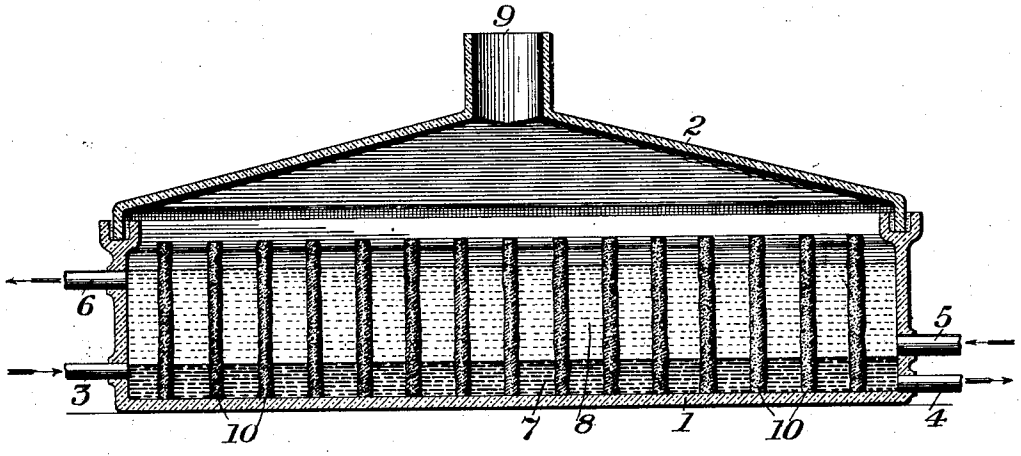
No. 739,140. PATENTED SEPT. 15, 1903.

C. E. BAKER & A. W. BURWELL.

APPARATUS FOR OXIDIZING METALS DISSOLVED IN MERCURY.

APPLICATION FILED NOV. 11, 1902.

NO MODEL.



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No. 739,140. Patented September 15, 1903.

UNITED STATES PATENT OFFICE.

CHARLES E. BAKER AND ARTHUR W. BURWELL, OF CLEVELAND, OHIO.

APPARATUS FOR OXIDIZING METALS DISSOLVED IN MERCURY.

SPECIFICATION forming part of Letters Patent No. 739,140, dated September 15, 1903.

Application filed November 11, 1902. Serial No. 130,847. (No model.)

To all whom it may concern:

Be it known that we, CHARLES E. BAKER and ARTHUR W. BURWELL, citizens of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Apparatus for Oxidizing Metals Dissolved in Mercury, of which the following is a specification.

This process is especially intended for the oxidation and removal of metallic sodium from the amalgam produced in electrolytic cells in which a solution of sodium chlorid is electrolyzed upon a mercury cathode. The sodium is ordinarily removed from these amalgams by bringing them in contact with water or a dilute solution of caustic soda, the sodium decomposing the water and becoming converted into hydroxid, which dissolves in the water. The reaction, however, proceeds slowly, and various efforts have been made to increase the rate of oxidation, as by passing an electric current from the amalgam through the oxidizing-electrolyte or by short-circuiting the amalgam to an electronegative body placed in such electrolyte.

This apparatus comprises a vessel containing a layer of the amalgam to be treated, a body of water, dilute caustic soda, or other oxidizing-electrolyte in contact with the amalgam, and pieces of carbon in contact with both the amalgam and the water. We have found that bodies of carbon which have been produced by molding the body from a plastic mass and then baking the product are of little value for use in this apparatus, and we use carbon from which the original molded surface has been removed, so as to expose inner portions thereof. We preferably use pieces of carbon having a rough surface, which has several functions which will be described in detail.

One form of apparatus which has been employed is shown in the accompanying drawing, in which the figure is a vertical longitudinal section.

The apparatus shown comprises a rectangular vessel 1, having a cover 2. Near the bottom of the vessel and at opposite ends thereof are pipes 3 4 for introducing amalgam and delivering mercury, respectively. Pipes 5 6 are provided for introducing the oxidizing-electrolyte, such as water, and removing the caustic-soda solution. Water-inlet pipe 5 is preferably arranged directly above mercury-outlet pipe 4, and caustic-outlet pipe 6 is preferably arranged above amalgam-inlet pipe 3. The layer of amalgam 7 and the body of water 8 lying upon it are thereby kept in continuous movement in opposite directions. The pipes 3 4 may or may not directly communicate with the electrolytic cell in which the amalgam is produced. The cover 2 has an outlet 9 for the hydrogen or other gaseous product of decomposition of the electrolyte. A number of pieces of carbon, here shown as vertical rods 10, are placed in contact with both the amalgam and the water and preferably extend some distance into or through the bodies of amalgam and water. We have found that carbon bodies—such as arc-light rods, which are produced by forcing a plastic mixture of carbon and hydrocarbons through a die and then baking the product—are entirely unsuitable for use in this apparatus. This we believe to be due to the fact that when such a molded mixture is baked the hydrocarbons throughout the mass are driven outward to the surface and there decomposed, depositing a thin outer layer of substantially pure carbon, and to the further fact that such pure carbon does not come into satisfactory metallic contact with mercury, so as to be wetted thereby. If this original surface of pure carbon, however, is mechanically removed, the inner portion, which almost invariably contains a small percentage of metallic iron, is exposed, and such surface, which we term a "secondary surface," is readily wetted by or amalgamated with mercury. We have found that it is also of great advantage to roughen the surface of the carbon bodies 10. A roughened surface possesses several advantages over a smooth one in that it gives greater superficial contact with both the mercury and the water, seems to carry down water beneath the surface of the mercury by capillary action, and more freely delivers hydrogen from the surface in contact with the water, thus decreasing polarization. Each body of carbon by reason of its contact with the amalgam and the amount of cathode-surface which it exposes to the electrolyte serves to cause a vigorous

reaction between the sodium in the amalgam, acting as anode, and the water, whereby the sodium is soon oxidized and the resulting oxid dissolved to produce a strong caustic solution, which escapes through a pipe 6.

The apparatus may evidently be used for removing any easily-oxidizable metal from its amalgam with mercury.

The electrolyte employed may be one which will furnish either oxygen or any other negative radical which it is desired to combine with the metal held by the mercury.

The apparatus may be used for the reduction of organic compounds or for the decomposition of solutions of compounds of metals which are less positive than that contained in the mercury.

Our carbon having a secondary surface containing iron is to be distinguished from a carbon made by embedding particles of iron in the carbon mixture while soft and then baking the product. The operation of baking invariably causes the deposit of a layer of pure carbon upon the surface of the article and between the particles of iron. In our carbon this skin of pure carbon is removed, exposing the inner portion, which makes perfect electrical contact with the amalgam.

We claim—

1. An apparatus for oxidizing metals dissolved in amalgams, comprising a vessel containing the amalgam, an oxidizing-electrolyte in contact with the amalgam, and a piece of carbon in contact with both the amalgam and the electrolyte, said carbon having a secondary surface capable of coming into direct electrical connection with the amalgam, as set forth.

2. An apparatus for oxidizing metals dissolved in amalgams, comprising a vessel containing the amalgam, an oxidizing-electrolyte in contact with the amalgam, and a piece of carbon in contact with both the amalgam and the electrolyte, said carbon having a secondary surface containing iron and capable of being wetted by or amalgamated with mercury, as set forth.

3. An apparatus for oxidizing metals dissolved in amalgams, comprising a vessel containing the amalgam, an oxidizing-electrolyte in contact with the amalgam, and a piece of carbon having a roughened secondary surface in contact with both the amalgam and the electrolyte, as set forth.

4. An apparatus for oxidizing metals dissolved in amalgams, comprising a vessel containing the amalgam, an oxidizing-electrolyte in contact with the amalgam, and a piece of carbon in contact with both the amalgam and the electrolyte, said carbon having a roughened secondary surface containing iron and capable of coming into direct electrical connection with the amalgam, as set forth.

5. An apparatus for oxidizing metals dissolved in amalgams, comprising a vessel containing the amalgam, an oxidizing-electrolyte in contact with the amalgam, and a piece of roughened carbon in contact with both the amalgam and the electrolyte, said carbon having a secondary surface containing iron and capable of being wetted by or amalgamated with mercury, as set forth.

6. An apparatus for oxidizing metals dissolved in amalgams, comprising a vessel containing the amalgam, an inlet and outlet for continuously supplying amalgam and removing mercury, an oxidizing-electrolyte in contact with the amalgam, and a piece of carbon in contact with both the amalgam and the electrolyte, said carbon having a secondary surface capable of coming into direct electrical connection with the amalgam, as set forth.

7. An apparatus for oxidizing metals dissolved in amalgams, comprising a vessel containing the amalgam, an inlet and outlet for continuously supplying amalgam and removing mercury, an oxidizing-electrolyte in contact with the amalgam, an inlet for the electrolyte above the mercury-outlet, an outlet for the electrolyte above the amalgam-inlet, and a piece of carbon in contact with both the amalgam and the electrolyte, said carbon having a secondary surface capable of coming into direct electrical connection with the amalgam, as set forth.

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

CHARLES E. BAKER.
ARTHUR W. BURWELL.

Witnesses:
A. C. BOWEN,
S. E. STONE.