

No. 655,343.

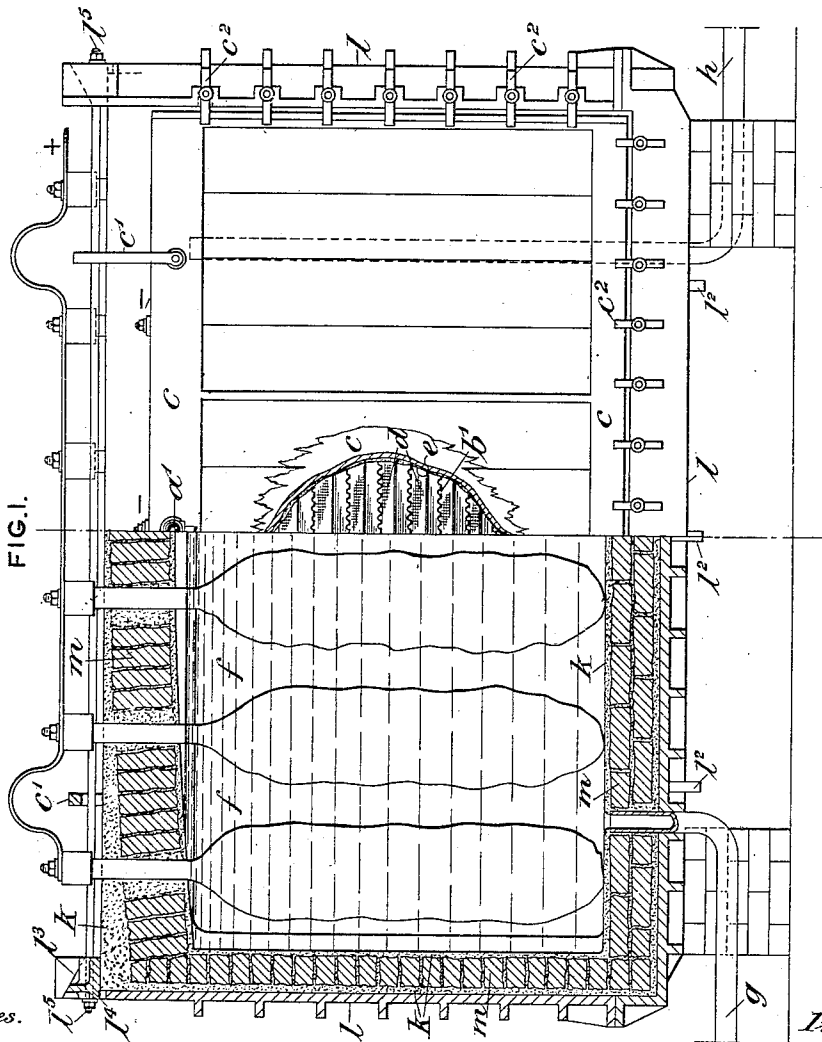
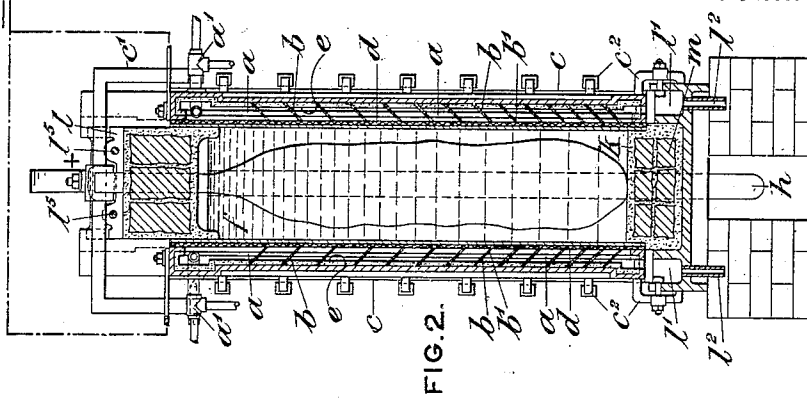
Patented Aug. 7, 1900.

J. HARGREAVES.  
ELECTROLYTIC CELL.

(Application filed Jan. 31, 1899.)

(No Model.)

3 Sheets—Sheet 1.



Witnesses.  
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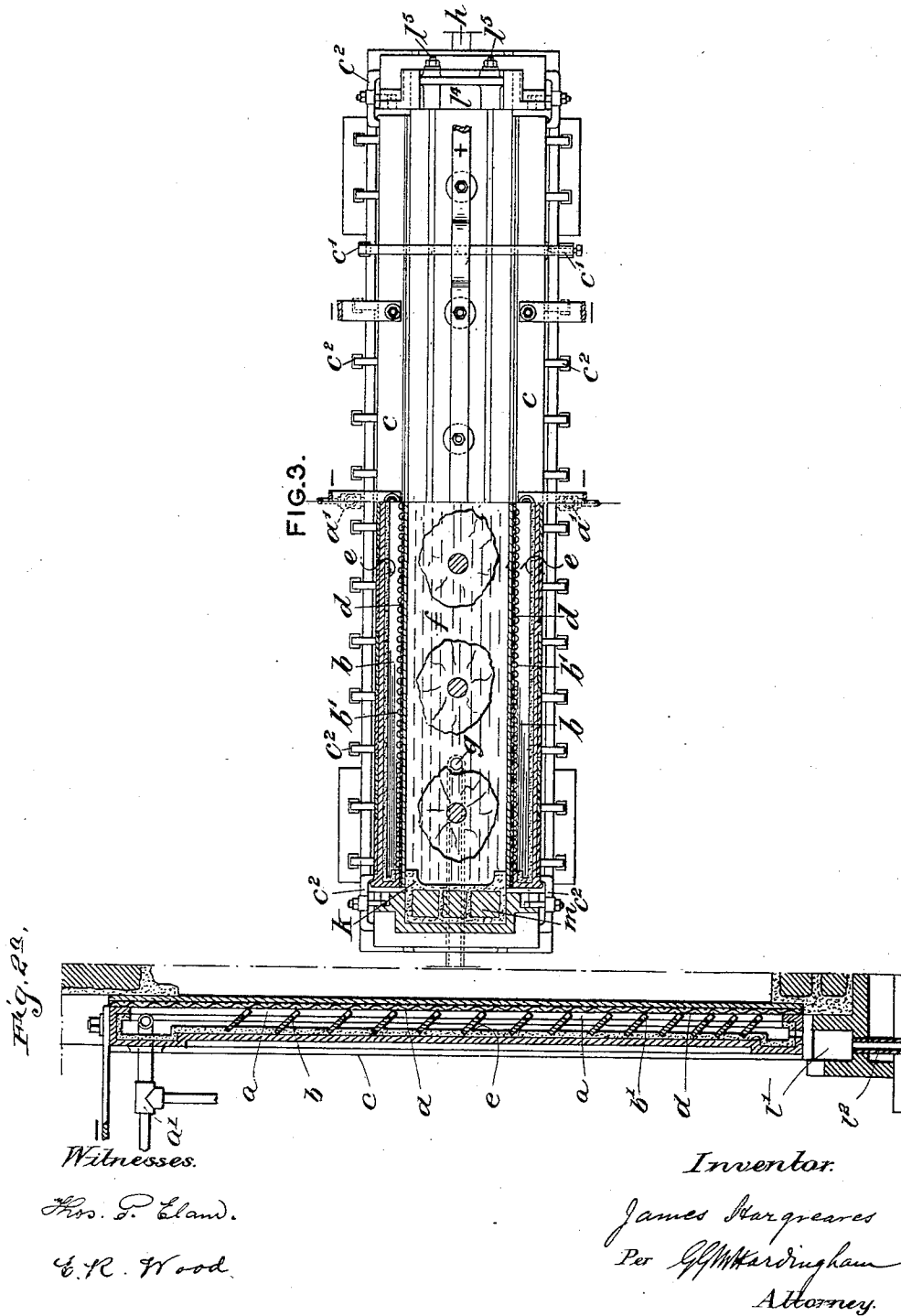
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3 Sheets—Sheet 2.





# UNITED STATES PATENT OFFICE.

JAMES HARGREAVES, OF WIDNES, ENGLAND.

## ELECTROLYTIC CELL.

SPECIFICATION forming part of Letters Patent No. 655,343, dated August 7, 1900.

Application filed January 31, 1899. Serial No. 704,057. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES HARGREAVES, a subject of the Queen of Great Britain and Ireland, residing at Farnworth-in-Widnes, in the county of Lancaster, England, have invented new and useful Improved Means Applicable for Use in the Manufacture of Alkalies by Electrolysis, (in respect whereof I have applied for a patent in Great Britain, to bear date July 14, 1898, No. 15,502,) of which the following is a specification.

This invention relates to the manufacture of alkalies by electrolysis; and it consists in an improved electrolytic cell whereby the efficiency of the process is increased, while economy in working and other advantages are secured.

In the accompanying drawings, Figure 1 is a partial longitudinal section and side elevation of an electrolytic cell embodying my improvements. Figs. 2, 2<sup>a</sup>, and 3 are respectively a transverse section, an enlarged transverse section of one side of the cell, and a plan. Figs. 4 and 5 are respectively a longitudinal section and a plan of the left-hand end of Figs. 1 and 3, illustrating a modification, Figs. 6 and 7 being similar views illustrating a further modification.

According to the method of working illustrated in Figs. 1, 2, and 3 the electrolyte or brine solution is circulated through the cell, the weakened solution, in company with the chlorin, flowing away from the cell into a receptacle for separating the chlorin, the weakened solution being then strengthened by the addition of salt and recirculated through the cell. According to the methods illustrated in Figs. 4, 5, 6, and 7 dry or new solid salt is supplied to a saturating vessel situated within the anode-compartment of the cell.

In working with electrolytic cells of the type described in the specification to my Letters Patent, dated December 28, 1897, No. 596,157 and illustrated in the accompanying drawings I place in the cathode-chamber *a* a series of strips *b*, formed of copper or other suitable metal, the same extending from the cover-plate *c* to the surface of the cathode *d* and inclining downward. These strips or plates operate to direct the condensed vapor or other liquid formed in the cathode-chamber against the surface of the cathode and

more completely and rapidly to wash away the alkali as it is formed upon the said surface of the cathode and diaphragm. For holding the inclined strips in position upon the cover-plate I bed the former in cement *e*, the latter serving the further purpose of a non-conductor of heat and preventing loss of heat from the cells. The inclined strips *b* also serve to support the cathode *d* in close contact with the diaphragm. I form the lower edges *b'* of the inclined strips *b* with suitable serrations or openings, so as to permit the steam and gases to pass freely over the surface of the cathode. *a' a'* are injectors for supplying carbonic-acid gas and steam to the cathode-chambers *a a*.

In treating brine or salt solution the strengthened brine enters the anode-chamber *f* of the cell by way of the pipe *g*, the weakened or exhausted solution, together with the chlorin, passing away through the pipe *h* to a well or receptacle, wherein the gas and weakened brine are separated. Salt is added to the latter for strengthening the same, whereupon it is again conducted through the cell by way of the pipe *g* for retreatment by the electric current.

When treating dry or new salt in a solid or crystal state, I employ within the cell a saturating vessel or compartment *i*, constructed according to either of the alternative modes illustrated in Figs. 4 to 7, inclusive. In Figs. 4 and 5 this vessel is of tubular form and is preferably elliptical in transverse section, its sides being provided with perforations *i'*. These perforations are preferably disposed at an inclination, as shown in Fig. 4, with a view to preventing the escape previous to the saturation of the electrolyte of the salt into the anode-compartment of the cell. The saturating-compartment *i* is charged through the charging-aperture formed by the pipe *i<sup>2</sup>*, which is arranged to enter the upper end of the saturating-compartment below the surface of the electrolyte, and thereby prevent the escape through the charging-aperture of the chlorin generated in the cell. The upper extremity of the charging-aperture may, moreover, be luted or furnished with a water seal. According to the construction shown in Figs. 6 and 7 the saturating-compartment *i* is formed by placing transversely in the cell a number of

slats  $i^0$ , the same being disposed at an inclination, so as to form inclined transverse slits or openings  $i^{10}$ , and serve a similar purpose to the inclined perforations in the sides of the tube  $i$ . With a view to preventing the escape of chlorin the roof of the cell is formed with a depending flange  $i^{20}$ , which dips into the compartment  $i$  below the surface of the electrolyte.

The tube  $i$  and the slats  $i^0$  may be formed of earthenware, of slate, or of tiles. In using tiles, as shown in Figs. 6 and 7, the ends may be embedded in cement, as at  $i^3$ .

To purify the carbonic-acid gas from sulphurous acid and other impurities, I cause the gases (which may be the waste gases from gas-engines, coal fires, or limekilns) while in a heated state to be saturated with moisture and then cool the said gases, so as to effect the condensation of the moisture, the latter being removed by causing the gases to traverse suitable scrubbers.

To avoid the presence of chlorate or hypochlorite in the electrolyte and to prevent the complicated reactions, destruction of anodes, and loss of power caused by their presence, I analyze the solution and add thereto sufficient hydrochloric acid to decompose the said chlorate or hypochlorite, the chlorin being liberated from the hydrochloric acid without having any hydrochloric acid in excess. Where the presence of carbonic acid mixed with the evolved chlorin is not injurious, I add to the circulating electrolyte some organic substance—such, for example, as sugar, sawdust, or the like—for the purpose of deoxidizing the chlorate or hypochlorite.

In constructing the anode-cell instead of using stone or slate I employ Portland or other like cement  $k$ , and I provide an outside framing  $l$ , of iron or other metal, the cement being cast therein; or instead of cement alone I fill up a portion of the framing with bricks, stone, or other suitable material  $m$ . To prevent leakage, I saturate the filling material employed in the construction of the cell with paraffin-wax, pitch, tar, or other substance adapted to fill up the pores of or the interstices between the bricks or other filling material. The framing  $l$  is formed in three portions, the base and the end pieces. The base comprises a central space, forming a tray for the reception of the cement  $k$ , and a channel  $l'$  upon either side thereof for conducting away the product from the cathode-chamber  $a$ .  $l^2 l^3$  are pipes for draining the channels  $l'$ . The end pieces are secured by bolts to flanges formed on the base-plate. The upper extremities of the end pieces are

provided with inclined surfaces  $l^3 l^3$ , beneath which work the wedges  $l^4 l^4$ , situated one at each end of the cell. These wedges rest upon the upper surface of the end walls of the cell and are connected together by means of the tie-rods  $l^5 l^5$ . Upon tightening the nuts pertaining to the tie-rods  $l^5 l^5$  the wedges are drawn toward each other, with the effect that a downward pressure is exerted upon the end walls, while maintaining the stability of the roof, the form of the cell being hereby preserved. The cover-plates  $c c$  are held in position by means of "cramps"  $c' c^2$ . The cover-plates may be protected by wooden planks with a view to preventing loss of heat from the cathode-chambers.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. For use in the manufacture of alkalies by electrolysis, an electrolytic cell having an anode disposed in a chamber adapted for the reception of the electrolyte, a diaphragm and wire-gauze cathode, a series of inwardly and downwardly inclined metal strips or plates arranged between the cathode and the dished outer or cover plate inclosing the cathode, and forming a chamber for the cation; the said strips or plates extending from the said cover-plate to the surface of the cathode, substantially as and for the purposes herein described.

2. For use in the manufacture of alkalies by electrolysis, an electrolytic cell having an anode disposed in a chamber adapted for the reception of the electrolyte, a diaphragm and wire-gauze cathode, a series of inwardly and downwardly inclined metal strips or plates and a dished outer or cover plate inclosing a cathode and forming a chamber for the cation; the said strips or plates being arranged in the cathode-chamber so as to extend from the cover-plate to the surface of the cathode and being held in position by bedding them in a layer of cement formed against the inner side of the said cover-plate, substantially as and for the purposes specified.

3. For use in the manufacture of alkalies by electrolysis, an electrolytic cell having a series of inwardly and downwardly inclined metal strips or plates formed with serrations or openings on their lower edges, arranged in the cation-chamber and extending from the outer or cover plate of the cell to the surface of the cathode, substantially as and for the purposes specified.

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Witnesses:

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