Nov. 11, 1924. 1,515,348

I. H. LEVIN

ELECTRODE

Filed Sept. 24, 1921

Fig. 1.

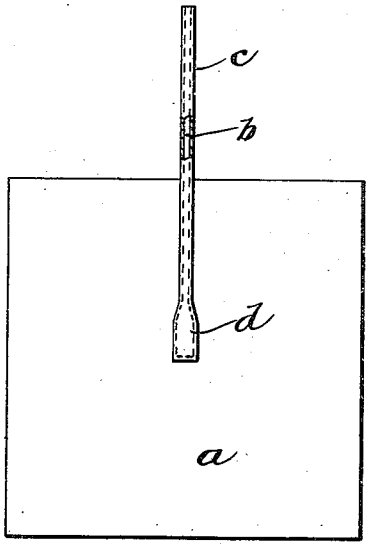


Fig. 2.

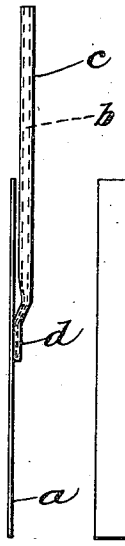


Fig. 4.

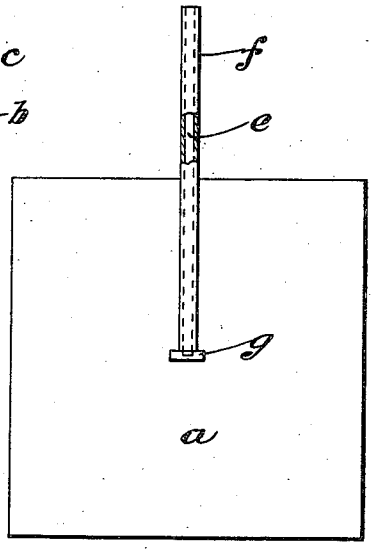


Fig. 5.

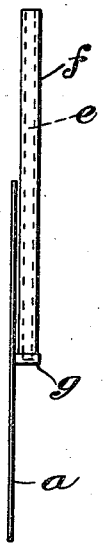


Fig. 3.

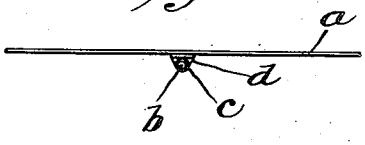


Fig. 6.

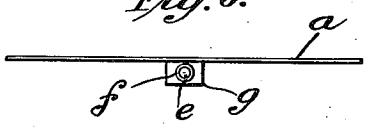


Fig. 7.

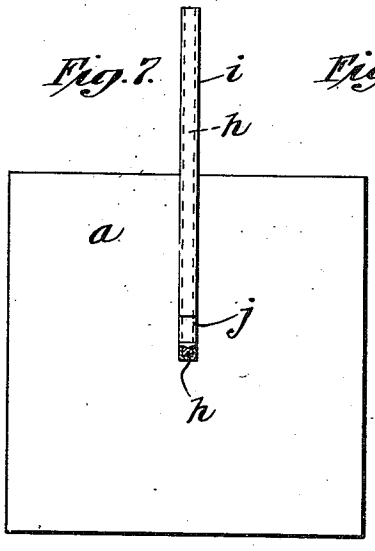


Fig. 8.

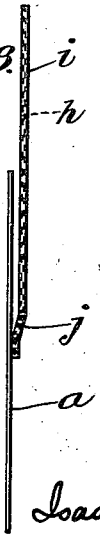
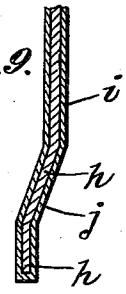


Fig. 9.



Isaac H. Levin Inventor

By his Attorney

Francis T. Wentworth

Patented Nov. 11, 1924. 1,515,348

UNITED STATES PATENT OFFICE.

ISAAC H. LEVIN, OF NEW YORK, N. Y.

ELECTRODE.

Application filed September 24, 1921. Serial No. 503,012.

To all whom it may concern:

Be it known that I, ISAAC H. LEVIN, a citizen of the United States, residing at the borough of Manhattan, 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, reference being had therein to the accompanying drawings, which form a part thereof.

My invention relates to electrodes, and more particularly to an anode for use in electrolytic cells for the generation of oxygen and hydrogen.

In the operation of electrolytic cells for the generation of oxygen and hydrogen there has always been a certain loss in the efficiency of the cell due to the resistance of the metal of the anode as well as to the resistance of the metal of the terminal bar. This loss has been due in part to the practical necessity for using thin electrode plates of ferrous material and for using terminal bars of similar material of insufficient cross-sectional area to secure a minimum voltage loss as a result of resistance inherent thereto.

While resistance of the electrode plate itself may be reduced and a more effective distribution of the current secured by connecting the terminal bar within the perimeter of the electrode, there has heretofore, to the best of my knowledge, been no effort made to avoid loss of efficiency due to excessive resistance in the terminal bar itself.

With the above conditions in mind, I have devised an electrode, the terminal bar of which is so constructed as to impart high conductivity to the bar in its entirety while avoiding electrodecomposition of the material of the bar, which factor has heretofore precluded the use of metal with high conductivity in the terminal bars.

In an electrode embodying my invention, the terminal bar is so formed as to be in its entirety an electrical conductor, different portions of which, however, have relatively different degrees of conductivity, although the major portion thereof has low resistance.

The terminal bar of the electrode embodying my invention may be readily connected electrically and mechanically with the electrode plate or plates so as to ensure effective electrical contact between the plate and the terminal.

The invention consists primarily in an electrode embodying therein an electrode plate having large surface capacity and a terminal bar mechanically and electrically connected therewith having an electroconductive core of low resistance and an electroconductive protecting sheathing about the core; and in such other novel features of construction and combination of parts as are hereinafter set forth and described, and more particularly pointed out in the claims hereto appended.

Referring to the drawings,

Fig. 1 is a rear elevation of an electrode showing one embodiment of my invention;

Fig. 2 is a side elevation thereof;

Fig. 3 is a plan view thereof;

Fig. 4 is a rear elevation of an electrode showing another embodiment of the invention;

Fig. 5 is a side elevation thereof;

Fig. 6 is a plan view thereof;

Fig. 7 is a rear elevation of still another embodiment of the invention;

Fig. 8 is a side view thereof; and

Fig. 9 is an enlarged cross-sectional view of the portion of the terminal bar adjacent the point of attachment to the electrode plate.

Like letters refer to like parts throughout the several views.

In the several embodiments of my invention shown in the drawings, *a* indicates an ordinary electrode plate for use as the anode of an electrolytic couple, and may be of the usual or any desired construction such as ordinary sheet iron, or steel, with or without a facing of cobalt, nickel, or other material for reducing the tension at the surface of the plate. Such plates ordinarily are of comparatively thin metal of from one-eighth to three-sixteenth of an inch, the thickness varying with the surface dimensions of the plate or according to the desired conductivity in the plate necessary to secure an effective distribution of the current throughout same with a minimum resistance in the plate commensurate with the desired rigidity thereof.

Mechanically and electrically secured to the plate in any desired manner is a terminal bar, the essential characteristics of which are a core of metal having high conductivity, such as copper, completely surrounded as to the portion thereof within the cell, and particularly that portion sub-

merged within the electrolyte, with a protecting sheathing which will not be decomposed by electrolytic action in the cell, and which will yet serve as a conductor so as to increase the capacity of the terminal and permit the current to flow through the sheathing to the electrode at the point of attachment therewith.

Referring to Figs. 1 to 3 of the drawings, the copper or other light core is shown at *b* and the protecting metal sheathing of iron or steel at *c*, this ferrous sheathing extending entirely about the metal of the core and across the end thereof adjacent the point of attachment with the electrolyte.

The terminal *b*—*c* is bent to form as shown in Fig. 2, the upper portion of the terminal bar and its sheathing being round in cross-section, and the end thereof flattened or splayed as shown at *d* to increase the area of the electrical and mechanical connection between it and the plate. The portion *d* is the only portion of the electrode which is in mechanical connection with the plate and the point of connection preferably is well within the edges of the plate so as to permit an effective distribution of the current throughout the plate and limit the resistance of the plate to the distance between the point of attachment of the electrode therethrough and the edges of the plate.

Referring to Figs. 2 to 6 of the drawings, the high conductivity core is shown at *e*, and the protecting sheathing at *f*, the terminal bar being connected with the plate through the medium of the steel or iron block *g* welded or otherwise electrically and mechanically connected with the plate. The lower end of the terminal bar is screw-threaded and welded, or otherwise secured to said block *g* in a manner to exclude the electrolyte from the core *e* at the point of attachment to the block *g*. In this embodiment of the invention, the core *e* and its sheathing *f* are round and of uniform diameter throughout, and the block *g* is positioned within the edges of the plate *a*.

Referring to Figs. 7 to 9 of the drawings, the copper or low resistance core is shown at *h* and the iron or steel protecting sheathing at *i*.

This core and sheathing are substantially flat and of substantially uniform width and thickness throughout, the lower end thereof being offset by the bend *j* so as to form a contact area between the electrode plate and the terminal of limited area adjacent the point of mechanical connection between the electrode and the plate. In this form of the invention, the sheathing *i* extends completely about the core *h* and across the bottom thereof, the point of connection with the electrode being well within the edges of the plate.

While in the accompanying drawings, I have shown three embodiments of the invention, as to different conformations of the cross-sectional area of the sheathed terminal core, and different manners of mechanically and electrically connecting same with the electrode plate, it is apparent that the scope of the invention is such as to include various modifications as to the cross-sectional area and general configuration of the terminal bar, and various means for securing the desired mechanical and electrical connection thereof with the plate.

Preferably the sheathing for the electrode is of iron or steel in order to make it practically immune to electrolytic action as to those portions thereof submerged in the electrolyte, while affording an electrical path for the current supplementing the high conductivity core. At the same time this material will lend itself to being readily welded to the plate itself, or to the block *g*, and will increase the tensile strength of the terminal in its entirety.

The protecting sheathing may be applied to the core by any desired or approved methods, such being immaterial to the invention.

It is immaterial whether or not there be a continuous surface contact between the core and its sheathing, although such intimate contact is desirable at the points of connection of the terminal with the bus bars and with the electrode plate.

From the foregoing description, it is apparent that, by proportioning the cross-sectional area of the high conductivity core with relation to the capacity of the electrode plate, voltage loss in the terminal bar may be decreased in proportion to the increased conductivity of the core *a*, *e* or *h*, as compared with the conductivity of terminal bars of iron or steel, such as are commonly used. At the same time, if desired the sheathing may be utilized as a conductor throughout substantially the entire length thereof as well as at the point of connection of the bar with the plate.

Experience has demonstrated that in electrolytic cells for the generation of oxygen and hydrogen there is little or no depreciation in the anode due to its decomposition as a result of electrolytic action within the cell, so that by using a metal sheathing as described, for a core of high conductivity which itself is subject to such decomposition, I secure all the advantages of a terminal bar having high conductivity, or low resistance, and avoid that decomposition thereof which would occur were such sheathing not employed, since this sheathing is immune to the action of the electrolyte in the presence of the current and may be attached to the plate by a liquid-tight joint without likelihood of exposure of any portion of the core.

It will be observed that in each form of the invention shown, the area of electrical

contact of the terminal bar with the plate *a* is relatively greater than the cross-sectional area of the terminal bar.

While I have described my invention as being applied to the anode of an electrolytic cell, it is apparent that a similar construction may be applied to the cathode, although the terminal bar is not subjected to the decomposition to which the terminal bar of the anode is subjected.

If desired, as heretofore practiced by myself, with cells employing plates having very large surface area, a plurality of terminal bars, as herein described, may be connected with each plate and this connection may be at two or more points between the plate and the terminal bar.

It is not my intention to limit the invention to the precise details of construction shown in the drawings, it being apparent that such may be varied without departing from the spirit and scope of the invention.

Having described the invention, what I claim as new and desire to have protected by Letters Patent, is:—

1. An electrode embodying therein an electrode plate having large surface capacity and a terminal bar mechanically and electrically connected therewith having an electroconductive core of low resistance and an electroconductive protecting sheathing about the core.

2. An electrode embodying therein an electrode plate having large surface capacity and a terminal bar mechanically and electrically connected therewith having a copper core and a ferrous sheathing about same.

3. An electrode embodying therein an electrode plate having large surface capacity and a terminal bar mechanically and electrically connected therewith having an electroconductive core of low resistance and an electroconductive protecting sheathing about the core, the portion of said bar in electrical connection with the plate having relatively greater contact area than the cross-sectional area of the bar.

4. An electrode embodying therein an electrode plate having large surface capacity and a terminal bar mechanically and electrically connected therewith having a copper core and a ferrous sheathing about same, the portion of said bar in electrical connection with the plate having relatively greater contact area than the cross-sectional area of the bar.

5. An electrode embodying therein an electrode plate having large surface capacity and a terminal bar mechanically and electrically connected therewith at a point within the perimeter of the plate, having an electroconductive core of low resistance and an electroconductive protecting sheathing about the core.

6. An electrode embodying therein an electrode plate having large surface capacity and a terminal bar mechanically and electrically connected therewith at a point within the perimeter of the plate, having a copper core and a ferrous sheathing about same.

7. An electrode embodying therein an electrode plate and a terminal bar including a block mechanically and electrically connected with said plate and an extension having an electroconductive core of low resistance and an electroconductive protecting sheathing about the core.

In witness whereof I have hereunto affixed my signature in the presence of two subscribing witnesses this 19th day of September, 1921.

ISAAC H. LEVIN.

Witnesses:
C. A. KANFOLD,
LENA FRIEDMAN.