M. REID.

ELECTROPLATING APPARATUS.

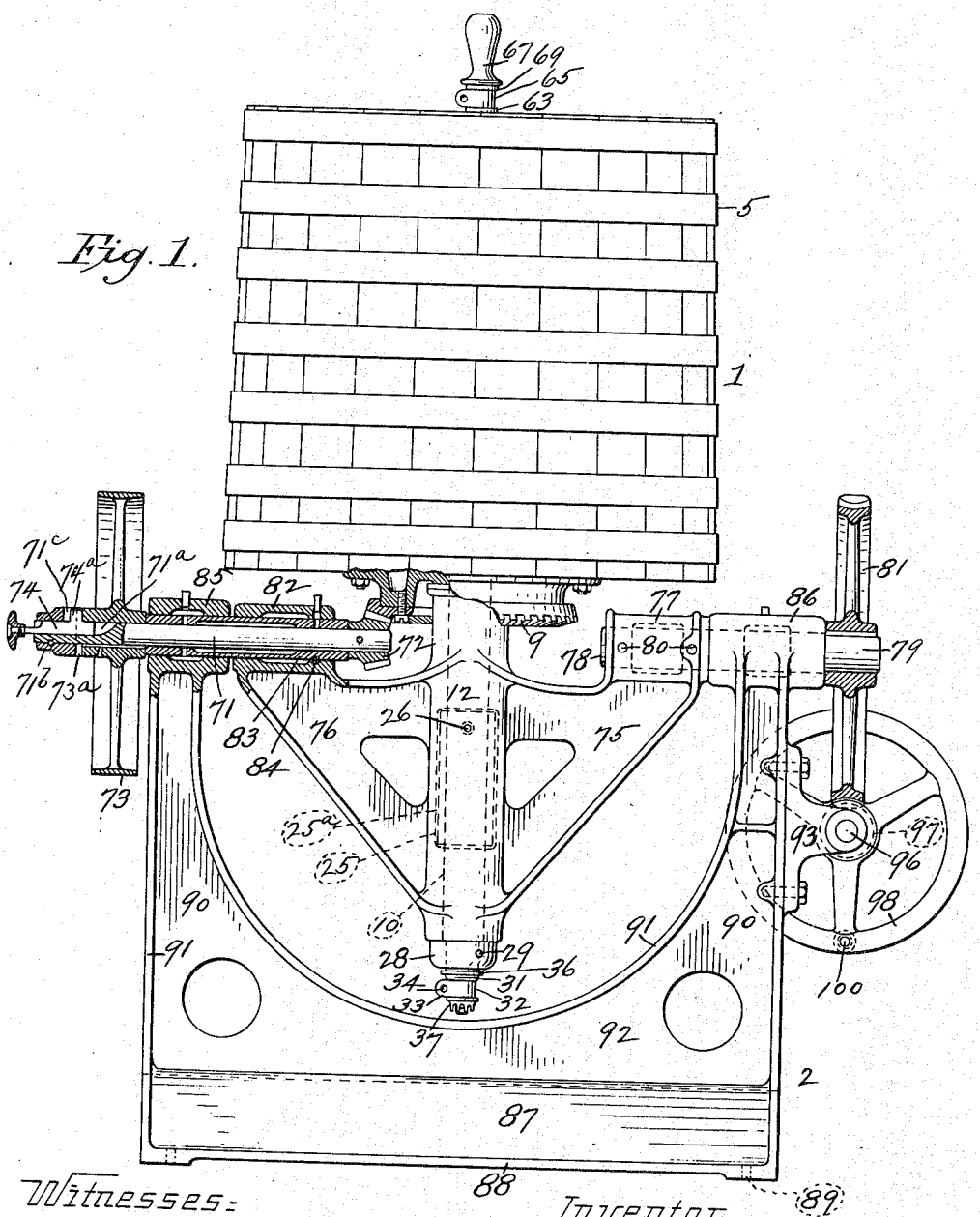
APPLICATION FILED FEB. 19, 1906.

981,004.

Patented Jan. 10, 1911.

4 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

A. L. Lord.

A. S. Hull.

Inventor,

Marcellus Reid

By Fouts & Hull,

Attorneys.

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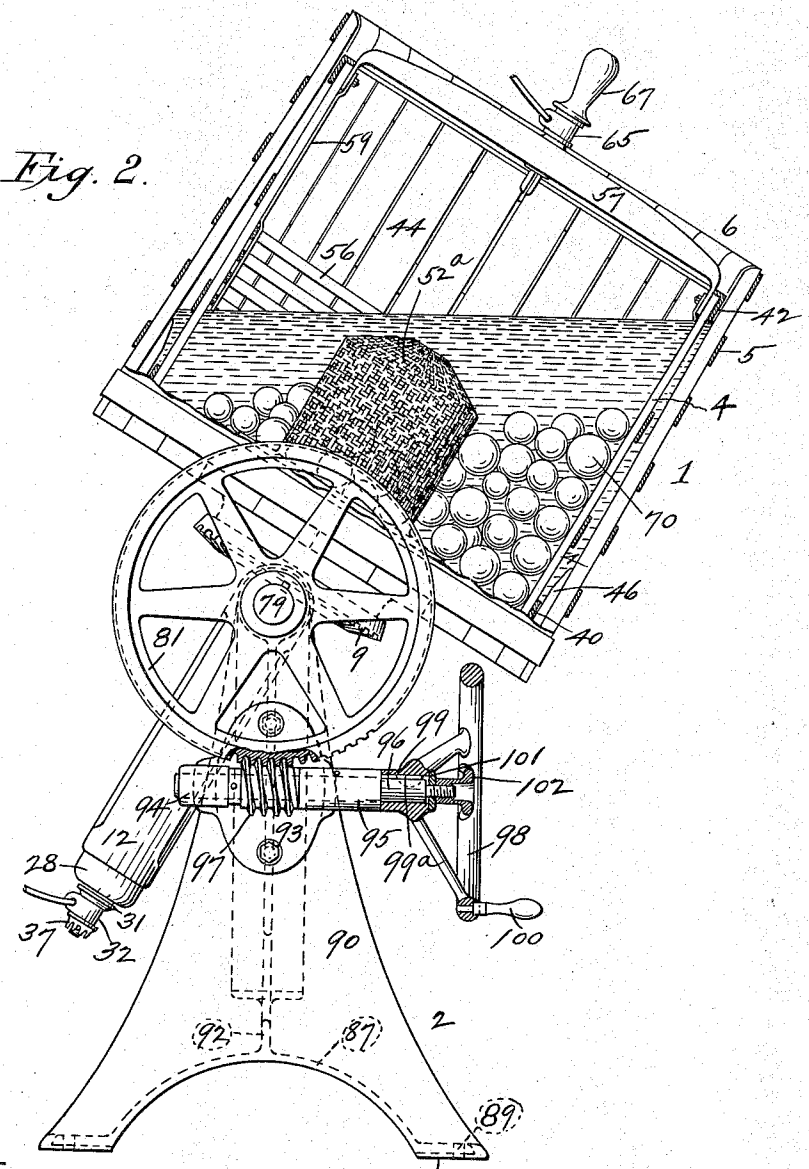
4 SHEETS—SHEET 2.

Fig. 2.



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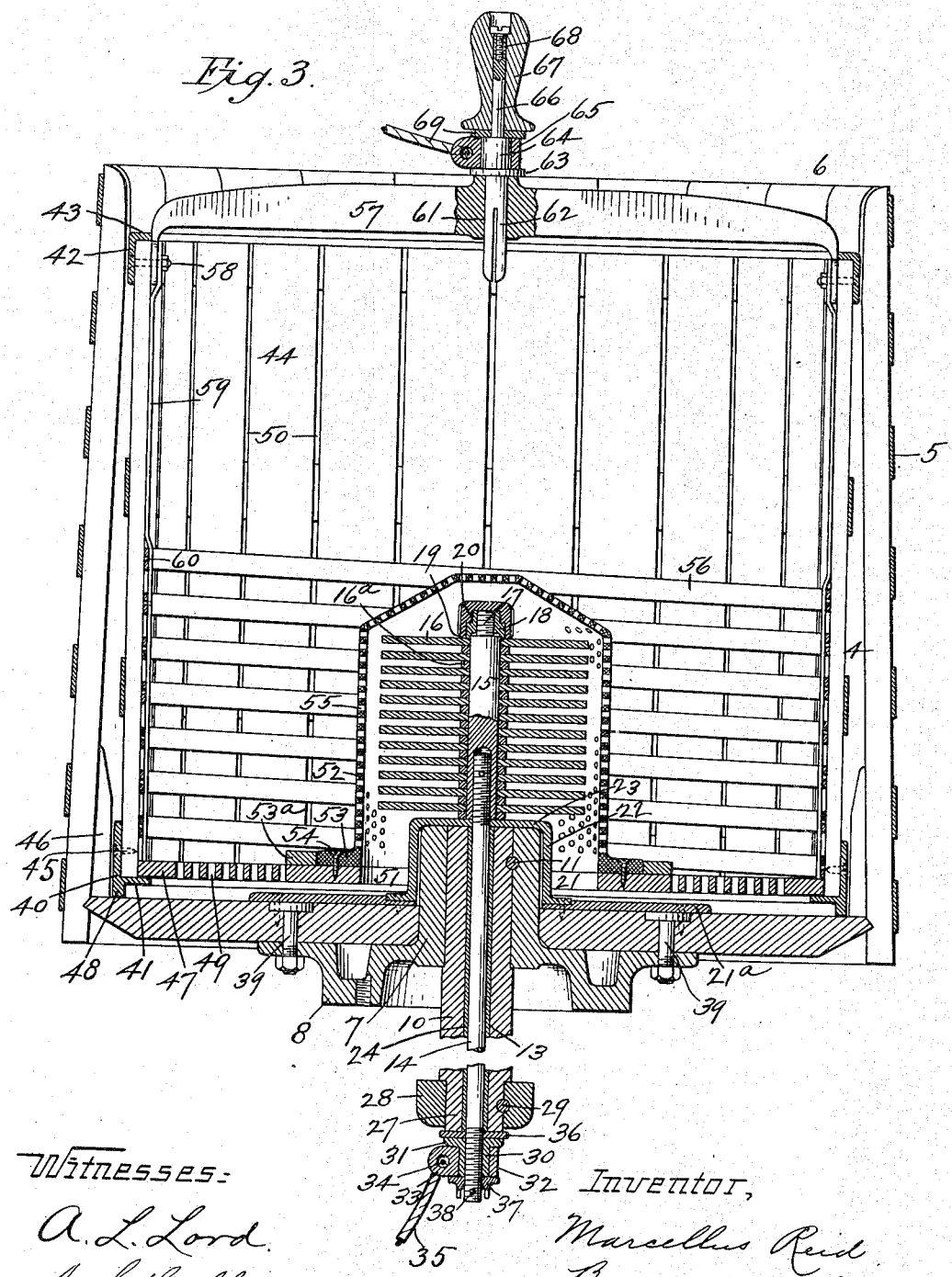
4 SHEETS—SHEET 3.

Fig. 3.



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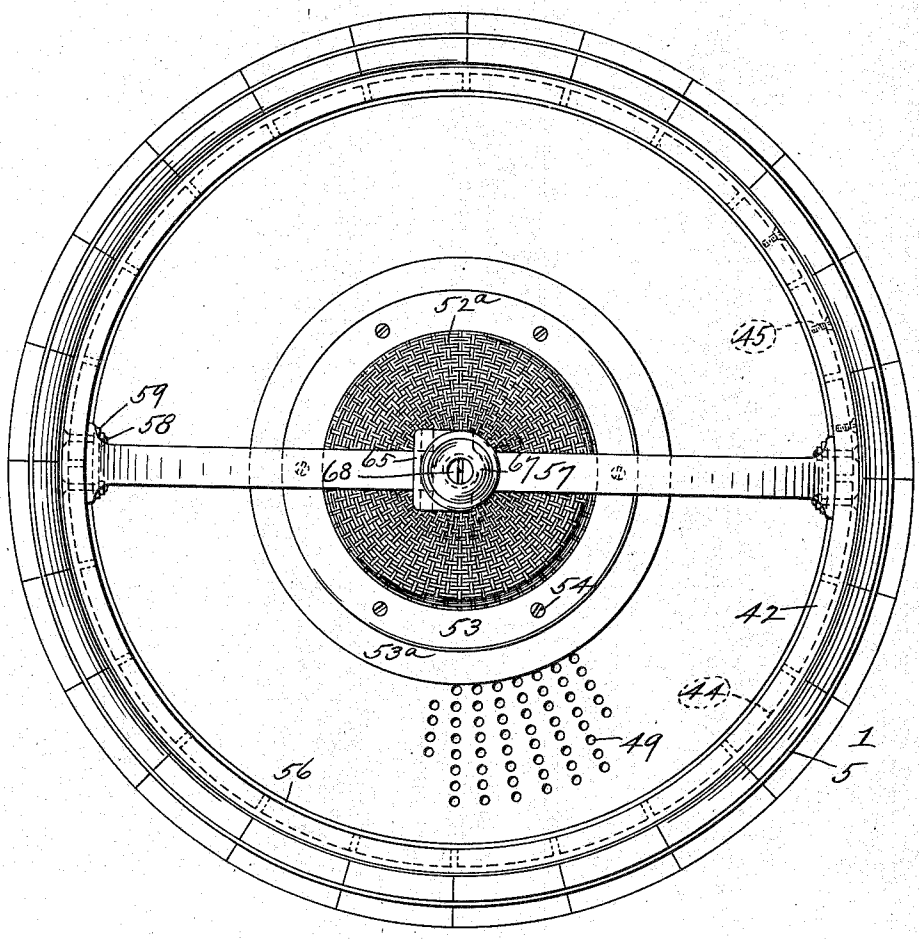
4 SHEETS—SHEET 4.

Fig. 4.



Witnesses:

A. L. Lord.

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Inventor,

Marcellus Reid,

By Fouts & Hull.

Attorneys.

UNITED STATES PATENT OFFICE.

MARCELLUS REID, OF CLEVELAND, OHIO.

ELECTROPLATING APPARATUS.

981,004. Specification of Letters Patent. Patented Jan. 10, 1911.

Application filed February 19, 1906. Serial No. 301,772.

To all whom it may concern:

Be it known that I, MARCELLUS REID, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Electroplating Apparatus, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

My invention relates to electro-plating apparatus generally, and more particularly to an apparatus of this kind wherein the articles to be plated are subjected to a tumbling action during the plating operation.

The objects of my invention are to increase the rapidity of plating, to improve and simplify the construction of the apparatus, and to lessen the cost of production thereof.

Generally speaking, the invention may be defined as consisting of the combinations of elements embodied in the claims hereto annexed.

In the drawings forming a part hereof:— Figure 1 represents an elevation of an apparatus constructed in accordance with my invention, some of the parts being broken away to illustrate more clearly the manner of supporting the shaft which rotates the tank and the accessories thereof; Fig. 2 represents an elevation, at right angles to Fig. 1, the tank and basket and a portion of the worm wheel being broken away for clearness of illustration, the tank being shown in an inclined position; Fig. 3 represents an enlarged longitudinal section through the tank; and Fig. 4 represents a plan view of said tank.

The apparatus consists generally of the tank 1 and a supporting frame 2 therefor. The complete tank, when ready for plating purposes consists of an outer casing or receptacle and an inner receptacle or basket 4 within which the articles to be plated are placed, the basket being removably fitted within the outer casing. The outer receptacle or tank has its inner surface composed of material which will not be decomposed by the electrolyte and is preferably constructed of wooden staves to which there are applied the hoops 5. The body of the tank is frusto-conical in shape, having its largest diameter at the bottom and tapering inwardly toward the top, whereby a somewhat contracted mouth 6 is provided. The bottom is provided with a central opening for the reception of the hub 7 which is preferably a casting and projects inwardly through said bottom from the ring 8. Attached to this ring preferably by being bolted thereto, as shown in Fig. 1, is a bevel gear 9, by means of which the tank is rotated to tumble the articles placed therein.

10 designates a shaft which is rigidly secured to the hub 7 by means of one or more pins 11. This shaft projects downwardly a considerable distance from the tank, being journaled in an elongated bearing 12, which will be described more particularly hereinafter. The shaft 10 is provided with a central bore 13 for the reception of a rod 14, which may be of copper or other suitable conducting material, said rod projecting through the said shaft and having its upper end threaded to engage the corresponding threaded interior of a stud 15, which is also of copper or similar conducting material. This stud forms the support for the anode plates 16, each of said plates being in the shape of a circular disk provided with a central perforation of a size permitting it to fit closely around the stud.

To prevent the electrolyte from obtaining access to the stud and to expose both the top and the bottom surfaces of said plates to the action of the electrolyte, I space said plates by means of washers 16^a, said washers being of fiber, hard rubber, or other suitable material which will not be decomposed by the electrolyte and fitting closely around the stud. The upper end portion of the stud is threaded at 17. To clamp the plates firmly together, thereby preventing the electrolyte from passing between the plates and the washers, and to protect the upper end of the stud from the electrolyte, I employ a nut 18 which is threaded onto the end 17, said nut having a depending rim 19 which engages the uppermost plate, and I cover said nut with a cap of hard rubber or similar material. The upper end of the nut may be reduced, as shown at 20, and may be provided with an external thread to increase the adherence of the cap thereto. The lower portion of the cap projects downwardly into contact with the uppermost plate of the anode, thereby preventing the access of the electrolyte to the stud and nut.

To protect the hub 7 and shaft 10 from the electrolyte, I provide a dome 21 of hard rubber, wood fiber, or similar material, said dome having an upwardly directed central

portion 22 provided with a cap 23 which extends across the upper surface of the hub 7 and shaft 10, being provided with a central aperture of sufficient diameter to permit the rod 14 to pass therethrough. The lower end of dome 21 is flanged and the flange is secured, as by screws, to a disk 21ª which centers the dome and covers a considerable area of the bottom of the tank. This disk is preferably of wood, as this material is cheap and is not attacked by the electrolyte. One of the washers 16ª is applied to the stud, between the lowermost anode plate and the top of the cap 23. A sleeve or tube 24 of non-conducting material is employed between the rod 14 and shaft 10 to prevent short circuiting of the current.

The anode plates 16 are made of pure rolled metal, as distinguished from cast metal, and are superior to anodes made of cast metal, owing to the great uniformity and density of the rolled sheet, permitting uniform decomposition thereof from the periphery to the center, although the electrolytic action occurs on the faces of the plates as well. The plates are shown somewhat thick, for clearness of illustration, but are actually made very thin, thereby affording a maximum surface for decomposition from a given weight of anode metal.

The bearing 12 is economically formed as part of a casting which contains bearings for the shafts which rotate and tilt the tank. The first-mentioned bearing is provided with an internal chamber 25 (shown in dotted lines in Fig. 1) for the accommodation of one or more layers of felt (indicated at 25ª) applied to the shaft and serving to supply and distribute oil to the same, an oil opening 26 being provided through which oil may be introduced into such chamber. The lower end of the shaft 10 extends through the bearing 12 and is contracted, as shown at 27, for the reception of a short sleeve 28, which may be slipped over said shaft and secured thereto, as by a pin 29. 30 designates a sleeve which is threaded onto the lower end of the rod 14 and is provided with a flange 31 at its upper portion, said flange forming a stop and bearing for the upper end of a terminal sleeve 32, said sleeve 32 being provided with a lug 33 having an aperture 34 therein for the application of the electrical conductor or cable 35. Between the flange 31 and the lower end of the shaft 10 there is fitted a washer 36 of fiber or similar non-conducting material. The sleeve 30, flange 31, and terminal sleeve 32 are held in place by means of a jam nut 37, which is preferably a crown nut, said nut being prevented from unscrewing by means of a pin 38 extending through the rod 14 and passing between oppositely located teeth on said nut.

While the hub 7 and ring 8 may be formed integral with the bevel gear 9, for convenience and cheapness of construction I prefer to make said gear separate from the ring and hub and to bolt it thereto, as shown in Fig. 1. The disk 21ª is of such extent as to cover the heads of the bolts 39 by which the ring 8 is secured to the bottom of the tank, to prevent short-circuiting, the upper surface of the tank bottom being recessed for the reception of the heads of the bolts.

The basket 4, in which are placed the articles to be plated, is of cylindrical shape, is preferably removably fitted in the tank, and is constructed as follows:—40 designates a ring which is provided above the bottom thereof with an inwardly directed flange 41. This ring is made of brass or similar material, which is capable of withstanding the action of the electrolyte. A ring 42 of similar material is provided for the upper end of the basket, said ring having an inwardly directed flange 43 at the top thereof. Staves 44 extend between said rings, said staves having their upper ends abutting against the flange 43 and their lower ends abutting against the flange 41. The staves are secured in place by means of screws 45. The basket is preferably cylindrical in shape, the outside diameter of the ring 42 being just enough smaller than the internal diameter of the top of the tank to permit of its ready insertion into and withdrawal from said tank. Near the bottom of the tank I provide a suitable number of ribs 46 of wood or similar material projecting inwardly from the inner surface of the tank, the amount of projection of such ribs being sufficient to permit the ready insertion and removal of the basket while centering it with respect to the tank. The flange 41 projects inwardly a sufficient distance to provide a support for the bottom 47 of the basket, and the ring projects downwardly beyond the flange to provide a spacing ring or flange 48 between the bottom of the basket and the bottom of the tank. The basket bottom is provided with perforations 49, a sufficient number of which are shown to indicate the uniformly-perforated character of the bottom. These perforations, with the spaces 50 between the staves 44, permit free access of the electrolyte to the interior of the basket. The basket bottom is formed of wood or similar material which is not decomposed by the electrolyte. At its center, the bottom 47 is provided with an opening 51, preferably circular and of a diameter sufficiently greater than that of the anode plate to permit the basket to be inserted into and removed from the tank without engaging said plates. To protect the anode from injury by the articles that are being plated, I provide a dome-shaped cage 52, the internal diameter of which is preferably the same as the diameter of the opening 51. This cage is provided with an

outwardly extending flange 53 by means of which it is conveniently fastened to the bottom 47, as by screws 54, and is provided with a sufficient number of perforations 55 to permit substantially free flow of the electrolyte therethrough. In Fig. 3, I have shown a sufficient number of these perforations to illustrate the uniformly-perforated character of the dome. The bottom flange 53 is backed by a ring 53^a which is fitted outside said flange, closely thereagainst, said ring being secured to the bottom of the basket and being preferably of wood, for cheapness of production.

56 designates the cathode terminal. In the embodiment of my invention disclosed herein, this cathode terminal consists of a strip of metal, as copper, secured to the lower portion of the basket, to the inside of the wall or casing thereof, and is formed of a spiral extending from the bottom somewhat above the top of the anode. To permit of its ready removal from the tank, the basket is provided with a bail 57 having its opposite ends secured to the upper portion of the basket body, as by means of bolts 58 extending through said ends and the ring 42. This bail forms part of the circuit between the cathode terminal and the source of electrical energy. The lower ends of the bail are in electrical contact with the cathode terminal, as by means of plates or strips 59, which may be conveniently secured to the ends of the bail by the bolts 58, being fastened to the cathode terminal as by rivets 60. At its central portion, the bail is provided with a bore 61 for the metallic pin 62, the lower end of which is split to prevent displacement. This pin is provided with a flange 63 engaging the top of the bail and with a body or barrel 64 above said flange for the reception of the terminal sleeve 65. This sleeve is similar in construction to the sleeve 32 hereinbefore described. Above the body 64 the pin 62 is provided with a reduced extension 66 for the application of the handle 67 of wood or similar non-conducting material, said handle being conveniently secured in place by means of a screw 68. Between said handle and sleeve 65 there is interposed a washer 69.

The construction of the anode hereinbefore described is particularly effective, as it provides, within a minimum space, a maximum surface from which decomposition may proceed. The arrangement of the anode plates, with the cathode terminal surrounding and in substantially the same plane as the plates, permits decomposition to proceed radially from the anode in all directions toward the cathode terminal, thereby subjecting the articles to be plated at all times to the effect of this decomposition and insuring the speedy application of the coating thereto. Even with the receptacle tilted at a considerable angle, as shown in Fig. 2, the decomposition may proceed radially in substantially all directions from the anode plates to the cathode terminal and may at all times proceed radially from the anodes in such direction as to expose the articles 70 to the action thereof.

As previously stated, I provide the tank with means for rotating and tilting the same. The means for rotating the tank comprises a shaft 71 having at the inner end thereof a bevel gear 72 for engaging the bevel gear 9 carried by the bottom of the tank. The shaft 71 is provided with the pulley 73, which is loose thereon, but which may be engaged therewith by a very simple form of clutch. The end of the shaft is provided with a longitudinal slot or keyway 71^a and has pinned thereto a collar 71^b, which is provided at its inner end with a slot 71^c for the reception of a lug or spline 74^a of a sliding key 74. Short slots 73^a are provided at diametrically opposite points of the outer end of the pulley hub. By pushing the key 74 inwardly, the lug or spline 74^a will enter one or the other of the slots 73^a, according to the position of the shaft and of the sleeve 71^b and thus clutch the pulley to the shaft 71. When it is desired to stop the tumbling operation, it is only necessary to withdraw the key 74, whereupon the pulley will be disconnected from and turn idly upon the shaft 71.

As stated hereinbefore, the bearing 12 is part of a casting and has projecting laterally therefrom the wings or brackets 75 and 76, each wing or bracket comprising a web having at its upper and lower edge a rib merging with the bearing 12. The wing 75 has cast therewith a hub 77 for the inner end 78 of the shaft 79. The inner portion 78 of this shaft is secured to the hub 77, as by pins 80, and the outer end of said shaft is provided with a worm wheel 81 which is keyed thereto, as shown in Fig. 1. The wing 76 is provided with a hub 82 similar to the hub 77 but, as the shaft 71 is employed only to rotate the barrel and does not have to withstand the strain produced by tilting the barrel, it is made of smaller diameter than shaft 79. For cheapness of construction, however, I make the hubs 77 and 82 of the same internal diameter and provide the shaft 71 with a surrounding sleeve 83, which itself serves as a bearing for the shaft, being pinned to the journal 82, as shown at 84. The outer ends of shafts 71 and 79 are supported in bearings 85 and 86 respectively, carried by opposite sides of the frame 2. This frame is constructed especially with a view of obtaining the maximum amount of strength with a minimum amount of material as well as with a minimum amount of machine work, thereby producing a very cheap and effective con-

struction. The frame is made of a single casting and consists of an arch 87 (see Figs. 1 and 2) extending the full length of the frame and provided at its bottom edges with lateral flanges 88, to extend the width thereof and to provide means whereby it may be bolted in place, openings 89 being provided for this purpose. Extending upwardly from each end of the arch is a bracket, said bracket comprising a plate 90 which tapers upwardly from the side flanges to the upper end thereof.

91 designates a rib or plate extending continuously from side to side of the frame and presenting a concave face upwardly, said rib or plate being substantially semicircular in outline.

92 designates a web extending between the rib 91 and the arch 87 and plates 90. The bearings 85 and 86 are formed with and carried by the upper ends of the side brackets consisting of the rib 91, plates 90 and connecting web 92. The internal diameter of the bearings 85 and 86 is the same as that of the bearings 77 and 82, the sleeve 83 which surrounds the shaft 71 being extended through the bearing 85. The hubs 77 and 82 and the bearings 85 and 86 are each chambered out for cheapness of production, the recesses in the bearings 85 and 86 providing oil chambers.

It will be apparent that the frame herein described, while extremely cheap of construction, possess the requisite strength, with a minimum amount of material, to support the tank and to withstand the strains to which it may be subjected.

Below the worm wheel 81, the appropriate plate 90 has bolted thereto a casting 93, said casting being provided with bearings 94 and 95 for supporting the shaft 96 which carries a worm 97 preferably pinned thereto. 98 designates the operating wheel for said worm, said wheel being connected to the worm shaft by means of a sleeve 99, which may be secured thereto by a key 99ª, the sleeve being slipped in place. An operating handle 100 is provided for said wheel. The wheel is conveniently secured in place on the shaft by means of a washer 101 and a nut 102 threaded onto the outer end of said shaft, said nut having its outer end corrugated to provide an effective grip. The jar of the tumbling combined with the leverage thrown onto the worm by the inclination and weight of the tank and its contents may cause the same to rotate, thereby allowing the tank to assume too great an angle, spilling the solution and producing other undesirable effects. The provision of the key 99ª and the washer 101 and nut 102 permits the worm shaft to be locked, by tightening the nut, against such rotation by the tumbling operation.

It will be understood that the interior of the tank, the basket, cage, and various other parts which are exposed to the action of the electrolyte need not be made of the particular materials set forth herein, as any material which will withstand the action of the electrolyte and will not be coated by the metal of which the anode is composed will answer the purpose. For cheapness of production, I may make the cage of wicker work, as indicated at 52ª in Figs. 2 and 4. The material of which the cage is made in this case is preferably willow, the interstices 55ª between the withes permitting the flow of the electrolyte through the cage. The materials specified are those preferred by me as best combining cheapness and efficiency.

While, by the details of construction herein set forth, I have described a particularly effective and economical embodiment of my invention, I do not propose to be limited to such details except as the same may be positively included in the claims hereto annexed or may be rendered necessary by the prior state of the art.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:—

1. In an electro-plating apparatus, the combination of a tank, a centrally arranged anode, a cage surrounding said anode, and a cathode terminal surrounding said anode and extending from the lower portion of the tank to at least the same height as the anode, substantially as specified.

2. In an electro-plating apparatus, the combination of an exterior tank, an open-work casing or basket in said tank, a centrally arranged anode projecting into the lower portion of said basket and a cathode terminal consisting of a metallic strip extending continuously around the side of the basket and secured thereto, substantially as specified.

3. In an electro-plating apparatus, the combination of an exterior tank, an open-work receptacle or basket in said tank, a centrally arranged anode projecting into the lower portion of the basket, a cathode terminal consisting of a metal strip formed into a spiral and secured to the inner wall of said basket, a metallic bail for said basket, and electrical connections between said bail and said cathode terminal, substantially as specified.

4. In an electro-plating apparatus, the combination of a tank, an open-work casing or basket within said tank, an anode for the lower central portion of said basket, a cathode terminal surrounding said anode and carried by the side wall of the basket, a metallic bail for said basket, and an electrical connection between said bail and cathode terminal, substantially as specified.

5. In an electro-plating apparatus, the

combination of a tank, an anode therein, said anode consisting of a central conducting stud in the lower portion of said tank, a series of spaced anode plates on said stud, and a cathode terminal surrounding said anode, substantially as specified.

6. In an electro-plating apparatus, the combination of a tank, an anode in the central portion of said tank, said anode comprising a centrally located stud, spaced anode plates mounted on said stud, a cage surrounding said plates and stud, and a cathode terminal surrounding said cage, substantially as specified.

7. In an electro-plating apparatus, the combination of a tank, an anode within said tank, said anode comprising a metallic stud, a series of anode plates mounted on said stud, washers of fiber or similar material between said plates, means for protecting the portions of the stud which project beyond the plates from the action of the electrolyte, and a cathode terminal also located in said tank, substantially as specified.

8. An anode for an electro-plating apparatus comprising a stud of conductive material, a series of anode plates mounted on said stud, non-conducting washers interposed between said plates and surrounding said stud, one end of said stud projecting beyond the plate adjacent thereto and provided with a screw thread, a nut threaded onto such end of said stud, and a protecting cap of non-conducting material covering said stud and extending to the adjacent plate, substantially as specified.

9. An anode for an electro-plating apparatus comprising a stud of conductive material, a series of anode plates or disks mounted on said stud, non-conducting washers interposed between said plates and surrounding said stud, and a clamp for securing said plates on said stud, said clamp being provided with an outer surface of material which is capable of withstanding the action of the electrolyte, substantially as specified.

10. An anode for an electro-plating apparatus comprising a stud of conducting material, a series of spaced plates on said stud, the planes of said plates being at substantially right angles to the length of said stud, means for protecting the portions of the stud intermediate of said plates from electrolytic decomposition, and a clamp for retaining said plates on said stud, said clamp being provided with an exterior surface capable of withstanding the action of the electrolyte, substantially as specified.

11. In an electro-plating apparatus, the combination of a tank, of a removable basket therein, said basket having a centrally located cage projecting from the bottom thereof, and a perforated bottom exterior to said cage, a cathode terminal within said basket and secured to the inner wall thereof, and an anode projecting centrally from the lower portion of the tank and adapted to be inserted into said cage, means being provided for spacing the bottom of the basket from the bottom of the tank, substantially as specified.

12. In an electro-plating apparatus, the combination of a tank, a basket within said tank having its bottom and side walls spaced from the bottom and side wall of said tank, said basket comprising a centrally arranged cage projecting upwardly from the bottom thereof, the bottom of the basket outside said cage being perforated, an anode carried by the tank and projecting into said cage, and a cathode terminal for said anode, substantially as specified.

13. In an electro-plating apparatus, the combination of a tank, a basket removably fitted in said tank and having its bottom and side wall spaced from the corresponding parts of the tank, said basket being perforated to permit access of the electrolyte thereto, an anode, and a cathode terminal within said basket, a bail for said basket electrically connected with one of the electrodes and an electric terminal carried by said bail, substantially as specified.

14. In an electro-plating apparatus, the combination of a tank having a closed bottom, a tapering side wall and a contracted mouth, a substantially cylindrical basket removably fitted in said tank, said basket being perforated for the access of the electrolyte thereto, the diameter of the top of said basket being substantially equal to the internal diameter of the mouth of the tank, and means for centering and spacing the lower portion of said basket with respect to the corresponding inner portion of the tank, substantially as specified.

15. A basket for an electro-plating apparatus comprising top and bottom rings, the bottom ring having an inwardly extending flange, staves extending between said rings, and a perforated bottom supported by the flange on the bottom ring, substantially as specified.

16. In an electro-plating apparatus, the combination of a tank having a centrally arranged anode in the lower portion thereof, and a basket for said tank, said basket having a bottom provided with an upwardly extending centrally located cage for the reception of said anode, a cathode terminal carried by the side wall of said basket, perforations being provided in said basket for the passage of the electrolyte therethrough, substantially as specified.

17. In an electro-plating apparatus, the combination of a tank having a centrally arranged anode in the lower part thereof, a basket within said tank having a perforated bottom spaced from the bottom of the tank

and provided with a central upwardly extending cage for the reception of the anode, and a cathode terminal carried by the inner wall of said basket, substantially as specified.

18. In an electro-plating apparatus, the combination of a tank having a centrally arranged electrode in the lower portion thereof, a perforated basket within said tank provided with a central upwardly extending cage for the reception of said electrode, and a second electrode carried by the side wall of said basket, substantially as specified.

19. In an electro-plating apparatus, the combination of a tank having an electrode therein, means for rotating said tank, a terminal electrically connected with said electrode, a basket within said tank or receptacle, said basket carrying the other electrode, and a terminal on said basket electrically connected with its electrode, substantially as specified.

20. In an electro-plating apparatus, the combination of a tank carrying an electrode, means for rotating said tank, a shaft projecting from said tank, a terminal sleeved on said shaft, a basket within said tank, said basket carrying the other electrode, and a terminal sleeved to a portion of said basket, substantially as specified.

21. In an electro-plating apparatus, the combination of a tank having therein an electrode, means for rotating said tank, a shaft projecting from said tank, a terminal sleeved on said shaft, a basket within said tank, said basket being provided with the other electrode, a bail for said basket, an electrical connection between said bail and the electrode in said basket, and a terminal sleeved on said bail, substantially as specified.

22. In an electro-plating apparatus, the combination of a tank, a drive shaft for rotating said tank, and a frame for supporting said tank, said frame comprising a casting having a longitudinally extending arched base and a bracket projecting upwardly from each end of the arched base, said bracket being provided with a bearing for the drive shaft, substantially as specified.

23. In an electro-plating apparatus, the combination of a tank, a driven member on said tank for rotating the same, a drive shaft having a driving member thereon for engaging said driven member, and a supporting frame for said tank, said frame comprising a base having a longitudinally extending arch, said arch being provided at each end with an upwardly projecting bracket, said bracket having formed therewith a bearing for the driving shaft, substantially as specified.

24. In an electro-plating apparatus, the combination of a tank, said tank being provided at the lower portion thereof with a depending shaft, a bearing for said shaft, said bearing being provided with lateral webs each having thereon a substantially horizontal bearing, a driven member for rotating said tank, a drive shaft having thereon a driving member for said driven member, said shaft projecting through and supporting one of the aforesaid horizontal bearings, and a shaft for varying the inclination of said tank, said shaft projecting through and supporting the other horizontal bearing, substantially as specified.

25. In an electro-plating apparatus, the combination of a tank, said tank having projecting from the bottom thereof a shaft, a frame having therein three bearings, a central bearing for the reception of said shaft, and a pair of lateral bearings at substantially right angles to said central bearing, a driven member for rotating said tank, a shaft having a driving member for said driven member, said shaft extending through one of the lateral bearings, and a shaft for varying the inclination of said tank, said shaft extending through the other lateral bearing, substantially as specified.

26. In an electro-plating apparatus, the combination of a tank, said tank having a downwardly extending shaft, a bearing for said shaft, a shaft for rotating said tank, a shaft for varying the inclination of said tank, and a frame provided with bearings for the last mentioned shafts, said frame comprising a base portion and a pair of vertically extending brackets projecting from said base portion, each of said brackets being provided with a bearing for an operating shaft, the upper portion of said frame being concaved to permit the passage of the shaft depending from the tank, substantially as specified.

27. In an electro-plating apparatus, the combination of a tank, said tank having a shaft depending therefrom, a bearing for said shaft, a shaft for rotating said tank, a shaft for varying the inclination of said tank, and a supporting frame for said tank, said frame comprising an arch provided with vertically extending brackets, said brackets being connected by a transverse web which is concaved to permit the passage of the shaft depending from the tank, each of said brackets being provided with a bearing for one of said operating shafts, substantially as specified.

28. In an electro-plating apparatus, the combination of a tank, a shaft depending therefrom, a bearing for said shaft, an operating shaft for rotating said tank, a second operating shaft for varying the inclination thereof, and a frame for supporting the tank and the operating shafts, said frame comprising a casting the lower portion of which is arched and is provided at each end thereof with a vertically extending bracket,

said brackets comprising each an external lateral plate and an internal rib extending continuously from bracket to bracket and a web connecting said rib with the exterior plates and arch, said rib being concaved to permit the passage of the depending shaft, and a bearing, integral with the upper end of each of said brackets, for the support of one of said operating shafts, substantially as specified.

29. In an electro-plating apparatus, the combination of a tank, a shaft depending therefrom, a bearing for said shaft, an operating shaft for rotating said tank, a second operating shaft for varying the inclination thereof, and a frame for supporting the tank and the operating shafts, said frame comprising a casting the lower portion of which is arched and is provided at each end thereof with a vertically extending bracket, said brackets comprising each an external lateral plate and an internal rib extending continuously from bracket to bracket, and a web connecting said rib with the exterior plates and arch, said rib being concaved to permit the passage of the depending shaft, and a bearing, integral with the upper end of each of said brackets, for the support of one of the aforesaid operating shafts, substantially as specified.

30. In an electro-plating apparatus, the combination of a tank having a centrally arranged depending shaft, an operating shaft for rotating said tank, an operating shaft for tilting said tank, the latter shaft being of greater diameter than the former, a supporting frame for said tank and shafts, said frame comprising a base and upwardly extending brackets, each bracket having cast therein a bearing for an operating shaft, said bearings being of the same internal diameter, and a sleeve surrounding the first-mentioned operating shaft and connected to its bearing to fill the space between said shaft and the interior of said bearing, substantially as specified.

31. In an electro-plating apparatus, the combination of a tank and a supporting frame therefor, said frame consisting of an integral casting comprising an arched base, a plate projecting upwardly from the base at each end thereof, an internal concave plate or rib extending continuously from side to side of the frame, a web connecting said rib or plate with the outer plates and with the base, and a bearing for the tank carried by and integral with the upper end of each of said brackets, substantially as specified.

32. In an electro-plating apparatus, the combination of an exterior tank, a casing or basket surrounded by said tank, a centrally arranged anode projecting into the said basket, and a cathode terminal surrounding said anode, substantially as specified.

33. In an electro-plating apparatus, the combination of a tank, a casing or basket in said tank, a centrally arranged electrode projecting into the lower portion of said basket, and a second electrode consisting of a metallic strip extending around the side wall of the basket and secured thereto, substantially as specified.

34. In an electro-plating apparatus, the combination of an exterior tank, a casing or basket in said tank, a centrally arranged electrode projecting into the lower portion of the basket, and a second electrode consisting of a metallic strip formed into a spiral and secured to the side wall of said basket, substantially as specified.

35. In an electroplating apparatus, the combination of a tank or receptacle for the articles to be plated, means for rotating said tank or receptacle, means for adjusting the inclination of said tank or receptacle, and means for securing the adjusting means against displacement to prevent the vertical displacement of the tank or receptacle during its rotation, substantially as specified.

36. In an electro-plating apparatus, the combination of a tank or receptacle, means for rotating the same, a shaft for adjusting the inclination of said tank or receptacle, a worm wheel on said shaft, a worm shaft having thereon a worm for operating said wheel, and means for clamping the worm shaft against rotation, substantially as specified.

37. In an electro-plating apparatus, the combination of a tank or receptacle, means for rotating said tank or receptacle, a shaft for varying the inclination of said tank or receptacle, a worm wheel on said shaft, a worm shaft, bearings for said shaft, a worm rigid with said shaft and intermediate said bearings, an operating wheel having a sleeve slidingly fitted on the outer portion of said shaft, and means, as a nut, for adjusting said sleeve on said shaft to bind the worm against one of the bearings and prevent rotation of the worm shaft, substantially as specified.

38. In an electroplating apparatus, the combination of an exterior tank, an open-work receptacle or basket in said tank, a centrally arranged electrode projecting into the lower portion of the basket, a second electrode consisting of a metal strip formed into a spiral and secured to the inner wall of said basket, a metallic bail for said basket, and electric connections between said bail and the electrode carried by the basket, substantially as specified.

39. In an electroplating apparatus, the combination of a tank, an electrode therein, said electrode consisting of a conducting stud in the lower portion of said tank, a series of spaced electrodes placed on said stud, and a second electrode within said tank, substantially as specified.

40. In an electroplating apparatus, the combination of a tank, an electrode in said tank, said electrode comprising a metallic stud, a series of electrode plates mounted on said stud, washers of fiber or similar non-conducting material between said plates, means for protecting the portion of the stud which projects beyond the plates from the action of the electrolyte, and a second electrode also located in said tank, substantially as specified.

41. An electrode for an electroplating apparatus comprising a stud of conducting material, a series of spaced electro plates on said stud, means for protecting the portions of the stud intermediate of said plates from electrolytic decomposition, and a clamp for retaining said plates on said stud, said clamp having an exterior surface capable of withstanding the action of the electrolyte, substantially as specified.

42. In an electroplating apparatus, the combination of a tank, a basket within said tank having its bottom and side walls spaced from the bottom and side walls of said tank, said basket comprising a centrally arranged cage projecting upwardly from the bottom thereof, an electrode carried by the tank and projecting into said cage, and a second electrode within said tank, substantially as specified.

43. In an electroplating apparatus, the combination of a tank having a closed bottom, a tapering side wall and a contracted mouth, a substantially cylindrical basket removably fitted in said tank, said basket being perforated for the access of the electrolyte thereto and the diameter of the top of said basket being substantially equal to the internal diameter of the mouth of the tank, means for centering and spacing the lower portion of the tank, an electrode projecting into the central portion of the basket, and a second electrode carried by the side wall of the basket, substantially as specified.

44. In an electroplating apparatus, the combination of a tank, a basket in said tank, a centrally arranged anode projecting into the lower portion of said basket, and a cathode terminal carried by said basket and extending around the side of the same, substantially as specified.

45. In an electroplating apparatus, the combination of a tank, a basket in said tank, a centrally arranged anode projecting into the lower portion of the basket, and a cathode terminal formed into a spiral and secured to the inner wall of said basket, substantially as specified.

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

MARCELLUS REID.

Witnesses:
B. W. Brockett,
J. B. Hull.