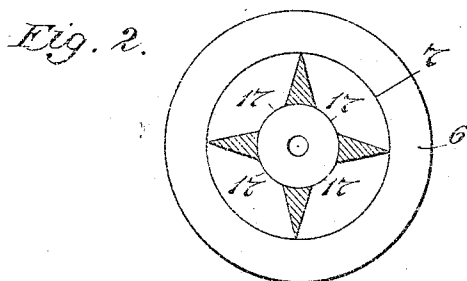
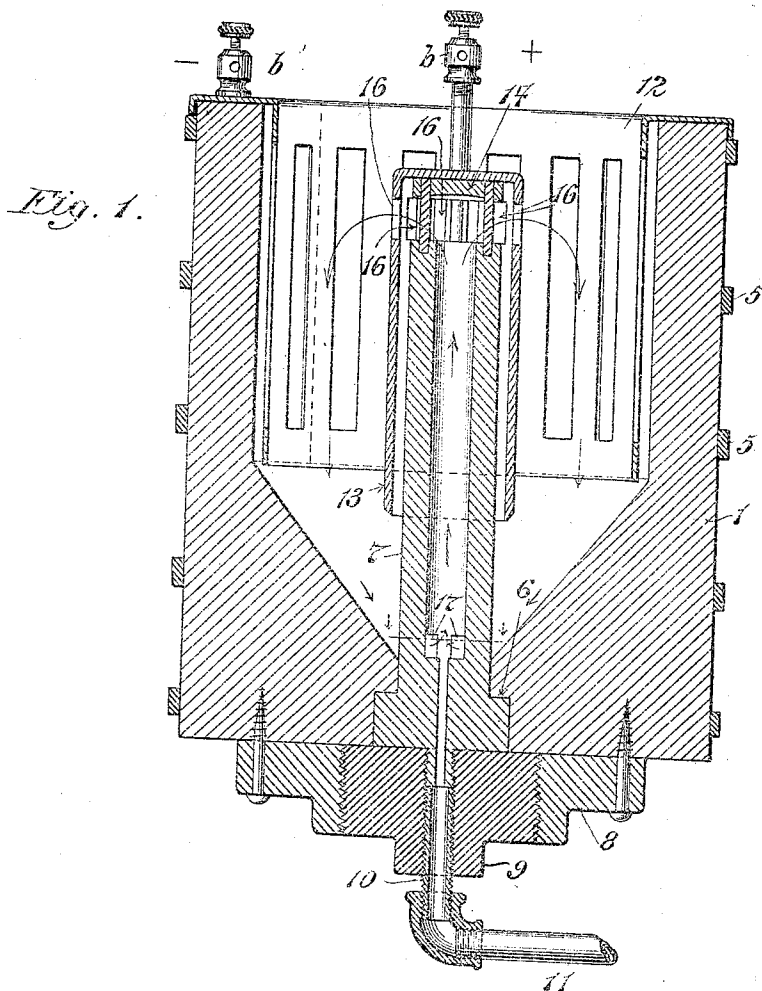


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 APPLICATION FILED JUNE 8, 1910.

988,210.

Patented Mar. 28, 1911.

2 SHEETS—SHEET 1.



Witnesses:  
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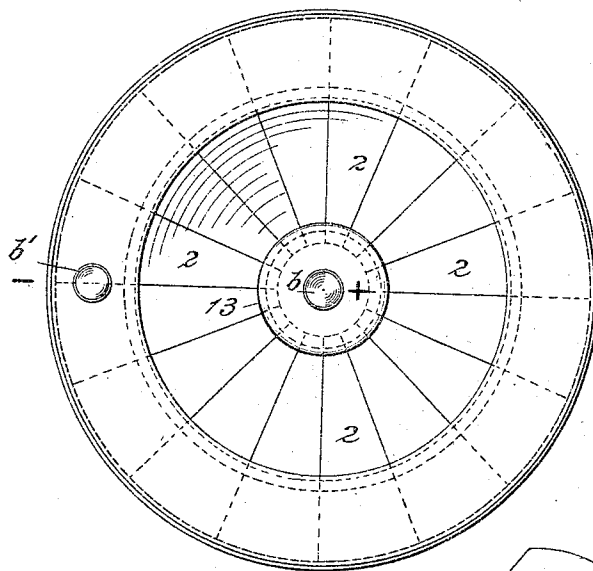
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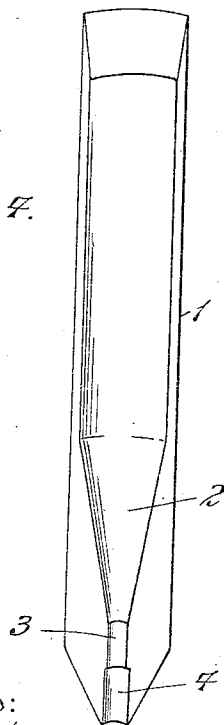
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2 SHEETS—SHEET 2.

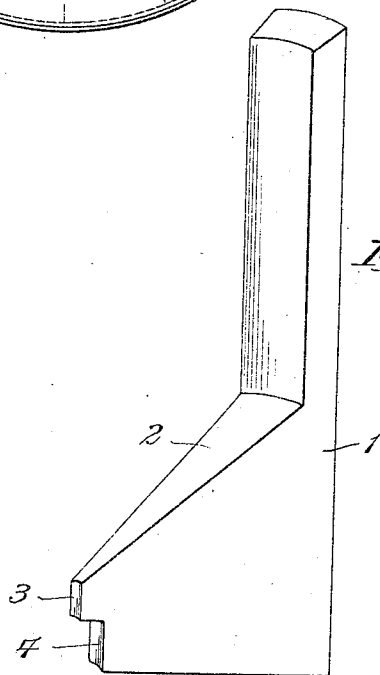
*Fig. 3.*



*Fig. 4.*



*Fig. 5.*



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# UNITED STATES PATENT OFFICE.

WILLIAM D. RENNIE, OF HACKENSACK, NEW JERSEY, ASSIGNOR TO UNIVERSAL ORE REDUCTION COMPANY, OF PHOENIX, ARIZONA TERRITORY, A CORPORATION OF ARIZONA TERRITORY.

ART OF ELECTROLYTICALLY EXTRACTING METALS FROM THEIR ORES.

988,210.

Specification of Letters Patent.

Patented Mar. 28, 1911.

Application filed June 8, 1910. Serial No. 565,693.

*To all whom it may concern:*

Be it known that I, WILLIAM D. RENNIE, a citizen of the United States, and resident of Hackensack, county of Bergen, and State of New Jersey, have made a new and useful Invention in the Art of Electrolytically Extracting Metals from Their Ores, of which the following is a specification.

My invention is directed particularly to a novel method of and apparatus for effecting the extraction of metals from their ores, and it has for its most essential object, to thoroughly and continuously agitate an electrolyte in which a powder of an ore is held in suspension during the time that the same is being acted upon by an electrical current flowing therethrough.

My invention will be fully understood by referring to the accompanying drawings, in which,

Figure 1 is a vertical sectional view of my novel agitator and electrical appliances used therewith in practicing the methods hereinafter described and claimed; and Fig. 2 is an enlarged sectional view taken through the lower end of the vertical tubular agitating standard which supports at its upper end the anode of the apparatus, and conveys the powdered ore held in suspension from the bottom to the top of the cell where it is distributed radially and allowed to descend through the electrolyte under the influence of gravity. Fig. 3 is a plan view of Fig. 1 as seen looking thereat from the top toward the bottom of the drawing. Fig. 4 is a perspective view of one of the staves of which the agitating vessel is constructed; and Fig. 5 is a perspective view similar to Fig. 4, but as seen from a different view point.

Referring now to the drawings in detail I have illustrated in Fig. 1 an agitating vessel which is constructed preferably of wedge-shaped wooden staves 1 having the conformation shown in Figs. 4 and 5, said staves being held together by hoops 5, 5, 5, and when assembled, as shown, with the inclined surfaces 2 2 constituting a cone-shaped throat or means for conveying the powdered ore held in suspension in the electrolyte downward by gravity into the effective flow of the agitating medium, as hot air or steam under pressure. The surfaces 3 and 4 constitute, when assembled, cylindrical means of support extending through the bottom of the vessel for a tubular agitating standard 7 having an enlarged head 6 in its lower end, the same being secured in the manner shown from below by a base 8 and screws extending therethrough.

9 is a detachable screw-threaded part of the base 8 for receiving a tubular screw-threaded connector 10 secured by an elbow to an air or steam pipe 11 connected in turn with a source of air or steam under pressure, but not shown.

12 represents a cylindrical metallic cathode provided with vertically disposed slots or openings, or this cathode may be of any preferred form, such as are used in electrolytic appliances of this nature, the same being hung within the upper end of the agitating vessel in the manner shown.

13 is the anode which is cylindrical in form and is supported by a plurality of pins in the upper end of the tubular standard 7.

14 is a deflector located at the upper end of the anode and supported by the same pins which sustain said anode, its function being to effect the complete distribution of the powdered ore held in suspension so that as it slowly descends by the action of gravity it will be continuously subjected to the electrolytic action of the current.

16, 16 represents a series of openings extending through the upper end of the anode, and 17, 17 represents a series of openings at the bottom of the standard 7 connecting the interior thereof with the interior cone-shaped bottom of the vessel, the function of these openings being to receive the powdered ore held in suspension as it descends by the action of gravity and again present it for the upward action of the agitating agent.

16, 16 represents a series of openings extending through the upper end of the anode, and 17, 17 represents a series of openings at the bottom of the standard 7 connecting the interior thereof with the interior cone-shaped bottom of the vessel, the function of these openings being to receive the powdered ore held in suspension as it descends by the action of gravity and again present it for the upward action of the agitating agent.

*b* represents the binding post of the anode and *b*<sup>1</sup> the binding post of the cathode.

The apparatus having been assembled in the manner shown and described the operation is as follows—The electrolyte holding the powdered ore in suspension is placed in the agitating vessel to the desired depth preferably to the depth of the top of the openings 16. The source of electrical energy is then connected to the binding posts *b* and *b*<sup>1</sup> and steam or air is admitted through the pipe 11 at the proper pressure. Immediately, therefore, there is set up in the tubu-

lar agitating standard 7 an upward movement (in the direction of the arrows) of the materials held in suspension. This action being in the nature of a propulsion 5 causes the powdered ore held in the electrolyte to be forced upward under pressure against the under surface of the deflector 14 and to then pass radially outward in the direction of the curved arrows and ultimately slowly downward under the action 10 of gravity alone throughout all points, both between the anode and cathode and the exterior surface of the latter, so that so long as this action continues the powdered ore is 15 equally subjected to the direct plating action of the source of electrical energy. This agitation is kept up continuously until the metal is all extracted and deposited upon the cathode 12, after which said cathode is removed 20 and the metal is recovered under any of the well known processes, such as fusion, etc.

I do not limit my invention to the specific details of the structural apparatus disclosed in the drawings and hereinbefore described 25 for practicing the novel method of agitating electrolytes containing powders, as obviously these structural features might be materially departed from and still come within the scope of my claims hereinafter made.

30 Having thus described my invention what I claim and desire to secure by Letters Patent of the United States is—

1 The described method of effecting a thorough distribution of a powder of the 35 ore of a metal throughout the volume of an electrolyte, consisting in causing a continuous upward and outward movement thereof due to an applied force and a continuous downward movement thereof due to the action 40 of gravity alone.

2. The described method of extracting a metal from an ore thereof, consisting in continuously causing a powder of such ore to 45 ascend through an electrolyte by an applied force and to then allow it to descend there-through under the action of gravity alone while subjected to the influence of an electrical current.

3. The described method of distributing 50 a powder of an ore throughout the volume of an electrolyte, consisting in subjecting the same, while held in suspension, to a lifting and distributing pressure, and then allowing it to descend through the electrolyte 55 under the influence of gravity alone.

4. An agitator for effecting a thorough mixture of a powder, and an electrolyte em-

bracing a vessel having a vertically disposed agitating standard or tube connected at its bottom with the vessel and also to a source 60 of pressure; in combination with means at the top of the tube for effecting a radial distribution of the powder at that point, substantially as described.

5. An agitator embracing a vessel and a 65 tube secured therein, said tube being connected at its bottom to the interior of the vessel and also to a source of steam, air or gas pressure, and provided at its top with a deflector for effecting radial distribution 70 of the powder, substantially as described.

6. An agitator embracing a vessel having an interior cone-shaped bottom; a tube secured therein and operatively connected at 75 both ends with the interior of the vessel and also at its lower end with a source of air or gas supply under pressure, substantially as described.

7. An agitator embracing a vessel and a tube for forcing the liquid and substance to 80 be agitated upward through the vertical axis of the vessel and without disturbing effect upon the liquid at other points, and additional means for causing the suspended substance or substances to be forced outward 85 radially in all directions near the surface thereof, substantially as described.

8. An agitator embracing a vessel having an interior cone-shaped bottom and a vertically disposed tube connected at its bottom 90 with an exterior source of pressure; said tube having openings at top and bottom for permitting of a continuous upward flow of the liquid under pressure.

9. Means for effecting the extraction of 95 metals from the powder of their ores embracing an agitating vessel provided with an agitating tube connected at top and bottom with the interior of the vessel and also at its bottom with a source of pressure; in 100 combination with an anode and a cathode, the arrangement thereof being such that the liquid and the powder held in suspension therein will be caused to move continuously upward and outward under pressure and 105 downward between said anode and cathode by the influence of gravity alone.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM D. RENNIE.

Witnesses:

BARTON B. WARD,  
C. J. KINTNER.