April 9, 1963 H. P. SCHARMER ET AL 3,084,916

PLATING BARRELS

Filed Oct. 12, 1959 2 Sheets-Sheet 1

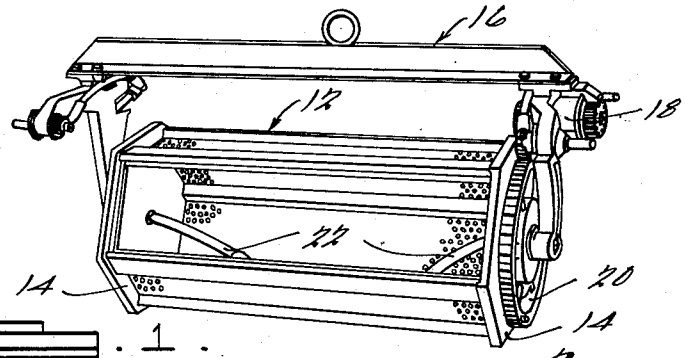


FIG. 1.

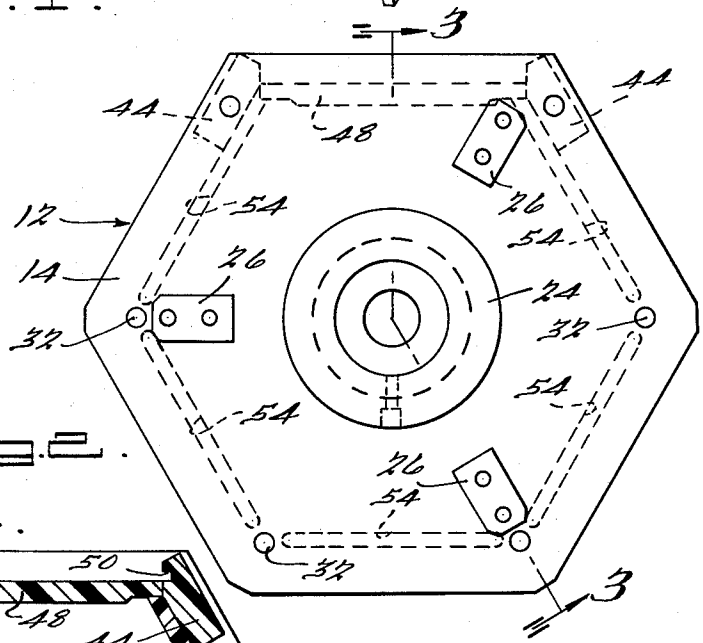
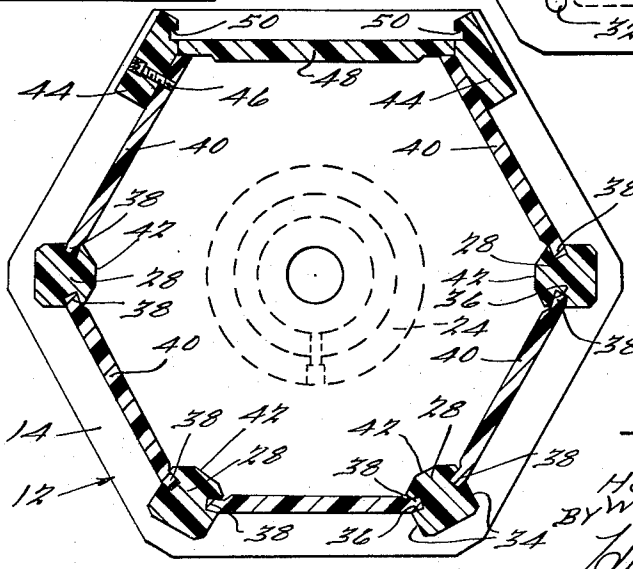


FIG. 2.

FIG. 4.



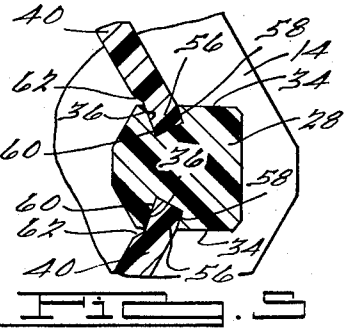


FIG. 5.

INVENTORS.
Herman P. Scharmer
BY William H. Jackson.
Harness, Dickey & Pierce
ATTORNEYS.

April 9, 1963 H. P. SCHARMER ET AL 3,084,916

PLATING BARRELS

Filed Oct. 12, 1959 2 Sheets-Sheet 2

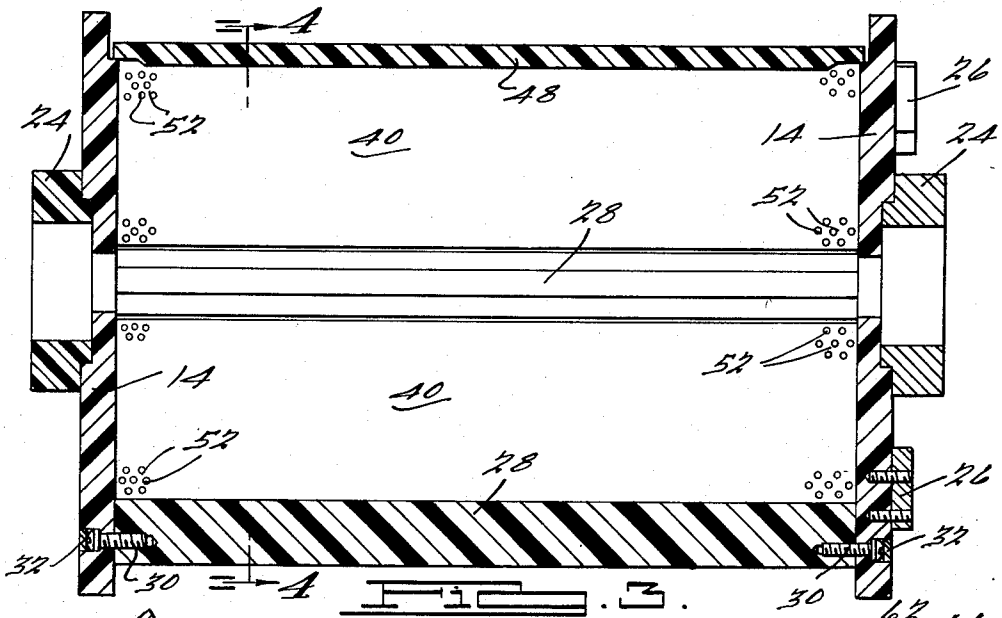


Fig. 3.

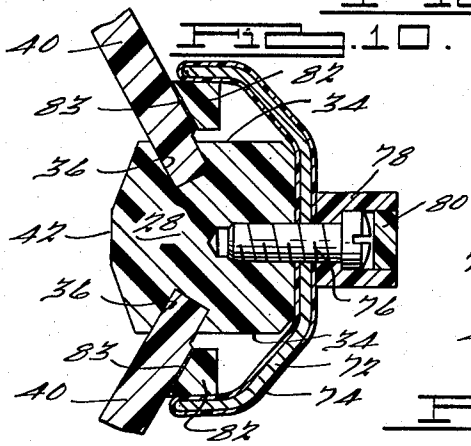


Fig. 10.

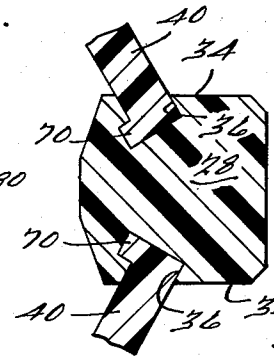


Fig. 9.

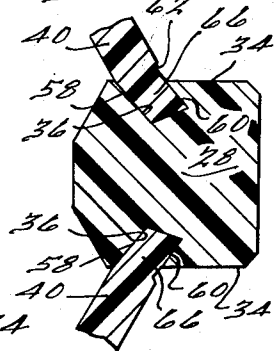


Fig. 7.

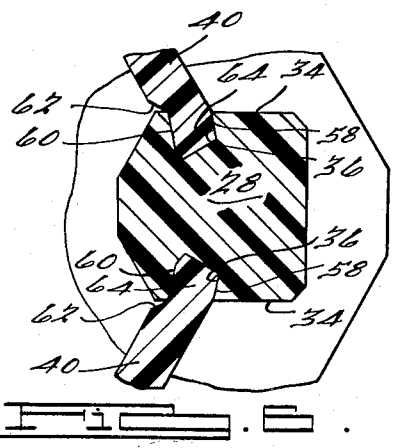


Fig. 6.

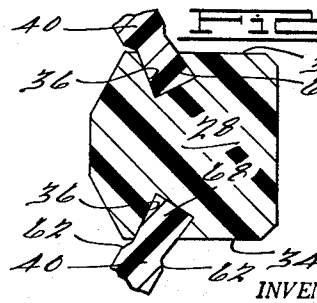


Fig. 8.

INVENTORS.
Herman P. Scharmer.
BY William H. Jackson.
Harness, Dickey & Pierce.
ATTORNEYS.

United States Patent Office

3,084,916
Patented Apr. 9, 1963

3,084,916

PLATING BARRELS

Herman P. Scharmer, Detroit, and William H. Jackson, Birmingham, Mich., assignors to The Udylite Corporation, Detroit, Mich., a corporation of Delaware

Filed Oct. 12, 1959, Ser. No. 845,677
8 Claims. (Cl. 259—89)

This invention broadly pertains to electroplating apparatus and more particularly to improvements in assemblable and disassemblable plating barrels adapted for processing a multitude of small workpieces in bulk.

Plating barrels of the general type herein described are extensively employed in industry for simultaneously treating bulk quantities of small workpieces which, because of their small size, cannot be efficiently and economically handled individually. Treating sequences through which the plating barrels and workpieces contained therein are sequentially conveyed often include high temperature alkaline and acid immersion steps and one or more electroplating steps. To assure satisfactory contact of the treating solutions with the individual workpieces the plating barrels are rotated while immersed in the treating receptacle thereby imparting a tumbling action to the workpieces contained therein. The combined effect of high temperature, chemical attack and physical abrasion on the plating barrel have occasioned intensive investigation of new materials and methods of construction of plating barrels to increase their durability, useful operating life and ease of maintenance. The problem is further aggravated by the necessity of employing nonconductive construction materials which generally do not possess the requisite strength and resistance to physical punishment encountered during the processing of workpieces and in general plant handling. Materials such as polymethyl methacrylate, phenol formaldehyde, and synthetic and natural hard rubbers, have been alternately employed in constructing plating barrels which are substantially resistant to chemical attack and are of adequate structural strength. The construction of suitable plating barrels comprised of the aforementioned materials generally involves elaborate machining and assembly methods to form a unitary plating barrel which when assembled is not readily dis-assemblable to enable the replacement of one or more failed or worn component parts. This necessitates either the complete replacements of the plating barrel, or a very time consuming and costly repair, or replacement of the component part.

Accordingly, the primary object of the present invention is to provide an improved plating barrel of a readily assemblable and dis-assemblable construction that possesses the requisite strength and resistance to physical abuse and chemical attack.

Another object of this invention is to provide an improved plating barrel construction that is of simple design, durable in operation, and which restrains the deflection of the component parts under the separating stresses imposed thereon by the weight and tumbling action of the workpieces contained therein.

Still another object of this invention is to provide an improved plating barrel of a readily assemblable and disassemblable construction that enables simple and quick replacement in the field of worn and broken components, thereby increasing the efficiency and useful operating life of the plating barrel.

A further object of this invention is to provide an improved plating barrel employing a unique interlocking rail and panel construction which is simple and economical to manufacture, and simple and economical to maintain.

Other objects and advantages of the present invention

will become apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a perspective view of a plating barrel incorporating the preferred embodiments of this invention rotatably supported at its ends on a typical supporting framework;

FIG. 2 is an elevational view of an end wall of the plating barrel shown in FIG. 1 and removed from the supporting framework;

FIG. 3 is a longitudinal sectional view through the plating barrel shown in FIG. 2 and taken along line 3—3 thereof;

FIG. 4 is a transverse vertical sectional view through the plating barrel shown in FIG. 3 and taken along the line 4—4 thereof;

FIG. 5 is an enlarged fragmentary sectional view of one of the corner joints of the plating barrel shown in FIG. 4; and

FIGS. 6–10 are enlarged fragmentary sectional views of alternate satisfactory corner joints which may be used in lieu of the corner joint shown in FIG. 5.

Referring now to the drawings, and as may be best seen in FIG. 1, a typical plating barrel apparatus is comprised of a plating barrel **12** having a polygonal cross-sectional shape and which is rotatably mounted at its end walls **14** on a suitable overhanging framework **16**. Rotation of plating barrel **12** may be achieved, for example, by suitable drive gearing **18**, mounted on the over-hanging framework and in constant mesh with driven gear **20** affixed to the exterior surface of one of the end walls **14** of the plating barrel. When the plating barrels are to be employed in an electroplating operation, electrification of the workpieces contained therein may be satisfactorily achieved by means of flexible electrodes **22** extending inwardly from substantially the center of each of end walls **14**.

As shown in FIGS. 1–4, the plating barrel **12** incorporating the preferred embodiments of this invention is comprised of two spaced end walls **14** of a general hexagonal configuration, having an annular boss **24** fixedly secured at substantially the center of each of the outer surfaces thereof for rotatably supporting the barrel from the overhanging framework **16**. It will be understood, of course, by those skilled in the art that the specific embodiments of this invention are equally applicable to plating barrels having more than or less than six sides as incorporated in the hexagonal plating barrel herein described. One end wall **14**, as shown in FIG. 2, may be provided with support blocks **26** for removably mounting a suitable driven gear **20**. Four support rails **28** extend longitudinally between end walls **14** and have the end portions thereof detachably secured to the end walls by means of fillister head machine screws **30** which have the head portions thereof recessed below the exterior side surfaces of end walls **14**. A suitable plug or filler material **32** may be utilized to fill the bore in end walls **14** above the heads of fillister head machine screws **30**, thereby preventing contact thereof with the treating solution. Support rails **28** are of an irregular polygonal cross-sectional shape which may be conveniently fabricated by chamfering the corners of a rectangular or substantially square rail. The opposite side wall portions **34** of support rails **28** are provided with longitudinally grooves or slots **36** extending therealong for substantially the entire length thereof and are adapted to receive the longitudinal tongues **38** along the side edges of side panels **40**. The beveled inwardly projecting portions **42** of support rails **28** which define the longitudinal corners of the polygonal chamber act as tumbling ribs tending to deflect workpieces impinging thereon toward the interior of the plating barrel preventing their entrapment in the longitudinal corners.

A pair of closure rails 44 extend longitudinally between end walls 14 along the upper portion of the plating barrel 12 as viewed in FIGS. 2 and 4, having the end portions thereof secured to the end walls by suitable screws 30 in a manner similar to that employed in detachably securing support rails 28. Side panels 40 adjacent to closure rails 44 are secured to the inner surface thereof by a suitable adhesive or alternately by a series of nonconductive screws 46 longitudinally spaced along closure rails 44 and in threaded engagement with side panels 40 adjacent thereto. The upper end edges of side panels 40 adjacent to closure rails 44 are beveled to define a supporting ledge for closure panel 48 removably mounted thereon. The upper inner side portions of closure rails 44 are beveled to enable unrestricted removal and installation of closure panel 48 for loading and unloading workpieces from the interior of plating barrel 12. Closure panel 48 when installed in position between closure rails 44 is retained in appropriately closed position by means of a suitable latching mechanism (not shown) having the end portions thereof slideably secured in longitudinal slots 50 extending along the upper inner surfaces of closure rails 44 immediately above the exterior face of closure panel 48. Side panels 40 and closure panel 48 are provided with a multitude of perforations or apertures 52 communicating with the interior of the chamber to facilitate circulation of the treating solutions and electrolytes into and out of the plating barrel. The size of each of the apertures or perforations is of course, limited to a size smaller than the size of the workpieces contained within the plating barrel. Moreover, the relative spacing between adjacent apertures is restricted by the relative strength of the material from which the panels are made.

As aforementioned, side panels 40 are rigidly connected to support rails 28 by means of longitudinal tongues 38 along the side edges of panels 40 disposed in longitudinal slots 36 in support rails 28. The inner surfaces of end walls 14 are provided with rectangular slots 54 extending between and communicating with longitudinal slots 36 in support rails 28 and are adapted to receive the end edges of side panels 40. The slideable retention of the side edges of side panels 40 in longitudinal grooves 36 in the support rails and the end edges in rectangular slots 54 in the end walls enables quick and simple disassembly of the plating barrel to replace one or more worn or failed side panels or support rails.

In operation, the plating barrel is filled approximately half full with a multitude of small workpieces which are gently tumbled in the plating barrel as it is conveyed through the treating sequence. The weight of the workpieces is distributed over substantially the lower half portion of the plating barrel and has a tendency to outwardly deflect the support rails 28 and side panels 40 which in turn tends to separate or withdraw the tongues 38 from within longitudinal slots 36. The separating forces acting substantially in the planes of the side panels and substantially perpendicular to longitudinal slots 36, are effectively counteracted by the unique configuration of longitudinal tongues 38 disposed in and coacting with the side surfaces of complementarily shaped longitudinal slots 36 in the support rails 28. A series of alternate satisfactory tongue and groove connections between side panels 40 and support rails 28 are shown in FIGS. 5–10. Of these connections, the configuration shown in FIG. 5 is preferred because of its high strength, effectiveness in interlocking the side panels to the support rails, and the simplicity and low cost of manufacture. As shown in section in FIG. 5, tongue 56 extending longitudinally along the side edges of side panels 40 is comprised of a chamfered surface 58 and an interior surface 60 substantially parallel to chamfered surface 58 and constituting the outermost side surface of V-groove 62 extending longitudinally along the interior face of panels 40 adjacent the side edges thereof. The interior surface 60 of tongue 56 is angularly inclined inwardly and adapted to intersect the plane of the interior face of side panel 40 along the line of intersection between the plane of the side edge surface with the plane of the interior face surface. The angularity of tongue 56 relative to the plane of side panel 40 forms a rigid interlocking connection which offsets the separating force acting in the plane of panel 40. The greater the angularity of tongue 56, with respect to the plane of side panel 40, the greater the interlocking characteristics of the tongue 56 in complementarily shaped longitudinal slot 36 in the support rail 28. However, the greater the angularity of tongue 56, the deeper V-groove 62 must be, which progressively decreases the cross-section and accordingly, the strength of side panel 40. With the aforementioned factors constituting practical design limitations, satisfactory operation has been obtained from experimental plating barrels embodying the connection shown in FIG. 5 wherein the angular offset of tongues 56 with respect to the planes of side panels 40, ranged from approximately 10° to approximately 20°.

A similar and satisfactory alternate tongue and groove connection between the side panels and support rails is shown in FIG. 6, wherein the longitudinal V-grooves 62 in the interior faces of side panels 40 are disposed inwardly of the side edges of the panels so that the interior surface 60 of tongue 64 intersects the plane of the interior face of the side panel along a line parallel to and spaced inwardly a distance from the side edge of the panel. The configuration of tongue 64 shown in FIG. 6 provides for a greater thickness thereof at a given angular offset in comparison to tongue 56 shown in FIG. 5. The same limitations as to interlocking and panel strength apply to tongue 64 as to tongue 56, and accordingly, it is preferred that the angular offset of tongue 64 with respect to the plane of side panel 40 be restricted to a range from about 10° to about 20°.

Still another alternate satisfactory modification of the connection shown in FIG. 5 is illustrated in FIG. 7 wherein the angular offset of tongue 66 is toward the exterior face of side panel 40 and opposite to that of tongue 56. The reversal of the angularity of depending tongue 66 has the advantage of increasing the locking angle thereof in support rail 28 as side panels 40 are deflected outwardly under the load of the work-pieces contained therein. The same design parameters are applicable to tongue 66 as were mentioned in regard to tongues 56 and 64, and accordingly the preferred angular offset is preferably within the range of from about 10° to about 20°. As will be appreciated by those skilled in the art, tongues 56, 64 and 66 as shown in FIGS. 5, 6 and 7, respectively, can be simply, quickly and economically incorporated along the edges of a substantially flat rectangular panel by simply chamfering one face surface thereof along the edge and milling a V-groove in the opposite face surface forming therewith an angularly projecting tongue. The configuration of tongues 56, 64 and 66 enables their assembly into complementarily shaped longitudinal slots 60 either sidewise or endwise increasing the flexibility of assembly of the plating barrels.

Positive interlocking connections between side panels 40 and support rails 28 are illustrated in FIGS. 8 and 9 which constitute alternate satisfactory modifications of the angularly depending tongues heretofore described. As shown in FIG. 8, the side edges of side panels 40 may be provided with a dovetail tongue 68 having outwardly diverging side surfaces in slidable engagement with the side surfaces of complementarily shaped longitudinal slots 36 in support rail 28. The dovetail configuration of tongue 68 may be fabricated by simply machining a V-shaped groove in opposing faces of side panels 40 longitudinally along the side edges thereof, thereby obtaining a symmetrical outwardly diverging tongue. To achieve satisfactory interlocking between tongue 68 and support rail 28 while retaining satisfactory panel strength, it is preferred that the included angle between the side surfaces of tongue 68 be limited to a range from about 10°

to about 15°. As in the case of tongues **56**, **64** and **66**, dovetail tongue **68** is disposed within the planes of the interior and exterior faces of side panels **40**.

An alternate positive locking connection between the side edges of side panel **40** and support rail **28** is shown in FIG. 9, wherein a longitudinal rib **70** is integrally connected to the interior face of side panel **40** immediately adjacent the side edges thereof. The coaction between projecting longitudinal rib **70** and the mating surfaces of complementarily shaped longitudinal grooves **36** in support rail **28** provide a rigid interlocking connection preventing withdrawal of side panels **40** from support rails **28** when a separating force is applied thereto. Longitudinal projecting rib **70** may either be formed integrally with side panel **40** by machining a recess in the interior face of panel **40**, or may be comprised of a longitudinal rectangular strip fixedly secured to the interior face of panel **40** by means of a suitable adhesive, fastening screws or the like. Side panels **40** provided with either the dovetail tongue **68** or longitudinal rib **70**, as shown in FIGS. 8 and 9, respectively, are simply assembled in interlocking engagement with support rails **28** by sliding side panels **40** endwise between adjacent support rails.

Another satisfactory alternate method of maintaining the side edges of side panel **40** in engagement with appropriately contoured longitudinal slots **36** in support rail **28** is shown in FIG. 10, wherein a U-shaped clamp **72** detachably secured to the exterior surface of support rail **28** is employed for clamping and retaining side panels **40** in engagement with support rails **28**. U-shaped clamp **72** is preferably made of a high strength material such as steel, for example, having an exterior protective coating **74** over the entire outer surface thereof to prevent corrosive attack of U-shaped clamp **72** by the acidic and alkaline solutions to which it may be subject. Protective coatings suitable for this purpose are now well known in the art and include vinyl resins and highly fluorinated polymeric hydrocarbons such as tetrafluoroethylene. The bight portion of U-shaped clamp **72** is detachably secured to the exterior surface of support rail **28**, such as by fillister head machine screw **76** having the head and upper shank portion thereof disposed in cup **78** comprised of a suitable chemical resistant material. The outer bore of cup **78** may be filled with a suitable putty or filler plug **80** protectively sealing the head of machine screw **76** from attack by the corrosive acidic and alkaline treating solution. The depending legs of U-shaped clamp **72** overlie and are in abutting engagement with the sides of longitudinal members **82** fixedly secured to the exterior faces of side panels **40** and disposed longitudinally along the side edges thereof. The side edges of side panels **40** may be of a plane rectangular tongue, slightly recessed if dsired and are disposed in abutting engagement in longitudinal slots **36** in support rail **28**. Longitudinal members **82** are rigidly afixed to the exterior faces of side panels **40** by a suitable resin adhesive **83** or by fastening screws and preferably extend longitudinally along side panels **40** for substantially the entire length thereof. U-shaped clamp **72** may be comprised of a single U-shaped element substantially coextensive in length with said longitudinal members **82** or preferably are of a short section enabling a plurality thereof to be disposed at spaced intervals along the exterior of support rail **28** between end walls **14**.

The aforementioned tongue and groove connections between side panels **40** and support rails **28** provide a plating barrel construction that is readily assemblable and disassemblable, enabling the quick and simple replacement of one or more worn or broken components. Moreover, the interlocking connections between the side edges of side panels **40** and support rails **28** increase the strength and rigidity of the plating barrel by transmitting and distributing the load forces applied to the side panels and support rails along the lower-half portion of the plating barrel to adjacent unloaded panels and support rails, thereby partially relieving the stressed members.

While it will be apparent that the preferred embodiments herein illustrated are well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. An electroplating barrel construction of the type having side panels and end walls defining a chamber of polygonal cross-sectional shape having a plurality of longitudinal work deflecting corners, including at least one said longitudinal corner comprising a support rail having slots in opposite side wall portions thereof extending longitudinally for the full length of said support rail, a pair of substantially flat side panels having longitudinal tongues along the side edges thereof, said tongues disposed within the planes of the barrel interior and exterior faces of said panels and having substantially parallel side surfaces angularly inclined toward the plane of one of said faces, said tongues disposed in said slots in said support rail, said slots complementarily shaped relative to said tongues and forming a rigid interlocking connection that is maintained when a separating force is applied to said side panels and said support rail.

2. An electroplating barrel construction of the type having side panels and end walls defining a chamber of polygonal cross-sectional shape having a plurality of longitudinal work deflecting corners, including at least one said longitudinal corner comprising a support rail having slots in opposite side wall portions thereof extending longitudinally for the full length of said support rail, a pair of substantially flat side panels having the barrel exterior faces thereof chamfered along the side edges and longitudinal grooves of a V-shaped cross-section in the interior faces adjacent said side edges forming therewith angularly depending tongues having substantially parallel side surfaces, the plane of the outermost surface of each of said V-shaped grooves intersecting the plane of said interior face along the line of intersection between the plane of the side edge surface with said plane of said interior face, said tongues disposed in said slots in said support rail, said slots complementarily shaped relative to said tongues, and forming a rigid interlocking connection that is maintained when a separating force is applied to said side panels and said support rail.

3. In an electroplating barrel construction as described in claim 2, wherein the angularity between said side surfaces of said tongues and said planes of said faces of said side panels is in the range from about 10° to about 20°.

4. An electroplating barrel construction of the type having side panels and end walls defining a chamber of polygonal cross-sectional shape having a plurality of longitudinal work deflecting corners, including at least one said longitudinal corner comprising a support rail having slots in opposite side wall portions thereof extending longitudinally for the full length of said support rail, a pair of substantially flat side panels having longitudinal tongues along the side edges thereof, said tongues disposed within the planes of the barrel interior and exterior faces of said panels and having substantially parallel side surfaces angularly inclined toward the plane of said exterior faces, said tongues disposed in said slots in said support rail, said slots complementarily shaped relative to said tongues and forming a rigid interlocking connection that is maintained when a separating force is applied to said side panels and said support rail.

5. An electroplating barrel construction of the type having side panels and end walls defining a chamber of polygonal cross-sectional shape having a plurality of longitudinal work deflecting corners, including at least one said longitudinal corner comprising a support rail having slots in opposite side wall portions thereof extending longitudinally for the full length of said support rail, a pair

of substantially flat side panels having the barrel interior faces thereof chamfered along the side edges and longitudinal grooves of a V-shaped cross-section in the barrel exterior faces adjacent said side edges forming therewith angularly depending tongues having substantially parallel side surfaces, the plane of the outermost surface of each of said V-shaped grooves intersecting the plane of said exterior face along the line of intersection between the plane of the side edge surface with said plane of said exterior face, said tongues disposed in said slots in said support rail, said slots complementarily shaped relative to said tongues and forming a rigid interlocking connection that is maintained when a separating force is applied to said side panels and said support rail.

6. In an electroplating barrel construction as described in claim 5, wherein the angularity between said side surfaces of said tongues and said planes of said faces of said side panels is in the range from about 10° to about 20°.

7. An electroplating barrel construction of the type having side panels and end walls defining a chamber of polygonal cross-sectional shape having a plurality of longitudinal work deflecting corners, including at least one said longitudinal corner comprising a support rail having slots in opposite side wall portions thereof extending longitudinally for the full length of said support rail, a pair of substantially flat side panels having the barrel exterior faces thereof chamfered along the side edges and longitudinal grooves of a V-shaped cross section in the barrel interior faces adjacent said side edges forming therewith angularly depending tongues, the plane of the

outermost surface of each of said V-shaped grooves being parallel to the chamfered surface and intersecting the plane of said interior face along a line parallel to and spaced inwardly a distance from said side edge of said panel, said tongues disposed in said slots in said support rail, said slots complementarily shaped relative to said tongues and forming a rigid interlocking connection that is maintained when a separating force is applied to said side panels and said support rail.

8. In an electroplating barrel construction as described in claim 7, wherein the angularity between said chamfered surfaces of said tongues and said planes of said faces of said side panels is in the range from about 10° to about 20°.

References Cited in the file of this patent

UNITED STATES PATENTS

345,944	Anderfuren	July 20, 1886
757,558	Lynam	Apr. 19, 1904
876,120	Ware	Jan. 7, 1908
1,030,053	Catlin	June 18, 1912
1,032,674	Holland	July 16, 1912
1,378,197	Schwab	May 17, 1921
2,249,609	Jackson	July 15, 1941
2,673,076	Colclesser	Mar. 23, 1954
2,836,400	Jackson	May 27, 1958

FOREIGN PATENTS

4,256	Norway	Jan. 25, 1896