

J. WHITING & C. F. BURGESS.
 METHOD OF OXIDIZING METALS DISSOLVED IN MERCURY.
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937,128.

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Fig. 1.

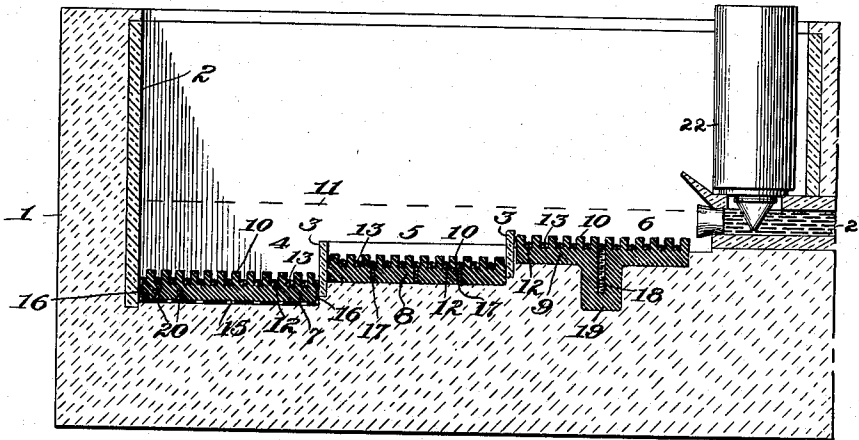
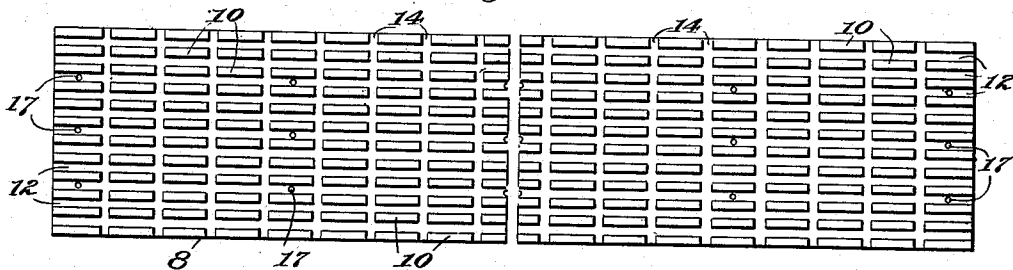


Fig. 2.



Witnesses:

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UNITED STATES PATENT OFFICE.

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METHOD OF OXIDIZING METALS DISSOLVED IN MERCURY.

937,128.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, (1) JASPER WHITING and (2) CHARLES F. BURGESS, citizens of the United States, residing at (1) Boston, (2) Madison, in the counties of (1) Suffolk, (2) Dane, and States of (1) Massachusetts, (2) Wisconsin, have invented certain new and useful Improvements in Methods of Oxidizing Metals Dissolved in Mercury, of which the following is a specification.

This invention relates to the electrolysis of alkali metal salts in cells employing a cathode of mercury, the object of the invention being the provision of a method whereby the oxidation of an alkali metal existing as a component of an amalgam in contact with water or an oxidizing electrolyte may be accelerated. It is well known that such oxidation may be accelerated by local action, so-called, that is to say by providing in contact with the amalgam and an oxidizing electrolyte, a conductive body electronegative to the alkali metal. Thus it has been proposed to place upon the surface of the amalgam in the oxidizing compartment pieces or fragments of metals or their conductive compounds; such substances however are liable to reduction by the hydrogen evolved, or in use eventually become so coated or amalgamated with mercury as to destroy their efficiency. The use of carbon or graphite in contact with the amalgam and water or oxidizing electrolyte has not heretofore proved satisfactory, for the reason that it is difficult to secure efficient contact therewith, minute bubbles or films of hydrogen adhering to the surfaces and so preventing the perfect contact which is essential to satisfactory action. It has also been proposed to incorporate iron with the carbon or to attach it thereto, but such expedients have been commercially unsuccessful by the reason of the injurious effect of iron, exposed to the action of the amalgam, upon the mercury.

We have discovered that under certain conditions it is practicable to secure an excellent and enduring contact between the amalgam and the carbon or graphite, whereby an efficient local action may be secured and maintained. According to the present invention this is effected by establishing electrical contact between the carbon and the amalgam through a body, column or stratum

of comparatively pure mercury or relatively dilute amalgam, usually underlying the amalgam. The word "carbon" is intended to include graphite.

The above result may be accomplished in many ways, certain of which will be illustrated and described by way of example without thereby limiting the invention.

In the accompanying drawings:—Figure 1 is a transverse vertical section of the oxidizing compartment of an electrolytic cell exhibiting certain embodiments of the invention; and Fig. 2 is a plan view of one form of carbon or graphite plate illustrated in Fig. 1.

The particular form of oxidizing compartment illustrated comprises a body portion of cement, concrete or the like, which may be lined if desired with glass, slate, vitrified earthenware or other suitable material as indicated in 2. The compartment is shown as subdivided by means of partitions 3, 3, into a series of wide shallow channels 4, 5, 6, disposed at successively lower levels and so arranged that the amalgam is directed through the several channels in succession, the denuded metal returning from the lowermost channel to the decomposing compartment of the cell. This arrangement may be substantially as described in my copending application, Ser. No. 467,874 filed December 16, 1908. In the bottom of each channel is a carbon or graphite plate or slab 7, 8, 9, having integral projections or members 10 extending upwardly into contact with the water or oxidizing electrolyte 11. The amalgam flowing from the decomposing compartment through conduit 21 controlled by a mechanically actuated valve 22 onto the plate 9 in the uppermost channel 6, fills the lower portions of the longitudinal channels 12 between the projecting members 10 as indicated at 13 and flows therethrough, this flow being aided if desired by a suitable inclination of the plate. The amalgam then flows in a similar manner over the plates 8 and 7, the total path beneath the liquid 11 being sufficient to complete the oxidation of the contained alkali metal. In order to facilitate the flow of the amalgam and equalize its distribution over the carbon plates, as well as to increase the active carbon surface, we prefer to provide transverse channels 14 as

clearly shown in Fig. 2, intersecting the longitudinal channels 12 and of equal depth therewith.

In order to secure and maintain effective contact between the amalgam and the carbon, it is necessary to provide conditions under which a body, column or stratum of comparatively pure mercury, that is to say of mercury containing little or no alkali metal, may be maintained in contact with the carbon. This may be accomplished in various ways. For example, the carbon plate 7, Fig. 1, is illustrated as somewhat loosely fitting the sides and bottom of the channel 4, in such manner that the liquid metal lies in the form of a film or layer 15 beneath the plate 7 and in extended electrical contact therewith. This film or layer 15 consists of comparatively pure mercury, the lighter amalgam being confined to the upper surface of the plate: it is however in electrical contact with the amalgam through the metal in the lateral crevices 16, and is moreover in effective electrical contact with the carbon by reason of the pressure exerted by the overlying liquid. Inasmuch as the film or layer 15 consists of comparatively pure mercury, is remote from the electrolyte, is not subject to agitation or movement, and is under a considerable hydrostatic pressure, it maintains a close and electrically efficient contact with the carbon, and its presence insures a greatly increased rate of oxidation of the alkali metal. The same result may be accomplished by perforating the carbon plates at suitable intervals as illustrated at 17 in Figs. 1 and 2. The liquid metal fills the perforations as a quiescent column, the lower portion of which at least consists of substantially pure mercury. The contact in this case may be extended and rendered more effective by the presence of films or layers of mercury underlying the plate 8 and filling such crevices as may normally exist between the plate and the cement body. A further means of accomplishing the same result is also illustrated in Fig. 1 in the form of a relatively deep well 18, shown as extending into a longitudinal rib 19 formed integral with the bottom of the carbon plate 9. Any desired number of such wells may be provided, and serve to improve the electrical contact by reason of the comparative purity of the mercury therein and the pressure of the overlying liquid.

Inasmuch as comparatively pure mercury, as distinguished from an alkali metal amalgam, has little or no action upon iron and certain other metals it is practicable to still further increase the efficiency of the contact by providing metallic connections extending from the carbon into contact with the com-

paratively pure mercury beneath the amalgam. For example, we have shown in Fig. 1 metallic screws 20 inserted in the lower face of the carbon plate 7 and exposed to the mercury in the layer or film 15. In this case the metal exhibits little or no tendency to pass into solution or to contaminate the mercury, and such solution or contamination as may occur is localized and is without injurious effect upon the liquid metal as a whole. It will be obvious that similar means may be resorted to in order to increase the effectiveness of contact in any embodiment of the invention.

We claim:—

1. The method of oxidizing metals dissolved in mercury, which consists in providing carbon surfaces exposed to an oxidizing electrolyte and a moving body of amalgam, and establishing electrical contact between the carbon and the amalgam through a relatively quiescent body of comparatively pure mercury.

2. The method of oxidizing metals dissolved in mercury, which consists in providing carbon surfaces exposed to an oxidizing electrolyte and a moving body of amalgam, and establishing electrical contact between the carbon and the amalgam through a relatively quiescent body of comparatively pure mercury underlying the amalgam.

3. The method of oxidizing alkali metals dissolved in mercury, which consists in providing carbon surfaces exposed to an oxidizing electrolyte and a moving body of amalgam, and establishing electrical contact between the carbon and the amalgam by means of a metallic connection in contact with said carbon and a relatively quiescent body of comparatively pure mercury.

4. The method of oxidizing alkali metals dissolved in mercury, which consists in providing carbon surfaces exposed to an oxidizing electrolyte and a moving body of amalgam, and establishing electrical contact between the carbon and the amalgam by means of a metallic connection in contact with said carbon and a relatively quiescent body of comparatively pure mercury underlying the amalgam.

In testimony whereof, we affix our signatures in presence of witnesses.

JASPER WHITING.

CHARLES FREDERICK BURGESS.

Witnesses as to the signature of Jasper Whiting:

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