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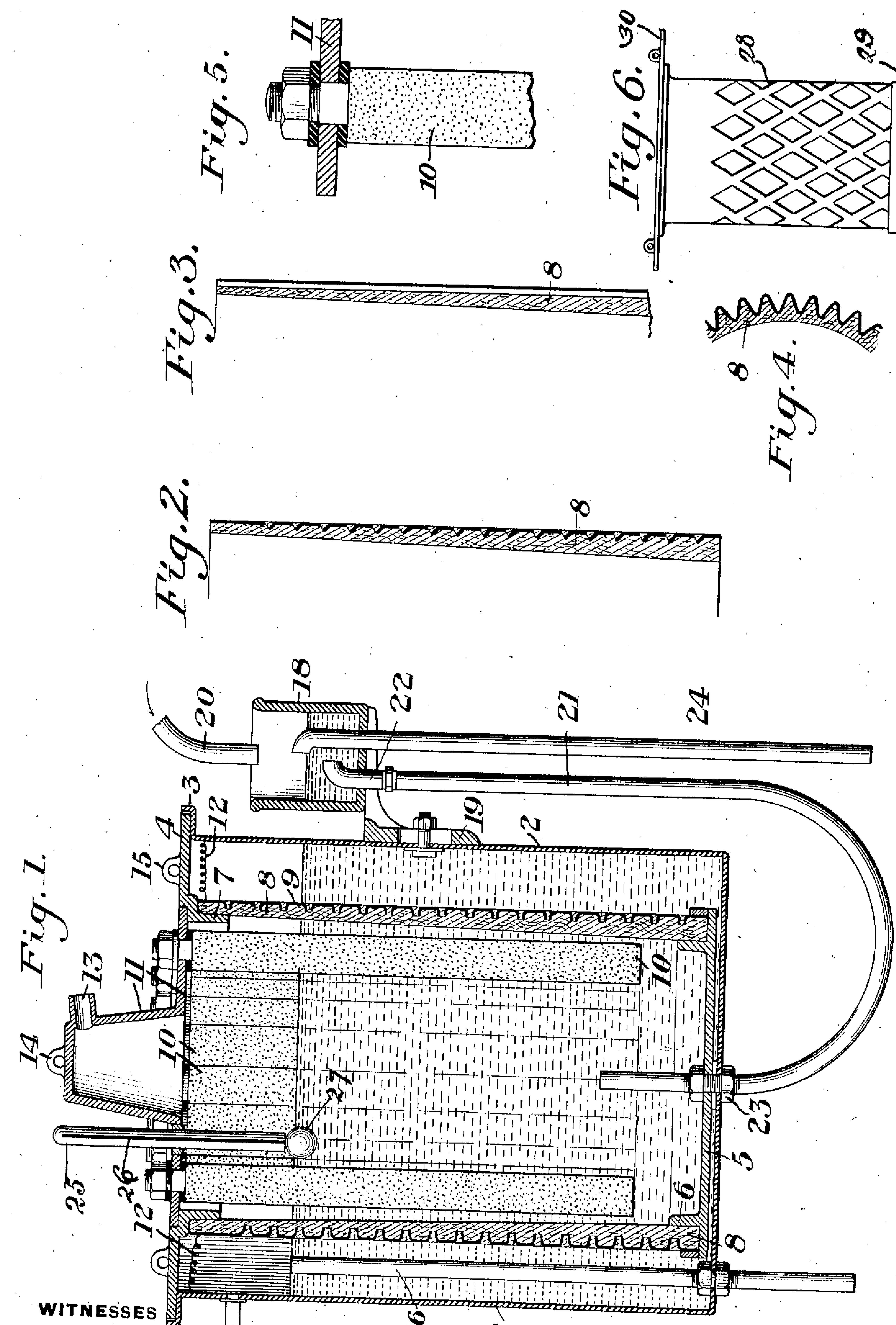
A. E. GIBBS.

ELECTROLYTIC CELL.

APPLICATION FILED JUNE 2, 1906.



WITNESSES

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ELECTROLYTIC CELL.

No. 874,064. **Specification of Letters Patent.** **Patented Dec. 17, 1907.**

Application filed June 2, 1906. Serial No. 319,870.

To all whom it may concern:

Be it known that I, ARTHUR E. GIBBS, of Wyandotte, Wayne county, Michigan, have invented a new and useful Electrolytic Cell, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a sectional side elevation of an electrolytic cell constructed in accordance with my invention; Figs. 2, 3 and 4 are detail views showing modifications of the diaphragm construction; Fig. 5 is a detail view of the anode and Fig. 6 is a detail view of a modified form of diaphragm support.

My invention relates to the class of electrolytic cells having diaphragms, and particularly to those arranged for wet electrolysis, such as the electrolysis of alkaline chlorids.

The object of the invention is to reduce the expense of operation, to increase the output, and also make the cells longer lived.

A further object is to provide a cell which may be cheaply and easily made, and can also be readily repaired or renewed.

An important feature of my invention consists in forming the cathode as a metal jacket surrounding the diaphragm, said metal jacket having a number of inner projections or points facing and preferably embedded in the diaphragm.

It further consists in the above construction wherein the cathode is provided with holes or passages through or along which the products of electrolysis may be forced into the cathode chamber, and thus out of the sphere of electrolytic action.

The invention further consists in an improved feed device for the liquor, in a constant indicator for the level of the liquid in the cell, and also in the construction and arrangement of the cell and its parts as hereinafter more fully described and claimed.

In the drawings, I show the cell as comprising an outer vessel 2 which may be of sheet steel or of any other desirable material. This vessel is provided with an annular flange 3 around its top on which rests the projecting annular ring portion 4 of the cathode.

The cathode and diaphragm are preferably built up as follows: A lower disk 5 is preferably provided with an upwardly-projecting flange 6 of substantially the same diameter as the flange 7 on the ring 4. The ring 4 and the disk 5 may consist of iron castings, or may be of earthenware, or any other desirable material; if made of iron the inner portions or those subject to action of anode liquor should be insulated, enameled or otherwise protected. Around the registering flanges 6 and 7 I form a barrel consisting of the permeable diaphragm 8 around which is the metal jacket 9 which forms the cathode. The diaphragm may be formed of asbestos or any suitable permeable material which is not attacked by the liquid. It is preferably formed with walls which gradually decrease in thickness from the bottom toward the top, so that the difference in permeability shall substantially correspond to the difference in hydrostatic pressures. The jacket may consist of a sheet of steel or other suitable metal, which is provided with a series of projections on one face. This sheet may be wrapped around the diaphragm; or may be made in the form of a cylinder or jacket which is slipped over the diaphragm. If the cathode is formed of sheet metal wrapped around the diaphragm it may be held in place by clamping bands or any other suitable securing device.

I prefer to provide the jacket-like cathode either with a series of holes or passages extending through it, or with vertically-extending passages between the cathode and the diaphragm. The first form may be obtained by simply punching holes in the sheet metal jacket leaving burs at the inside, no metal being removed; or the sheet may be slotted and bent inwardly, or struck-up in any other desired manner. If the cathode is not provided with holes, I prefer to corrugate the sheet longitudinally, and then wrap it around the diaphragm, in which case, vertical passage ways are provided along the inner face of the cathode through which the products may rise or fall and be carried out of the electrolytic region. In Figs. 3 and 4, I show a corrugated cathode while in Figs. 1 and 2, is shown a lip slot.

The anode preferably consists of a series of carbon rods 10 arranged in annular form and projecting through the dome 11 which may rest upon an annular recess in the ring 4. These anodes are preferably square or angular in cross-section except at their tops which are cylindrical for the threading at joint with cover. The positive wires or connections lead to these anodes, while the negative wire leads from the cell jacket to which the cathode is connected by a series of suitable connections 12 extending through the cathode compartment. The dome is preferably provided with a gas outlet 13 and also with a ring or suspending device 14 which may be engaged by a crane or hoisting device to lift out the anode.

In case the ring 4 is of metal provided with insulation between it and the dome 11, I may band the cathode thereto, in which case the wires 12, 12 are not necessary. The ring 4 is also preferably provided with eye-bolts or suspending devices 15 which may be engaged by an over-head crane to lift out the cathode and diaphragm, or both the cathode and anode.

16 is the outlet pipe for the liquid cathode products, while 17 is a gaseous outlet to allow escape of any gas in the cathode compartment.

For feeding the solution to the cell I preferably employ a vertically-adjustable cup 18 which is carried on a bracket 19 secured to the casing 2.

20 is the inlet pipe feeding solution into the cup while 21 is a flexible rubber tube connected to a pipe 22 within the cup having a lateral inlet at one side. The flexible tube 21 leads through the bottom of the casing 2 and through the disk 6 being held by the clamp connection 23. The cup is provided with an over-flow pipe 24 which maintains a substantially constant level in the cup; and the inlet to this pipe is also lateral and protected from dropping of solids into it.

As shown in Fig. 1, I preferably employ a continuous visual indicator to show the height of liquid in the cell. In the form shown, this consists of a tube 25 which is closed at the top and open at the bottom and extends above the dome far enough to allow the stem 26 of the float 27 to be seen. This stem extends below the dome a sufficient distance to hold the same in vertical adjustment, and the float 27 resting on the liquid indicates by the position of the stem 26 the level of the liquid within the cell.

In the operation of the cell, the solution to be treated is fed into the cup at a faster rate than it is passed through the cell. The overflow feeds out through pipe 24 and the solution feeds into the anode compartment of the cell through the flexible tube. By adjusting the height of the cup I can adjust the feed so as to give the best efficiency in different stages of the life of the cell. As the solution passes outwardly through the diaphragm, where alkaline chlorids are treated, the caustic will form upon the projections or points of the cathode. The bulk of the electrolysis takes place at these points or projections, and as the caustic is formed, the flow of electrolyte carries it outwardly through the holes in the cathode and out of the region of electrolytic action. By thus carrying away the caustic as it is formed, I avoid decomposing of the caustic itself, and increase the efficiency of the cell.

In the case of the cathode having the vertical passages, the liquid will flow either up or down or along these passages and obtain the same result of carrying away the products as they are formed. In both cases the electric current will flow mainly to the points or projections embedded in the diaphragm, and there will be little or no electrolytic action in the valleys or portions more remote from the anodes.

The advantages of my invention result particularly from the cathode having points or projections entering the diaphragm. Also from the use of off-take channels for the product in connection with these embedded points or projections. The adjustable cup enables me to adjust the flow to give the best efficiency and this will of course vary to some extent during the life of the cell. By embedding the points or projections of the cathode in the diaphragm, I produce electrolytic action at separated points or places, while allowing the products to pass immediately into an inactive region. By using this peculiar diaphragm and jacket cathode with embedded points, I can maintain substantially the same permeability for an indefinite period. With an ordinary diaphragm, its filtering action will cause its permeability to gradually decrease owing to clogging; but I find that my diaphragm builds up to some extent on the inner side, while it disintegrates to some extent on the outer side, owing to the gas evolved at the points or projections. This double action goes on substantially continuously, and keeps the permeability approximately constant. This is of great commercial importance, as it enables the operation to be carried on with little attention, and consequently one operator can attend to a very large number of cells. The varying thickness of the diaphragm at different levels also gives a uniform action throughout the whole cathode. The adjusting of the cell will enable the operator to compensate for any clogging, if such takes place, although as above stated, such action hardly ever occurs, if at all, in my system. My improved cathode prevents the destructive effect of the small percentage of hypo-chlorite, which is present in the final liquor of ordinary cells. The intimate contact between the liquor coming from the anode compartment and the cathode points insures a complete action of the nascent hydrogen at such points, thus effectively destroying all hypo-chlorite. The adjustable inlet cup affords a simple and effective way of regulating the strength of the solution. The anode or cathode may be easily removed and replaced, and the cell may be cheaply and easily made, while its efficiency is remarkably high.

Instead of the upper ring and lower disk for the diaphragm and cathode I may form a perforated cylinder 28 with a bottom 29 and with upper flanges around which the diaphragm would be placed. The cathode may be made either of sheet metal or of cast metal, and either in one or more parts; the joint between the anodes and the cover may be varied so long as a tight joint is obtained, and the form of the anode may be changed. The materials of the different parts may also be varied, the diaphragm may be of other forms in cross-section than cylindrical, and other variations may be made without departing from my invention.

I claim:—

1. In electrolytic apparatus, a diaphragm and a cathode having projections embedded in said diaphragm; substantially as described.

2. In electrolytic apparatus, a diaphragm and a metallic jacket surrounding the diaphragm and forming the cathode, said jacket having projections embedded in the diaphragm; substantially as described.

3. In electrolytic apparatus, a diaphragm and a cathode having projections embedded in the diaphragm, said projections having outlet channels for the products of electrolysis, substantially as described.

4. In electrolytic apparatus, a permeable diaphragm, a cathode having hollow projections extending within the wall of the diaphragm, the inner ends of the projections forming outlet channels for the products of electrolysis; substantially as described.

5. In electrolytic apparatus, a diaphragm, and a cathode having projections entering the diaphragm, said cathode having outlet channels for the products of electrolysis; substantially as described.

6. In electrolytic apparatus, a diaphragm, and a cathode having projections entering the diaphragm, said cathode having holes to allow passage therethrough of the products of electrolysis; substantially as described.

7. In electrolytic apparatus, top and bottom rings, a hollow permeable filtering diaphragm, and a jacket cathode clamping the diaphragm to the rings, said cathode having projections entering the diaphragm; substantially as described.

8. In electrolytic apparatus, top and bottom rings, a hollow diaphragm permeable as a filter clamped to the rings and forming a surrounding wall, and a perforated jacket cathode having inwardly projecting walls around the perforations, said walls entering the face portion of the diaphragm; substantially as described.

9. In electrolytic apparatus, a cylindrical anode compartment, and anodes having an independent support carried on said compartment; substantially as described.

10. In electrolytic apparatus, a container, a cathode and diaphragm within the container arranged to form an anode compartment, said cathode having suspending devices by which it may be lifted from the container, and anodes depending into the anode compartment and supported independently thereof, whereby they may be lifted independently; substantially as described.

11. In electrolytic apparatus, an insulated dome covering the anode chamber and having anodes depending from it, said dome being supported directly upon an upper ring of the anode vessel; substantially as described.

12. In electrolytic apparatus, a separate feed cup having a tube leading into the anode compartment, and a vertically-adjustable support for said cup; substantially as described.

13. In electrolytic apparatus, a cell having a vertically-adjustable bracket mounted thereon, a feed cup supported on the bracket, and a pipe or connection leading from the feed cup to the anode compartment; substantially as described.

14. In electrolytic apparatus, a cell having a vertically-adjustable bracket mounted thereon, a feed cup supported on the bracket, and a pipe or flexible connection leading from the feed cup to the anode compartment; substantially as described.

15. In electrolytic apparatus, a feed cup having an inlet, an over-flow, and a pipe leading to the anode compartment and a vertically-adjustable support for said cup arranged to vary the hydrostatic pressure of the liquor; substantially as described.

16. In electrolytic apparatus, a cathode compartment containing a diaphragm of less thickness in its upper portions than in its lower portions; substantially as described.

17. In electrolytic apparatus, a diaphragm having upwardly-tapering walls; substantially as described.

18. An electrolytic apparatus having a closed upper chamber with a transparent portion, and an indicator float in the anode compartment visible through said transparent portion; substantially as described.

19. In electrolytic apparatus, a cell having an upwardly projecting closed tube formed at least in part of transparent material, and a float in the anode compartment having an upwardly projecting portion within the tube and visible through its transparent portion; substantially as described.

20. In electrolytic apparatus, a tube extending within the cell and a bulb tube within this tube arranged to indicate the level of the liquid; substantially as described.

21. In electrolytic apparatus, a vertically extending tube open at its lower end, and a float projecting into the tube and having an indicating portion external of the cell; substantially as described.

22. In electrolytic apparatus, top and bottom rings, a cylinder supported by the rings and having external depressions, and an

electrode embracing the cylinder and snugly fitting the depressions, substantially as described.

23. In electrolytic apparatus, a metallic cathode having projections, and a diaphragm in contact with and supported by said projections; substantially as described.

24. In electrolytic apparatus, a separate feed cup having a tube leading into the anode compartment, and a support for the cup arranged for adjusting the cup to different levels; substantially as described.

25. In an electrolytic apparatus, a cathode, a cover support for anodes independent of the anode compartment, and a container, said cover and cathode being arranged to be lifted out of said container; substantially as described.

In testimony whereof, I have hereunto set my hand.

ARTHUR E. GIBBS.

Witnesses:

ANNA RUSSOW,

FLORENCE E. ROFTER.