This invention relates to apparatus for electroplating, and more particularly to a container for receiving small parts to be electroplated, which parts may be placed in a plating barrel arranged to be immersed and rotated within a tank containing electroplating solution.

Heretofore, in electroplating relatively small parts in small quantities, it has been necessary to provide special equipment for use in the electroplating tank. Such equipment was not only quite expensive from a cost and maintenance standpoint, but failed to produce satisfactorily plated parts. It was found that in many cases the plating solution failed to circulate properly throughout the container holding the parts, resulting in non-uniformly plated surfaces. Furthermore, the use of such equipment entailed the consumption of an excessive amount of current to obtain results, thus adding to the cost of producing the parts.

Where small parts containers have been employed in the usual barrel plating apparatus, there has been a failure to obtain uniform plating of the parts, due not only to the lack of circulation of the plating solution throughout the container, but also to the texture of the inner surface of the container which resulted in the parts sliding alongside the container was tumbled or agitated within the plating barrel. In sliding along this inner surface, the parts became an integrated mass, leaving surfaces on some parts only partially exposed to the plating solution. Prior small parts containers failed to provide proper provision for the current carrying member within the container, thus further contributing to the inadequacy of prior devices.

Accordingly, it is among the objects of this invention to provide a container for holding small parts to be electroplated which is sturdy in construction and capable of withstanding tumbling and agitation with other parts in an electroplating barrel, and wherein adequate apertures are provided through the wall thereof to facilitate the free flow of plating solution through the container.

A further object of the invention is to provide a small parts container for use in an electroplating barrel having agitating means therefor for effecting tumbling of the parts within the container, and wherein means are provided to effect the flow of current through such parts.

Another object of the invention is to provide a small parts container for use in an electroplating barrel, wherein means are provided for the free flow of plating solution through the container and for maintaining the parts therein, and wherein an inner wall surface is presented to the parts disposed within the container which enhances the tumbling and agitating thereof in the plating solution, thereby insuring a uniformly plated surface.

These and other objects and advantageous features of the invention, not at this time more particularly pointed out, will become apparent as the nature of the invention is better understood from the following detailed description of a preferred embodiment thereof taken in conjunction with the accompanying drawings, wherein like reference characters denote corresponding parts, and wherein:

FIGURE 1 is a fragmentary longitudinal elevational view of barrel plating apparatus disposed within a plating tank with parts broken away, omitted and shown in cross-section, embodying the device of the present invention,

FIGURE 2 is a top plan view of a small parts container constructed in accordance with the present invention,

FIGURE 3 is an exploded plan view illustrating the arrangements of the several components of the container of FIGURE 2,

FIGURE 4 is a longitudinal sectional view, on an enlarged scale, of the container of FIGURE 2, taken on the line 4—4 of FIGURE 2,

FIGURE 5 is a sectional view of the container, taken along the line 5—5 of FIGURE 4,

FIGURE 6 is a fragmentary sectional view of the inner wall surface of the container, taken along the line 6—6 of FIGURE 4, and

FIGURE 7 is a fragmentary sectional view on an enlarged scale through the wall of the container, taken along the line 7—7 of FIGURE 6 and illustrating the position of small parts in the container which are to be electroplated.

With reference to the accompanying drawings and particularly FIGURE 4, there is illustrated electroplating apparatus employing a small parts container in accordance with the present invention including a conventional rectangular open top plating tank A mounted in a fixed position on the floor and a removable plating assembly B mounted on the tank with portions submerged in the liquid within the tank. The tank A comprises a flat rectangular bottom wall 1, flat vertical end walls (not shown) and flat parallel vertical side walls 2 and 3. Metal angles 4 are rigidly mounted on the top portions of the wall of the tank to provide horizontal edges at the top of the tank for supporting a pair of cylindrical low-resistance copper cathode rods 5. The rods are supported with their axes parallel and in substantially the same plane by two pairs of detachable clamping elements 6. Each of the clamping elements 6 includes a Y-shaped lower portion rigidly bolted to the angle 4 and an inverted U-shaped upper portion bolted to said lower portion. An electrical connection is provided between the cathode rods 5 including a copper bus bar 7 of rectangular cross-section. The bus bar 7 is connected to the negative terminal of a source of electric current in a conventional manner. The positive terminal of said source is connected in a similar manner to the anode bars of the tank whereby a current can be conducted from the anodes to the cathodes in the usual manner.

The removable assembly B includes a steel frame 8 having end portions which may be mounted on top of the cathode rods 5. The frame 8 includes a rotatable perforated barrel 10 suspended from the frame between the guide members 9 and submerged in the plating solution when the frame rests on the side walls of the tank. The plating barrel may be of any suitable shape. As shown in FIGURE 1, the barrel 10 is of regular polygonal cross-section and comprises a series of flat rectangular side walls 11 which are provided with rows of perforations 12 and are held in fixed position relative to each other by parallel ribs or bars 13. The opposite ends of the barrel are closed by a pair of coaxial vertical pulleys 14 which are rigidly attached to the ribs 13 and side walls 11 to support the barrel. Access to the interior of the barrel is provided through a lid 14a.

The barrel 10 is supported from the frame 8 by means of a horizontal shaft 15. A pair of spaced upper pulleys 16 is mounted on the shaft 15 between the guide members 9 in alignment with the lower pulleys 14. The shaft 15 is journaled for rotation in a pair of longitudinally aligned bearing blocks 17 and may be driven by means of a motor (not shown) through suitable spur gears 18 and 19 positioned beyond the end of the frame 8.

Electrode means are provided for the barrel 10 including a pair of flexible conduits or cables 20. A pair of coaxial horizontally aligned non-rotatable stub shafts 21 is provided at the opposite ends of the barrel 10 to hold
the conduits 20 in position during rotation of the barrel. The stub shafts are supported in the vertical guides 8. The lower ends of the conduits 20 (FIGURE 1) are rigidly secured to the saddles 23 formed on the frame 20 which are adapted to rest on the cathode rods 5. The lower ends of the conduits 20 disposed within the interior of the barrel 10 engage the articles to be plated and convey current thereto.

As shown in FIGURE 1, the container 25 for receiving small parts to be electroplated is disposed in the barrel 10 and is subjected to rotation and tumbling in the same manner as other parts being processed therein. When disposed in a plating barrel, the container 25 may be subject to rather severe treatment from engagement with parts being plated and, accordingly, the container 25 has been constructed to withstand such treatment.

With reference to FIGURES 2, 3, and 4, the container 25, constructed in accordance with the teachings of the present invention, comprises a cylindrical open end body portion 26 having a wall of substantial thickness defining a chamber 26a for the reception of parts to be treated. The body portion is made of a synthetic plastic material, preferably polyvinyl chloride, which is capable of withstanding severe punishment and is impervious to plating solutions. Adjacent the opposite ends of the body portion 26 there are provided opposite end plates 27 which are of sufficient depth to extend through the wall of the body portion and effect communication with the interior of the chamber. The wall of the container is provided with rows of relatively large perforations 28 of a size to facilitate the free-flow of plating solution through the container.

Closure members 29 are provided for the ends of the body portion 26 and include a cylindrical portion 29a which extends into the chamber 26a and is provided with an outwardly projecting peripheral end flange 29b, for engaging the end wall of the body portion 26. Adjacent the inner end of the cylindrical portion 29a there is formed in the surface thereof a circular groove or recess 30. The groove 30 is so positioned with respect to the end flange 29b that, when the closure member 29 is seated within the end of the body portion 26, slots 27 and groove 30 are in substantial alignment as shown in FIGURE 4. An O-ring 31 is adapted to engage the outer wall surface of the body portion 26 and engage within the slots 27 thereof and the groove 30 formed on the cylindrical body 29a of the closure members 29. When so engaged in the groove 30, the closure member is securely held within the end of the container.

The inner end wall surface of the cylindrical portion 29a is scored as at 29c to present a surface which will repel and agitate the small parts in the container as they are subjected to tumbling therewithin. An axial opening 32 is provided through closure members 29 to receive an electrode 33. The electrode 33 is preferably encaised in a protective sheath 34, and the outer end thereof is secured to a terminal member 35 which either engages the parts disposed within the barrel 10 or the end of conduit 20 to effect an electrical connection therewith.

The opening 32 through the closure member 29 is counter bored on the inner end of closure members 29 to form a recess 36 in which is mounted a terminal member 37 securely fixed to the end of conduit 33 projecting through the opening 32. An outwardly projecting pin 38 is formed on the terminal 37. Connecting the terminal members 37 of the closure members 29 at the opposite end of the body portion 26 is a length of braid chain 39 provided with a connector 40 at each end thereof for receiving the pin 38. Any suitable member, such as a cotter pin 41, extending through the pin 38 serves to maintain the connector 40 thereon.

The braid chain 39 is approximately twice the length of the distance between the terminal 37 and is so disposed within the container housing 26 that effective electrical engagement is maintained with the parts contained therewithin. The bead chain is so constructed that small parts do not become immeshed with links thereof, and further serves to alleviate any massing or piling up of the small parts within the container during the processing thereof. Accordingly, by means of the electrodes 33 and unique characteristics of the bead chain 39, a flow of current through the container is provided which adequately serves the parts being processed within the container.

As shown in FIGURE 3, there is provided a lining 42 of screening material which lies closely adjacent the inner wall of the body portion 26. This screening material is of relatively fine mesh, permits passage therethrough being of such a size that parts to be plated cannot escape from the container through the perforations 28. However, the screen does not interfere with the free-flow of electroplating solution through the container 25. Within the lining 42 of the housing 26 there is provided an agitating member 43 which takes the form of a perforated cylindrical sleeve having an inner surface presenting spaced ribs extending spirally from the interior of the container. The surface thus presented to the small parts disposed within the container mitigates against any sliding of the parts on the interior surface and the formation of an integrated mass and promotes tumbling or churning of the parts, thus presenting all surfaces of such parts to the electroplating solution to effect uniform plating.

The liner screen 42 and agitating member 43 are preferably made of a plastic material which is impervious to the plating solution and can be readily replaced at a nominal cost.

The container 25 of the present invention, when used with relatively small parts, makes it possible to process such parts in the ordinary commercial plating barrel. The wall of the container is of sufficient thickness to withstand severe usage when disposed in such a plating barrel. The perforated side wall is such that there is free-flow of plating solution through the container and the parts disposed therein. The interior construction of the container promotes agitation and tumbling of the parts within the container as the same is subjected to the action of the plating barrel. The braid chain disposed within the container serves as an excellent conductor of electrical current to the parts disposed therein and maintains itself free from entanglement with the parts being processed.

While there has been described herein and illustrated in the accompanying drawings a presently preferred embodiment of the present invention, it is to be understood that various modifications and refinements which depart from the illustrated embodiment may be adopted without departing from the spirit and scope of the invention.

I claim:

1. In apparatus for electroplating including a tank for electroplating solution and a plating barrel arranged to be rotated therein, a container for receiving small parts adapted to be placed within the barrel comprising a perforated hollow cylindrical housing and closure members at the opposed ends thereof, agitating means supplemental to the inner surface of the housing, and means for conveying electric current through the container and the parts disposed therein.

2. In apparatus for electroplating including a tank for electroplating solution and a plating barrel arranged to be rotated within a tank, a container for receiving and processing relatively small parts comprising a perforated hollow cylindrical housing, means for agitating the parts within said container, said means including a removable cylindrical sleeve complemental to the inner surface of the container and having an inner surface presenting a plurality of ribs extending spirally from the length of the housing, a layer of fine mesh material disposed between the said agitating means and the inner wall of the hous-
ing, and means for conveying electric current through the container and the parts contained therein.

3. A container for use in electroplating small parts comprising a cylindrical housing defining a chamber having a perforated wall portion for receiving the parts to be electroplated, means within said chamber for agitating the parts during the plating process, said means including a sleeve having longitudinally extending spaced ribs projecting from the inner surface thereof, a covering of fine mesh material on the inner surface of said housing, closure means for the opposite ends of the housing, resilient means for maintaining said closure means on the ends of the housing, and means for conveying electric current through the container.

4. In apparatus for electroplating including a tank for electroplating solution and a plating barrel arranged to be rotated within the tank, a container for receiving small parts adapted to be placed within the barrel comprising a hollow cylindrical housing member having a perforated wall portion through which the plating solution freely flows, a liner of relatively fine mesh material covering the interior wall surface of the housing, a perforated sleeve superimposed on said liner and having a ribbed inner surface, said surface adapted to effect a tumbling of the parts disposed within the container as the latter is rotated within the plating barrel, closure members for the ends of said housing member, and means for conveying electric current through the container and the parts disposed therein.

5. A container for receiving small parts adapted to be processed within a plating barrel comprising a hollow cylindrical housing member having a perforated wall portion, a liner of relatively fine mesh material covering the interior wall surface of the housing, means for agitating the parts within the container including a perforated sleeve superimposed on said liner, longitudinal ribs spirally arranged on the inner surface of said sleeve, closure members for the end of said housing member, means for resiliently maintaining said closure members on the housing, and means carried by said closure members for conveying electric current and the parts disposed therein.

6. In apparatus for electroplating including a tank for electroplating solution and a plating barrel arranged to be rotated within the tank, a container for receiving small parts adapted to be placed within the barrel comprising a hollow cylindrical housing member having a perforated wall portion through which the plating solution freely flows, a line of relatively fine mesh material covering the interior wall surface of the housing, means for agitating the parts within the container as the latter is rotated within the plating barrel, said means including a perforated sleeve having a plurality of spirally disposed ribs projecting inwardly therefrom, closure members for the ends of said housing member, said closure member having means for conveying electric current to the interior of the container and means for resiliently maintaining the closure members within the ends of the cylindrical housing.

7. A container for receiving small parts to be processed within a plating barrel comprising a cylindrical housing member having a perforated wall portion and defining a chamber, concentric members disposed within said chamber adjacent the inner wall surface thereof one of said members presenting a ribbed surface to the parts disposed within the housing, closure members for the ends of said housing, means for securing the closure members within the ends of said housing, said means including diametrically opposed slots extending through the wall adjacent each end of the housing, a circumferential groove formed on the portion of the closure member disposed within the end of the housing and adapted to be aligned with said slots, resilient means encircling the outer surface of the housing and engaging within the aligned slots and groove and means for conveying electric current through the container.

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JOHN H. MACK, Primary Examiner.
W. VAN SISE, Assistant Examiner.