

April 28, 1925.

1,535,577

A. H. W. CLEAVE

APPARATUS FOR THE ELECTROLYTIC DEPOSITION OF METALS

Filed Jan. 4, 1923

5 Sheets-Sheet 1

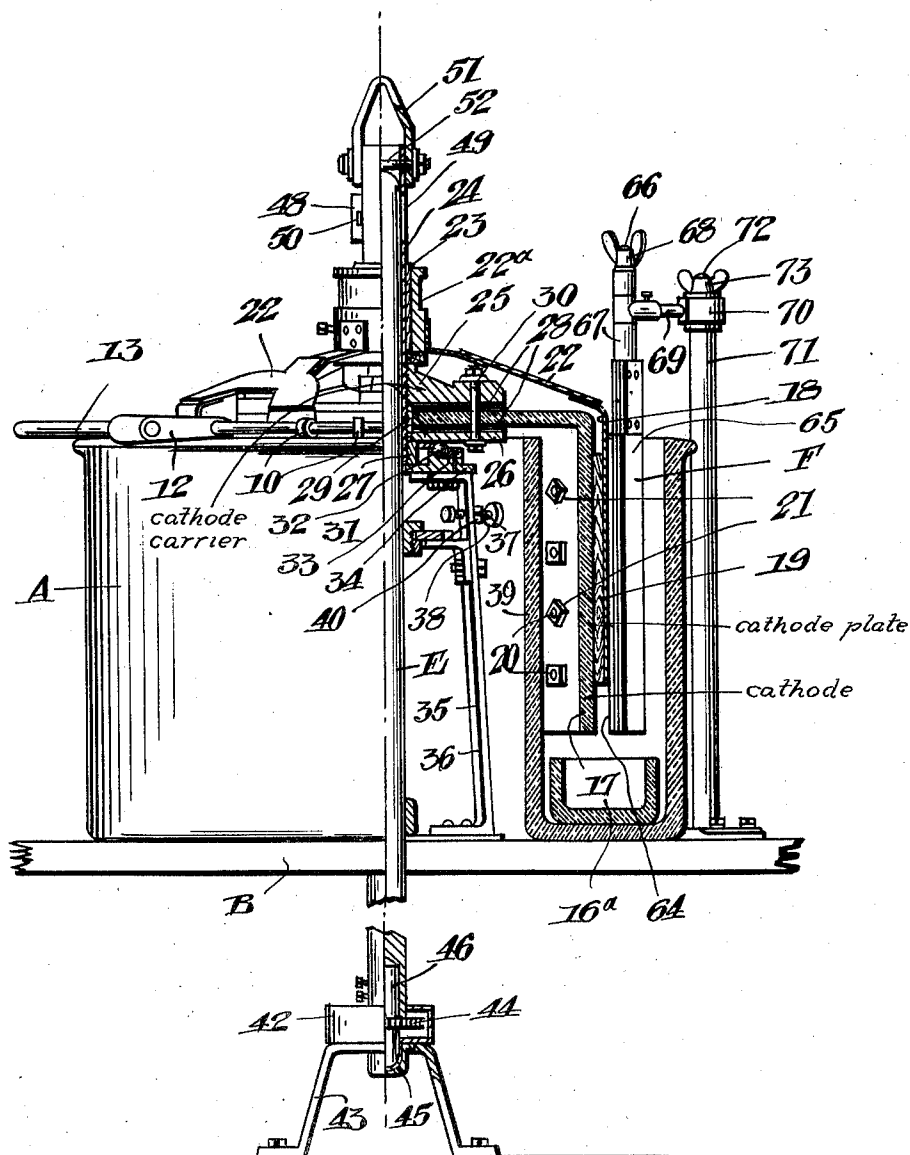


Fig. 1.

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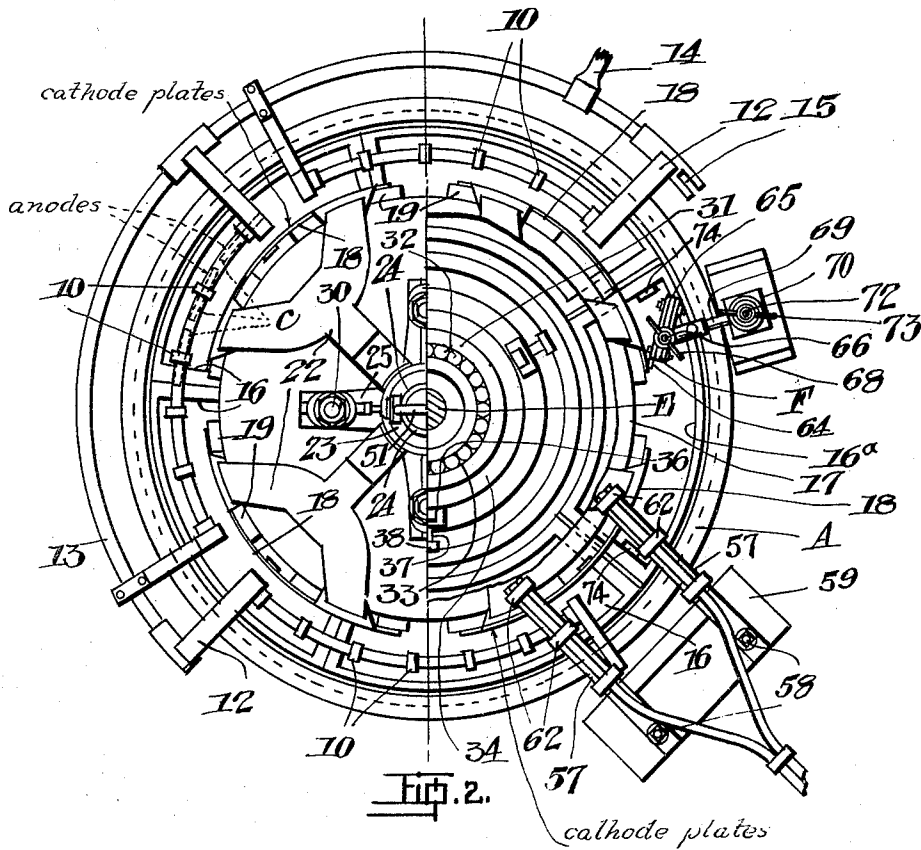
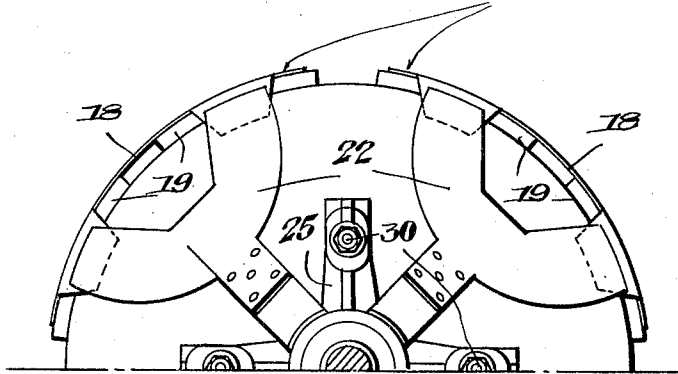
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5 Sheets-Sheet 2



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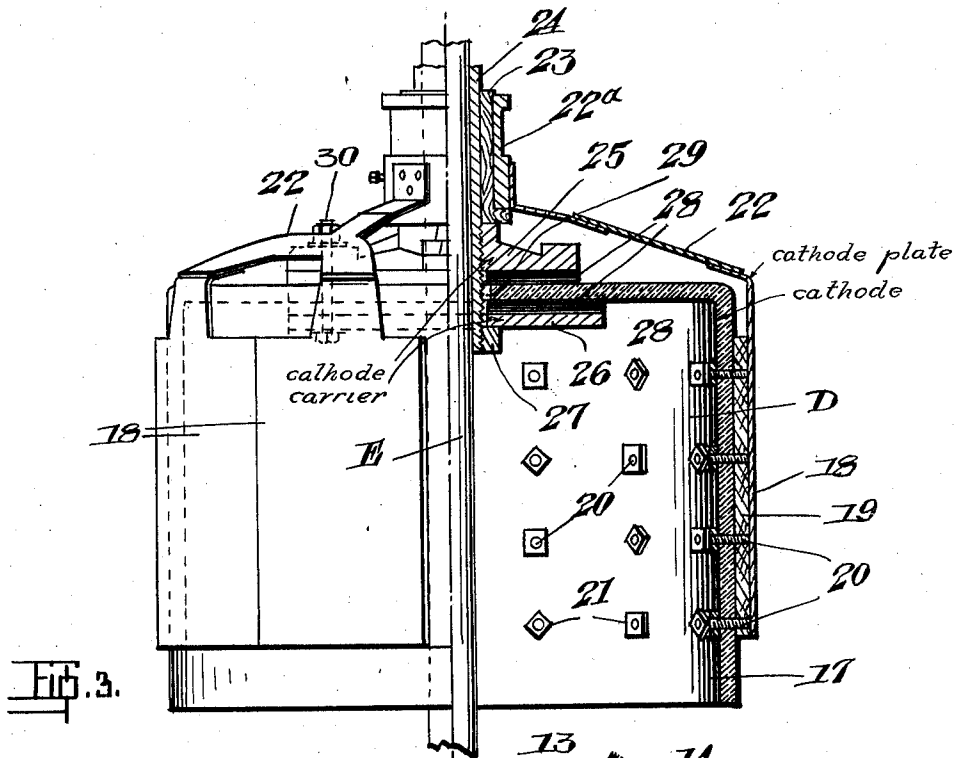
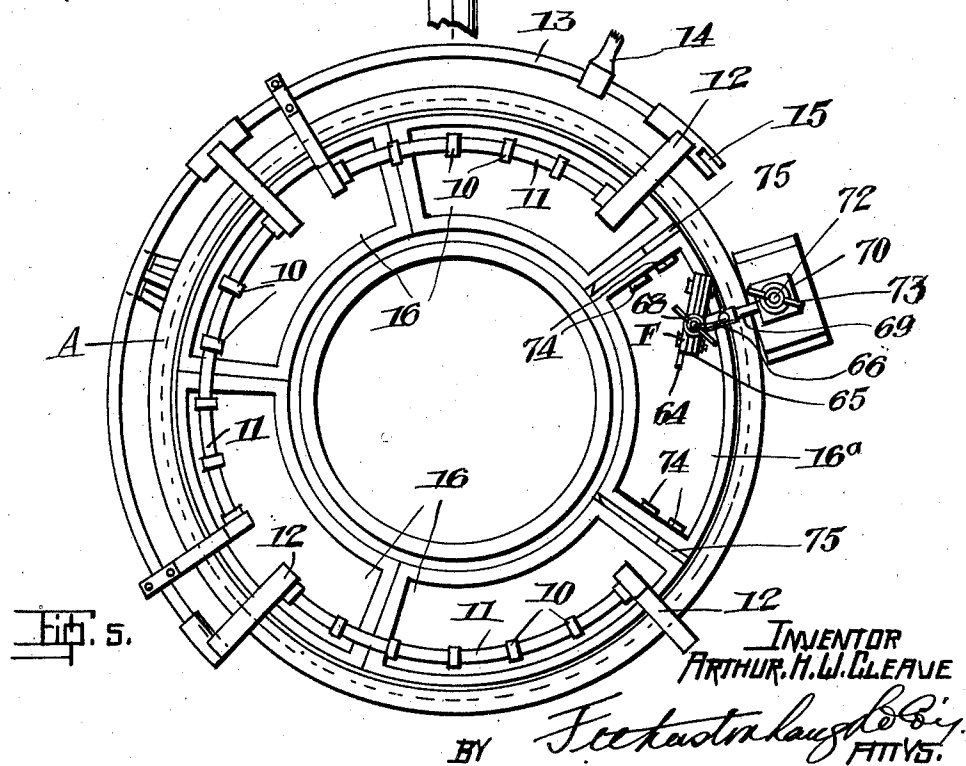
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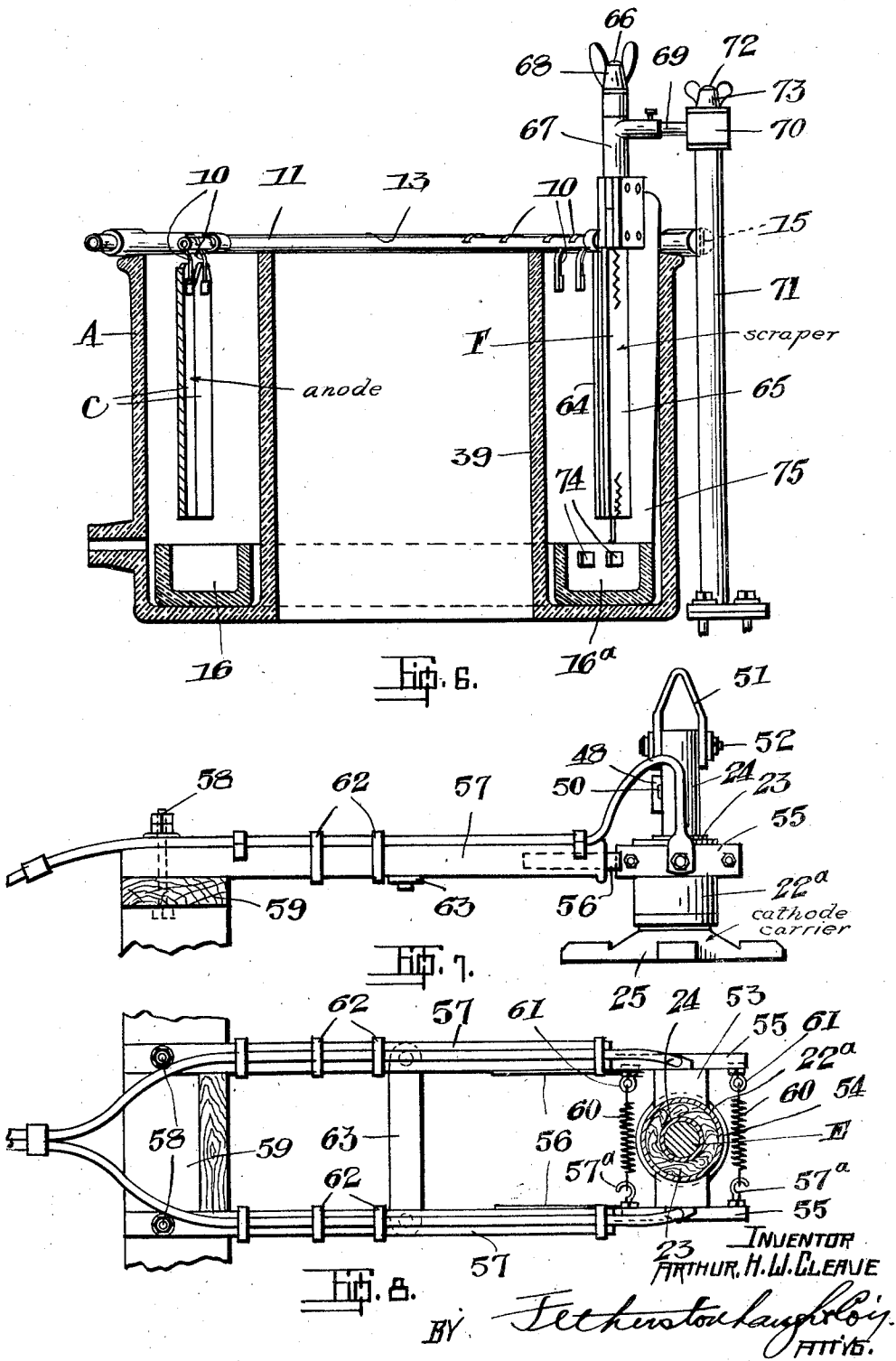
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APPARATUS FOR THE ELECTROLYTIC DEPOSITION OF METALS

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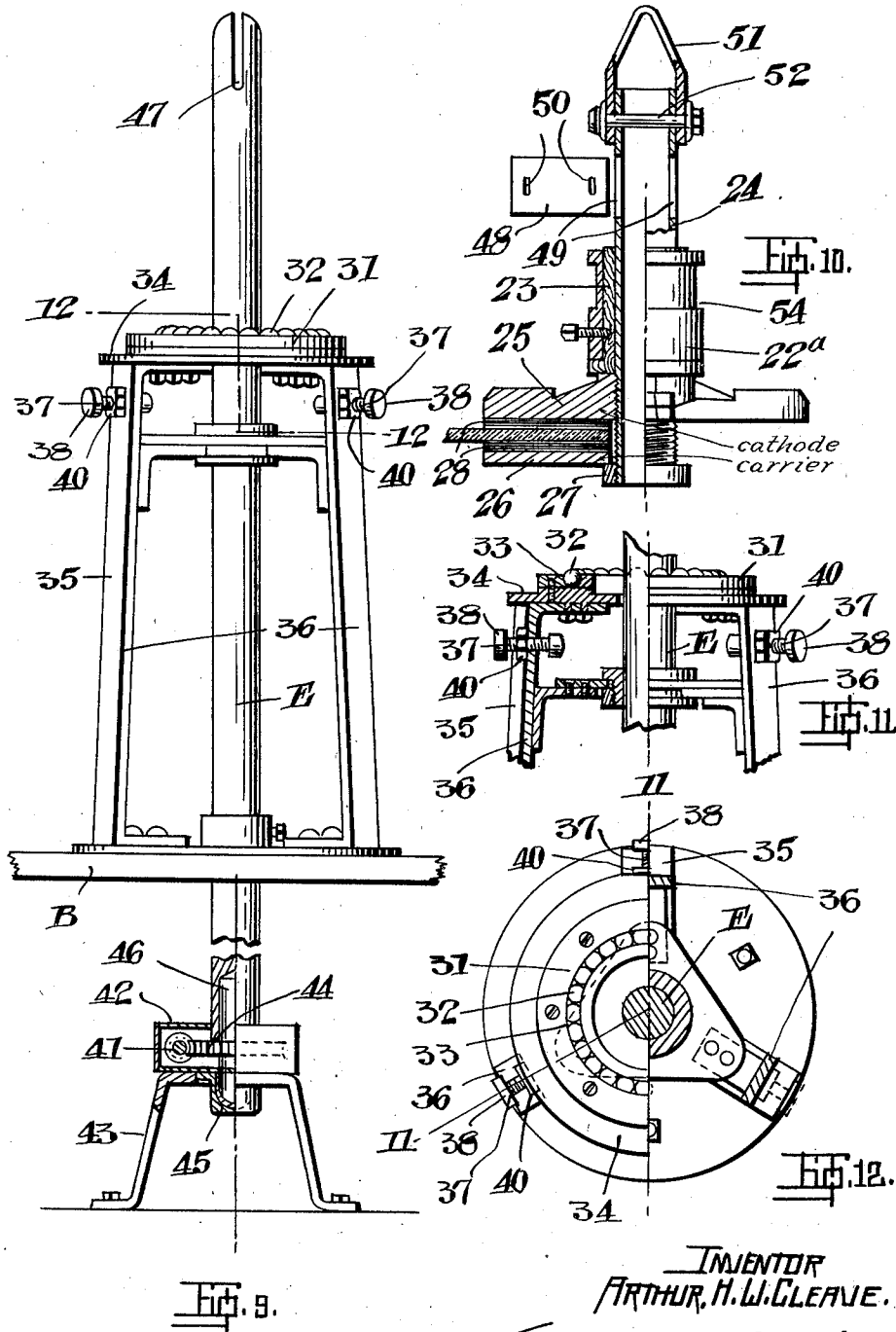
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APPARATUS FOR THE ELECTROLYTIC DEPOSITION OF METALS

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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE.

ARTHUR HAROLD WYLD CLEAVE, OF OTTAWA, ONTARIO, CANADA.

APPARATUS FOR THE ELECTROLYTIC DEPOSITION OF METALS.

Application filed January 4, 1923. Serial No. 610,648.

To all whom it may concern:

Be it known that I, ARTHUR HAROLD WYLD CLEAVE, a subject of the King of Great Britain, and a resident of the city of Ottawa, in the Province of Ontario and Dominion of Canada, have invented certain new and useful Improvements in Apparatus for the Electrolytic Deposition of Metals, of which the following is a specification.

This invention relates to improvements in apparatus for the electrolytic deposition of metals, especially such as used for the purification of silver in refineries, and the objects of the invention are to provide for increased efficiency in operation and greater permanency in the operated parts.

Further objects are to enable the operation to be carried through in a shorter space of time and with less attention, and to reduce the amount of metals locked up in the process.

Further objects are generally to improve and simplify the construction of the apparatus to adapt better the various parts to perform the functions required of them.

In its construction the invention includes a suitable jar for the electrolyte and means for suspending the anodes therein, a rotary cathode of novel design, means for supplying current thereto while rotating, an adjustable and automatic scraper designed to operate on the cathode, all as hereinafter more fully set forth and described in the accompanying specification and drawings.

In the drawings:

Figure 1 is an elevation, half in section, of an embodiment of the invention.

Figure 2 is a plan view, on one-half of which the upper parts of the cathode, cathode carrier and the commutator are broken away.

Figure 3 is an elevation, half in section, of the cathode, cathode carrier, commutator and driving shaft.

Figure 4 is an half plan view of the cathode and cathode carrier.

Figure 5 is a plan view of the jar, anode supports and scraper.

Figure 6 is a sectional elevation, showing the jar anodes with supports and the scraper.

Figure 7 is an elevation of the commutator brushes and leads.

Figure 8 is a plan view of the commutator brushes and leads.

Figure 9 is a sectional elevation of the

central cathode carrier support driving shaft and drive for the latter.

Figure 10 is an elevation, half in section, of the connection between the cathode and driving shaft.

Figure 11 is an elevation, half in section, the section being taken on the line 11—11 of Figure 12.

Figure 12 is a plan view, half in section, the section being taken on the line 12—12 of Figure 9.

In the drawings, like characters of reference indicate corresponding parts in all the figures.

Referring to the drawings:

A indicates the jar for the electrolyte of suitable insulating material, such as earthenware, and preferably of annular form, being supported on a suitable platform B. C indicates the anodes or anode plates which are suitably supported within the jar A by suitable hooks 10 which suspend them from segmental supporting rails 11, the ends of which are connected by brackets 12 to a circular connecting rail 13. The connecting brackets 12 as well as the hooks 10 may be conveniently formed of copper. The connecting rail 13 may be provided at one point with an electrical lead 14, and its extremity may be conveniently formed with a slot 15 designed to receive a connector by which it may be connected for use when the current is received from the main supply instead of from the next adjacent cell.

The anode plates C are suspended within the jar A, and below their lower extremities segmental earthenware pans 16 are provided designed to catch any small particles which may drop from the anode. D indicates the rotary cathode and cathode carrier comprising an inverted earthenware jar 17, or other suitable insulating supporting member, and a plurality of cathode plates 18 on the jar and supported by insulating strips 19 thereon of wood or the like, which may be retained in position by means of wooden bolts 20 connected to the earthenware carrier by means of wooden nuts 21 on the inner side. The cathode strips 18 are fastened to the insulating strips 19 by means of tacks or screws.

A convenient number of cathode plates are provided; as shown four, and all the plates are united by conducting lead mem-

bers 22 of copper or the like which extend to the commutator 22^a which is supported on a wooden insulating brush 23 mounted on the sleeve 24 designed to surround the central drive shaft E. The lower part of the sleeve 24 is screw-threaded and provided with an upper clamp plate 25 which engages the screw-threading and a lower clamp plate 26 which is supported by a clamp nut 27 mounted on the screw-threaded portion of the sleeve 24, the said clamp plates embracing insulating material 28 such as india rubber packing which extends between the upper and lower sides of the jar and the clamp plates.

The jar is further formed with a central perforation 29 through which the driving shaft E and the sleeve 24 may extend. The clamp plates are united by a suitable number of bolts 30 which extend through both plates as well as through the jar 17 and the packing 28.

During rotation, the rotary cathode, is supported by a ball bearing 31 including balls 32 which run on the underside of the plate 26, being themselves supported in a ball race 33 on a plate 34 which is suitably secured to a supporting bracket 35 mounted on the platform B. The bracket is conveniently formed with three legs 36, and its position may be adjusted by means of set screw 37 extending through these legs and having heads 38 designed to bear against the inner wall 39 of the jar 17, the bolts being located in adjusted position by nuts 40.

The driving shaft E is driven by a suitable motive power, that shown comprising a driving worm 41 mounted in a housing 42 on a bracket 43, the driving worm meshing with a worm wheel 44 on the lower extremity of the shaft, the shaft being provided with a suitable step bearing 45 which receives a rounded supporting pin 46 which is inserted into the lower end of the shaft. It will be seen that the drive shaft E does not support the weight of the cathode which is taken by the roller bearing 31 and bracket 35 as already explained.

To provide for transmission of rotary motion between the shaft and the rotating cathode, a slot 47 is provided in the upper end of the shaft designed to receive a cotter 48 which also extends through slots 49 provided in the sleeve 24, the lower end of the slot 47 being below the lower ends of the slots 49 whereby the cotter will not bear on the bottom of the slot 47, and hence none of the weight of the cathode will be transmitted to the shaft. The cotter may be locked in position by suitable split pins inserted through apertures 50 provided in the cotter.

For convenience in lifting, a shackle 51 is provided at the upper end of the rotary cathode, being connected to the sleeve 24 by

means of a bolt 52. The construction of the commutator brushes and leads for the rotary cathode is shown in Figures 7 and 8. The brushes 53 are designed to fit the groove 54 in the commutator 22^a, the brushes themselves being supported on the end of the conducting leads. The brushes are steadied by spring steel arms 56 which are connected to pivoted supporting arms 57 which are pivoted by bolts 58 to a portion 59 of the frame B.

The brushes are held in contact with the commutator by means of springs 60 on opposite sides of the commutator, which connect eye-bolts 61 on one supporting block 55 with hook bolts 57^a on the opposite block 55. The conducting leads are mounted on the arms 57, being held in position by suitable clips 62. The arms 57 are connected intermediate of their length by a connecting bar 63 one end of which is suitably bolted to one arm and the other end provided with a slot which engages with a bolt on the other arm. It will be seen that, when the slotted end of the connecting arm is slipped from the bolt and the springs 60 disengaged, the brushes may be freely away from the commutator, the arms 57 turning about the pivoting point 58.

During rotation the cathode is designed to be automatically scraped by a scraper F which includes a flexible resilient scraping strip or edge 64 of rubber or the like supported from angularly set wooden plates 65, the upper extremity of which is connected to a shaft 66 which extends through a supporting bearing 67, and may be locked in angular adjusted position by means of a wing or other nut 68, the bearing 67 being supported by an arm 69 which leads to a sleeve 70 fitted with a square hole for engaging with the square boss on the standard 71 which supports it. The sleeve 70 is held in position by a supporting pin 72 which extends through it and which is screw-threaded, the sleeve being locked in adjusted position by a convenient or other nut 73 on the pin 72.

One of the jars or pans 16 are located below the edge of the scraper F so that the material scraped may be collected in the same and removed at intervals from the same. The pan 16^a is held temporarily in position by means of wooden nuts 74, attaching the same to a vertically extending support 75, at either end.

From the foregoing, it will be seen that the scraper may be readily adjusted in position, and by adjustment in the position of the scraping edge, the thickness of the silver which is allowed to grow on the cathode may be regulated which will reduce the space between the anodes and cathodes, and consequently regulate the resistance of the cell.

In operation, the anode and cathode plates being set in position and the jar A being filled with electrolyte, the current is applied and the cathode rotated continuously.

Experience has shown that a rotary cathode of this character has greatly increased efficiency for the electrolytic refining of silver such as is practised in mints and refineries. It also effects a reduction of the metal locked up in the process, by reason of the increased speed at which the operation takes place. It is possible with it to use a high amperage density per square foot with low cell resistance.

The apparatus occupies small space, and, by reason of the automatic nature of the scraper, a minimum amount of manual attention is required. The arrangement of anode and cathode causes the current to pulsate which produces a loose deposit on the cathode, which may be readily removed by the india rubber scraper without injury to the cathode.

As many changes could be made in the above construction and many apparently widely different embodiments of my invention within the scope of the claims, constructed without departing from the spirit or scope thereof, it is intended that all matter contained in the accompanying specification and drawings shall be interpreted as illustrative and not in a limiting sense.

What I claim as my invention is:

1. Improved apparatus for the electrolytic deposition of metals comprising in combination, a jar, a plurality of fixed anodes suspended in the jar, a rotary cathode, a cathode carrier adapted to rotate in a horizontal plane, means for supplying current to the anodes, means for rotating the cathode including a vertical shaft, a cotter and slot connection between the vertical shaft and the cathode carrier, and an automatic scraper operating on the cathode as and for the purpose specified.

2. Improved apparatus for the electrolytic deposition of metals comprising in combination, a jar, a plurality of anodes suspended in the jar, a rotary cathode, a cathode carrier in the form of an inverted earthenware jar, means for supplying current to the anodes, means for rotating the cathode including a vertical shaft, a sleeve for the cathode carrier in a cotter and slot connection between the sleeve and the vertical shaft whereby the cathode is rotated in a horizontal plane, an automatic adjustable scraper operating in the cathode during rotation as and for the purpose specified.

3. Improved apparatus for the electrolytic deposition of metals comprising in combination, a jar, a plurality of anodes suspended in the jar, a rotary cathode, a cathode carrier adapted to rotate in a horizontal plane, a rotating driving shaft extending vertically through the jar, and having a loose coupling connection with the cathode carrier, and an automatic scraper operating on the cathode during rotation, as and for the purpose specified.

4. Improved apparatus for the electrolytic deposition of metals comprising in combination, a jar, a plurality of fixed anodes suspended in the jar, a rotary cathode, a cathode carrier adapted to rotate in a horizontal plane, means for supplying current to the anodes, means for rotating the cathode including a vertical shaft, a slot in the vertical shaft, a sleeve for the cathode carrier, a slot in said sleeve so arranged that the lower edge of said slot is above the lower edge of the slot of the driving shaft whereby the weight of the cathode carrier is supported irrespective of the shaft and an automatic adjustable scraper operating on the cathode during rotation.

5. The device as claimed in claim 4, in which the rotating cathode is supported on an adjustable bracket mounted on a platform carrying the electric light jar to relieve the driving shaft of weight.

6. Improved apparatus for the electrolytic deposition of metals comprising in combination, a jar, a plurality of anodes suspended in the jar, a rotary cathode, a cathode carrier adapted to rotate in a horizontal plane, means for supplying current to the anodes, means for rotating the cathode including a vertical shaft, not attached to the cathode, but driving it through a cotter and slot connection in a horizontal plane, an automatic scraper operating on the cathode during rotation, and a scraping member, a standard supporting the same, an angularly adjustable arm extending from the standard to the scraper, and means for angularly adjusting the scraper with respect to the arm.

7. Improved apparatus for the electrolytic deposition of metals comprising in combination, a jar, a plurality of anodes suspended in the jar, a rotary cathode, a cathode carrier adapted to rotate in a horizontal plane, means for supplying current to the anodes, means for rotating the cathode including a vertical shaft, not attached to the cathode, but driving it through cotter and slot connection in a horizontal plane, a segmental connecting member, and segmental conductors extending from the connecting member to the anodes, and an automatic scraper operating on the cathode during rotation, as and for the purpose specified.

8. Improved apparatus for the electrolytic deposition of metals comprising in combination, a jar, a plurality of anodes suspended in the jar, a rotary cathode, a cathode carrier adapted to rotate in a horizontal plane, means for supplying current

to the anodes, means for rotating the cathode including a vertical shaft, not attached to the cathode, but driving it through cotter and slot connection in a horizontal plane, segmental annular pans beneath the anodes, and an automatic scraper operating on the cathode during rotation, as and for the purpose specified.

9. Improved apparatus for the electrolytic deposition of metals comprising in combination, a jar, a plurality of anodes suspended in the jar, a rotary cathode, a cathode carrier adapted to rotate in a horizontal plane, means for supplying current to the anodes, means for rotating the cathode including a vertical shaft, not attached to the cathode, but driving it through cotter and slot connection in a horizontal plane, and an automatic adjustable scraper operating on the cathode during rotation, and a removable pan beneath the scraper, as and for the purpose specified.

10. Improved apparatus for the electrolytic deposition of metals comprising in combination, a jar, a plurality of anodes suspended in the jar, a rotary cathode, a cathode carrier adapted to rotate in a horizontal plane, means for supplying current to the anodes, means for rotating the cathode including a vertical shaft, not attached to the cathode, but driving it through cotter and slot connection in a horizontal plane, a sleeve surrounding the shaft having clamping plates engaging the cathode carrier, and an automatic scraper operating on the cathode during rotation, as and for the purpose specified.

11. Improved apparatus for the electrolytic deposition of metals comprising in combination, a jar, a plurality of anodes suspended in the jar, a rotary cathode, a cathode carrier adapted to rotate in a horizontal plane, means for supplying current to the anodes, means for rotating the cathode including a vertical shaft, not attached to the cathode, but driving it through cotter and slot connection in a horizontal plane, and a commutator on the cathode carrier having suitable commutator brushes and leads, and an automatic scraper operating on the cathode during rotation, as and for the purpose specified.

12. Improved apparatus for the electrolytic deposition of metals comprising in combination, a jar, a plurality of anodes suspended in the jar, a rotary cathode, a cathode carrier adapted to rotate in a horizontal plane, means for supplying current to the anodes, means for rotating the cathode including a vertical shaft, not attached to the cathode, but driving it through a loose coupling in a horizontal plane, and a commutator on the cathode carrier having suitable commutator brushes and leads, and an automatic scraper operating on the cathode

during rotation, pivoted arms supporting the brushes and spring means for retaining the brushes in contact with the commutator.

13. Improved apparatus for the electrolytic deposition of metals comprising in combination, a jar, a plurality of anodes suspended in the jar, a cathode carrier comprising an insulating supporting member, plates on the supporting member, a sleeve, clamping plates on the sleeve embracing the supporting member, a commutator, conducting members extending from the commutator member to the cathode plates, a driving shaft, a cotter and slot connection between the driving shaft and the cathode carrier, means for rotating the shaft, as and for the purpose specified.

14. Improved apparatus for the electrolytic deposition of metals comprising in combination, a jar, a plurality of anodes suspended in the jar, a cathode carrier, comprising an insulating supporting member, plates on the supporting member, a sleeve, clamping plates on the sleeve embracing the supporting member, a commutator, conducting members extending from the commutator member to the cathode plates, a driving shaft, a loose coupling between the driving shaft and the cathode carrier, means for rotating the shaft, and an automatic scraper operating on the cathode during rotation.

15. Improved apparatus for the electrolytic deposition of metals comprising in combination, a jar, a plurality of anodes suspended in the jar, a cathode carrier comprising an insulating supporting member, plates on the supporting member, a sleeve, clamping plates on the sleeve embracing the supporting member, a commutator, conducting members extending from the commutator member to the cathode plates, a driving shaft, a cotter and slot connection between the driving shaft and the cathode carrier, means for rotating the shaft and a supporting bracket having a bearing engaging the underside of one of the clamping plates.

16. Improved apparatus for the electrolytic deposition of metals comprising in combination, a jar, a plurality of fixed anodes suspended in the jar, a rotary cathode, a cathode carrier adapted to rotate in a horizontal plane, means for supplying current to the anodes, means for rotating the cathode including a vertical shaft, not attached to the cathode, but driving it through a loose coupling in a horizontal plane, and an automatic scraper operating on the cathode during rotation, and means for causing the current to pulsate to produce a loose deposit on the cathode, as and for the purpose specified.

17. Apparatus of the character described, comprising in combination, a jar, a plurality of anodes suspended in the jar, a cathode carrier, supported with freedom to turn

about a vertical axis, cathodes on the carrier, and a pivotally mounted angularly adjustable scraper adapted to operate on the cathodes during rotation.

5 18. Apparatus of the character described, comprising in combination, a jar, a cathode carrier adapted to turn about a vertical axis, a cathode carrier thereon, anodes suspended in the jar, an adjustable scraper designed to
10 operate on the cathode, and a removable segmental pan beneath the scraper.

19. Improved apparatus of the character described, comprising in combination, a jar, a cathode carrier mounted to turn about a
15 vertical axis, a segmental anode support, a plurality of anodes suspended from such support in the jar, a plurality of cathodes mounted on the cathode carrier, a scraper adapted to operate on the cathodes during
20 rotation.

20. Improved apparatus of the character described, comprising in combination, a jar, a cathode carrier mounted to turn about a
25 vertical axis, a segmental anode support, a plurality of fixed anodes suspended from such support in the jar, a plurality of cathodes mounted on the cathode carrier, a scraper adapted to operate on the cathodes during rotation, a plurality of segmental
30 pans provided beneath the anodes and scraper.

21. Apparatus of the character described,

comprising an annular jar, a cathode carrier mounted to turn about a vertical axis, cathodes carried on the carrier depending into the jar, supporting means for the cathode carrier mounted in the centre part of the jar, and supporting the weight of the said cathode carrier, a vertically extending driving shaft, a cotter and slot connection between the said driving shaft and the cathode carrier.

22. Apparatus of the character described, comprising an annular jar, a cathode carrier adapted to turn about a vertical axis, and designed to be removable by lifting vertically, a plurality of cathodes carried by the cathode carrier and dripping into the jar, a vertically extending driving shaft, connecting means extending between the driving shaft and cathode carrier designed to cause the carrier to rotate with the shaft without causing the weight of the cathode carrier to be borne by the shaft.

23. Apparatus for the electrolytic deposition of metals in which the rotating cathode is in the form of an insulating member having mounted thereon a plurality of cathode plates supported in position by insulating strips.

In witness whereof I have hereunto set my hand.

ARTHUR HAROLD WYLD CLEAVE.