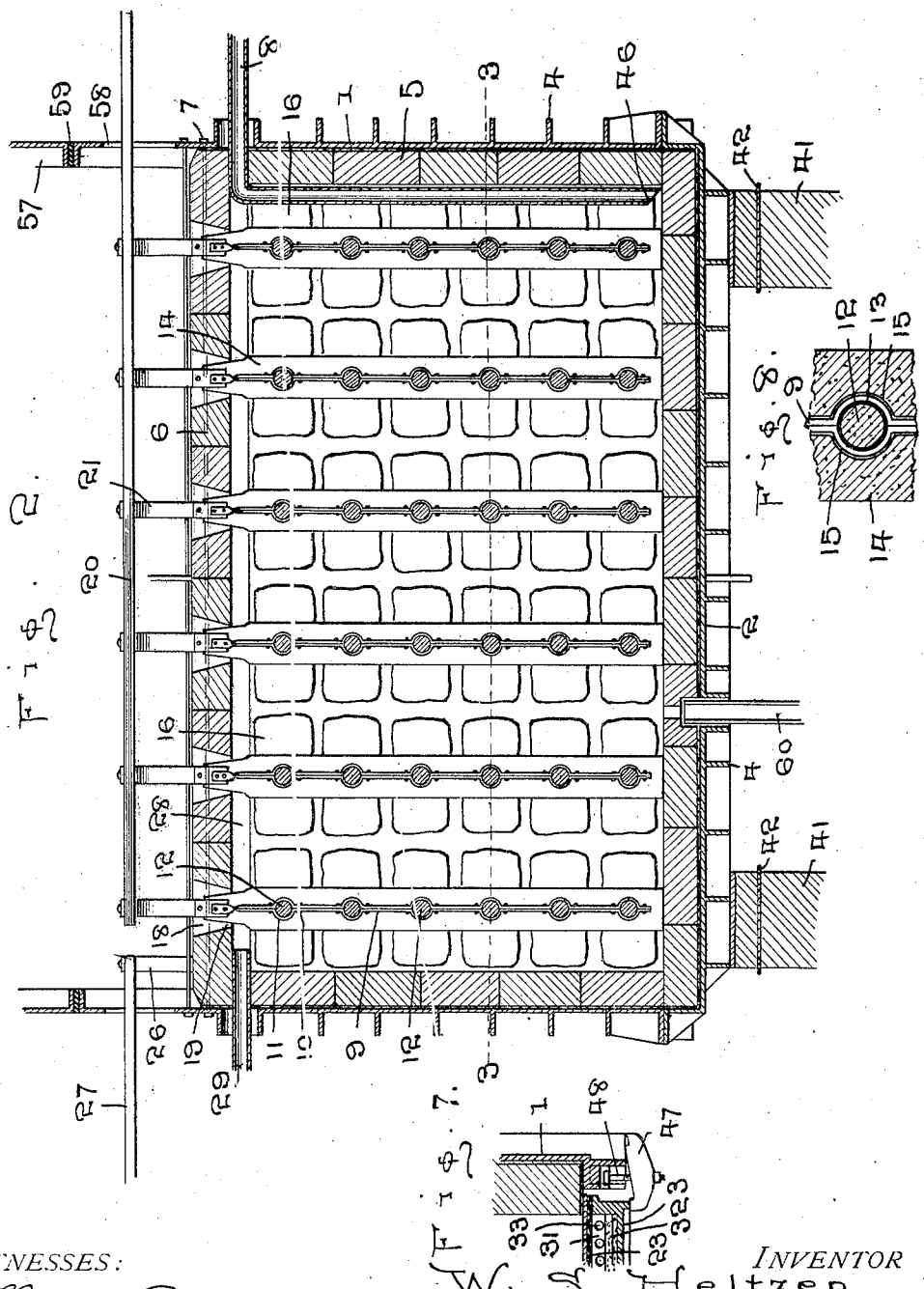

Fig. 2.

Fig. 8.

Fig. 7.

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3 SHEETS—SHEET 3.

Fig. 3.

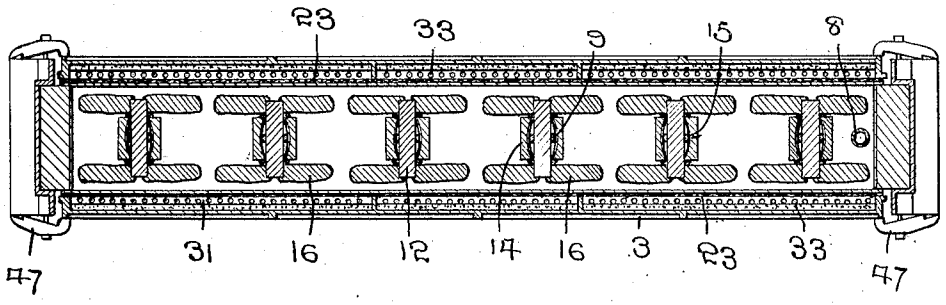


Fig. 4.

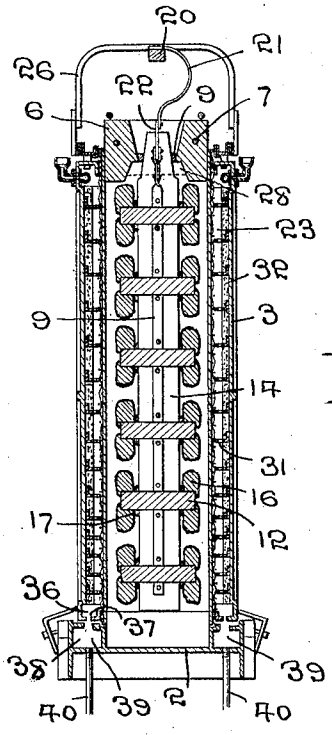


Fig. 6.

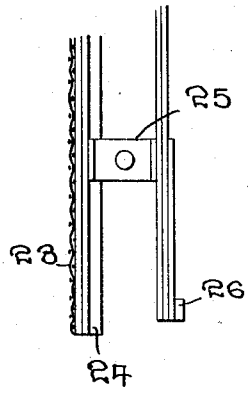
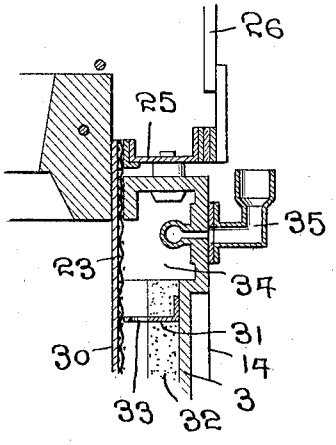


Fig. 5.



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UNITED STATES PATENT OFFICE.

WILLIAM S. HELTZEN, OF DAVIS, WEST VIRGINIA.

ELECTROLYTIC CELL.

1,002,989. Specification of Letters Patent. Patented Sept. 12, 1911.

Application filed May 25, 1910. Serial No. 563,370.

To all whom it may concern:

Be it known that I, WILLIAM STANLEY HELTZEN, a citizen of the United States, residing at Davis, in the county of Tucker and State of West Virginia, have invented certain new and useful Improvements in Electrolytic Cells; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to new and useful improvements in electrolytic cells and more particularly to that class adapted to be used for decomposing salt products and my object is to provide means for directing a current of electricity through a solution of salt products, whereby a chlorin gas will be produced.

A further object is to provide means for separating the by-product of soda from the salt products and gas.

A further object is to provide means for gathering and disposing of the soda.

A further object is to provide means for producing a carbonate of soda.

A further object is to provide means for introducing the salt solution within the cell, and, a further object is to provide suitable anodes for the cells, parts of said anodes being covered so as to protect the same from disintegration.

Other objects and advantages will hereinafter be referred to and more particularly pointed out in the specification and claims.

In the accompanying drawings which are made a part of this application, Figure 1 is a side elevation of a cell in its operative position. Fig. 2 is a longitudinal sectional view thereof. Fig. 3 is a horizontal sectional view as seen on line 3—3 Fig. 2. Fig. 4 is a transverse vertical sectional view through the cell. Fig. 5 is an enlarged detail sectional view through the upper edge of one side wall of the cell. Fig. 6 is an enlarged detail plan view showing the manner of attaching one pole of the electric circuit to the cathode of the cell. Fig. 7 is a detail sectional view on an enlarged scale showing the manner of connecting parts of the cell together, and, Fig. 8 is an enlarged sectional view through one of the anodes.

Referring to the drawings in which similar reference numerals designate corresponding parts throughout the several views, 1 and 2 indicate respectively the end and bottom walls of the cell or vat and 3 indicates the side walls thereof, said side walls being removable from the end and bottom walls, whereby access may be had to the interior of the cell for cleaning and repairing the same.

The outer surfaces of said walls are provided with integral ribs 4, which serve to fully reinforce said walls and prevent springing or breakage thereof.

The interior of the cell is lined with brick 5 or any suitable substance, which will be acid proof, thereby protecting the metallic walls of the cell, while the cell is also covered with suitable composition blocks or bricks 6, said blocks being supported between the upper edges of the side and end walls by rods 7 extending lengthwise of the cell and through openings in said blocks.

It has been customary in the art to construct the top or cover of the cell as a masonry arch. In cells with removable side walls, this construction becomes disadvantageous because of the considerable end thrust developed in such an arch, especially in a very flat one such as is considered necessary in this connection. When the side walls are removed for the purpose of inspection or repair, all of this thrust is transferred into a bending stress on the end walls, necessitating either exceptionally heavy construction or auxiliary bracing of these parts. The exigencies of this situation are fully met by the novel construction shown herein. The rods 7 not only support the cover, acting as simple beams with minimum stress, but serve as tie rods, binding the whole structure together. It will be remembered that the primary consideration is not one of strength but of rigidity. The masonry walls are at best a source of frequent trouble and a construction which renders them least liable to deformation and consequent cracking is in the highest degree advantageous.

A salt solution is entered into the cell through a feed pipe 8, which feed pipe is preferably constructed of terra cotta or similar acid proof substance and in order to place the pipe in position to prevent accidental breakage thereof, said pipe is intro-

duced through one end wall of the cell at a point immediately below the blocks 6 and is then extended downwardly to the bottom of the cell, so as to discharge the salt solution at a point adjacent the bottom of the cell.

The object in carrying the salt solution to the bottom of the cell before discharging the same is that the solution is normally stronger at the upper edge of the cell, so that by discharging the fresh solution at the bottom of the cell, causing the same to arise therein, the strength of the solution within the cell is kept substantially uniform throughout the height of the cell.

In order to produce chlorin gas from the salt solution, an electric current is conducted into the cell and through the salt solution; and to accomplish this result, I provide a plurality of pairs of straps 9, preferably formed of copper and secured together at intervals by rivets or the like 10, said straps extending vertically of the cell and each strap having semi-circular sections, which when the straps are bolted together, form sockets 11 for the reception of spindles 12, said spindles being formed of carbon.

Instead of providing the copper straps 9, it will be fully understood that cables formed of strands of copper wire may be used.

The carbon spindles 12 are attached to the straps 9 in any suitable manner, as by means of tin and leaded contact joints, the coating of this substance being shown at 13 in Fig. 8.

The straps and parts of the spindles carried thereby are fully protected from decomposition by the brine within the cell, by covering said straps and parts of the spindles with a coating 14 of concrete or similar substance, a layer of asbestos 15 being preferably placed around the straps before the concrete is applied thereto.

The spindles 12 project beyond the coating of concrete 14 and have attached to their ends rough carbon anode blocks 16 and in order to create a perfect seal around the spindles to prevent the brine from reaching the copper straps, a composition sealing ring 17 is placed around the spindles at the point of their projection from the concrete coating.

The upper ends of the straps 9 and the concrete coating therearound extend through openings 18 in the composition blocks 6 and in order to form a perfect seal at the points of projection of said straps and their coverings through the blocks, a seal 19 of cement or similar substance is placed in the openings and around the projecting ends of the straps and their coatings, the openings being preferably flared from their lower to their upper ends, while that portion of the coating around the straps projecting into said openings is tapered in the opposite direction, thereby forming a firm seat for the seal.

Extending longitudinally of the cell and above the blocks 6 is a bar 20, which is preferably constructed of copper and is adapted to conduct an electric current. Depending from said bar are a plurality of flexible conductors 21, there being one conductor for each pair of straps, the lower ends of the conductors being attached to the straps 9 in any suitable manner, as by means of links 22, the upper ends of which are engaged with the conductors 21, while the lower ends thereof are entered into the upper ends of the concrete coating and are engaged with the straps 9 embedded therein. By conducting the current into the anodes in this manner, they are caused to act as the positive poles for the electric current. The current when entering the straps passes outwardly through the spindles 12 and carbon anode blocks 16, thence through the salt solution within the cell and into a perforated metal strip 23, there being a strip on each side of the straps and as the metal strips are preferably formed of copper or steel or closely woven wire cloth, they will form the negative poles for the electric current.

Connected to the upper edges of the metal strips 23, as by means of soldering, are angle plates 24 Figs. 5 and 6, to which are attached straps 25 and to these straps are connected the ends of a yoke 26, said yoke being adjacent the end of the cell and connected to the bar 27 of the next succeeding cell, so that the current will be carried from the negative poles of one cell to the positive poles of the next succeeding cells and in this manner the current can be carried through a battery or series of the cells.

As shown in Fig. 2 of the drawings, the bar 27 is spaced a distance from the yoke 26, but if it is desired to cut out one of the cells, it can be cut out of the circuit by bolting a short circuiting piece of copper (not shown) of sufficient size on to the meeting ends of the bars 20 and 27, this being necessary when the carbons and other parts of the device are renewed.

By passing the electric current through the salt solution in the manner shown, a chlorin gas is produced, which arises to the top of the cell and into a space 28 below the blocks 6, said space being formed by providing a channel in the lower faces of the blocks, which channel is above the water line of the cell and by extending the space in a straight line across the cell, the pressure of the gas against the blocks will be equal throughout the length of the cell.

The water level within the cell is maintained at a uniform height by placing an outlet pipe 29 through one end wall of the cell, said pipe being so positioned as to in-

tersect the space 28 below the blocks and as the solution is fed into the lower portion of the cell, the solution at the top of the cell is passing through the pipe 29, from whence it is conveyed to a suitable point to be again supplied with the salt to renew the strength thereof. The gas is also removed from the cell through the pipe 29 and is conveyed to any suitable point for use.

As the pipes 8 and 29 are preferably formed of terra cotta and are easily broken, they are entered into the cell at a point adjacent its upper edge, so as to position said pipes at such a height as to render the breakage of the same practically impossible.

Disposed over the inner faces of the metallic strips 23 and removably secured thereto are diaphragms 30, which diaphragms are preferably constructed of a composition of cement, lime and pulverized asbestos, thereby providing a porous substance and at the same time one that is impervious to the liquids within the cell.

The action of the current passing from the anodes to the cathodes or metallic strips on the solution within the cell, will, in conjunction with producing a gas, produce soda and said soda will pass through the diaphragms and cathodes on to horizontal plates 31, which plates have vertical flanges attached to the inner faces of the side walls 3 of the cell, the inner edges of the plates resting squarely against the metal strips and forming braces therefor.

The cathodes are spaced a distance from the side walls of the cell and the plates 31 are reinforced, as against the pressure of the cathodes against the edges of the plates, by placing a filling 32 of plastic material on the inner faces of the side walls, said filling enveloping about one half of the plates 31, there being a sufficient space between the cathodes and the filling for the reception of the soda. The soda is moved downwardly and discharged from the cell by providing the plates 31 with a plurality of openings 33, said openings being placed intermediate the edges of the plates. The soda is caused to leave the space between the filling and the cathodes by introducing steam into chambers 34 formed at the upper edges of the side walls 3, the steam being introduced into the chambers through suitable pipe connections 35 and as the steam condenses and trickles down over the plates 31, the soda will be carried from off said plates and through the openings 33 into chambers 36 in the lower edges of the side walls and thence through ports 37 and 38 into chambers 39 in the bottom wall 2 of the cell. The by-product or soda is then removed from the chambers 39 through suitable outlet pipes 40 or in any suitable manner.

The cells are preferably mounted upon a supporting base 41, said base being constructed of brick, cement or other suitable substance and in order to prevent the electric current from being grounded through the base, a sheet of glass 42 or other insulating substance is interposed between the cell and the ground.

As shown in Fig. 1, the outlet pipe 29 terminates in a four-way coupling 43, two ends of the coupling being closed by caps 44 and 45 and by this construction should the end of the pipe 29 become obstructed by the decomposition of the anodes and the briny substance within the cell, the cap 44 may be removed and any suitable form of instrument entered through the horizontal portion of the pipe 29 and the obstruction removed from the end of said pipe, while should an obstruction occur in the downwardly extending portion of said pipe, the cap 45 may be removed and the depending portion of the pipe cleaned in like manner.

To prevent choking of the lower end of the feed pipe 8, said lower end is disposed at an angle, as shown at 46 in Fig. 2 and in view of the elliptical opening thus created and also by the force of the liquid passing therethrough, said end will not become obstructed, as is usual with pipes entering from the bottom of the cell.

When the anodes are to be renewed, access may be had to the interior of the cell by removing the side walls 3, said side walls being securely clamped in engagement with the bottom and end walls by the usual or any preferred form of locking dogs 47, Fig. 7, which locking dogs are engaged with the stationary parts through the medium of bolts 48 and by arranging the dogs in the manner shown, a sufficient pressure can be applied against the side walls to form a perfect seal.

If it is desired to obtain a carbonate of soda instead of caustic soda, a quantity of CO_2 gas is introduced through the pipe sections 35 and into the chambers 34, said gas entering said chambers with the steam.

The salt solution is entered into the cells by extending a pipe 49 over the cells, said pipe being provided with nozzles 50, through which the solution is introduced into the feed pipes 8, a valve 51 being provided for each nozzle. The steam and gas for the soda is also conveyed through pipes 52 and 53, the pipe 53 having a connection 54, which unites with the steam connection 55 and the connection 55 is entered into the pipe connections 35, thus conveying the steam and gas into the chambers 34 at the upper edges of the side walls. The connection 54 is also provided with a valve 56, whereby the flow of the gas may be regulated or entirely stopped when desired.

The solution pipe and the steam and gas pipes are supported by trusses 57, which are mounted upon brackets 58 formed on

the end walls of the cells, any suitable form of insulation 59 being introduced between the brackets and trusses, thereby preventing the electric current from passing into the trusses and pipes carried thereby.

Extending downwardly from the bottom 2 of the cell is a pipe 60, whereby the cell may be drained and cleaned when desired and the cleaning operation can be accomplished without removing the side walls of the cell. By this construction, it will be readily seen that the chlorin gas can be readily and cheaply produced from a salt solution and the by-product of soda separated from the salt solution and entered into a separate chamber from the gaseous product and it will likewise be seen that a carbonate of soda may be readily produced by introducing gas into the chambers containing the soda together with the steam. It will likewise be seen that by placing the feed and outlet pipes at the upper edge of the cell, said pipes will be properly protected against breakage and it will likewise be seen that by disposing the discharging end of the feed pipe 8 at an angle, the opening 46 in said pipe will not be closed by the sediment or corrosion within the cell and by placing the portion of the discharge pipe 29 entering the cell in a horizontal position, the corrosion at the end of the pipe can be readily removed by introducing a rod or other device through the blank end of the four-way connection 43. It will also be seen that by removably attaching the diaphragms to the metal plates, said diaphragms can be renewed without disturbing the side walls of the cell, and it will further be seen that by placing the rough carbon blocks carried by the spindles adjacent to the cathodes or metallic plates, the resistance within the cell will be materially lessened.

What I claim is:—

1. A cell of the class described, comprising the combination with side and end walls and a bottom wall and means to convey an electric current through the contents of the cell, of a feed pipe entering the cell at the upper edge thereof and extending to the bottom of the cell, the lower end of said pipe being at an angle, an outlet pipe at the opposite end of the cell and entering the end wall adjacent the upper edge of the cell, and means whereby an instrument may be entered into the part of the outlet pipe entering the cell for removing an obstruction at the end of said outlet pipe within the cell.

2. An electrolytic cell comprising the combination of bottom and end walls, with side walls, horizontal plates extending inwardly from the side walls and having vertical flanges attached thereto, said plates having also a plurality of openings intermediate their edges, a composition filling on the inner faces of said side walls enveloping substantially one half of said plates, a metallic strip resting squarely against the inner edges of said plates and being braced thereby, a removable diaphragm secured against the metallic strip, and means to convey an electric current through said diaphragm and metallic strip.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM S. HELTZEN.

Witnesses:
HERBERT A. VERNET,
MARSHALL. LINTHICUM.