Sept. 4, 1923. 1,467,217

J. M. WILLIAMS

ELECTROLYTIC CELL

Filed June 24, 1920 2 Sheets-Sheet 1

Fig 1

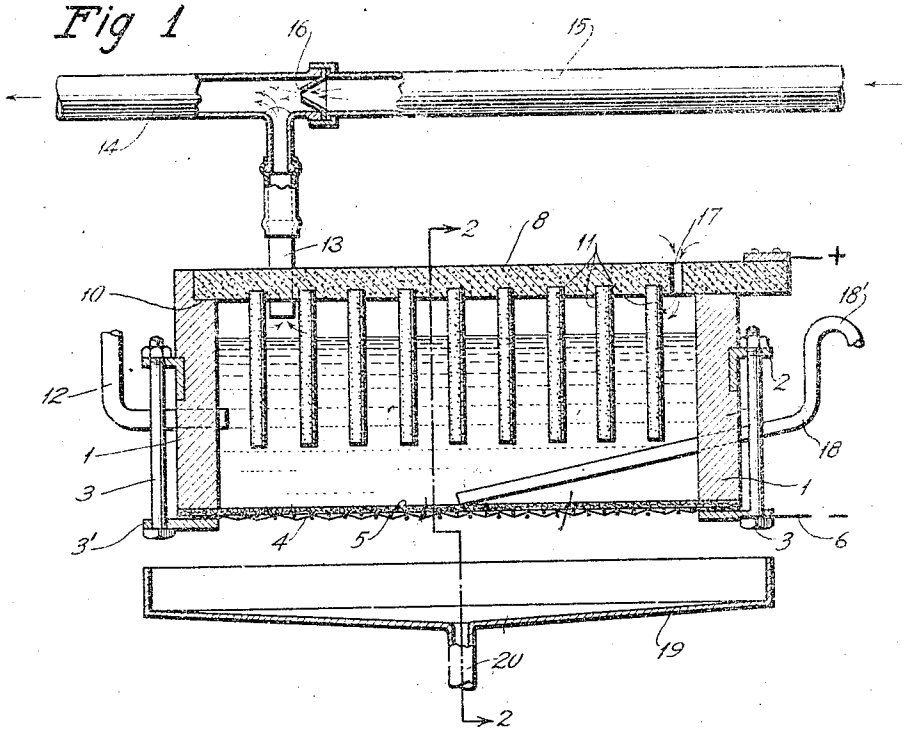
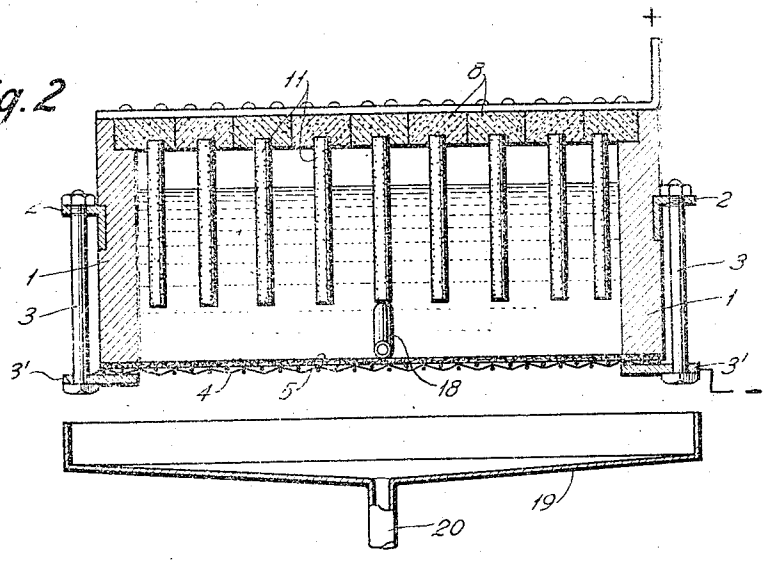


Fig. 2



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Fig. 3.

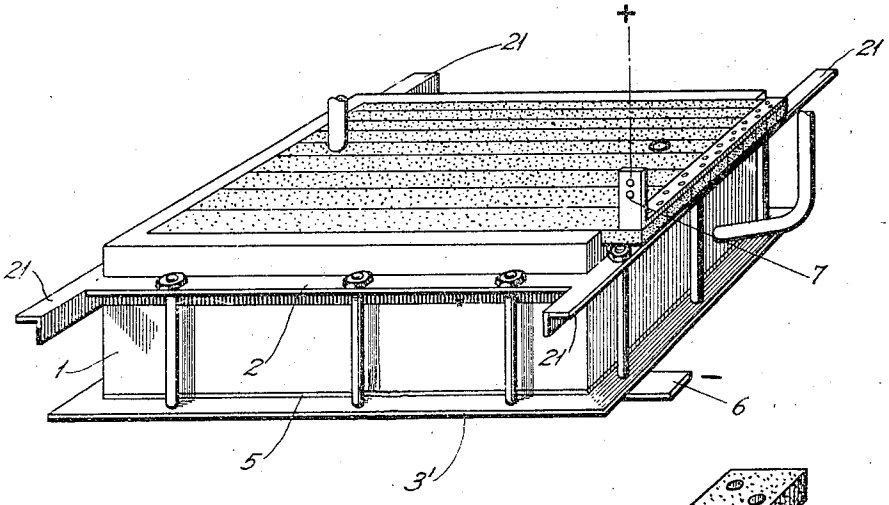
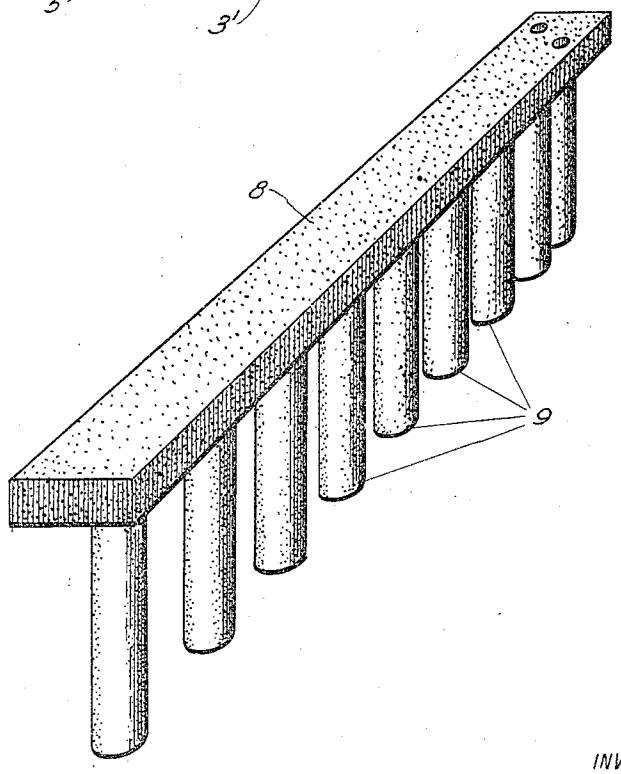


Fig. 4.



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Patented Sept. 4, 1923.

1,467,217

UNITED STATES PATENT OFFICE.

JOHN M. WILLIAMS, OF HENRYETTA, OKLAHOMA.

ELECTROLYTIC CELL.

Application filed June 24, 1920. Serial No. 391,416.

To all whom it may concern:

Be it known that I, JOHN M. WILLIAMS, a citizen of the United States, residing at Henryetta, county of Okmulgee, State of Oklahoma, have invented a certain new and useful Electrolytic Cell, of which the following is a specification.

This invention is an electrolytic cell, and the object of the invention is to construct a cell in a simple and economical manner, yet one which will operate with exceptional efficiency particularly in the electrolyzing of common salt for the production of chlorine and caustic soda, for use in connection with the milling business, water works, sewage purification, etc.

Apparatus has been heretofore suggested for the electrolyzing of salt for the production of chlorine with caustic soda as a by-product, but such apparatus has not been efficient for numerous reasons. As these cells are usually constructed, a diaphragm is positioned between the anode and the cathode and the caustic soda is supposed to pass through the diaphragm and be removed from the cathode side thereof. Practical experience has proven, however, that caustic soda is very apt to accumulate on the anode side of the diaphragm and hypochlorites which greatly decrease the efficiency of the cell in a relatively short time, and necessitate a secession of the electrolyzing operation and a cleaning of the cell.

Careful observation of electrolytic cells has convinced me that means should be provided for removing the caustic soda from the anode side of the diaphragm, so as to preclude the building up or accumulation of such material in this location. If the anode side of the diaphragm can be kept free from accumulations of caustic soda, the efficiency of the cell is increased to a maximum and the cell continues to function with the highest degree of efficiency through prolonged periods of time without requiring secession of the electrolyzing of the salt solution.

From a more specific standpoint, the object of this invention is, mainly, to provide means for precluding choking of the cell through the accumulation of caustic soda, although the invention further contemplates a simplification of cell construction and a combination of elements thereof which will faciliate the manufacture of the cell, inexpensive maintenance and efficient operation.

Features of the invention, other than those adverted to, will be apparent from the hereinafter detailed description and claims, when read in conjunction with the accompanying drawings.

The accompanying drawings illustrate one practical embodiment of the invention, but the construction therein shown is to be understood as illustrative, only, and not as defining the limits of the invention

Figure 1 is a perspective view of an electrolytic cell embodying the present invention.

Figure 2 is a vertical, longitudinal section of said cell.

Figure 3 is a section on the line 3—3 of Fig. 2; and,

Figure 4 is a perspective view of one of the anode sections.

In the accompanying drawings, the cell is shown as of a box-like structure, having side walls 1 of concrete, pottery, or other material resistant to the action of chlorine and caustic soda and of proper diaelectric properties. Intermediate the top and bottom of the side walls there is molded or otherwise secured thereto, an angle iron frame 2, which extends about the four sides of the cell as clearly shown and is provided at spaced intervals with holes through which bolts 3 may be passed for the purpose of bolting the bottom of the cell to the side walls thereof. The bottom of the cell is in the form of an iron frame 3′ made of such size that the marginal edges thereof will protrude beyond the side walls of the cell and such marginal edges are apertured to correspond with the apertures in the angle iron frame 2, so that the bolts 3 may be passed through the apertures of both the frame 3′ and the frame 2 and tightened to firmly clamp the frame 3′ to the bottom of the cell, and at the same time rigidly clamp in place a sheet of wire mesh 4 and a sheet of asbestos paper 5, which are superimposed on the frame 3′ and underlie the lower edges of the side walls. The asbestos plate 5 not only serves as the diaphragm of the cell, but also as a gasket between the frame 3′ and the side walls of the cell.

In accordance with the present invention,

the wire mesh 4 constitutes the cathode of the cell and is included in circuit through the frame 3' and a strip 6 of conducting material with a suitable source of current supply, current of positive polarity being fed to the cell through a strip 7 to the anode. In the preferred embodiment of this invention, the anode is made sectional in the form of a plurality of graphite slabs 8, one of which is shown in detail in Figure 4. Each slab 8 is provided with a number of depending conductive fingers or rods 9 in three of the four side walls 1 of the cell and are rabbeted to provide shoulders 10 on which these slabs may rest. The fourth wall is made lower than the other three or on a level with the shoulder 10 of said three walls. With this construction, the slabs may be laid side by side, after the manner shown in Figure 1 so as to form a closure for the top of the cell, which will be flush with the top of three of the side walls thereof. The slabs, however, are made longer than the body of the cell, so as to extend slightly over the low walled end thereof and the conductor or electric current feeding the strip 7, passes across all of said slabs after the manner of a cleat and is secured to each slab as shown in Figure 1, so that current may be fed simultaneously to all of the slabs and their associated rods 9.

When the anode is in place upon the side walls of the cell, the rods extend downwardly into the interior thereof, but terminate at a point above the asbestos diaphragm 5, so that current flowing from the anode to the cathode is required to pass through the electrolyte 11, with which the cell is adapted to be charged. For the production of chlorine and caustic soda this electrolyte is preferably brine, which may be fed into the cell through a suitable pipe 12 passing through one of the side walls thereof.

When the current to the cell is switched on, the electrolyte is electrolyzed with the result that chlorine is set free, and, being of less specific gravity than the electrolyte, rises to the top of the cell above the electrolyte level and at the same time caustic soda is formed and settles to the bottom of the cell. The chlorine gas finds exit through an outlet pipe 13, which may be exhausted either by exerting pressure within the cell or by employing suction. The accompanying drawings show the latter method of drawing off the chlorine, through the employment of a draw off pipe 14. Associated with the draw off pipe 14 is a pipe 15, which leads from a suitable source of air under pressure and at the junction of the pipes 14 and 15 is included an ejector nozzle 16, the outlet end of which is adjacent the pipe 13. The air under pressure passing through the pipe 15 and through the ejector 16, sets up a suction in the pipe 13, which draws the chlorine out of the cell to be carried along with the air through the draw off pipe 14. To allow of the drawing off of the chlorine gas in the manner specified, one of the slabs 8 is provided with an air vent 17, and the constant circulation of air results between the air vent 17 and the pipe 13 within the cell, so that the chlorine gas is drawn off as soon as it is evolved.

The caustic soda which drops to the bottom of the cell is found in practice to stratify in the region of the diaphragm 5, and while considerable amounts of such caustic soda filters through the diaphragm and is freed from the cell through the wire meshed cathode 4, the choking of the cell through accumulation of caustic soda on the diaphragm is obviated by the provision of a caustic soda draw off tube 18, which passes through one of the side walls of the cell, as shown in Figure 2 with its inner opening resting upon the diaphragm 5. During the operation of the cell, brine is fed, through the pipe 12, preferably in a constant flow, and rises to a level in the cell corresponding to the turn 18' in the tube 18, which forms the overflow. As the feed of brine continues, the level is maintained constant by the outflow of liquid through tube 18 and the caustic soda, which does not filter through the diaphragm, is carried off through tube 18. The provision of this tube is a vital feature of the cell, since it keeps the strata of caustic soda below the ends of the pins or rods 9 and preserves the full chlorine efficiency of the cell. In practice, the flow of brine into the cell may be so regulated that the cell is kept substantially entirely free from residual caustic soda. Hydrostatic pressure and the difference in specific gravity preclude the caustic soda and chlorine from reuniting above the diaphragm, but if the caustic soda strata were allowed to build up to the plane of the lower end of the rods 9, hypos would be formed, which would greatly reduce the efficiency of the cell.

A sink or drain 19 is preferably positioned below the cell to catch caustic soda which works through the diaphragm thereof, and this caustic soda may be led off from such drain through a pipe 20 to any desired location.

In practice, I have found that the cell may be conveniently supported by providing the angle iron frame 2 with lateral extensions 21 which form bearers adapted to rest upon any suitable firm support.

The cell of the present invention may be used separately, but for a large production, a plurality of such cells may be used to provide the desired output of chlorine gas. The cell of the invention works with high efficiency and through prolonged periods,

since it cannot become choked as cells of the type heretofore employed and in the case of injury to any of the parts through wear or long continued use, the structure is such that it may be readily dismantled and repaired or new parts as easily substituted.

The manner of removing the caustic soda from the anode side of the diaphragm, as well as the manner of drawing off the chlorine gas, as hereinbefore described, constitute a new process, described and claimed in my copending method application, filed June 24, 1920, Ser. No. 391,417.

Having thus fully described the invention, what I claim as new and desire to secure by Letters Patent is:

1. An electrolytic cell embodying side walls, a foraminous bottom having a superimposed diaphragm of asbestos, said foraminated bottom forming the cathode of the cell, an anode embodying a plurality of graphite slabs laid edge to edge on the side walls to form a closure for the top of the cell and each of which slabs carries a plurality of depending conductor rods adapted to be partially submerged in the electrolyte within the cell, a duct for feeding electrolyte into the cell, and a draw off duct for drawing off certain products of the electrolyzing operation from the zone directly adjacent the diaphragm and on the anode side thereof.

2. An electrolytic cell embodying, an anode, a flat cathode, a diaphragm positioned intermediate the anode and the cathode, a portion of the anode being submerged within brine electrolyte, which the cell is adapted to contain, and a duct for drawing off caustic soda, resulting from the electrolyzing of the brine, from the zone directly adjacent the diaphragm and on the anode side thereof.

3. An electrolytic cell embodying an anode, a cathode, a diaphragm positioned intermediate the anode and the cathode, a portion of the anode being submerged within brine electrolyte, which the cell is adapted to contain, and a pipe leading out of the cell and having its open inner end resting upon the diaphragm, whereby caustic soda may be drawn off and its accumulation within the cell precluded.

4. An electrolytic cell embodying an anode adapted to be partially submerged in an electrolyte which the cell is adapted to contain, a cathode, a diaphragm intermediate the anode and the cathode and electrical connections for passing a current through the cell for the purpose of electrolyzing the electrolyte and evolving a gas, in combination with means for circulating a current or air through the cell for the purpose of carrying off the evolved gas.

5. An electrolytic cell embodying side walls provided with supporting shoulders and a substantially horizontal foraminous bottom, said bottom forming the cathode of the cell, an anode supported by the side walls of the cell and embodying a plurality of graphite slabs laid side by side on the shoulders of the side walls, said graphite slabs being provided with depending rods adapted to be partially submerged by the electrolyte in the cell, an asbestos diaphragm superimposed upon the cathode and intermediate the cathode and anode, attaching members partly embedded in the exterior surfaces of the side walls of the cell, and means cooperating with said attaching members and with the cathode of the cell for holding the latter securely in position.

6. An electrolytic cell embodying an anode, consisting of a plurality of graphite slabs positioned above the surface of the electrolyte contained in the cell and forming a cover of the cell, each of which slabs is provided with depending conductor rods partially submerged by said electrolyte, a cathode forming the bottom of the cell, and a diaphragm superimposed upon the cathode intermediate the cathode and anode.

7. An electrolytic cell embodying an anode, a flat horizontal cathode positioned below the anode, means for feeding brine to the cell, and an overflow duct, the inlet of which is between the anode and the cathode, for drawing off the spent brine and caustic soda resulting from the electrolyzing of the brine.

8. An electrolytic cell embodying an anode, a substantially flat, horizontal cathode positioned below the anode, means for steadily feeding brine into the cell and means for steadily drawing off the spent brine and caustic soda resulting from the electrolyzing of the brine, from a point between the anode and the cathode.

9. An electrolytic cell embodying an anode, a substantially flat, horizontal cathode positioned below the anode, means for steadily feeding brine into the cell, and an overflow pipe leading out of the cell and having its inner receiving end positioned in the zone directly adjacent the cathode, whereby the electrolyte displaced by inflowing brine, is freed from the cell at a point adjacent the cathode and carries off the caustic soda produced by the electrolyzing of the brine.

10. An electrolytic cell embodying an anode, a substantially flat, horizontal cathode, a draw off duct having its inlet end intermediate the anode and the cathode and its outlet end at a height corresponding to the desired surface level of the electrolyte adapted to be contained in the cell, and means for feeding electrolyte into the cell for the purpose of displacing a portion of the contents via the overflow duct.

11. An electrolytic cell embodying an

anode, a cathode, a draw off duct having its inlet end intermediate the anode and the cathode and its outlet end at a height corresponding to the desired surface level of the electrolyte adapted to be contained in the cell, and means for steadily feeding electrolyte into the cell for the purpose of effecting a steady flow of spent electrolyte and certain products of the electrolyte action out of the cell through the overflow duct.

In testimony whereof, I have signed my name to this specification.

JOHN M. WILLIAMS.