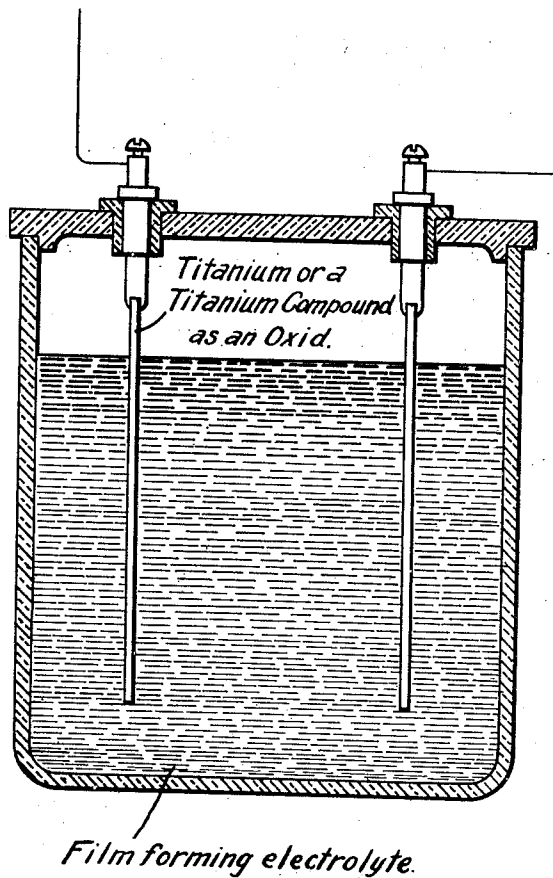


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ELECTROLYTIC CELL.
APPLICATION FILED FEB. 3, 1917.

1,344,752.

Patented June 29, 1920.



WITNESSES:

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ELECTROLYTIC CELL.

1,344,752.

Specification of Letters Patent. Patented June 29, 1920.

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To all whom it may concern:

Be it known that I, LEWIS W. CHUBB, a citizen of the United States, and a resident of Edgewood Park, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Electrolytic Cells, of which the following is a specification.

My invention relates to electrolytic cells, such as condensers, lightning arresters, rectifiers and the like, consisting of plates or other active members which are composed of film-forming material and are adapted for immersion in suitable film-forming electrolytes.

The object of my invention is to provide active conducting members for electrolytic cells of the above-indicated character which shall be composed wholly or in part of titanium or of compounds of titanium.

Electrolytic cells of the kind to which my invention relates depend, for their operation, upon the property possessed by certain substances of acquiring asymmetric conducting films when impressed with electric potential in the presence of a suitable film-forming electrolyte. The metal most commonly employed for this purpose is aluminum but the same property of forming asymmetric conducting films is possessed by other metals and also by certain non-metallic substances.

I have discovered that metallic titanium is well suited for use as the active material in electrolytic cells of the above-indicated character, because of its ability to form asymmetric conducting films and also because its superficial film possesses very high specific inductive capacitance and is thin enough to have a high capacitance per unit area.

The single figure of the accompanying drawing illustrates a conventional type of electrolytic cell that may be constructed in accordance with my invention. In view of the well known manner of constructing the various parts of an electrolytic cell, it is unnecessary to give a detailed description of such a construction and the electrolyte employed may be any suitable film-forming electrolyte, as indicated by the legend on the drawing. The electrodes may be formed of titanium or a titanium compound as an oxid, as indicated on the drawing and more fully described hereinafter.

Titanium has not, until recently, been prepared in pure metallic form, the materials which have heretofore been described as titanium being very impure and consisting largely of carbid and oxid. It is now possible, however, to produce substantially pure titanium by reduction of titaniferous ores, such as rutile or ilmenite from titanium compounds such as the tetrachlorid or from ferro-titanium, the metal being reduced either by means of alkali metals or by electrolysis. My present invention, so far as it relates to metallic titanium, is concerned with the pure or substantially pure metal, as distinguished from titanium containing large amounts of impurities.

Titanium plates for electrolytic condensers, lightning arresters and similar cells may be provided with conducting films by means of any usual or desired film-forming electrolyte and may be treated and operated in the same manner as ordinary aluminum plates. Such treatment may, for example, include pickling with acid and heat treatment in order to improve the characteristics of the metal.

Plates having desirable characteristics may also be made from certain compounds of titanium, such as titanium dioxid, in the form of natural rutile, or iron-titanium oxid in the form of ilmenite. Since it is difficult to obtain masses of these substances of the proper size and shape for use as the active members of electrolytic cells, the oxids may be applied in finely divided form to the surfaces of supporting plates or other materials such as aluminum.

I have found that the titanium film has a specific inductive capacitance many times greater than that of the aluminum film, being about 80, or nearly the specific inductive capacitance of pure water. Titanium plates may be operated at moderately high alternating-current voltages, the permissible voltage which the films will withstand being dependent, in a general way, upon the nature of the treatment which the plates have received. The great superiority of titanium with respect to capacitance per unit of surface is sufficient to render the titanium plates much better in service than aluminum plates.

It is to be understood that my present invention is not restricted to plates of any particular form or size or to any particular

kind of service, since plates of titanium and titanium oxids may be used in electrolytic cells under all circumstances where aluminum plates have heretofore been employed.

- 5 If desired, the entire plate need not be composed of titanium, but may consist of aluminum, iron or other conducting material provided with a surface coating of titanium, the plates, in such cases, operating substantially as if the entire plate consisted of titanium. In view of the wide variety of applications to which my invention is adapted, it is to be understood that no limitations are to be imposed thereon except such as are indicated in the appended claims.

I claim as my invention:

1. A film-forming conductor for electrolytic cells composed of metallic titanium.
2. A film-forming conductor for electrolytic cells adapted for immersion in an electrolyte and having its surface exposed to the electrolyte composed of metallic titanium.
3. An electrolytic cell comprising a plurality of conducting electrodes adapted to cooperate with an electrolyte and at least one of which is composed of metallic titanium.
4. An electrolytic cell comprising a plu-

30 rality of conducting electrodes adapted for immersion in an electrolyte and having surfaces exposed to the electrolyte that are composed of metallic titanium.

5. A film-forming conductor for electrolytic cells embodying titanium.

6. A film-forming conductor for electrolytic cells embodying titanium and provided with an asymmetric film.

7. A film-forming conductor for electrolytic cells adapted for immersion in an electrolyte and having a surface embodying titanium exposed to the electrolyte.

8. An electrolytic cell comprising a plurality of plates adapted for immersion in an electrolyte and embodying titanium.

9. An electrolytic cell comprising a plurality of conducting electrodes adapted for immersion in an electrolyte and having surfaces exposed to the electrolyte that are covered with an asymmetric film embodying titanium.

In testimony whereof, I have hereunto subscribed my name this 19th day of January, 1917.

LEWIS W. CHUBB.