Sept. 5, 1967 A. A. MARULLI ETAL 3,340,170

ELECTROPLATING BARREL WITH INTEGRAL ELECTRODES

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FIG. 1

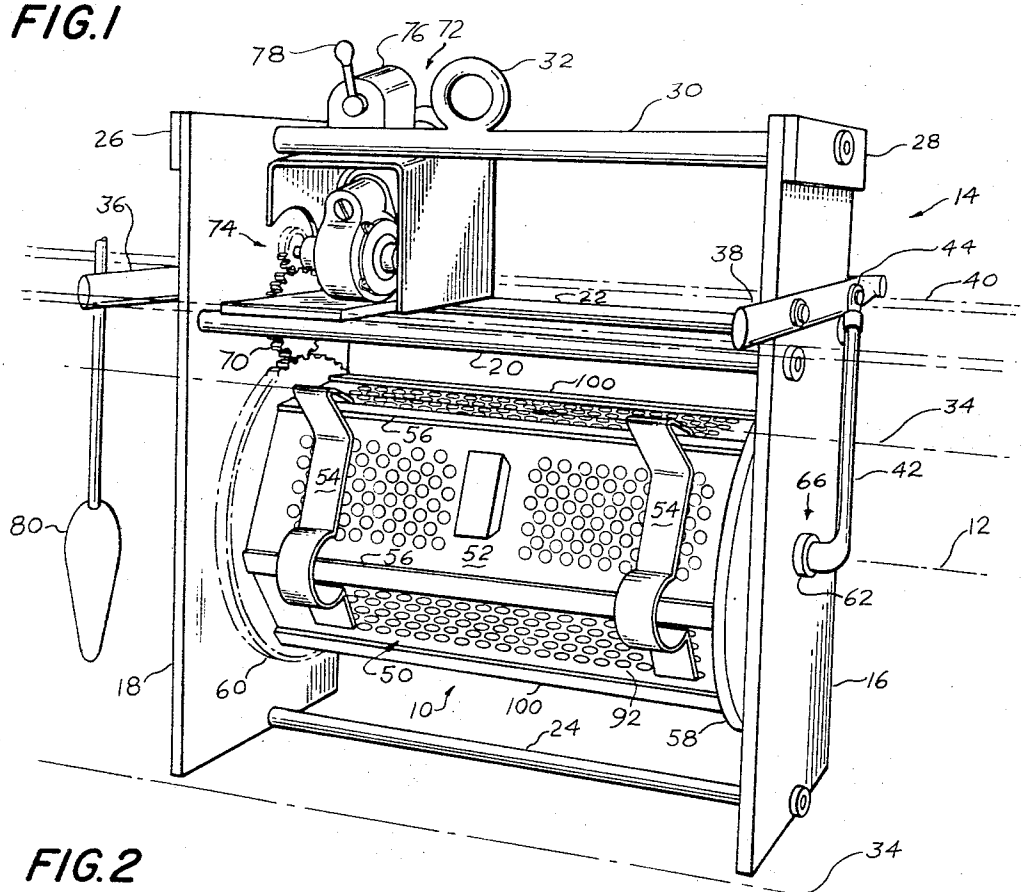
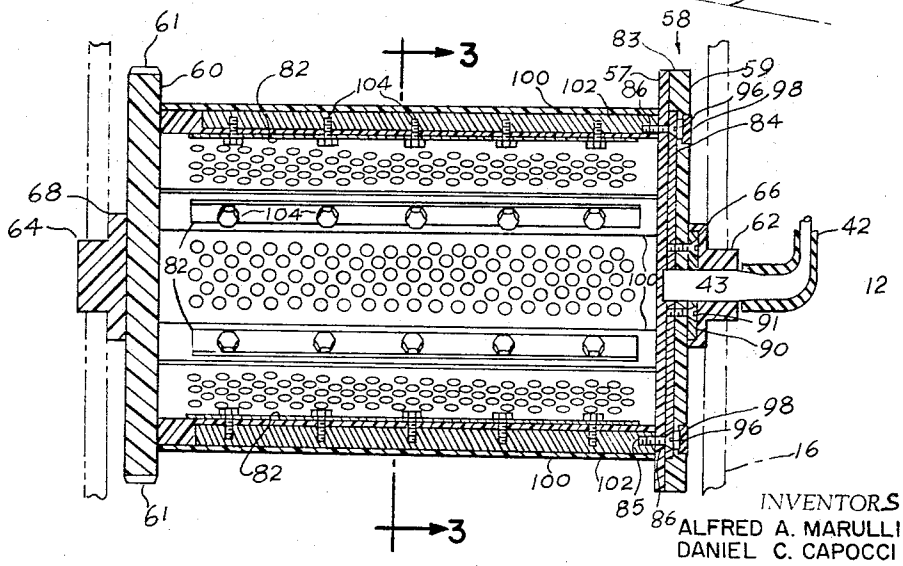


FIG. 2



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FIG.3

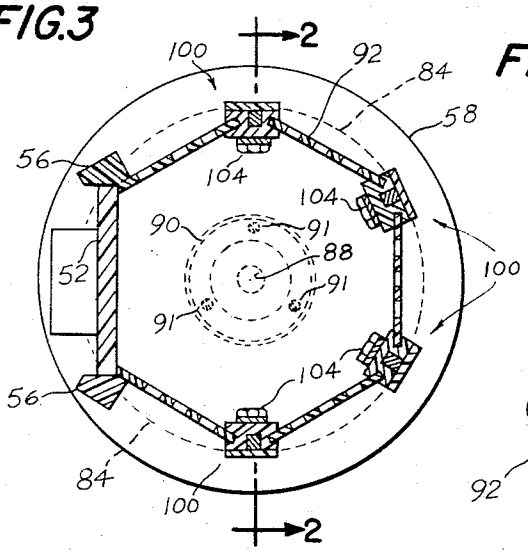


FIG.4

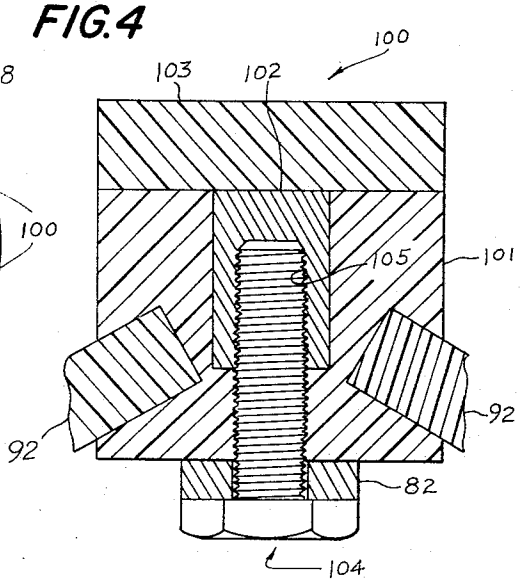


FIG.5

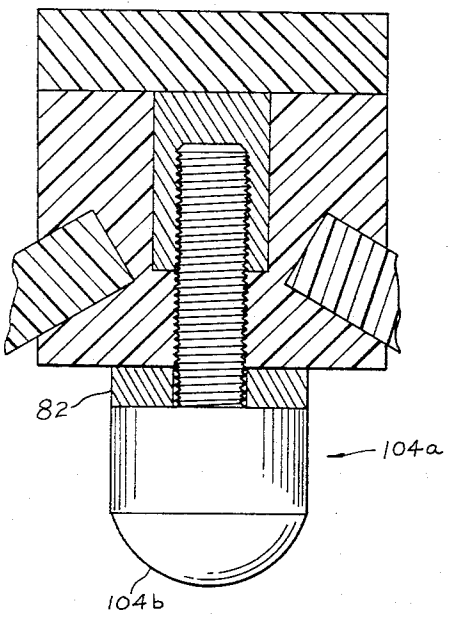
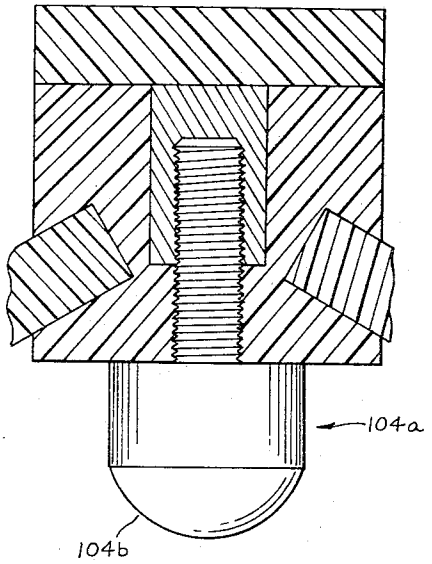


FIG.6



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ELECTROPLATING BARREL WITH INTEGRAL ELECTRODES

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2 Claims. (Cl. 204—213)

ABSTRACT OF THE DISCLOSURE

An electroplating barrel having end plate assemblies which rotatably support the barrel between parallel fixed plates. One of the end plate assemblies defines a socket for receiving a stationary electrode plug, or trunnion, and the barrel has a body portion with conductive strips laminated in its side wall. The end plate assembly includes a pair of axially spaced circular metallic plates which have central openings for receiving the electrode plug. One of the circular plates is laminated in a plastic disc and is electrically connected to each of the conductive strips by a plurality of screws. The other circular plate is slightly less than one-half the diameter of the first and is sandwiched between the plastic disc and a plastic hub portion, which hub portion is rotatably received in one of the fixed plates. The circular plates are electrically connected to one another by a plurality of screws so that the electrical resistance between the electrode plug and the conductive strips is minimized.

The present invention relates to barrels for use in electroplating small articles in tanks, and more particularly to a barrel which is provided with a plurality of electrodes integrally mounted in the barrel.

The general object of the present invention is to provide a barrel in which the electrodes therein minimize the arcing and burning of articles which is normally encountered with dangling contacts or the like usually employed in electroplating barrels.

The drawings show preferred embodiments of the invention and such embodiments will be described, but it will be understood that various changes may be made from the constructions disclosed, and that the drawings and descriptions are not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

Of the drawings:

FIG. 1 is a perspective view showing a barrel of the present invention and its relation to a typical electroplating apparatus, including a tank containing the electrolyte and shown in broken lines;

FIG. 2 is a sectional view of the barrel of FIG. 1 showing the construction of the integral electrode and laminated end disc in detail;

FIG. 3 is a sectional view along the line 3—3 of FIG 2;

FIG. 4 is a sectional view of one of the cross members of the FIG. 2 barrel drawn to a somewhat larger scale than that of FIG. 3;

FIG. 5 is a view similar to FIG. 4 showing an alternative construction of the integral electrode; and

FIG. 6 is a view similar to FIG. 5 showing still another alternative construction of the integral electrode.

Referring first to FIG. 1, a generally cylindrical container or barrel **10** is there shown rotatably supported

about its central axis **12** by a conventional supporting structure indicated generally at **14**. This structure may take any convenient form and as shown it comprises two oppositely disposed end plates **16** and **18** held in spaced parallel relationship by two upper tie rods **20** and **22**, and a lower tie rod **24**. The upper ends of these end plates extend upwardly beyond said upper tie rods and are reinforced by two plates **26** and **28** attached to said upper end portions. A lift rod **30** connects these upper end portions and carries a lifting eye **32** by which the entire supporting structure can be lifted for insertion into or removal from an electroplating tank such as indicated in broken lines at **34**. Alternative means for lifting the structure are provided in the form of two generally horizontal arms **36** and **38** attached to these end plates **16** and **18**. These arms provide a convenient manual means for inserting this structure in said tank **34** or removing the same therefrom. These arms are attached to the end plates below said reinforced upper end portions and above said upper tie rods **20** and **22**. The near ends of the arms may be gripped by a workman for this purpose while the far ends are preferably notched for providing an electrical contact with the rod **40** in the tank **34** as shown. This rod is connected to a source of direct current (not shown) and a lead **42** is electrically connected to said arm **38** by a bolt **44**. This lead extends down to the barrel but does not project into the barrel as best shown in FIG. 2.

Turning now to the construction of the barrel **10**, a body portion **50** is generally hexagonal in cross section and in the form of a hollow shell so as to hold a plurality of articles to be plated. The various panels **92, 92** of this hexagon are supported by longitudinally extending cross members **100, 100**. One side or panel of this hexagon is open and an access cover **52** is provided to close the opening so formed after the articles have been placed in the barrel. Two springlike clamps **54, 54** are provided to hold the cover **52** in place and ribs **56, 56** are provided along the longitudinal edges of the hexagonal body portion which define said opening so as to hold these clamps in position after the cover has been so installed. The barrel **10** is further defined by two generally circular axially spaced discs **58** and **60** which are rigidly attached to the ends of the body portion of the barrel providing a completely enclosed container for holding the articles to be plated. These discs support two hub portions **66** and **68**. A cylindrically extending flange **62** defined by the hub portion **66** is rotatably received in a circular opening **69** in the plate **16** providing the means for supporting the right-hand end of the barrel of FIG. 1. A second cylindrically extending flange **64**, defined by the hub portion **68**, best shown in FIG. 2, similarly supports the left-hand end of the barrel in a second opening (not shown) in the plate **18**.

One of these discs, as shown in FIG. 1, the left-hand disc **60** is provided with gear teeth **61, 61** which mesh with the teeth of a gear **70** on a stub shaft that is supported in the left-hand end plate **18** as shown. Means are provided for driving these gears whereby the barrel **10** can be rotated about its central axis causing the articles to be plated to tumble therewithin and thus to be plated in a uniform manner. As shown, said means comprises an electric motor **72** with suitable gear reduction means, indicated generally at **74**. Also shown is a clutching mechanism **76** having a manually operable handle **78**. This clutch mechanism permits the barrel to be rotated until the access cover has reached a convenient position for in-

serting articles to be plated into the barrel, or removing the same after they have been so plated.

The barrel **10** is perforated throughout the body portion thereof in a conventional manner to provide a path for the electrolyte and the ions carrying the metal to be plated from the cathode, indicated generally at **80**, into the interior of the barrel. The anode in this circuit comprises the circumaxially spaced strips **82, 82** which are electrically connected to the lower end of the aforementioned lead **42** by various conductive means to be described. Also part of the anode are the articles to be plated (not shown) on which the cathode metal is to be deposited. The strips **82, 82** and the lower plug portion **43** of the lead **42** are preferably of nickel steel or the like to minimize the plating of cathode metal on these parts.

It will be apparent that the material from which the barrel is made must be impervious to the electrolyte and also have sufficient dielectric properties so that current is not wasted by leaking through the barrel, and so that the cathode metal is not wasted by being plated on the barrel itself. The usual material, from which these barrels are constructed, is a Plexiglas initially plastic substance produced by polymerization of the monomeric derivatives of acrylic and methacrylic acids, which substance is known as an acrylic "plastic" and is heat moldable and resistive to most ionized electrolytes used in the electroplating art. Such a substance has the added feature of being transparent so as to permit the operator of the apparatus to view the articles within the barrel. Other materials of appropriate dielectric properties can be used to particular advantage in special applications but the Plexigas described above has been found to be generally preferred in the majority of electroplating applications.

Turning now to the construction of the right-hand disc **58** in greater detail, excluding the hub portion **66**, said disc comprises three laminations. The center layer is shown as a generally circular metallic plate **84** but this center layer may take any convenient shape as long as it provides a means for conducting current radially with respect to the axis **12**. As shown, the plate **84** is insulated from the electroplating solution by the inner and outer layers **57** and **59** respectively, and the latter is provided with an annular peripheral portion **83** which also insulates the periphery of the plate **84**. As so constructed said plate can be made from brass or the like and need not be of nickel steel or other relatively expensive metal since it is effectively insulated from the electrolyte by the dielectric Plexigas.

As shown in FIGS. 3 and 4 the cross members **100, 100** are also of laminated construction whereby a plurality of conductive bars **102, 102** are effectively insulated from the electroplating solution by inner and outer members **101** and **103**, respectively. It will be apparent that the hexagonal body portion of the barrel is materially strengthened by these bars which like the plate **84** may be of brass or other relatively inexpensive material and that the cross sectional area of the resulting cross members **100, 100** can be substantially reduced from the size required in a conventional plating barrel not equipped with such bars.

A series of axially spaced screws **104, 104** extend radially through holes provided therefor in each anode strip **82** and in the inner layer **101** of each of said cross members **100**. Each conductive bar **102** has threaded openings **105, 105** therein in which these screws **104, 104** are threadably received. As so constructed each strip **82** is securely held to the barrel and electrically connected to its corresponding bar **102**. It will be apparent that these screws **104, 104**, exposed as they are to the electroplating solution, must be of nickel steel or the like to avoid depositing cathode metal thereon.

As best shown in FIG. 2, a second series of metallic screws **86, 86** connect the right-hand ends of the bars **102, 102** to the periphery of the conductive plate **84**. These screws extend axially through openings provided therefor in the plate **84**, and in the plastic inner lamination **57** of said disc. They are threadably received in threaded openings **85, 85** in the right-hand end portions of said bars providing both an electrical connection of very low resistance, and also strengthening structurally the means for attaching the disc **58** to the barrel body portion. Finally, with reference to these axially extending screws **86, 86** they may be of any readily available conductive material such as brass or the like, for in the construction shown the shank of each is separated from the electroplating solution by the aforementioned barrel structure and the head portions of each of these screws are also insulated by a pair of plastic bungs **96** and **98**. These bungs are cemented in holes provided therefor in the outboard lamination **59** of the disc **58**, which holes also provide the means for installing these screws during assembly of the barrel.

As shown in FIG. 2 a second conductive plate **90**, of approximately half the diameter of said first mentioned plate **84**, is provided in parallel coaxial relation thereto, and is electrically connected to said first mentioned plate **84** by three axially extending screws **91, 91**. These plates are axially spaced from each other by the thickness of the outer lamination **59** of said disc **58**, and the smaller plate **90** is insulated from the electroplating solution by the hub portion **66**. As shown an annular peripheral portion of the latter insulates the periphery of the plate **90** which may be of brass or the like as a result of its protected location.

Finally, to complete the description of the FIG. 2 construction, electrically conductive means are provided for connecting the inner radial portion of the first mentioned plate **84** to the source of direct current. As shown said means include a cylindrical nonrotating plug **43** at the end of the lead **42**, which plug is received in a socket provided therefor in the disc **58**. As shown, this socket comprises a cylindrical bore in the disc **58** and in the hub portion **66**, which bore is concentrically located with respect to the cylindrical flange **62** and of such a diameter that the plug **43** can be snugly received therein without interferring with the rotation of the barrel. This bore is further defined by aligned apertures **88** and **92** in the conductive plates **84** and **90**, respectively, which apertures are aligned with the bore to receive the plug **43**. The bore does not extend through the disc **58** but terminates at a depth just beyond the plate **84** so as to provide a convenient socket for the plug **43**.

FIG. 5 illustrates an alternative construction of the electrodes carried by the barrel **10**. The same basic barrel construction is utilized except that each of the axially spaced screws **104, 104** of the previous embodiment is replaced by a special screw **104*a*** which has been fitted with a generally hemispherical nickel steel head **104*b***. As so constructed the anodes extend radially inwardly beyond the strips **82, 82** and also provide an increased anode area in the barrel.

FIG. 6 illustrates still another alternative anode arrangement for plating articles in the barrel **10**. The construction shown is similar to that of the previously described embodiment except that the anode strips **82, 82** are omitted and the head portions **104*b*, 104*b*** of the screws **104*a*, 104*a*** provide the area of the contact for the articles to be plated. As so arranged a pattern of button type anodes are provided at spaced axial distances along the interior of the barrel, which buttons are also circumaxially spaced about the interior of the barrel and adjacent to the interior surface of the body portion of the barrel in a manner similar to the spacing of the anode strips of the previous two embodiments.

The invention claimed is:

1. In a plastic electroplating barrel having a perforated body portion which is hollow to receive articles to be plated and which carries conductive strips in its side walls, the improvement comprising end plate assemblies for rotatably supporting said barrel and for receiving at least one stationary electrode plug, at least one of said end

plate assemblies including a circular plastic disc, a circular metallic plate integrally laminated in said plastic disc, screws connecting the peripheral portion of said plate with said conductive strips respectively, said metallic plate having a central opening for receiving the inner end of said electrode plug, an annular plastic hub bonded to said plastic disc and defining a circular cavity therebetween, said hub defining a cylindrical bearing surface for rotatably supporting said barrel, a metallic second plate in said circular cavity, said second plate having a central opening for receiving said stationary electrode plug, and screws connecting the peripheral portion of said second plate with said first plate to reduce the electrical resistance between said conductive strips and said electrode plug.

2. The combination as set forth in claim 1 wherein said second circular plate is slightly less than one-half the diameter of said first circular metallic plate.

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