(No Model.)

E. A. LE SUEUR.

ELECTROLYTIC CELL.

No. 518,040. Patented Apr. 10, 1894.

FIG. 3.

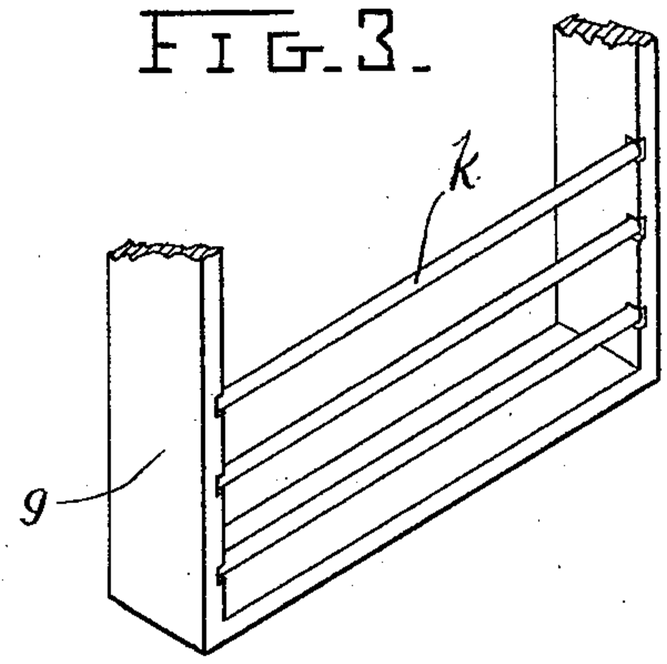


FIG. 2.

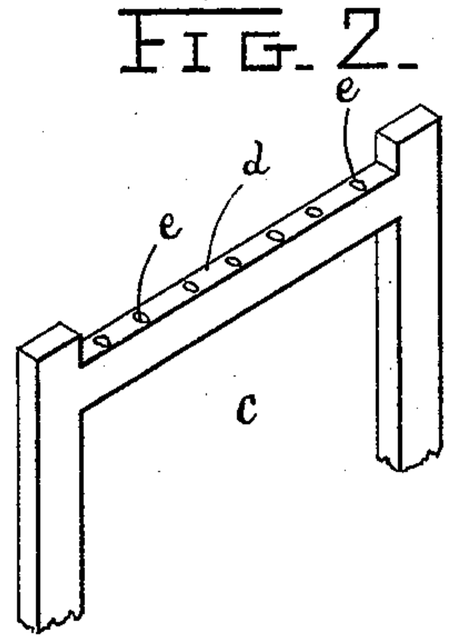
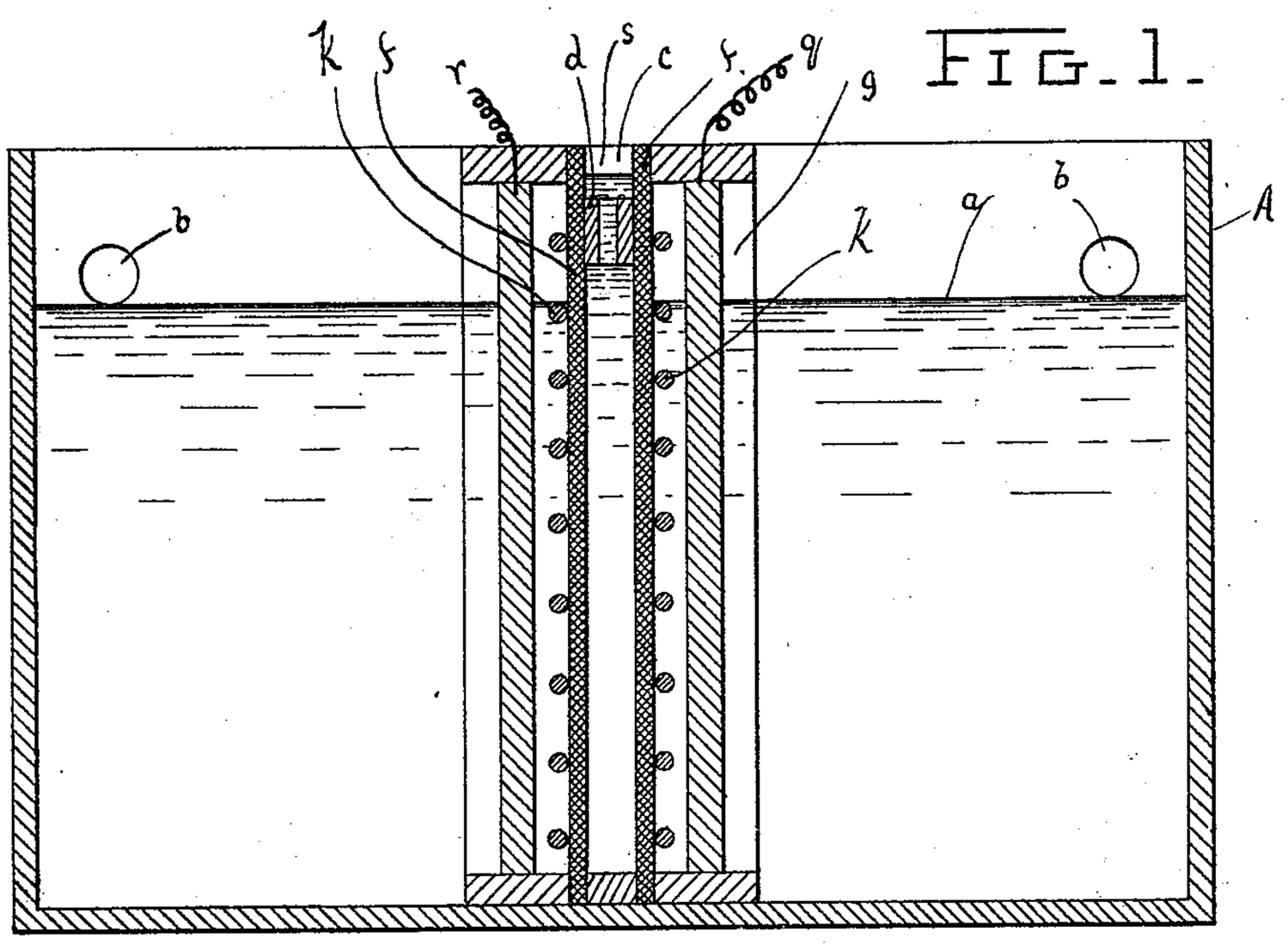


FIG. 1.



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UNITED STATES PATENT OFFICE.

ERNEST ARTHUR LE SUEUR, OF OTTAWA, CANADA.

ELECTROLYTIC CELL.

SPECIFICATION forming part of Letters Patent No. 518,040, dated April 10, 1894.

Application filed August 22, 1893. Serial No. 483,731. (No model.)

To all whom it may concern:

Be it known that I, ERNEST ARTHUR LE SUEUR, a subject of the Queen of Great Britain, residing at Ottawa, in the county of Carleton and Province of Ontario, Canada, have invented certain new and useful Improvements in Electrolytic Cells, of which the following is a specification, reference being had therein to the accompanying drawings.

In an electrolytic apparatus such as is used for the decomposition of common salt, and similar substances, a diaphragm is employed, the office of which is to keep the products of decomposition in their respective portions of the cell. If some such device were not employed, the apparatus would be impracticable for various reasons, apparent to those skilled in the art. Great difficulty has been experienced in obtaining suitable diaphragms for such cells, because a diaphragm impervious to the passage of the liquids and which will operate to keep them wholly separate is apt to interpose a high resistance to the passage of the current. The thing desired is some means of perfectly separating the contents of the cell while presenting a very low resistance to the passage of the electric current. Vegetable parchment, while affording a good diaphragm, lacks durability in a cell in which a corrosive substance like chlorine is evolved. Asbestus will resist the action of the chlorine, but, if used in a form thin enough to present a low resistance, will permit the liquid to pass through too freely, while if it is used in a thick form or sheet which will prevent the passage of the liquid, it presents too great resistance to the passage of the electric current.

My present invention has for its object to provide means by which these objections will be obviated, and by which the diffusion of the liquid contents of the cell may be prevented, while the resistance to the passage of the electric current is maintained at a minimum.

My device is simple and will be readily understood from the following description in which reference is made to the accompanying drawings.

The novel features of my invention are pointed out in the claims appended hereto.

In said drawings, Figure 1 is a vertical section of a cell or containing vessel showing my device. Fig. 2 is a perspective of the upper portion of the supporting frame hereinafter referred to. Fig. 3 is a perspective of a portion of one of the side frames in which an electrode is supported.

The outer containing vessel or cell is shown at A and may be of any well known shape or construction. The brine, or solution which is to be decomposed, is contained within the vessel A, the level of the liquid therein being indicated at *a*. An overflow is shown at *b*, which serves to prevent the liquid in the positive electrode compartment from rising above the level indicated. A similar overflow is provided in the negative electrode compartment. A frame, which may be termed the central frame, is shown at *c*, and may be constructed of lead or similar suitable material. This frame is made to fit the interior of the cell or vessel A closely. The cross-piece *d* at the top of the frame *c* is joined to the upright portions thereof somewhat below the top of the latter, as shown in Figs. 1 and 2, so that the uprights may project above the cross piece. The cross piece is provided with a series of vertical holes *e*. The sides of the frame *c* are made true so that a layer of material may be accurately and securely clamped on each of such sides, said layer being secured between the sides of said central frame *c*, and the adjacent side frame *g*, which latter is likewise made true so that the layer or septum may be evenly and tightly clamped. On each side of the central frame *c*, I place and securely clamp in the manner indicated, a pervious layer or sheet *f* of material preferably composed of asbestus. These layers should be thin enough to offer a low resistance to the passage of the electric current, and are secured in place by being firmly clamped between the central frame *c* and side frames *g*. A series of rods *k* is placed in each of the side frames, preferably crosswise thereof, and adjacent the sheets *f*. These rods may be secured in place by being laid in slots or recesses provided in the frames *g*, as shown in Fig. 3, and serve to prevent the asbestus layers from bulging toward the electrodes. The positive wire for the electric current is indicated at *q*, and the negative wire at *r*. It is unnecessary to do more than indicate these connections as the details are well known to

those skilled in the art. The amount of space between the layers or septa *f* of asbestus will be governed by the thickness of the frame *c*, and this may obviously be varied as desired. This space between the layers *f* contains brine which is supplied as desired to the space *s* directly above the cross-piece *d* of the central frame *c*. This brine thus supplied passes down through the holes *e* into the space below the cross piece, between the layers or sheets *f*. The level of the liquid in this intermediate space is maintained at a higher point than the level *a* of the liquid outside the space in the compartments of the cell. This causes a relatively greater pressure in the space between the sheets *f* and an outward flow or movement through the sheets *f* into the adjacent compartments of the cell and thus operates to prevent the contents of the compartments of the cell from mingling. The brine or liquid between the layers of asbestus *f* forms, as it were, a wall of liquid intermediate the compartments of the cell, and by reason of the pervious sheets of asbestus and the greater pressure produced by keeping the liquid at a higher level, causes a movement of the liquid from the intermediate space in both directions into the adjacent compartments of the cell, thus maintaining the liquid partition or wall between the layers *f* in a pure state and free from any admixture of the liquid in either compartment and thus preventing the contents of the compartments from mingling. The said greater pressure may be secured also by using between the sheets a liquid of higher specific gravity than is in the compartments of the cell. The wall of liquid aforesaid may be said to form the diaphragm. The asbestus layers are not subject to corrosion, and are therefore durable, and, being pervious, offer very slight resistance to the electric current. As these layers or sheets *f* are comparatively thin, it is desirable that they be supported at more or less frequent intervals across their surface, as is provided for by the rods *k*. The flow of fresh brine for the compartments of the cell may be introduced in the manner indicated through the space intermediate the sheets *f*, and the level of the liquid in each of the compartments may be regulated by means of the overflows in the vessel A.

In certain forms of cell, and, notably in those in which is effected the decomposition of solution of common salt, it is not objectionable for the solution in the positive electrode compartment to penetrate in small quantities to the negative electrode compartment. Therefore, the liquid partition or wall may be used with a liquid pressure therein greater than only that in the negative compartment, because in this case, passage will not occur from the negative compartment through the diaphragm and passage of liquid from the positive compartment to the negative compartment is not a serious objection, as passage in the other direction is.

What I claim is--

1. The method of separating from each other the fluid contents of the compartments of an electrolytic cell, which consists in first producing a separating wall or layer of fluid, then occasioning liquid pressure upon said fluid, and keeping the same under such pressure and thereby maintaining in the said fluid lateral pressure with tendency to lateral flow, substantially as and for the purposes set forth.

2. The method of separating from each other the fluid contents of the compartments of an electrolytic cell, which consists in first producing a separating wall or layer of fluid, then occasioning liquid pressure upon said separating wall or layer higher than exists in the negative electrode compartment, and keeping the same under such pressure and thereby maintaining in the said fluid lateral pressure with tendency to lateral flow, substantially as and for the purposes set forth.

3. An electrolytic cell having the compartments thereof separated by two or more pervious layers having between them a space forming a chamber containing liquid under greater relative pressure than the liquid in the adjacent compartments of the cell, whereby the movement of the liquid in the cell due to the said greater pressure will be from said chamber and through the pervious sheets or layers, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

ERNEST ARTHUR LE SUEUR.

Witnesses:

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A. H. FITZSIMMONS.