W. MORRISON.

ELECTROLYTIC RECTIFIER.

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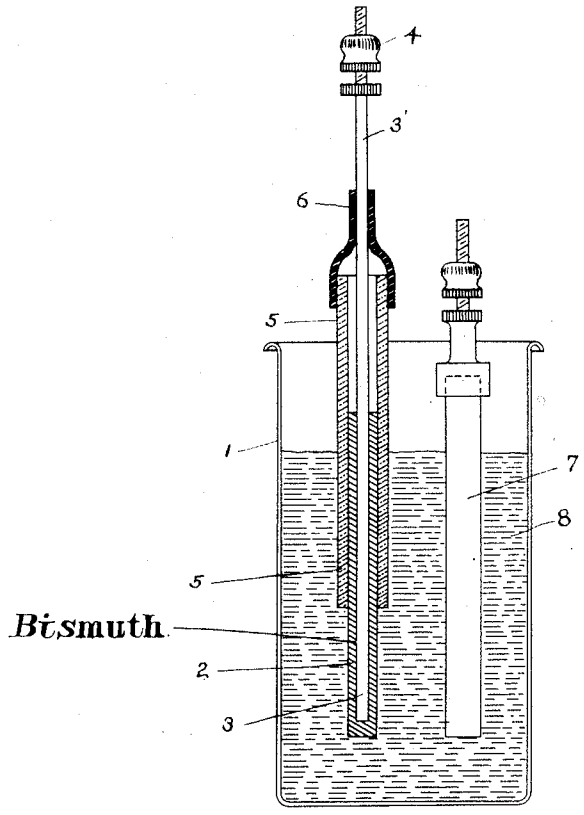
1,022,695.

Patented Apr. 9, 1912.



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UNITED STATES PATENT OFFICE.

WILLIAM MORRISON, OF DES MOINES, IOWA.

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Application filed October 14, 1910. Serial No. 587,129.

To all whom it may concern:

Be it known that I, WILLIAM MORRISON, a citizen of the United States, residing at Des Moines, in the county of Polk and State of Iowa, have invented certain new and useful Improvements in Electrolytic Rectifiers, of which the following is a specification.

This invention is an asymmetric electrolytic cell for rectifying alternating electric currents.

Various metals and solutions have been suggested for use as the anode and electrolyte of an asymmetric cell, but the combination which has heretofore been commonly employed is an anode of aluminum, with a cathode of carbon, lead or iron, in a phosphate, tartrate, citrate, or borate solution. It is however well known that the aluminum rectifier entirely fails when operated at a high temperature, that is, with current densities which cause much heating of the electrolyte. Furthermore, the anode film of aluminum oxid or hydroxid is not permanent but is apt to puncture and break down.

I have found that bismuth is especially well suited for the anode of an asymmetric cell; that a chromate solution is well suited for the electrolyte of such cell; and that a cell comprising an anode of bismuth, a cathode of carbon or lead, and an electrolyte of a chromate solution, constitutes a superior electrolytic rectifier. I have shown in the accompanying drawing a cell of this type, adapted for the rectification of small currents.

The figure is a transverse vertical section through the cell, solution and anode, the cathode being shown in elevation.

The cell illustrated comprises a vessel 1, which may be of rubber or glass. The anode 2 is a rod or plate of bismuth, preferably cast on a wire or grid support 3 of nickel. The support has an upper extension 3′ carrying a binding-post 4. In order to vary the exposed active surface of the anode, a vertically-movable sheath 5 is provided. When a rod anode is used, this sheath may be a glass tube, held in adjusted position by a short rubber sleeve 6, stretched on the upper end of the tube and sliding frictionally on the nickel rod extension 3′. The exposed surface is preferably such as to give a counter-electromotive force of about 90 volts with an applied potential difference of 110 volts and an alternating current having a frequency of 60 cycles. The cathode 7 may be a rod or plate of carbon or lead. The electrolyte 8 is preferably a solution of a chromium-oxygen compound, for example potassium chromate or dichromate. A solution of an alkali-metal phosphate or bicarbonate, or of both a chromate and phosphate or bicarbonate, or one of the solutions heretofore used with aluminum anodes, may also be employed. The solution may be neutral or somewhat acid or alkaline. For high current-densities a strong solution is preferably employed.

My experiments indicate that an anode of bismuth in a chromate solution becomes coated in use with a permanent adherent film of bismuth chromate, which is of high resistivity and is substantially insoluble in the solution, being one of the most insoluble compounds known.

It will be understood that either bismuth or a bismuth alloy may be used for the anode, provided the alloy contains sufficient bismuth to give its characteristic film. By alloying the bismuth for example with cadmium, the alloy anode is of sufficient strength to be self-supporting, not requiring the nickel support.

I claim:

1. In an electrolytic rectifier, an anode of bismuth, an electrolyte capable of reacting on bismuth to give an asymmetric film, and a cathode.

2. In an electrolytic rectifier, an anode containing bismuth, an electrolyte capable of reacting on bismuth to give an asymmetric film, and a cathode.

3. In an electrolytic rectifier, an anode of bismuth, an electrolyte of a chromium-oxygen compound, and a cathode.

4. In an electrolytic rectifier, an anode of bismuth, an electrolyte containing a soluble chromate, and a cathode.

5. In an electrolytic rectifier, an anode of bismuth, an electrolyte containing an alkali-metal chromate, and a cathode.

In testimony whereof, I affix my signature in presence of two witnesses.

WILLIAM MORRISON.

Witnesses:
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JAS. H. BLACKWOOD.