Jan. 20, 1948. A. E. ZU ELTZ 2,434,731

PLATINUM SHEET ELECTRODE

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Fig. 1

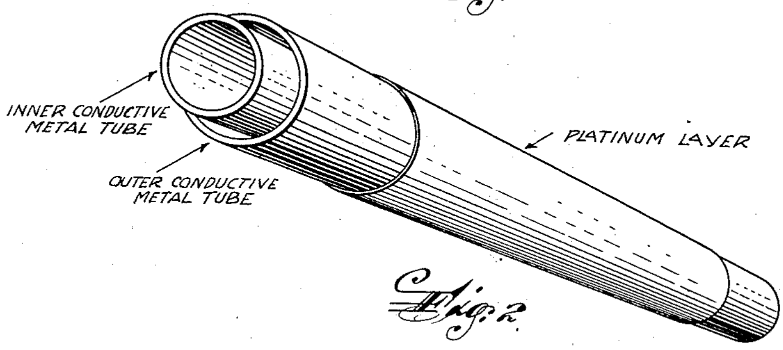


Fig. 2

Fig. 3

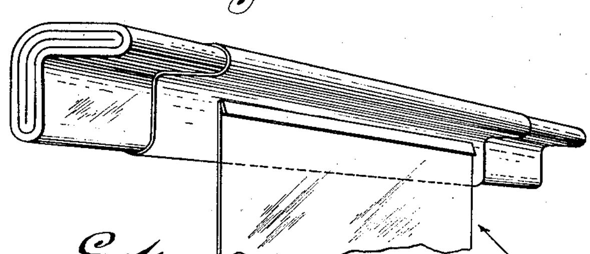
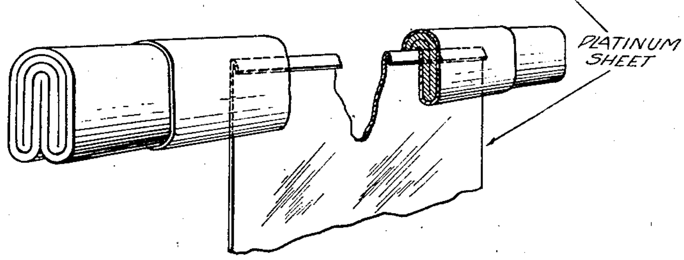


Fig. 4



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UNITED STATES PATENT OFFICE

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PLATINUM SHEET ELECTRODE

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2 Claims. (Cl. 204—286)

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The present invention relates to an electrode for use in electrochemical processes, more particularly to an improved type of platinum sheet electrode and to a method of forming same.

Platinum sheet electrodes are employed in many electrochemical processes, such as the electrolytic production of hypochlorites, chlorates, perchlorates, and persulphates. Platinum and its alloys with other metals, such as gold or iridium, are preferably used for such electrodes in spite of their very high initial cost and low electrical conductivity, because these metals produce results which cannot be obtained with other metals and because they are able to withstand the highly corrosive effects of the liquids and vapors with which the electrodes come in contact. These electrodes consist in substance of a thin sheet or foil of platinum or its alloys which is submerged in the electrolytic bath and to which the current is supplied by means of one or more current terminals that may, for example, have the form of feeding rods. The sheet form of the electrodes is dictated by the desire to provide a maximum of surface with a minimum weight of massive metal while maintaining sufficient electrical conductivity.

The high cost of platinum and its alloys makes it desirable to employ high current densities. In order to use such high current densities, it is necessary to provide for sufficient electrical conductivity to overcome excessive heating of the electrode, particularly of those parts which are not submerbed in the electrolyte and therefore do not benefit from the cooling effect of the electrolytic bath. Sufficient conductivity can be obtained by increasing the volume of the metal in relation to its surface area. This, however, will result in raising the cost of the electrode to a prohibitive level.

It has been attempted to solve the problem of overheating, particularly at the current terminals, by constructing these of a highly conductive metal, such as copper, bronze or silver. Thus, for example, the current has been led in at the top of the vertical sheet by means of a number of feeding rods of copper, it being desirable to place such feeding rods at frequent intervals along the upper edge in order to assure even distribution of current over the sheet and to avoid excessive heating at the contact points of the feeding rods and the sheet. Inasmuch as copper is readily corroded, it is necessary to cover the copper feeding rods with a corrosion resistant layer. They may, for example, be clad with platinum, but the labor involved in manufacturing a reliable, platinum clad feeding rod is excessive and the amount of platinum required remains considerable.

The object of the present invention is to construct a platinum sheet electrode which will have

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a maximum of active surfaces, will operate satisfactorily with a maximum current density, and will require a minimum weight of platinum or its alloys. Other objects will appear from the following description of my new platinum sheet electrodes and of the method whereby they are formed.

I have found that a high amperage can be satisfactorily supplied to a platinum sheet by means of a feeding bar which is constructed and attached along the upper edge of the sheet in the following novel manner. The feeding bar is made from a tube of a metal of high electrical conductivity, such as copper, bronze or silver. Said tube is platinum clad on the outside for which purpose one of several methods may be employed depending on the size required (cf., for example, the British Patent No. 447,827). This tube is carefully collapsed and flattened by applying controlled pressure, which results in a strip of conductive metal that is platinum clad on all sides except at the ends. This strip is then folded over along its longitudinal axis forming a channel-shaped clamp or vise into which the upper edge of a platinum sheet is inserted. To insure a better grip the sheet may be folded along its upper edge. Pressure is then applied to close the clamp or vise over the upper edge of the sheet thus firmly fixing the sheet therein. The original tube has now become a solid composite bar similar to a bus bar and constitutes a good conductor distributing the current evenly to the sheet along its upper edge. It might seem easier to simply weld or solder the sheet to a solid, platinum clad, base metal rod, but this is not practicable, because the thin platinum layer on the rod will blister or break during the welding or soldering operation due to the much lower melting point of the base metal.

It is obvious that my novel arrangement for supplying current to the sheet possesses a number of important advantages over those previously employed. In the first place the conductive metal included in the composite feeding bar supplies the required electrical conductivity to assure against overheating that portion of the electrode which is not immersed in the electrolytic bath. All parts of the feeding bar that can possibly come into contact with the corrosive vapors from the electrolytic bath are platinum clad, so that there is no danger whatever of the conductive metal becoming corroded. A minimum amount of platinum is required, because the protective layer can be kept quite thin. At the same time the bar provides a rigid support for the upper edge of the thin platinum sheet, which reduces the danger of its becoming bent or otherwise deformed. The ends of the novel feeding bar should project beyond either wall of the electrolytic tank or cell and can there be supplied with current by any suitable means at points removed from the corrosive effect of the vapors or splash from the electrolytic bath.

The platinum clad tube from which my feeding bar is constructed should not have too great a wall thickness, otherwise the platinum layer will crack during the folding operations. One may, for example, employ a tube one inch in diameter with a wall one-sixteenth of an inch thick. If more conductive metal is desired to insure ample conductivity and strength, one may loosely insert a smaller conductive metal tube inside the platinum clad one and thus increase the thickness of the resultant feeding bar. In this manner one also reduces the danger of cracking the platinum layer at the folds. The platinum layer need only be a few thousandths of an inch thick. I have found that layers from about 0.004 to about 0.008 inch thick are satisfactory. The platinum sheets are generally rectangular in shape, although this is not necessary. They should, of course, possess a straight upper edge to fit into the feeding bar. Later, if desired, the bar and sheet can be bent. The sheets vary in thickness from about 0.0005 to 0.01 inch depending on their size. Obviously the dimensions here given are merely illustrative and my invention is not limited thereto.

I shall now more particularly describe my novel electrode by reference to the accompanying drawings forming a part hereof:

Fig. 1 illustrates the platinum clad, conductive metal tube from which my novel feeding bar is constructed. The ends, which will not require protection from corrosion, are shown exposed. A conductive metal tube has been loosely inserted in the platinum clad one to insure ample conductivity and strength.

Fig. 2 shows the flattened tubes after the collapsing operation.

Fig. 3 illustrates the manner in which the composite strip is folded along its longitudinal axis to form a clamp or vise for holding the sheet electrode and this drawing shows the sheet electrode which is folded along its upper edge in order to insure a firmer grip by the feeding bar after the final pressing step.

Fig. 4 represents the final electrode according to my invention. Portions of the feeding bar and sheet are shown cut away to better illustrate the manner of attachment.

It will be noted that all parts of the electrode coming into contact with the liquid or vapors of the electrolytic bath either consist of solid platinum or are wholly clad therewith in such a way as to absolutely protect the conductive metal from corrosion. The ends of the feeding bar which, when the electrode is placed in the bath, project beyond the walls of the electrolytic cell, need not be platinum clad and the drawings, therefore, show the conductive metal exposed at these ends.

It is apparent that my invention is susceptible of many further modifications without departing from the spirit thereof. While the drawings show a plain platinum sheet, one may also use sheets that are perforated, protruded, corrugated or otherwise bent. Various types of gauze, strips or the like may likewise be employed. All that is necessary is that the active portion of the electrode possess a substantially two dimensional form. Furthermore, one might clamp several

sheets in the feeding bar and provide suitable means for holding them apart in the bath.

It is obvious that in place of pure platinum or its alloys with iridium or gold, one might employ for my electrodes any other highly corrosion resistant metal or alloy. Naturally, the chief benefits of my invention will be attained in the case of the very costly platinum and its alloys where a saving in the amount of metal employed is of paramount importance.

In the following claims the expressions "platinum" and "sheet" should be given their broadest possible interpretations in the light of the foregoing.

I claim:

1. A sheet electrode for electrochemical processes, comprising an electrode plate of electrically conductive corrosion resistant platinum metal, and a channel shaped electrical feeding bar having a core of electrically highly conductive metal, said core being subject to corrosion in an unprotected state, said electrical feeder bar, including its involute surfaces, and including all surfaces in contact with the electrode plate, being clad externally with a covering of corrosion resistant platinum metal, the ends of the feeder bar remaining unclad from such points which are safe from corrosion, said electrode plate being mechanically sealed to said feeder bar within the channel of said feeder bar along the full width of the upper portion of the electrode plate and in electrically conducting contact along both sides of said upper portion.

2. A sheet electrode for electrochemical processes, comprising an electrode plate of electrically conductive corrosion resistant platinum metal, and a channel shaped feeder bar having a core of electrically highly conductive copper, said copper core, including its involute surfaces, and including all surfaces in contact with the electrode plate, being clad externally with a covering of corrosion resistant platinum metal, the ends of the feeder bar remain unclad from such points which are safe from corrosion, said electrical plate being mechanically secured to said feeder bar within the channel of said feeder bar along the full width of the upper portion of the electrode plate and in electrically conducting contact along both sides of said upper portion.

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