No. 745,412. PATENTED DEC. 1, 1903.

H. BLACKMAN.

ELECTRODE.

APPLICATION FILED DEC. 8, 1896.

NO MODEL.

FIG. 2.

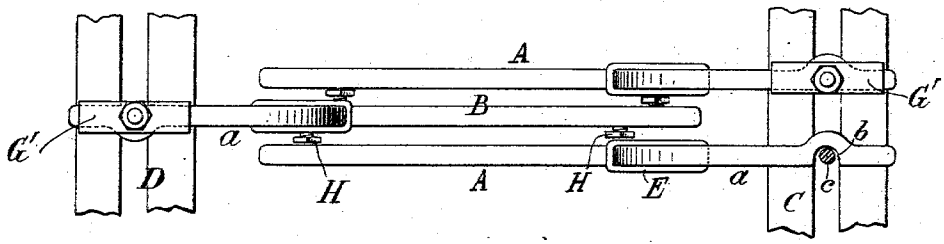


FIG. 1.

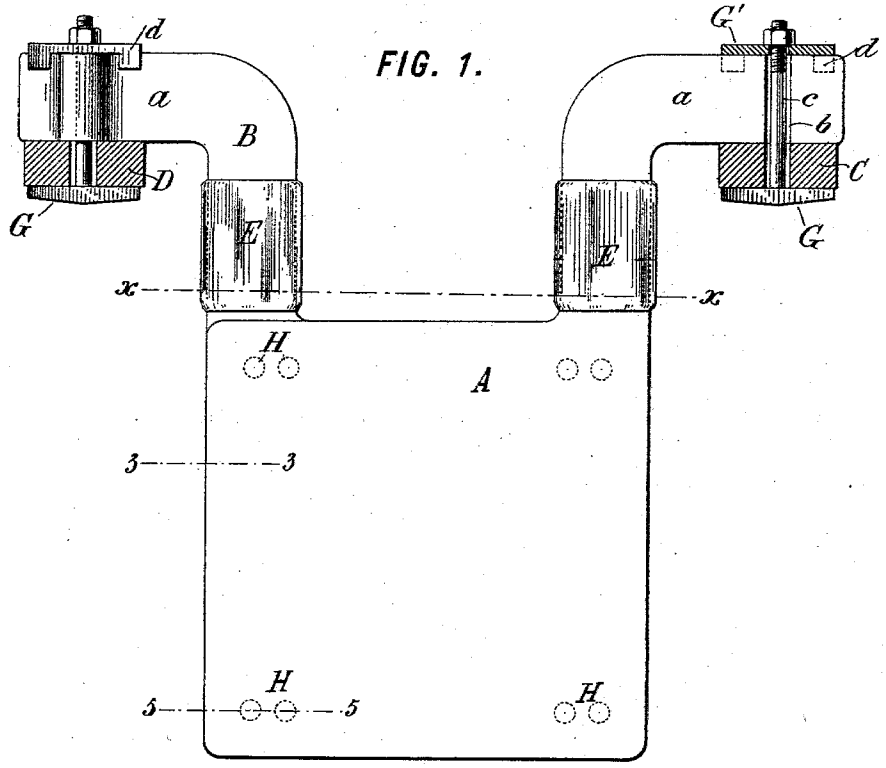


FIG. 3.

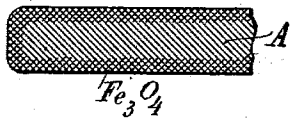


FIG. 4.

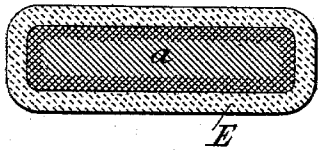
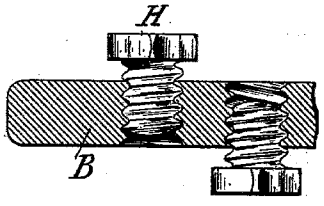


FIG. 5.



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No. 745,412. Patented December 1, 1903.

UNITED STATES PATENT OFFICE.

HENRY BLACKMAN, OF NEW YORK, N. Y.

ELECTRODE.

SPECIFICATION forming part of Letters Patent No. 745,412, dated December 1, 1903.

Application filed December 8, 1896. Serial No. 614,894. (No model.)

To all whom it may concern:

Be it known that I, HENRY BLACKMAN, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Electrodes, of which the following is a specification.

This invention relates to electrodes for electrolytic decompositions, of which the electrolysis of sodium chlorid is a type.

My invention relates to the means for mechanically and electrically connecting the electrodes and for keeping them properly spaced apart within the electrolyte.

Figure 1 of the accompanying drawings is an elevation of my improved electrodes and their connections, the bus-bars being in section. Fig. 2 is a plan showing three of the electrodes and their connections. Fig. 3 is a section of the anode on the line 3 3 in Fig. 1. Fig. 4 is a section on the line x x in Fig. 1. Fig. 5 is a section of an electrode on the line 5 5 in Fig. 1.

Referring to Figs. 1 and 2, let A designate the anode, and B the cathode, the line $x x$ indicating the level of the electrolyte. The cathodes are of extended surface beneath the level of the electrolyte and are extended above said level in any suitable shape for making electrical connection with positive and negative conductors or bus bars C and D. I prefer to form them with arms or elbows extending first upwardly and then outwardly, as shown, the outer ends of these arms being clamped to the bus-bars by means of any suitable screw-clamp. The shape of the electrodes, however, is not essential to my invention.

The anode-plate A illustrated is first formed by casting or forging and is then treated for the proper oxidation of its surface or of that portion of its surface which is exposed below the level $x x$. This treatment consists, essentially, in exposing it to oxidizing agents under such conditions as to convert the exterior portion of the iron into magnetic iron oxid, either Fe_3O_4 or other composition of magnetic or electroconductive oxid. The treatment must be continued until the oxid is formed of sufficient thickness and density to be impermeable to the chlorin or other oxidizing agents liberated at the anode during electrolysis in order that the layer of oxid may protect the underlying iron from corrosion. Not even the minutest pin-hole must be left unprotected.

The cathodes B B may be of iron, zinc, or other suitable metal. Preferably they are of the same shape as the anodes and are alternated therewith, their connecting-arms being, however, extended in the contrary direction in order that the positive conductors or bus-bars may extend along one side of the electrolytic tank and the negative bars along the other side thereof.

The particular mode of connecting the electrodes with the bus-bars which I have devised is advantageous in that it insures a firm mechanical connection combined with thorough electrical conductivity and the ability to readily remove any one electrode without disturbing its neighbors. The bus-bars are double, consisting of two bars arranged side by side, with a space between them, as shown, (or, if preferred, a single bar may have perforations spaced apart the same distance as the electrodes.) The end arm of the electrode rests upon the bus-bars and is held down upon them by a clamp G of special construction. The arm a of each electrode has a half-round upright groove b formed in it, which receives the bolt c of the clamp. The head G′ of the clamp is extended to lie along the top of the arm and has lugs d d projecting downwardly from it, which overhang the arm on the side opposite to that in which is formed the groove b. A nut screws on the threaded end of the bolt c of the clamp for drawing the latter together. By reason of the construction of the clamp, the bolt c being on one side of the arm and the lugs d on the other, the clamp is held in place with relation to the arm and its head is prevented from slipping off, thereby greatly facilitating the operations of applying or removing the clamp. The axis of the bolt is brought as near as possible in line with the longitudinal middle of the electrode-plate and of the arm a, so that the clamp bears equally upon the arm. The current is conducted in part directly between the arm and bus-bars where their surfaces come in contact and partly indirectly through the clamp, the bolt of which is of ample cross-section for carrying the en-

tire number of amperes flowing to or from the electrode.

For insuring that the positive and negative electrodes shall be kept properly spaced apart I provide insulating stops or buttons projecting from one electrode and preventing too close approach of the next. These stops or buttons H H are applied, preferably, to the cathode and are made adjustable, the preferred construction being shown in Fig. 5. The cathode has two holes bored through it, which are threaded with a coarse screw-thread, and the stops H H, which are made, preferably, of glass or porcelain, are formed as short screws, having a coarse thread fitting that of the holes, their heads being squared or flattened to enable them to be engaged for screwing them in or out. These stops can be screwed in more or less, according to the distance apart at which it is desired that the electrodes shall stand. Preferably there are four pairs of the insulating-stops H, as shown in dotted lines in Fig. 1. By means of these insulating-stops I can insure that the electrodes shall be spaced a uniform distance apart, thereby equalizing the resistance through the intervening electrolyte throughout the entire battery of plates, so that each electrode shall receive the same proportion of current and a uniform electrolytic action is set up in all the interspaces.

For protecting the electrodes from corrosion near the surface of the electrolyte each is provided with a band or layer of glass or vitreous glaze, (denoted at E.) This band is formed around that portion of each electrode adjacent to the level $x\,x$ of the electrolyte and should be continued, preferably, somewhat above and below this level in order to fully protect the plate from corrosion. Fig. 4 shows the anode in cross-section with its iron interior and oxidized surface and the glass band C around it. This band of glass may be applied in any manner known to glass-workers—as, for example, by heating the anode to approximately the softening-point of glass and applying a strip of plastic or semimolten glass around it, or a glaze may be prepared in the form of a powder with a cementatious vehicle, by which it is united to the anode, after which the latter may be baked in order to vitrify and set the glaze, as is practiced in the glazing of earthenware.

I do not in this application claim the improved anode-plate and process of making it shown and described or the electrode protected, as explained, by insulating material at the surface of the electrolyte, these parts of the invention being claimed in my application Serial No. 154,163, filed April 24, 1903.

I claim as my invention—

1. The combination with an electrode-plate having threaded sockets, of adjustable insulating-stops H constructed as screws screwing into said sockets.

2. The combination of an electrode having a projecting arm a, of a clamp G for fastening it to the bus-bar, with its bolt c arranged to extend along one side of the arm, and with a head having projections passing to the other side of the arm.

3. The combination with an electrode having a projecting arm a formed with a groove b on one side, of a clamp G for connecting said arm to the bus-bar, having a bolt c lying in said groove, and a head G' having projections engaging the opposite side of the arm.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

HENRY BLACKMAN.

Witnesses:
FRED WHITE,
THOMAS F. WALLACE.