Electroplating Barrel Assemblies

William E. Belke and Leopold Lang, Chicago, Ill., assignors to Belke Manufacturing Co., Chicago, Ill., a corporation of Illinois
Filed June 21, 1960, Ser. No. 37,785
2 Claims. (Cl. 204—213)

The present invention relates to electroplating barrel assemblies, and is particularly concerned with electroplating barrels of the type having a multiplicity of small apertures in the side wall of the barrel for the purpose of permitting the electroplating solution to have access to the articles being plated inside the barrel.

It is found that when the size of the apertures in the wall of the barrel is made quite small, such as one-sixteenth of an inch in diameter, to prevent the articles, which may also be quite small, from getting into the solution, there is a tendency for the solution in the barrel to become starved of electroplating metal because there is a greater resistance to the passage of the solution through the smaller apertures; and the electroplating metal in the barrel becomes used up.

In some cases it has been found that plating practically stops unless special action is taken to change the solution inside the barrel; and users of electroplating barrels having such small apertures have been compelled to lift the barrel out of the solution, permitting the solution to run out of the barrel, which is then replaced and filled with new solution from the tank during its immersion in the solution.

One of the objects of the present invention is the provision of an improved assembly in which the barrel is provided with auxiliary larger apertures in its end plates, which are so arranged that the solution may flow readily into or out of the barrel at its ends to replenish the solution and the plating metal in the barrel.

Another object of the invention is the provision of an improved barrel structure which is provided with such enlarged apertures in its end walls which includes end shields separating the apertured end walls from the articles in the barrel, and also having enlarged apertures which are located above the level of the articles in the barrel.

Another object of the invention is the provision of an improved electroplating barrel assembly including a reciprocating support for the barrel on the tank so that the barrel may be moved to and fro endwise to replenish the solution and speed up plating in the barrel.

Another object of the invention is the provision of an assembly including such a movable support which is also provided with automatic drive means for causing the barrel to move back and forth periodically, thus improving the circulation of solution into and out of the barrel.

Another object of the invention is the provision of an improved mechanism by which the end apertures for changes of solution in the barrel are increased in size to a maximum to permit the maximum circulation of the solution into and out of the barrel.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the four sheets of drawings accompanying the specification,

FIG. 1 is a view in perspective of an improved electroplating barrel, shown in connection with a tank for movably supporting the portable barrel unit and an electric motor drive for causing the barrel to reciprocate endwise in the solution contained in the tank;

FIG. 2 is a front elevational view of the portable electroplating barrel unit;

FIG. 3 is a fragmentary sectional view of the end structure of the barrel and frame, taken on the plane of the line 3—3 of FIG. 1, looking in the direction of the arrows;

FIG. 4 is an end elevational view partially broken away, showing the portable unit;

FIG. 5 is a sectional view taken on the plane of the line 5—5 of FIG. 3;

FIG. 6 is a fragmentary sectional view of the shield on an enlarged scale, showing the shape of the enlarged apertures;

FIG. 7 is an exploded view of the cover and barrel in perspective;

FIG. 8 is a fragmentary sectional view similar to FIG. 3 of a modification having maximum size end openings in the barrel;

FIG. 9 is an end elevational view of the unit similar to FIG. 4 of this modification;

FIG. 10 is a fragmentary sectional view taken on the plane of the line 10—10 of FIG. 8, looking in the direction of the arrows;

FIG. 11 is a sectional view taken on the plane of the line 11—11 of FIG. 10, looking in the direction of the arrows.

Referring to FIG. 1, 10 indicates in its entirety an electroplating apparatus assembly including a rectangular tank 11 having an upper outwardly extending supporting flange 12 carried by rectangular sides and ends 13. The tank flange 12 carries a plurality of U-shaped stirrups 14, 15, and 16, and a fourth one located behind the motor 17, each stirrup being secured to the flange 12 by screw bolts, and each having a grooved roller 18, the contour of which is complementary to the cylindrical rods 19, 20, which rest on the rollers.

The rods 19 and 20 may serve as cathode rods, one of them effecting an electrical connection to the bus bars 21, 22 carried by a portable electroplating unit 23, which rests on the rods.

The motor 17 forms part of a driving unit, indicated in its entirety at 24, and comprising a rod agitator unit carried by a bracket 25, which is secured to an end wall 13 of the tank 11 by screw bolts. Bracket 25 supports the motor 17 and a gear housing 26, changing the rotary motion of the shaft of motor 17 to an oscillating motion of the agitator shaft 27, which projects from both ends of the gear housing 26.

Agitator shaft 27 carries a crank arm 28, 29 at each end; and the crank arm has a pin 30 and slot 31 connection at each end to a connecting rod 32. In each case the connecting rod 32 is pivotally connected by means of a stirrup 33 and a pivot pin 34 passing through the end of each cathode rod in such manner that the oscillation of the cranks 28, 29 causes the cathode rods 19, 20 to reciprocate axially.

The rate of oscillation of the cathode rods may vary considerably; but as an example, they may be moved from sixteen to twenty-six strokes per minute.

The portable electroplating unit 23 preferably comprises a pair of insulating frame plates 35, 36, which are secured in spaced relation by three frame spacing rods 37, 38, 39. The upper rod 37 is cylindrical and provided with threaded ends, while the lower rods 38, 39 may be
rectangular for supporting platform 40; but they are also provided with threaded ends.

Each rod is provided on the inside of the frame plates 35. The width of bosses 41 and nuts 42 and similar washers and nuts 43 on the ends of the rods, clamping the frame plates between the nuts and washers on the rods in parallel position.

The platform 40 supports an electric driving motor 44, which drives the gears in a gear box 45, suitably reducing the speed of a driven shaft 47, carrying a pinion 48, which drives a gear 49, comprising an idler rotatably mounted upon stub shaft 49 and meshing with the barrel gear 50.

Frame plates 35, 36 and gears 47, 48, 50, and the barrel 51 may all be constructed of some chemically inert material, such as melamine or Temprone, or Lucite. Gear 52 indicates an electrical connector for connecting the motor to a standard 60 cycle 110 volt lighting circuit; and gear 53 indicates a double throw switch for controlling the motor and connecting it for rotation in either direction by means of the lever 54. The speed of rotation of the barrel may be varied; for instance, it may rotate four revolutions per minute.

The frame plates 35, 36 are provided with through bores 55, 56, forming supports for the trunnions 57, 58 for the barrel 51. The trunnion in each case may comprise a cylindrical body 59 having an integral circular plate 60 on its inner end.

The circular plate 59 is preferably beveled at 60 adjacent its outer edge 61; and this plate forms a fixed shield covering the inside of the barrel end plates 62, 63, which end plates are provided with multiplicity of enlarged apertures 64 and arranged on a pair of circles, as shown in dotted lines in FIG. 5.

The shields 59 also have apertures 65 of the same size only in the upper portion of the shield; and these apertures have a 45 degree taper 66 at their inner ends. The apertures 65 preferably are adapted to come into alignment with some of the apertures in the end plates 62, 63 of the barrel as the barrel rotates.

The frame plates 35, 36 are also provided with a series of relatively large apertures 67, as shown in FIG. 4, extending through the frame plates; and these are preferably in alignment with the apertures 65 in the shield. Each end plate 62, 63 of the barrel is preferably formed with a groove 68 on its inner face, this groove being hexagonal in elevation and rectangular in cross-section for receiving the hexagonal ends of the barrel wall 69 of the barrel 51, which is cemented in the groove 68.

The wall 51 is preferably hexagonal in form, having six sides, 70-74, integrally connected, and an open side 75, which is closed by cover 76.

The end plates 62, 63 are preferably cut away at each end of the opening 75, forming a slot 77 extending from the shoulder 78 to the periphery of each end plate 62, 63.

The shields 59 are circular in form and beveled adjacent their peripheral edges; and they are held against the end plates by the thrust washer on the trunnions 57 so that articles comprising the load in the barrel cannot get in between the shield and the end of the barrel.

The cover 76 may comprise a rectangular plate of the same material of sufficient length to extend between the cut out portions 78 in the end plates and of sufficient width to overlap the edges 79 and 80 of the wall 69 at the opening 75. Each end of the cover may be provided with a turnbuckle 81, 81 pivoted mounted on a stud 82 carried by the cover and having a thin end portion 83 adapted to be received in the slots 84 in the end plates to secure the cover in place.

The gear 50 may be secured to the end plate 62 by means of through screws or screw bolts, both ends of which are counter-sunk and covered with the same insulating material.

Whereas barrels of this type, having very small apertures 85 in the walls of the barrel 69, have caused difficulty in the past because the solution passes through the apertures 85 too slowly or in too small an amount, so that the solution inside the barrel became starved of the metal for plating, the present barrels are adapted to effect a change of the solution inside the barrel from the solution in the tank through the enlarged apertures 67, 69, and 65 without agitation. Their operation is greatly improved by oscillating the portable barrel unit along the axis with a suitable mechanism, such as that shown in FIG. 1.

With the present invention the solution inside the barrel does not become starved of the plating and the electroplating may proceed continuously and at a faster rate.

Referring to FIGS. 8-11, these are views of a modification which is similar to the construction shown in FIGS. 3-6 except that this modification includes end apertures in the ends of the barrel, which apertures are of maximum size and of a shape which permits their enlargement so that there is a maximum circulation of solution through both ends of the barrel.

Referring to FIGS. 8 and 9, the present modification includes a pair of end frame plates 90 and 91 similar to those previously described and held in parallel spaced relation by threaded rods 92, 93, 94 provided with nuts 95 on both sides of the frame plates.

The frame plates differ from those previously described in that each is provided with an upper arcuate opening 110 of maximum size adjacent to pass solution toward the end of the barrel. Each frame plate 90, 91 has a bearing bore 96 for receiving the trunnion 98, which is carried by the circular shield 97 located inside the barrel.

The circular shield 97 is also provided with an enlarged arcuate opening 105 located toward its upper side above the load of articles to be electroplated and in line with the aperture 110.

The barrel has its wall 102 located in a slot in the barrel end plate 101, which is provided with a bearing bore 96 for rotatably mounting the barrel on the trunnion 98. The trunnion 98 has a enlarged, engaging the inside of the frame plate 91 or 90 and a reduced portion 96 extending through the frame plate; and the trunnion has a thrust bearing 100, which holds the shield closed against the end of the barrel, preventing articles from getting in between the shield and the barrel end.

The edge of the shield is preferably beveled, as shown at 104.

The barrel end plates 101 are provided with a plurality of arcuate apertures 107, 108, 109 so that as the barrel rotates these apertures come successively into communication with the apertures 110 in the frame plate and the apertures 105 in the shield.

It will thus be observed that the modifications shown in FIGS. 3-6 and FIGS. 8-11 illustrate the wide variation that may occur in the shape and size of the end apertures in the barrels. The level of the solution is, of course, above the apertures 105, 108, 109, 110.

While we have illustrated and described a preferred embodiment of our invention, many modifications may be made without departing from the spirit of the invention, and we do not wish to be limited to the precise details of construction set forth, but desire to avail ourselves of all changes within the scope of the appended claims.

Having thus described our invention, what we claim as new and desire to secure to Letters Patent of the United States is:

1. An electroplating barrel assembly comprising a pair of frame plates and frame members extending between the frame plates and holding them in parallelism, each frame plate having a bearing bore, said bores being axially aligned, an electroplating barrel comprising two hexagonal end plates grooved on the opposite inside surfaces with a groove defining a hexagon, a barrel wall comprising a rectangular sheet of chemically inert plastic having parallel bends forming five sides of an integral
hexagonal barrel wall open on one side, the ends of said wall being cemented in said grooves, said end plates having a pair of aligned bearing bores, a cover plate closing the open side of the barrel wall, said barrel wall having a multiplicity of small openings admitting electrolyte, but preventing passage of small articles, said end plates having a plurality of large openings for admitting new electrolyte to avoid starvation of the solution in the barrel, and a fixed trunnion member secured in each of the bores in said frame plates and having a through bore in each trunnion with an electrical conductor extending through each trunnion and depending therein into contact with articles being electroplated, said trunnions extending through the bores in the barrel end plates and supporting a circular shield on each trunnion inside each end of the barrel, said shields each having a beveled outer edge and a plane outer surface held against each end plate, and said shields having upper apertures above the trunnions for passing electrolyte from the end plate apertures, and means for rotating the barrel.

2. An electroplating barrel assembly according to claim 1, in which the assembly includes a tank for electrolyte, a pair of roller supported spaced parallel rods on top of said tank, said rods supporting the barrel assembly by engagement with bus bars carried by said frame plates, an electric motor carried by the tank and speed reducing gearing extending from the motor to a pair of cranks, said cranks being reciprocably connected to said rods, moving the rods back and forth on the tank and rollers longitudinally of the rods, and the rods moving the barrel assembly and causing the electrolyte in the barrel to be renewed through the large openings in the end plates and shields, and the shields preventing the articles in the barrel from getting in the end plate apertures.

References Cited in the file of this patent

UNITED STATES PATENTS
1,916,465 Dawson .......................... July 4, 1933
2,746,732 Guillette ......................... May 22, 1956

FOREIGN PATENTS
471,259 Germany .......................... Feb. 9, 1929