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COPPER OXIDE RECTIFIER

Filed Sept. 30, 1927

Fig. 1.

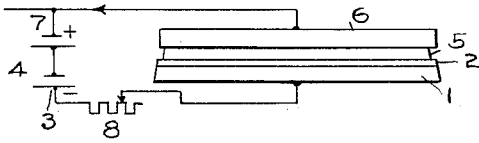
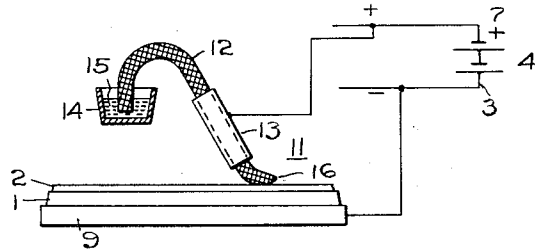


Fig. 2.



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COPPER OXIDE RECTIFIER

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My invention relates to electrolytic apparatus and processes and particularly to electrolytic means for producing chemical reactions by electrolytic decomposition at the surfaces of electrode materials.

One object of my invention is to provide means by which an electrolytic process may be practiced at the surface of a material without subjecting it to too intimate or too prolonged contact with the electrolyte.

Another object of my invention is to provide means for electrolytically affecting the surface of a porous material without permitting an appreciable impregnation of the material by the electrolyte.

A further object of my invention is to provide means by which the surface of an oxidized copper electrode may be reduced by electrolysis without permitting the electrode to become saturated with the electrolyte.

Other objects of my invention will become evident through reading the following specification, taken in connection with the drawings wherein:

Figure 1 is a diagrammatic side elevation of an apparatus embodying one form of my invention, and

Fig. 2 is a diagrammatic representation of another embodiment thereof.

In connection with the manufacture of oxidized copper blanks to be assembled into rectifiers of the thin-layer type, it has been desirable to reduce the outer surface of an oxidized layer by making it the negative electrode in an electrolytic cell containing dilute acid or other electrolyte. Such an oxidized surface is very likely to contain numerous cracks and pores, and difficulty arises from the fact that the electrolyte may penetrate these pores and thereby make contact with the mother copper beneath the oxide layer. This results in an increase of the inverse current through the resulting rectifier units and is undesirable.

In accordance with my invention, the above-mentioned difficulty is avoided by subjecting the oxidized surfaces to electrolytic action, not by immersing them in a liquid electrolyte, as is the common process in the electrolytic art generally, but by placing

them in contact with a pad of asbestos, or other chemically inert fibrous material, which is impregnated to a greater or less degree, by the electrolyte. By this means, the oxide surface never comes in contact with any large amount of free liquid, and it has been found that the penetration of liquid through the oxide layer is practically avoided.

Referring particularly to Fig. 1, a blank of copper 1, having a surface layer 2 of oxide thereon, is connected to the negative terminal 3 of a source of current 4. Upon the layer 2 is laid a pad 5 which may be of woven asbestos partially saturated with an electrolyte, such as a saturated solution of potassium fluoride, by previously dipping it in the latter. It may be found desirable to partially dry out this pad.

On top of the pad is laid an electrode 6 which may, for example, be of graphite, or other chemically inert conductor which is connected to the positive terminal 7 of the source 4. Any suitable current regulator 8 may be provided to adjust the density of current taking part in the electrolytic process. I have found 0.2 to 0.5 amperes per square centimeter to be a suitable density. The blank 1 should be kept in contact with the pad only so long as is necessary to affect a reduction of the surface of the layer 2 of the metallic condition.

Referring to the modification of my invention shown in Fig. 2, a copper blank 1, having a layer 2 of oxide formed thereon, is supported on a conductor 9 of any suitable material which is connected to the negative terminal 3 of a source of current 4. Connected to the positive terminal 7 of source 4, is a member 11 which may, for convenience, hereinafter be termed a brush. This member 11 comprises a core 12, which may be of woven asbestos, clamped in a conducting collar 13. The end of the brush 12 remote from the oxide layer may be dipped into a container 14 filled with an electrolyte 15. The member 12 acts as a wick and conducts the electrolyte 15 downward to its lower end 16, as shown in the drawing. The end 16 may then be rubbed over the surface of layer 2 until the required reduction has taken place

thereon. By this means, the impregnation of the electrolyte into the surface of the layer 2 is prevented. I have found that, with this method, a higher current density than that which is usual in electrolytic processes may
5 be employed. For example, a density of ten amperes per square centimeter has been found to give satisfactory results. At present, I regard the effect of the heat developed
10 at the surface in drying out the electrolyte before it can penetrate the pores of the material, as furnishing a probable explanation of the desirable results obtained. Because of the rectifying action of the junction between
15 the oxidized copper and the mother metal, an alternating electromotive force may be substituted for the direct-current sources above described, if it is desired to do so.

It will be evident that, while I have described this electrolytic process in connection
20 with electrolytic reduction of a surface of oxidized copper, it is broadly applicable to many other electrochemical processes, such as metallic deposition, as will be evident to
25 those skilled in the art. I desire, therefore, that the following claims be given the broadest interpretation of which they are susceptible in view of their expressed terms and of the prior art.

30 I claim as my invention:

1. The method of producing a conductive layer on the surface of an oxidized copper disc which consists in connecting said disc to one terminal of a source of electric current
35 and placing it in contact with a fibrous pad impregnated with an electrolyte adapted to yield reducing ions when connected to the other terminal of said source.

2. Apparatus including a cathode faced
40 with copper oxide, an absorbent body serving as an anode and impregnated with electrolyte and movable over the face of the copper oxide, the electrolyte being of such a character
45 as to yield hydrogen ions at the copper oxide surface, and electrical supply means for the electrodes.

3. In a method of preparing a conductor having a uni-lateral electric conductivity, the steps of electrolytically reducing the surface
50 of an oxidized layer at such a current density as to vaporize all electrolyte making contact with said layer before it has time to penetrate through said layer.

In testimony whereof, I have hereunto subscribed my name this 21st day of September,
55 1927.

JOSEPH SLEPIAN.