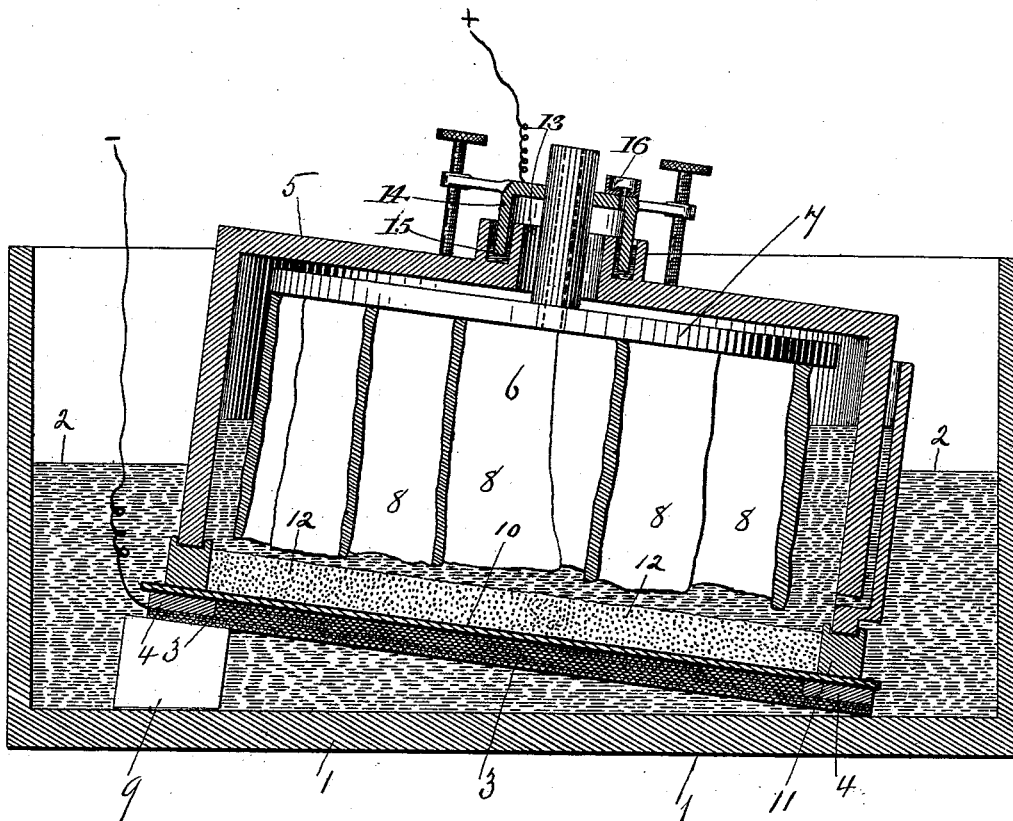


(No Model.)

C. N. WAITE.  
DIAPHRAGM FOR ELECTROLYTIC CELLS.

No. 523,026.

Patented July 17, 1894.



Witnesses:

Arthur F. Randall,  
Robert Wallace.

Inventor:

Charles N. Waite  
by Macleod Calver & Randall  
his Attorneys.

# UNITED STATES PATENT OFFICE.

CHARLES N. WAITE, OF RUMFORD, MAINE.

## DIAPHRAGM FOR ELECTROLYTIC CELLS.

SPECIFICATION forming part of Letters Patent No. 523,026, dated July 17, 1894.

Application filed August 12, 1893. Serial No. 483,006. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES N. WAITE, a citizen of the United States, residing at Rumford, in the county of Oxford and State of Maine, have invented certain new and useful Improvements in Diaphragms for Electrolytic Cells, of which the following is a specification, reference being had therein to the accompanying drawing.

The diaphragms which heretofore have been employed in electrolytic cells, more particularly those which have been employed in cells used for the decomposition of the alkaline chlorides in the manufacture of chlorine, quickly become injured or destroyed by the action of the products of decomposition. In the case of the said production of chlorine by electrolysis, the chlorine gas which is liberated as a result of the treatment of the chlorides aforesaid is highly corrosive, as is well known, and its injurious action upon an ordinary diaphragm soon becomes apparent. In practice frequent replacing of the diaphragms is thus rendered necessary. Serious explosions have resulted in cases where the injury to the diaphragm has escaped notice, and gas generated at the negative electrode has been permitted to leak through the diaphragm without the fact being observed or without the place of the leakage being discovered.

The object of my invention is to provide for use in electrolytic cells, and more particularly in those which are employed in the production of chlorine or other gaseous substances, a diaphragm possessing the requisite practical efficiency, and of inexpensive character, which shall be practically indestructible in use.

I shall proceed to describe my invention with reference to the accompanying drawing, and afterward shall particularly point out and clearly define the same in the claims at the end of this specification.

The drawing shows in vertical section an electrolytic cell having my invention applied thereto.

The cell itself, as shown in the drawing is of the general character which is fully explained in the United States patents to E. A. Le Sueur, No. 450,103, granted April 7, 1891,

and No. 468,880, granted February 16, 1892, to which reference may be had.

The present invention, it is to be understood, is not confined to use in a cell of the exact character shown in the drawing and in the said patents, and may be applied in connection with other forms of cells, although it is best adapted for use in connection with cells of the type wherein the positive electrode is above the negative electrode as in the drawing and said patents.

At 1 in the drawing is the outer vessel or tank of a cell, containing the liquid 2 in which the negative electrode 3 is immersed. The form of negative electrode shown is one consisting of a number of sheets of wire cloth laid together with a ring 4 preferably of metal applied to the upper surface thereof.

At 5 is shown the bell within which the positive electrode 6 is placed and by which the said positive electrode is supported. The form of positive electrode shown consists of a metal backing 7 in which are fixed a number of blocks of carbon 8, 8. The said positive electrode is partially immersed in the liquid which is within the bell, the said liquid being of somewhat higher level than the liquid which is outside the bell, as shown.

At 9 is shown a block which is placed underneath one side of the negative electrode for the purpose of holding the same and the bell 5, which latter is applied above the negative electrode in manner as shown and as presently will be described, in an inclined or tilted position which facilitates the escape of the gas which is formed at the negative electrode.

At 10 is shown an asbestos film, sheet or fabric which lies upon the upper surface of the negative electrode 3. At 11 is shown a ring of earthenware or other suitable material which is placed upon the upper side of the said film, sheet or fabric, and at 12 is shown comminuted matter consisting of fine sand, broken stone or other similar material, fine salt or the like. The ring 11 is in practice preferably from one to two inches in height and serves chiefly to retain the comminuted material in place. The lower edge of the rim of the bell bears upon the upper surface of the ring, and the proximate surfaces

of the rim and retaining ring are fitted together so as to produce a tight joint. The sand or other comminuted matter which is placed within the ring enters and more or less completely fills the interstices of the asbestos film, sheet or fabric and also holds it down in place upon the negative electrode so that it cannot be floated up or displaced by the gas generated at the said negative electrode. This backing or layer of comminuted material combined with the asbestos layer operates to prevent the passage of hydrogen gas into the anode compartment and this is of the greatest importance since hydrogen mingling with the chlorine and passing into the receiving chambers is liable to produce an explosion and is highly dangerous. If the level of the brine be kept higher within the bell than it is in the tank or containing vessel outside the bell as shown in the drawing, or if by other means a greater pressure is maintained inside the bell than exists outside the same, all caustic products of the electrolysis are prevented from washing up into the positive electrode compartment, and a higher degree of efficiency is obtained.

A diaphragm such as herein shown and described is cheap. It possesses comparative indestructibility inasmuch as it is not attacked by chlorine or alkali.

Inasmuch as the chlorine gas sought to be produced forms around the positive electrode, it is necessary that the electrolytic cell should be constructed as shown to contain a supply of liquid on the positive electrode side of the diaphragm as well as on the negative electrode side thereof. Also, inasmuch as such gas is freed in considerable quantity and continuously, it is necessary to adopt a construction of cell in which, as in the drawing, space exists around the positive electrode and adjacent to the diaphragm for the free discharge of the liberated gas. The gas makes its exit from the bell 5 through the aperture 13 in the upper portion thereof, passing into the inverted cup 14 which dips into the sealing liquid contained in the groove 15, the said cup having a passage 16 in its top for the discharge of the gas into a suitable conducting pipe applied thereto.

What I claim is—

1. The combination with the positive and negative electrodes of an electrolytic cell, of a diaphragm having a film, sheet or fabric of

indestructible material placed against the negative electrode and an adjacent layer of sand or similar comminuted material resting against said film, sheet or fabric and holding it pressed against the said electrode, substantially as described.

2. The combination with the positive and negative electrodes of an electrolytic cell, of a diaphragm having a film, sheet or fabric of asbestos, and a layer of sand, or similar comminuted material overlying said film, sheet or fabric and supported thereby, substantially as described.

3. The combination with the positive and negative electrodes of an electrolytic cell, of a diaphragm having a film, sheet or fabric of asbestos, and an overlying layer of sand or similar comminuted material bearing said film, sheet or fabric against the negative electrode, substantially as described.

4. The combination with the positive and negative electrodes of an electrolytic cell, of a diaphragm having a film, sheet or fabric of indestructible material, a layer of sand or similar comminuted material applied thereto, and a retainer for the said comminuted material, holding it in place on the surface of said film, sheet or fabric, substantially as described.

5. The combination with the positive and negative electrodes of an electrolytic cell, located one above the other, of a film, sheet or fabric of indestructible material overlying the negative electrode and a layer of sand or similar comminuted material resting upon such film, sheet or fabric, substantially as described.

6. An electrolytic cell for use in the production of chlorine, &c., constructed to contain a supply of liquid on each side of the diaphragm thereof, and with free discharge about the positive electrode for the liberated gas, and provided with a diaphragm consisting of a layer of sand or comminuted matter and a film, sheet or fabric of indestructible material which constitutes a support for the said layer.

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

CHARLES N. WAITE.

Witnesses:

WM. A. MACLEOD,  
ROBT. WALLACE.