

Nov. 5, 1974

A. SINGLETON

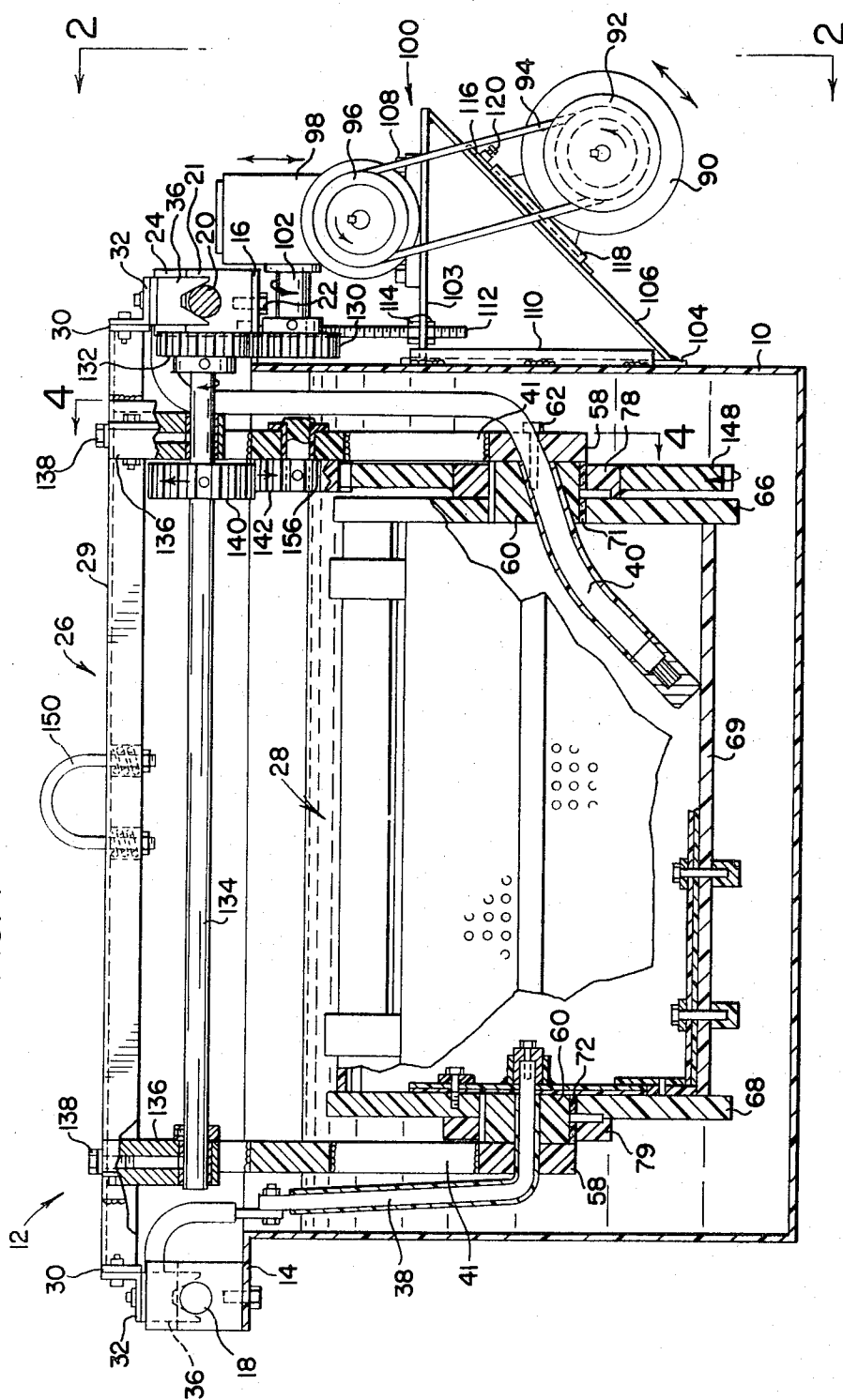
3,846,271

PLATING BARREL WITH SPIRAL SIDES

Filed Jan 27, 1972

4 Sheets-Sheet 1

FIG. 1



Nov. 5, 1974

A. SINGLETON

3,846,271

PLATING BARREL WITH SPIRAL SIDES

Filed Jan 27, 1972

4 Sheets-Sheet 2

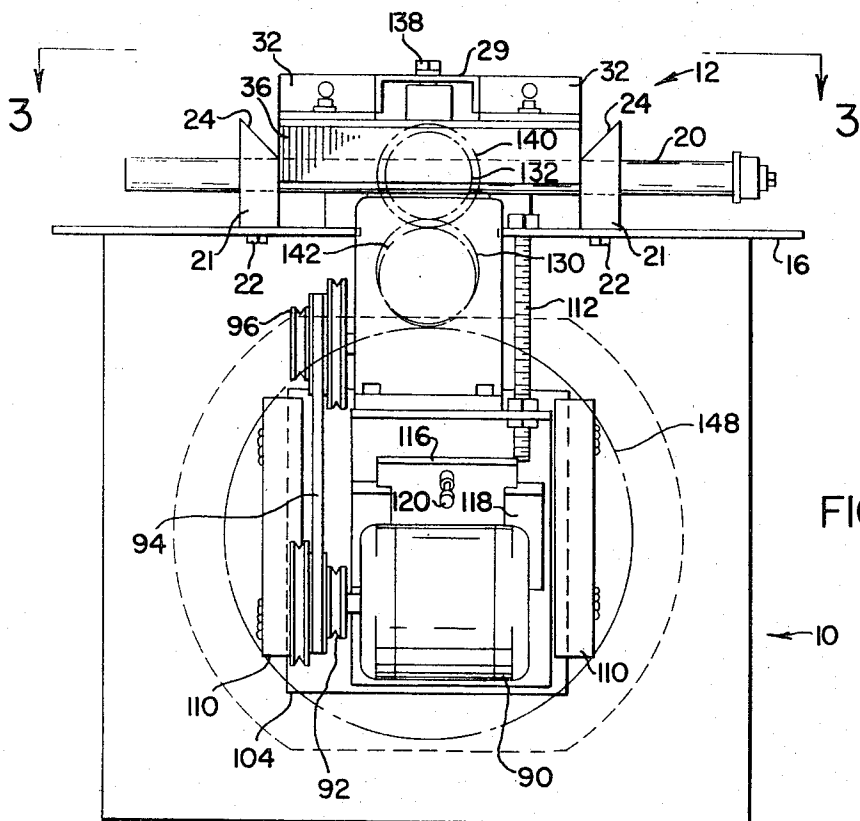


FIG. 2

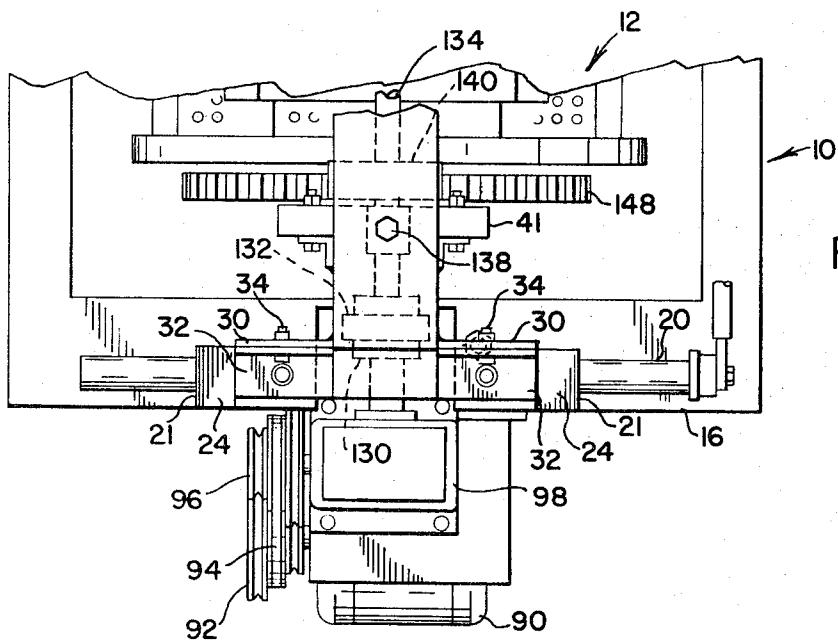


FIG. 3

Nov. 5, 1974

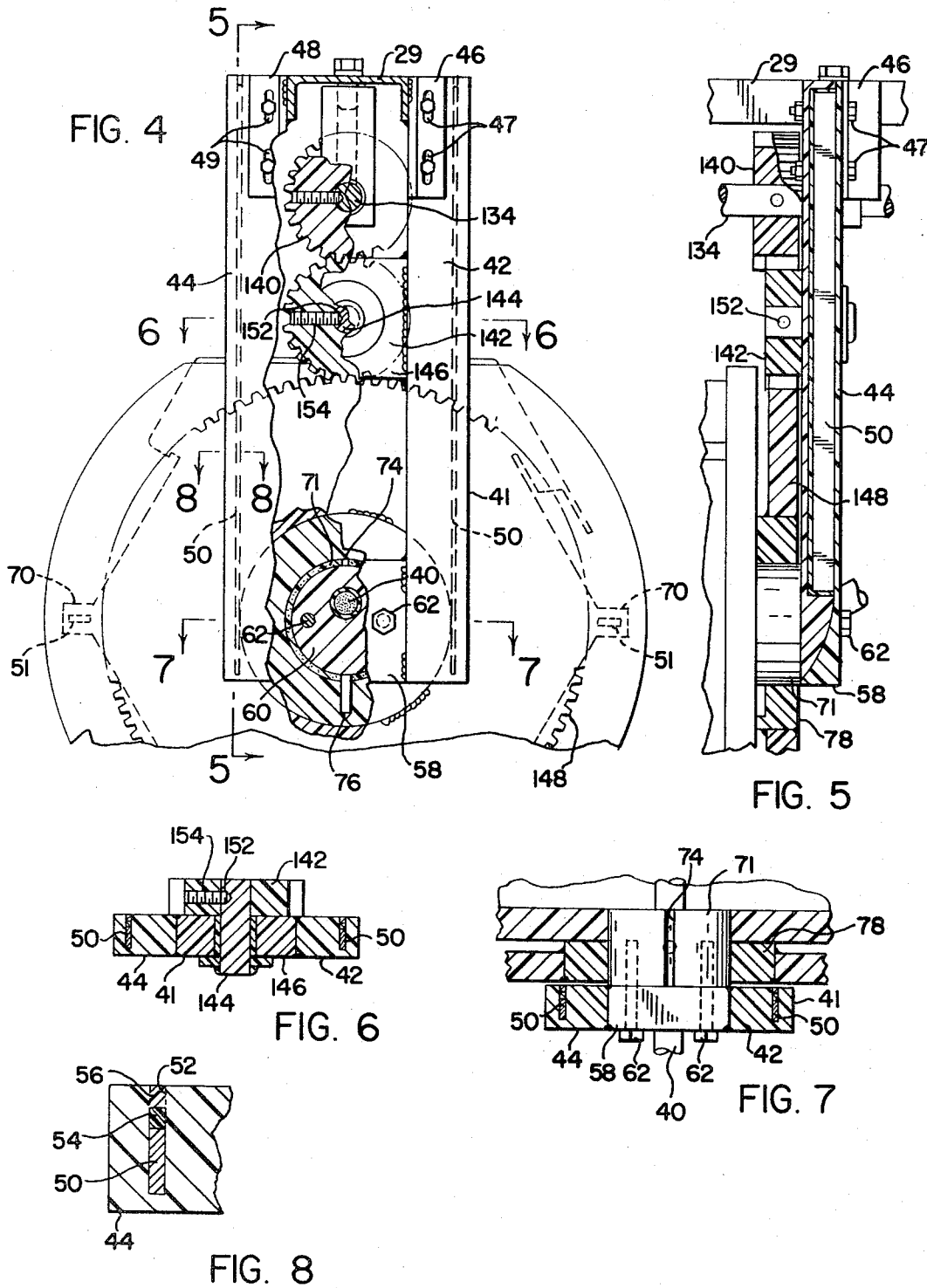
A. SINGLETON

3,846,271

PLATING BARREL WITH SPIRAL SIDES

Filed Jan. 27, 1972

4 Sheets-Sheet 3



Nov. 5, 1974

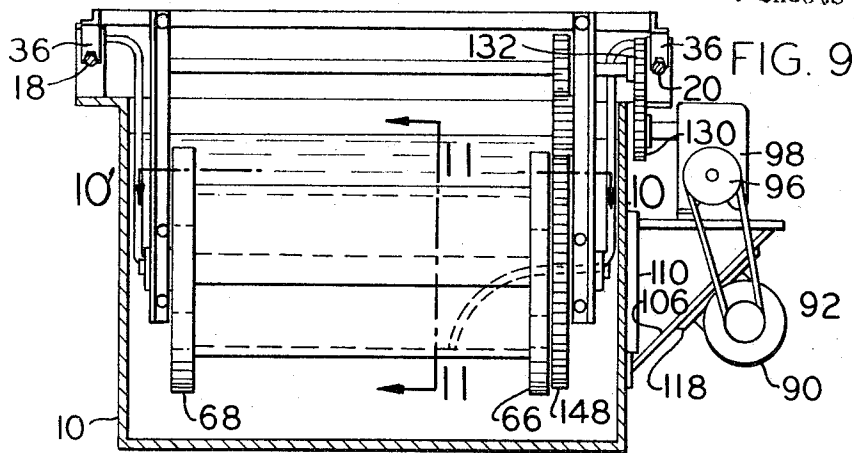
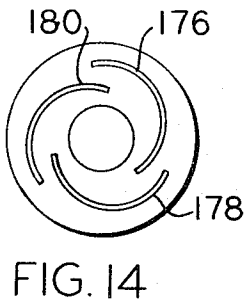
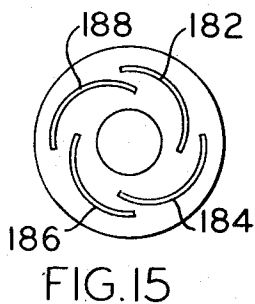
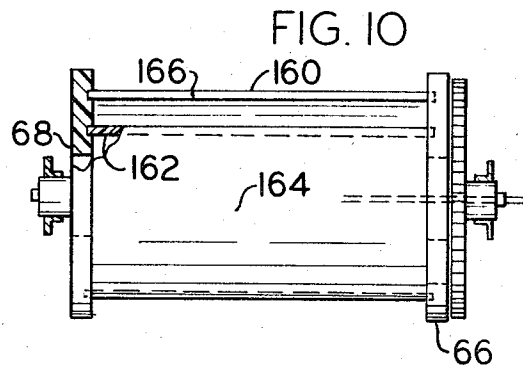
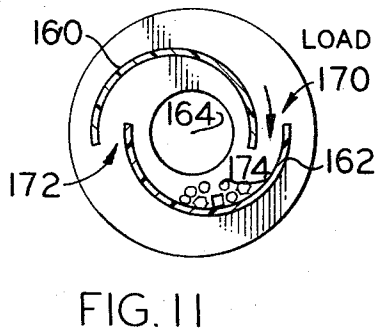
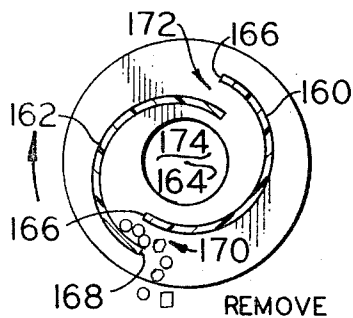
A. SINGLETON

3,846,271

PLATING BARREL WITH SPIRAL SIDES

Filed Jan 27, 1972

4 Sheets-Sheet 4



1

3,846,271

PLATING BARREL WITH SPIRAL SIDES

Albert Singleton, 7360 Brookside Parkway,
Middleburg Heights, Ohio 43336

Continuation-in-part of application Ser. No. 91,394, Nov. 20, 1970, now Patent No. 3,668,103, which is a continuation-in-part of abandoned application Ser. No. 86,523, Nov. 3, 1970. This application Jan. 27, 1972, Ser. No. 221,340

The term of this patent subsequent to June 6, 1989, has been disclaimed

Int. Cl. C23b 5/78

U.S. Cl. 204—213

17 Claims

ABSTRACT OF THE DISCLOSURE

The specification and drawings disclose a plating barrel assembly which comprises a barrel member mounted for rotation about its longitudinal axis. The barrel is supported from generally vertically extending hangers formed from metal reinforced plastic and are carried by a horizontally extending frame which is adapted to rest on the upper edge of the plating tank. Means are provided for rotating the barrel and the means include a shaft rotatably carried on the horizontal frame and connected through a gear train with a gear connected to an end of the drum. At least one end of the horizontal shaft extends outwardly of the frame for releasable engagement with a drive assembly. The drive assembly is mounted on one end of the plating tank and includes a first support frame mounted for vertical adjustment and including a horizontally extending portion and an inclined portion. A motor is adjustably mounted on the inclined portion and is drivingly connected with a gear reducer unit carried on the horizontal portion. The gear reducer is positioned with its output shaft extending horizontally and carrying a gear adapted to releasably engage a gear on the shaft member. The entire drum assembly has a low total height so that it can easily be lifted from the plating tank. The shape of the drum is optional but one desirable design includes flat ends and a plurality of spiral or curved sides.

BACKGROUND AND BRIEF DESCRIPTION OF THE INVENTION

This is a continuation-in-part of application Ser. No. 91,394, filed Nov. 20, 1970, now Pat. No. 3,668,103 and application Ser. No. 86,523, filed Nov. 3, 1970, now abandoned.

The present invention is directed toward the metal finishing art and, more particularly, to an improved plating barrel assembly for use in metal finishing operations.

The invention is especially suited for use as an electroplating barrel and will be described with particular reference thereto; however, it should be appreciated that apparatus of the type under consideration is used not only for plating but also can be used for cleaning, phosphating, and otherwise treating many types of parts. Hence, in the subject specification and claims, the terms "plating barrel" is used for convenience in referring to a barrel structure or apparatus for performing this general type of operation and is not to be considered as limited only to an apparatus for electroplating.

My U.S. Pat. No. 2,886,505, issued May 12, 1959 discloses a plating barrel assembly of the general type under consideration. In using plating barrels of this type, it is necessary to raise and lower the barrel assembly from the tank of electrolyte at frequent intervals during operation. In a typical plating operation, there may be thirty to one-hundred assemblies in use at any one time. Thus, it is important that the barrel assemblies be as

2

compact as possible to minimize the vertical distance which the assemblies must be moved during the raising and lowering operation.

Additionally, the power source and drive train for the barrel assembly should preferably be arranged so that the barrel assembly can easily be separated from the power source.

In addition to being compact and of relatively light weight, the barrel assembly must also be capable of operating in extremely corrosive environments.

In accordance with one aspect of the invention, there is provided a plating barrel assembly which comprises a barrel member mounted for rotation about its longitudinal axis. The barrel is supported from generally vertically extending hangers which are carried by a horizontally extending frame adapted to rest on a plating tank. Means are provided for rotating the barrel and the means include a shaft rotatably carried on the horizontal frame with a first gear fixed near one end. A second gear is engaged with the first gear and rotatably carried by a hanger member. A third gear is connected to the drum for driving engagement with the second gear. At least one end of the horizontal shaft extends outwardly of the first gear and is provided with means for releasably engaging a drive means. Preferably, the drive means is mounted on one end of the plating tank and includes a first support frame mounted for vertical adjustment and including a horizontally extending portion and an inclined portion. A motor is adjustably mounted on the inclined portion and is drivingly connected with a gear reducer unit carried on the horizontal portion. The gear reducer is positioned with its output shaft extending horizontally and carrying a gear adapted to engage a gear on the shaft member.

Another aspect of the invention is the shape of the sidewalls of the plating barrel. In an attempt to simplify the drum structure and eliminate the need for a door, it has been proposed in the prior art to form the drum from a single spiral member with the ends of the member radially spaced and circumferentially overlapping. The spaced ends of the spiral member provide an opening through which the parts can be inserted. As the drum is rotated in one direction, the parts are scooped toward the center of the spiral and maintained in the drum. However, when the drum rotation is reversed, the parts can slide out of the spiral for discharge.

The problem with the single spiral arrangement has been (1) the difficulty in assuring electrical contact with the materials inside the tank throughout the entire 360° of drum rotation and (2) a lack of free flow of fluid in and out of the enclosure. For example, unless the drum is completely submerged in plating fluid, there is a point on the circle of rotation during which the opening is out of the fluid. At this time, there is no electrical contact and, consequently, no plating. Additionally, the fluid within such a drum tends to be trapped because of the single opening and the necessary mixing with fresh electrolytic fluid is minimized. Some barrels including a plurality of spiral sides have been tried but have not met with commercial success.

The subject invention includes a plating drum arrangement which, in addition to the hanger structure and drive train, has the simplicity of the spiral arrangement but without the noted disadvantages. In particular, the invention contemplates a plating drum including a pair of spaced drum end defining members with mounting means for supporting the end defining members for selective rotation in either direction about a common axis extending between the members. A plurality of side panel members extend between the end defining members and define an enclosed working space. The panel members are spaced circumferentially about the axis and radially

outwardly thereof. Each of the side panel members has generally axially extending terminal side edge portions with the side edge portions of circumferentially adjacent panels being radially spaced and circumferentially overlapping to provide a plurality of commonly facing axial openings.

In accordance with a more limited aspect, the side panels are preferably of arcuate or spiral shape and of substantially uniform size.

By the use of the arrangement described, the operation of the device is similar to that described with reference to the single spiral drum. That is, parts can be inserted into the drum through the axial openings and as long as the drum is rotated in the direction the openings face, the parts are maintained in the drum. To discharge the parts, the drum is merely rotated in the opposite direction. One important advantage of the subject arrangement over the single spiral type drum is the fact that because there are a plurality of openings, electrical contact is continually maintained. This is so even when the drum is not completely submerged because at least one of the openings will normally be below the level of the plating fluid. Further, the plural openings and the side panel arrangement assures good flow of plating fluid through the interior of the drum at all times.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal cross-sectional view through a plating tank and barrel assembly formed in accordance with the preferred embodiment of the invention;

FIG. 2 is an end view taken on line 2—2 of FIG. 1;

FIG. 3 is a view taken on line 3—3 of FIG. 2 showing the motor, gear reducer, and drive train in detail;

FIG. 4 is a cross-sectional view taken on line 4—4 of FIG. 1 and showing the gear train and barrel support bracket in detail;

FIG. 5 is a cross-sectional view taken on line 5—5 of FIG. 4;

FIG. 6 is a cross-sectional view taken on line 6—6 of FIG. 4 and showing the mounting arrangement for the idler gear;

FIG. 7 is a cross-sectional view taken on line 7—7 of FIG. 4 and showing in detail the bearing and drum mounting assembly; and,

FIG. 8 is a cross-sectional view taken on line 8—8 of FIG. 4 and showing the reinforcing arrangement utilized in the barrel hanger arms;

FIG. 9 is a cross-sectional view through a plating tank assembly showing a plating drum formed in accordance with a preferred embodiment of the invention;

FIG. 10 is a view taken on line 10—10 of FIG. 9 with portions broken away to more clearly show the construction of the drum member;

FIG. 11 is a cross-sectional view through the plating drum taken on line 11—11 of FIG. 9;

FIGS. 12 and 13 are cross-sectional views similar to FIG. 11 but showing the drum operating for plating and discharging respectively;

FIG. 14 is a cross-sectional view through a modified form of the drum assembly which utilizes three side panels as opposed to the two panels shown in the FIGS. 9 through 11 embodiment; and,

FIG. 15 is a cross-sectional view through a third modification of the drum assembly which uses four side panel members.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring more particularly to FIG. 1, the overall assembly is shown in some detail and comprises an open topped tank 10 which functions to hold the electrolyte solution and supports the removable plating barrel assembly 12. The particular structural details of the tank 10 form no part of the present invention and could vary widely; however, in the preferred embodiment, the tank 10 is of

generally rectangular shape having a flat bottom wall and vertically extending side and end walls and is formed, for example, from metal and lined or covered with a relatively heavy corrosion resistant and non-electrically conductive material such as a suitable rubber or plastic material. Outwardly extending flanges 14 and 16 are joined to the upper edges of the side and end walls.

The plating barrel assembly 12 is releasably and removably carried on the outwardly extending flanges 14 and 16 at the upper end of tank 10 by a pair of straight cylindrical, low-resistance copper cathode rods 18 and 20 of circular cross-section. As best shown in FIGS. 1 and 2, the rods 18 and 20 are supported on the respective flanges by generally rectangular mounting blocks 21 joined to the flanges by vertically extending machine screws 22. In the embodiment under consideration, the blocks 21 are formed from polypropylene; however, it should be appreciated that other types of mounting blocks could be used. It will be noted in FIG. 2 that the upper surfaces 24 of the blocks 21 are inclined downwardly toward the center of the tank. As will be described more fully hereafter, this arrangement of the blocks produces a centering action on the barrel assembly when it is positioned on the bank.

Of particular importance to the invention is the overall arrangement of the plating barrel assembly 12. The assembly 12 includes a support frame 26 which extends across the upper end of the tank and carries the barrel 28. The support frame 26 is comprised of a transversely extending channel member 29 which extends the length of the tank with its channel legs facing downwardly. Connected to the ends of the channel member 29 are plates 30 (see FIGS. 1 and 3). In the embodiment shown, the plates 30 are welded to the channel ends and extend vertically and horizontally of the channel. A pair of angle members 32 are releasably connected to the plates 30 at each end of the channel by bolts 34. Electrical conduit or saddle blocks 36 of large cross-sectional area and low electrical resistance are connected to the lower faces of angles 32. Suitable insulation is positioned between the angles 32 and the saddle blocks 36 to prevent the flow of electricity therebetween. It will be noted that each of the saddle blocks 36 has a generally V-shaped recess formed in its lower surface which is arranged to engage a corresponding cathode rod 18 or 20. Connected to the bars 36 are flexible electrodes or conduits 38 and 40 which will be described subsequently in more detail.

The barrel 28 is supported from the channel member 29 by two pairs of hangers 41, each having upwardly extending arms 42 and 44. The arms 42 and 44 are adjustably joined to the channel by short angle members 46 and 48 respectively (see FIG. 4). Each of the angles 46 and 48 is welded to a lateral face of the channel 29 and has elongated bolt receiving slots 47 and 49 formed therein. Suitable machine screws pass through the slots into engagement with the respective hanger arms. By releasing the screws, the vertical position of the hangers 41 can be readily adjusted.

As best shown in FIGS. 1 and 4, the hangers extend vertically downward from the channel 29 and support the drum within the electrolyte solution. The construction of the hangers is of particular importance to the invention. As can be appreciated, because of the corrosive nature of the electrolyte or cleaning solutions used, the hangers, as well as the remaining elements of the drum assembly, must be capable of withstanding a particularly corrosive atmosphere. Further, the hangers must have suitable strength to resist the forces exerted thereon during operation and use of the assembly. In the subject embodiment, the hanger arms 42 and 44 are formed from a corrosion resistant plastic such as polypropylene with an internal reinforcing bar of steel or other suitable metal. FIG. 8 is a cross-section through one of the arms or bars 44 showing the internal reinforcing member 50 which is, in this instance, a flat steel bar. The construction of each

of the hanger arms 42 and 44 is identical and, accordingly, only one will be described in detail. While these remarks are directed to a polygonal plating barrel, it will be obvious that they are equally applicable to barrels with differently shaped sidewalls, for example, the barrels illustrated in FIGS. 9-15.

Referring again to FIG. 8, it will be seen that the arm 44 is formed from a rectangular, elongated section of polypropylene provided with a longitudinally extending slot 52 which is of a width sufficient to closely receive the metal bar 50. The slot 52 extends into the main body of polypropylene a depth greater than the width of bar 50. Positioned over the outer edge of the bar and within the slot 52 is a strip 54 of plastic or similar material having heat insulating properties. The strip 54 preferably extends throughout the length of the bar 50 and is of a thickness sufficient to provide a groove inwardly from the outer edge of the slot 52. A second strip of plastic 56 is welded to the main block over the strip 54. The welding is accomplished by a conventional plastic welding gun which extrudes a strip of heated plastic into the groove for bonding with the sidewalls of the groove and the insert 54. Insert 54 serves to prevent the metal reinforcing bar from acting as a heat sink and conducting heat away from the heated weld strip. Without strip 54, the weld bead 56 will deposit in the slot against the bar 50 without bonding to either sidewall because the metal bar will absorb all the heat. This layered arrangement assures a good fluid tight weld joint between the strip 56 and the main body of the block. Thus, the metal reinforcing strip is totally encased in the plastic and is not exposed to the corrosive environment.

The purpose of the encapsulated steel bars 50 is to strengthen the arms 42, 44 in shear, bending and torsion. The plastic is of sufficient strength in tension to carry the load in the drum but without the steel bars the arms fail rather quickly due to the bending moments resulting from the drum rotation and the sway imparted by the tumbling parts therein.

In addition to reinforcing the hanger rods 41, the transversely extending rods or bars 70 are also reinforced with steel strips 51 (see FIG. 4).

The barrel is rotatably supported from the lower end of the hangers by the assembly best shown in FIG. 7. It will be noted that a rectangular block of polypropylene 58 is welded between the lower ends of the hanger arms 42, 44. Referring again to FIG. 1, one of the members 58 is carried between each pair of the hanger arms and, in turn, supports a cylindrical hub member 60. The hub members 60 are removably connected to their respective block 58 by machine screws 62 which extend inwardly through the blocks 58 into threaded openings in the cylindrical hubs 60. It is obvious that the two arms 42, 44 and the block 58 could be integral and could be formed by merely cutting a slot in one end of a rectangular block of plastic to accommodate the channel 29 et al., if desired.

It will be noted in FIG. 1 that the electrode 40 extends through an opening in the block 58 and the hub 60, which opening is inclined downwardly to minimize the bending of the dangling electrode. The other electrode 38 does not include an inclined opening, although it is obvious that it could if desired.

The barrel assembly 28 is carried from the cylindrical hub members 60 by a particular bearing arrangement which will subsequently be described in detail; however, for the present, it should be noted that the barrel of FIGS. 1-8 is of regular polygonal cross-section and includes the end walls 66 and 68 joined by flat, rectangular sidewalls 69. The sidewalls are joined along their mating longitudinal edges by suitable parallel reinforcing bars 70 (see FIG. 4). Each of the sidewalls is preferably heavily perforated to allow free flow of the plating solution through the interior of the tank. Additionally, one of the sidewalls is removable and serves as an access opening.

The access opening is held in position by suitable clamps or the like such as shown, for example, in my previously mentioned U.S. Pat. 2,886,505.

One important aspect of the invention is the bearing arrangement for the barrels. As can be seen, the cylindrical hub members 60 extend into central openings formed in the end walls 66, 68. A sleeve bearing 71 is positioned about the right hand hub 60 (as viewed in FIG. 1) while a similar sleeve bearing 72 surrounds the left hand hub 60. The sleeve bearing is a polypropylene bushing which is filled with graphite. This greatly reduces friction and tends to eliminate freezing or galling between the surfaces; however, it has been found that the use of the graphite filled polypropylene alone does not completely eliminate freezing and galling problems. For this reason, as best shown in FIGS. 4 and 7, the bearings 71 and 72 each are provided with a longitudinal slot 74. The bushing is maintained in position by a suitable pin 76 which extends from the end plate 78 through the bearing 71. This causes the bearing 71 to rotate with the drum about the stationary hub 60. Should any seizing occur between the internal surfaces of the sleeve 71 and the outer surface of the hub 60, the groove or split 74 allows the bearing 71 to expand radially thereby relieving the tension and allowing a quick slippage, thus minimizing any possibility of galling.

The drive assembly for the drum 28 includes a standard electric motor 90 carried at the right hand end of the tank 10. The motor is connected through a three-step pulley 92, V-belt 94, and a second three-step pulley 96 with the input shaft of a right angle gear reducer 98. The motor 90 and the gear reducer 98 are carried from an angle bracket or frame assembly 100 which is arranged for vertical adjustment to vary the elevation of the output shaft 102 of the gear reducer 98. The mounting bracket 100 includes a horizontal support plate 103 which is welded to a vertically extending slide plate 104. An angle member 106 is connected between the outer end of plate 102 and the lower end of slide plate 104. It will be noted that the gear reducer 98 is affixed to the surface of plate 102 through the use of machine screws 108. In order to provide for adjustment of the mounting bracket in the vertical direction, it will be noted that the slide plate 104 is received within a guideway formed by a pair of spaced members 110 (see FIG. 2) which have overlapping edge portions that engage the slide plate at its opposite lateral edges. The slide plate is suspended from the flange 16 of tank 10 by an elongated stud bolt 112 that extends through openings in the support plate 103. Suitable nuts 114 allow the position of the angle bracket to be adjusted on the bolt 112. This arrangement permits the output shaft 102 to be positioned precisely relative to the drive train to insure proper mating between the drive gears. Additionally, the motor mounting arrangement is such that the belt 94 can readily be adjusted in tension. Also, the belt 94 can be shifted between various steps of the pulleys to change the drive speed of the drum 28.

Referring to FIG. 2, it will be seen that the motor 90 has its support plate 116 slidably engaged with a pair of guideway forming members 118 welded to the inclined plate 106. As mentioned, the motor mounting plate 116 is freely slidable within the guideway forming members 118. The lock is in a desired position of adjustment, there is a thumb screw or the like 120 which passes through a threaded opening or nut member carried on the plate 116. By tightening the nut or the screw member 120, the end of the screw engages the surface of the inclined bracket member 106.

An important feature of the invention is the construction of the drive train and its relationship to the frame and hanger assemblies. As shown, the drive train from the output shaft of the gear reducer 98 to the barrel 28 includes a first pinion gear 130 which is formed from a suitable corrosion resistant plastic, preferably a thermoplastic ABS Polymer or polypropylene such as Seilon S-3HT sold by

Seiberling Rubber Co. The gear 130 is connected to the shaft 102 by a set screw or other suitable means. It will be noted that the gear 130 is positioned so as to be closely adjacent the end wall of the tank 10 and approximately at the level of the flange 16. The flange 16 is cut out in the vicinity of the gear 103 to provide access to the pinion 130 by a driven pinion gear 132.

In the aforementioned Singleton patent, it will be noted that the driving gear projecting from the gear box is located wholly above the top flange on the tank of fluid. With the improvement of the instant invention, the driving gear 130 extending from the gear reducer 98 is almost completely below the flange 16. This improvement allows the shortening of the distance between the barrel 28 and the frame 12 by about four inches. While this may seem relatively insignificant to the average man, to one of ordinary skill in the art, it will loom as a substantial breakthrough in cost reduction. The costs in labor, time and power involved in lifting a hundred loaded drums an extra four inches an hour, twenty-four hours a day is not inconsequential.

Note that the gear 132 is carried on the end of a horizontally extending drive shaft 134 which extends parallel to the channel 29. The shaft 134 is carried in bearing blocks 136 which are formed from polypropylene or the like and extend downwardly from the underface of channel 29. As best shown in FIGS. 2 and 3, the bearing blocks 136 are supported from channel 29 by adjustable machine screws 138 which extend through openings in the channel. This allows the bearing blocks to be adjusted vertically with spacer washers and also permits them to be somewhat self-aligning.

Carried on the shaft intermediate the bearing blocks 136 is a pinion gear 140. The gear 140 is drivingly engaged with an intermediate idler gear 142. As best shown in FIG. 4, the gear 142 is pinned to a stub shaft 144 carried from a support block 146. As shown in FIG. 6, the support block 146 is welded to the hanger arms 42, 44.

The gear 142 is engaged with a large diameter gear 148 connected to the end of the drum for producing rotation of the drum. As best shown in FIG. 1, the gear 148 is formed from plastic and is bolted to the end plate 78.

The arrangement described allows substantially the entire drive train to be removed with the barrel assembly. Note that in FIG. 1 there is shown a U-bolt 150 which is centrally positioned on the channel 29. In lifting the barrel assembly, the barrel and the support frame are raised upwardly causing the gear 132 to disengage gear 130. After the necessary steps have been taken, such as filling the barrel and the like, replacement of the drum assembly is facilitated by the inclined surfaces of the blocks 21 (see FIG. 2). The gears 132 and 130 are automatically re-engaged in their proper relationship upon replacement of the drum assembly in the tank 10.

Because of the torsional forces imparted to the idler gear 142 by the driving pinion 140 and the heavy loaded drum, special assembling techniques are employed. The stub shaft 144 includes a hole 152 threaded transversely of its axis. A screw 154 projects through an aperture in the gullet of one of the gear teeth and into the hole. This locks the shaft and gear together with the gear substantially flush with the side of support block 146. Thus, torsional forces imparted to the gear 142 will immediately be transferred to the stronger block 146 due to the face-to-face contact, rather than tending to twist the gear out of alignment. The driving gear 140 is similarly attached to shaft 134.

Friction between the polypropylene block and gear is at a minimum and the shaft 144 is journaled in a Teflon bushing 156. Because of the corrosive nature of the environment, it is preferred that the screws for locking the gears 140, 142 to the shafts 134, 144, respectively, be of stainless steel, titanium, Carpenter No. 20CB or of suitable plastic.

Turning now to the embodiments of FIGS. 9-15, the basic environment is the same including the tank 10, motor 90, gear reducer 98, etc. The difference is the shape of the sidewalls of the barrel. As before, the end plates 66, 68 could be formed from many different types of electrically non-conductive material such as, for example, polypropylene or polyethylene. Extending between the end plates are a plurality of side panel members which enclose or define the drum working area. As shown in FIGS. 11-13, the preferred embodiment utilizes two side plate or panel members 160 and 162 mounted to rotate with the end plates about an axis 164.

Note that each of the side panels 160 and 162 is of arcuate cross-section and preferably has the spiral or semi-cylindrical shape shown. Further, each extends circumferentially through an arc in the range of at least 180° and is positioned between the end plates 66 and 68 to extend parallel to the center axis 164 and circumferentially thereof. The side plates have terminal side edge portions 166 and 168 respectively which are positioned in radially spaced and overlapping relationship. The side panel members are imperforate and overlap along their terminal side edge portions an amount at least as great as their radial spacing. This provides a pair of longitudinally extending and commonly facing openings 170 and 172 and the area or space 174 enclosed by the side plates is arranged to function as the working area and contain the parts to be plated.

FIGS. 12 and 13 demonstrate the functioning of the drum construction thus far described. Note in FIG. 12 that as the drum rotates in the counter-clockwise direction about the axis 164, the openings 170 and 172 face in the direction of the movement. Thus, the parts within the working space 174 are continually washed with fresh electrolyte while being maintained within the working space. Parts cannot escape because of the relationship of the overlapped edge portions of the side panels. As shown in FIG. 12, during rotation, the parts continually slide about the inner surface of the side panel members and are deposited from, for example, panel 160 to panel 162 as shown in FIG. 12. However, when the plating operation is completed, drum rotation is reversed and the parts will slide along the side panels in the opposite direction and exit through the openings 170 or 172 as shown in FIG. 13. As is apparent, there is no need for doors or other closable members on the openings 170 and 172. Further, because of the arrangement of the openings, a continual flow of plating fluid takes place through the drum at all times and the side panels can be solid imperforate sheets of any suitable non-conductive material.

Although the preferred embodiment of the barrel with spiral sides has been described with reference to but two side panel members, it should be understood that a greater number of side panels could be used as long as they are arranged to have overlapping and radially spaced terminal edge portions to provide commonly facing openings in the manner described with reference to FIGS. 11 through 13. For example, FIG. 14 is a cross-section through a drum constructed with three side panel members 176, 178 and 180; each of these side panel members are shown as having a common cross-sectional shape and size with a circumferential extent of approximately 120°.

Similarly, the FIG. 15 embodiment utilizes four side panels 182, 184, 186 and 188 each of which is of a uniformly curved cross-section with an arcuate extent in the range of 90°. Additional side panels could be used; however, it has been found that for most common drum sizes, approximately five is the maximum number which produces satisfactory results. Similarly, although the side panels have all been shown as having the same arcuate extent, it should be understood that on any one drum the side panels could be of different sizes. Similarly, the panels do not necessarily have to have a uniform arcuate shape and could be almost flat. Alternatively, each of the panels

160 and 162 could comprise a plurality of flat panels joined to form the spiral.

The invention has been described in great detail sufficient to enable one of ordinary skill in the plating art to make and use the same. Obviously, modifications and alterations of the preferred embodiments will occur to others upon a reading and understanding of the specification and it is my intention to include all such modifications and alterations as part of my invention insofar as they come within the scope of the appended claims. Having thus described my invention, I claim:

1. In the combination of a barrel assembly for finishing parts adapted for use in electroplating in combination with electrodes, said barrel member being mounted for rotation about its longitudinal axis;

hanger members supporting said barrel and extending downwardly from a horizontally extending frame adapted to rest on a plating tank;

means for rotating said barrel comprising a shaft member rotatably supported from said frame and having a first gear member carried thereon;

a second gear carried from one of said hangers and engaging said first gear, said second gear including a flat side in constant direct contact with a flat surface on one of said hangers of a size at least equal to the size of the gear;

a third gear connected to said drum and engaging said second gear;

said shaft having at least one end extending outwardly from said gear for engagement with drive means; means on the end of said frame for locating said assembly on a plating tank; the improvement comprising:

the barrel having a pair of spaced apart barrel end defining members;

a mounting means supporting said end defining members for selective rotation in first and second directions about a common axis extending therebetween; and

a plurality of side panel members positioned about said axis and radially outwardly thereof, said panel members extending between said end defining members to enclose a working space, each said side panel member having generally axially extending terminal side edge portions with the side edge portions of circumferentially adjacent panels being radially spaced and circumferentially overlapping to provide a plurality of circumferentially spaced openings.

2. The combination as defined in claim 1 wherein each said side panel is arcuate in shape.

3. The combination as defined in claim 1 wherein each said side panel is imperforate and of arcuate shape throughout its length.

4. The combination as defined in claim 1 wherein each said side panel is of identical shape.

5. The combination as defined in claim 1 wherein there are two of said side panel members, each having an arcuate extent of at least 180°.

6. The combination as defined in claim 1 wherein the side panel members are imperforate and overlap along their terminal side edge portions an amount at least as great as their radial spacing.

7. The combination of claim 1 including a plating tank having a drive assembly carried on one end thereof;

said drive assembly including a first support frame mounted for vertical adjustment and including a horizontally extending portion and an inclined portion;

a motor adjustably mounted on said inclined portion and drivingly connected with a gear reducer unit carried on said horizontal portion,

said gear reducer having a horizontally extending output shaft provided with a gear adapted to engage a gear on the shaft which carries said first gear.

8. The combination of claim 1 wherein said hanger

members comprise at least one plastic bar member having a metal reinforcing rod sealed therein.

9. In the combination of a hollow barrel enclosing metallic articles to be treated by fluid which penetrates said barrel from without,

hanger brackets for supporting said barrel for rotation about its axis in a substantially horizontal plane,

a support frame for supporting said brackets,

gear and motor means for rotating said drum,

electrode means for passing electric current through said fluid,

hubs extending through apertures in each end of said barrel about its axis, said hubs being fixed to said brackets,

openings through said hubs, said electrode means extending through said openings, one of said openings being inclined downwardly from outside the barrel toward the inside,

a cylindrical bearing disposed between each hub and barrel to support the barrel in sliding, rotary movement, said bearing being formed from a mixture of polypropylene and graphite and including a longitudinal slit extending for its full length to allow it to expand radially to relieve tension and minimize galling during rotary movement of said barrel, the improvement comprising:

a pair of spaced apart barrel end defining members,

a mounting means supporting said end defining members for selective rotation in first and second directions about a common axis extending therebetween, and

a plurality of side panel members positioned about said axis and radially outwardly thereof, said panel members extending between said end defining members to enclose a working space, each said side panel member having generally axially extending terminal side edge portions with the side edge portions of circumferentially adjacent panels being radially spaced and circumferentially overlapping to provide a plurality of circumferentially spaced openings.

10. The combination as defined in claim 9 wherein each said side panel is arcuate in shape.

11. The combination as defined in claim 9 wherein each said side panel is imperforate and of arcuate shape throughout its length.

12. The combination as defined in claim 9 wherein each said side panel is of identical shape.

13. The combination as defined in claim 9 wherein there are two of said side panel members, each having an arcuate extent of at least 180°.

14. The combination as defined in claim 9 wherein the side panel members are imperforate and overlap along their terminal side edge portions an amount at least as great as their radial spacing.

15. The combination of claim 9 including a plating tank having a drive assembly carried on one end thereof;

said drive assembly including a first support frame mounted for vertical adjustment and including a horizontally extending portion and an inclined portion;

a motor adjustably mounted on said inclined portion and drivingly connected with a gear reducer unit carried on said horizontal portion,

said gear reducer having a horizontally extending output shaft provided with a gear adapted to engage a gear on the shaft which carries said first gear.

16. The combination of claim 9 wherein said hanger members comprise at least one plastic bar member having a metal reinforcing rod sealed therein.

17. In the combination of a hollow barrel enclosing metallic articles to be treated by fluid which penetrates said barrel from without,

hanger brackets for supporting said barrel for rotation about its axis in a substantially horizontal plane,

a support frame for supporting said brackets,

gear and motor means for rotating said drum,

11

electrode means for passing electric current through said fluid,

hubs extending through apertures in each end of said barrel about its axis, said hubs being fixed to said brackets,

openings through said hubs, said electrode means extending through said openings, one of said openings being inclined downwardly from outside the barrel toward the inside,

a cylindrical bearing disposed between each hub and barrel to support the barrel in sliding, rotary movement, said bearing being formed from a mixture of polypropylene and graphite, said bearing including a longitudinal slit extending for its full length to allow the bearing to expand radially to relieve tension and minimize galling during rotary movement of said barrel, the improvement comprising:

a pair of spaced apart barrel end defining members,

a mounting means supporting said end defining members for selective rotation in first and second directions about a common axis extending therebetween, and

a plurality of side panel members positioned about said axis and radially outwardly thereof, said panel members extending between said end de-

5

10

15

20

25

12

fining members to enclose a working space, each said side panel member having generally axially extending terminal side edge portions with the side edge portions of circumferentially adjacent panels being radially spaced and circumferentially overlapping to provide a plurality of circumferentially spaced openings.

References Cited

UNITED STATES PATENTS

3,668,103	6/1972	Singleton	204—213
3,294,663	12/1966	Lazaro	204—213
2,451,676	10/1948	House	204—214
1,928,949	10/1933	O'Neill	204—213

FOREIGN PATENTS

237,586	3/1962	Australia	259—89
1,072,452	12/1959	Germany	204—213

JOHN H. MACK, Primary Examiner

W. I. SOLOMON, Assistant Examiner

U.S. Cl. X.R.

134—157; 259—89