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ELECTROPLATING APPARATUS

Filed May 13, 1963

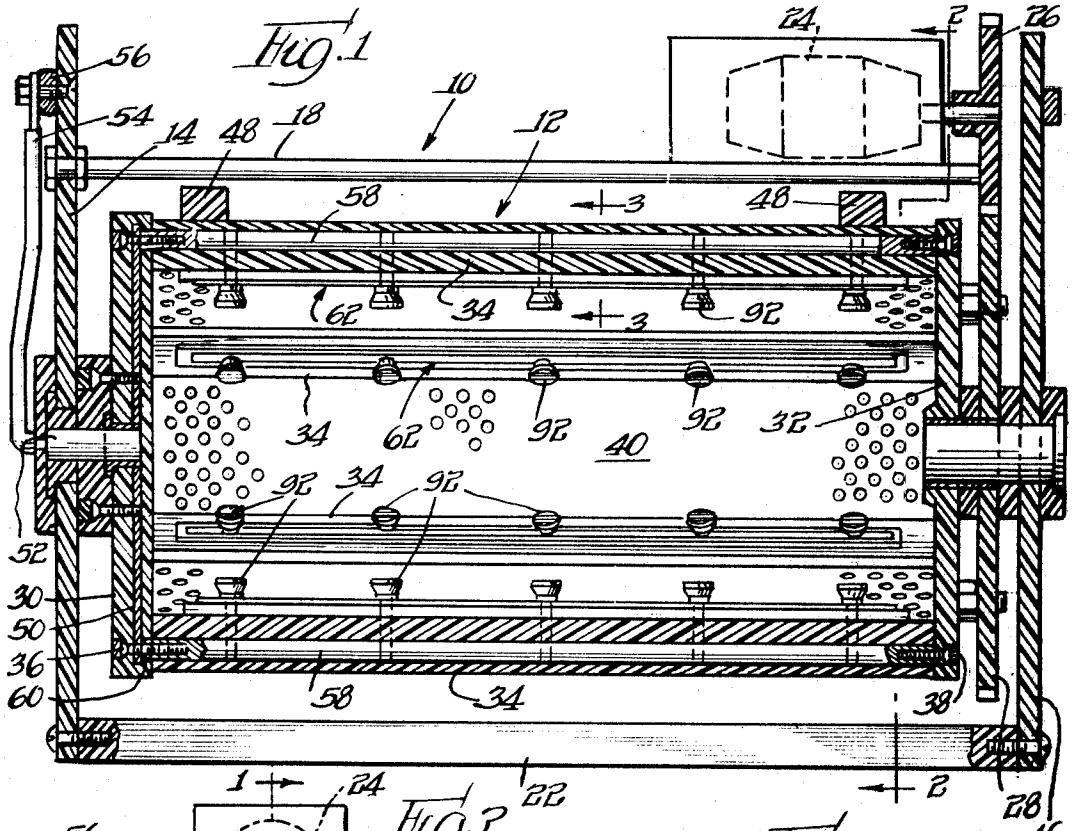


Fig. 1

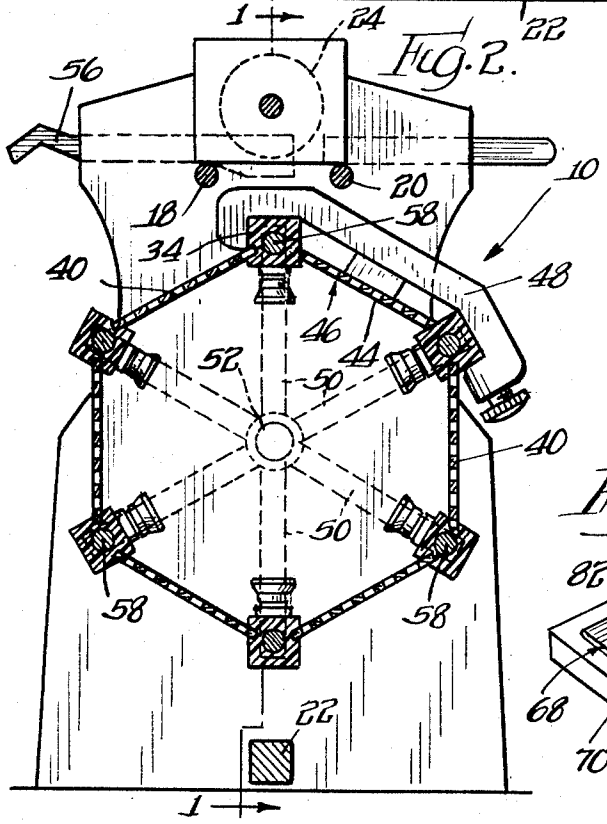


Fig. 2.

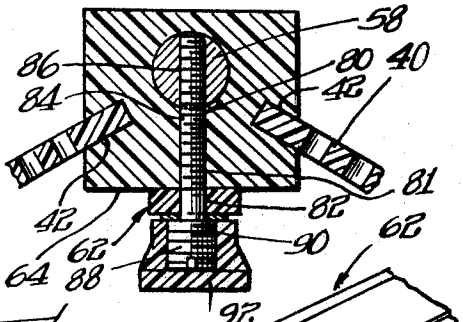


Fig. 3

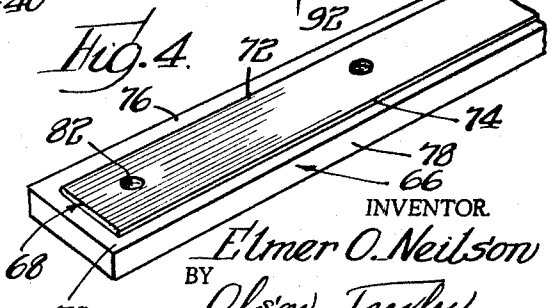


Fig. 4.

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ELECTROPLATING APPARATUS

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The present invention relates to a novel electroplating apparatus.

It is contemplated that an apparatus incorporating one embodiment of the present invention may include a barrel adapted to contain a mass of workpieces and to be rotated within a plating solution. While certain heretofore suggested structures have functioned generally satisfactorily, difficulties have been encountered in unloading workpieces from some barrels, particularly when the workpieces are very small, and undue amounts of plating material have been used, at least partially as a result of a buildup of deposits of the plating material on contact elements of the barrels.

It is an important object of the present invention to provide a novel electroplating apparatus and contact elements therefor constructed in a manner for facilitating unloading of the barrel and for reducing undesirable deposits of plating material on the contact elements.

A more specific object of the present invention is to provide novel electroplating apparatus and contact elements therefor constructed in a manner such that any deposits of plating material which may build up on the contact elements will not form projections or other means which might catch workpieces being processed and hamper unloading of the barrel.

Still another object of the present invention is to provide a novel apparatus of the above-described type wherein contact elements are formed of relatively simple and economical construction and may be readily removed and replaced.

Still a further object of the present invention is to provide a novel electroplating apparatus of the above-described type which is constructed so as to insure agitation of a mass of workpieces being processed in the barrel for promoting uniform plating of all of the workpieces.

Other objects and advantages of the present invention will become apparent from the following description and the accompanying drawings wherein:

FIG. 1 is a partial sectional view taken generally along line 1—1 in FIG. 2 and showing an apparatus incorporating features of the present invention;

FIG. 2 is a sectional view taken generally along line 2—2 in FIG. 1;

FIG. 3 is an enlarged fragmentary sectional view taken along line 3—3 in FIG. 1 and showing certain features of the present invention in greater detail; and

FIG. 4 is a fragmentary perspective view showing a contact element of the apparatus of the present invention.

Referring now more specifically to the drawings wherein like parts are designated by the same numerals throughout the various figures, an apparatus 10 incorporating features of the present invention is shown in FIGS. 1 and 2. The apparatus comprises a barrel 12 which may be supported and rotated in a tank containing a plating solution not shown, by any of various well-known means. In the embodiment shown for the purpose of illustrating the present invention, the barrel is rotatably supported at its opposite ends by suitable bearing means on side frame members 14 and 16. Additional frame members 18, 20 and 22 extend between upper and lower ends of the side frame members 14 and 16.

In order to drive the barrel, a motor and speed reducing unit 24 is mounted on the frame members 18 and 20. A gear 26 is secured to the output shaft of the unit 24 for driving a gear 28 fixed to and rotatable with one end of the barrel.

The barrel 12 comprises a pair of opposite end members 30 and 32 formed from a suitably chemically inert and electrical insulating material. The side walls of the barrel include a plurality of rib members formed from the same or similar material which ribs extend between and are spaced around opposing marginal portions of the end members 30 and 32. The rib members are detachably secured to the end members by screws 36 and 38.

Side members or panels 40 are formed so as to fit between adjacent ribs and between the opposite end members of the barrel. These panels which are also formed from a suitable chemically inert material are provided with a plurality of apertures for permitting the plating solution to flow into and out of the barrel. As shown in FIGS. 2 and 3, the ribs have slots 42 for receiving and supporting margins of the side panels. The barrel includes a door member 44 which is similar to the side panels 40 except that it is adapted to abut a side surface of a pair of ribs which define an opening 46 so that the door may be readily removed. Clamping devices 48 of known construction are included for releasably retaining the door panel 44.

In accordance with a feature of the present invention, the apparatus comprises electrical circuit elements including novel contact means for promoting a more efficient plating operation, facilitating unloading of the barrel, minimizing loss of the plating metal and facilitating maintenance. In the embodiment disclosed, the electrical circuit means comprises a plurality of conductor elements 50 embedded in the end member 30 as shown in FIG. 1 and radiating from a connection with a conducting metal shaft 52 outwardly and in alignment with the ends of the rib members 34 as shown best in FIG. 2. The shaft 52 is in turn operatively connected with a conductor 54 which is adapted to be connected with any suitable source of electrical current. In the embodiment shown the conductor 54 is connected with a contact element 56 secured to the frame member 14 and adapted to engage a bus bar or complementary contact element adjacent the plating tank in a known manner.

A metal electricity-conducting wire or rod 58 is inserted into a central longitudinally extending bore in each of the rib members 34.

As shown in FIG. 1, the screws 36 are threaded into apertures in ends of the rods 58, which ends extend into aligned bores 60 in the end member 30 so that the screws not only serve to secure the rib members with respect to the end member but also serve to draw the rod 58 against associated contact elements 50 for establishing an electrical connection between the elements 50 and the rod 58.

Contact elements 62 constructed in accordance with the present invention are removably disposed against a substantially flat inner surface 64 of each of the rib members 34 for direct contact with workpieces being processed. Each of the contact elements comprises an elongated bar or body 66 of a suitable plastic or other insulating material and a very thin strip 68 of copper or other electricity-conducting material secured to and extending along the top surface 70 of the plastic body member 66. The strip 68 is adhesively bonded or otherwise secured substantially throughout its length and width to the body member 66 so that it intimately contacts the surface 70 for precluding any possibility of a workpiece catching under opposite longitudinal edges 72 and 74 of the strip 68.

It is important to note that the strip **68** has transverse dimensions substantially less than corresponding dimensions of the plastic body member or bar **66**. Furthermore the strip **68** is substantially centrally located on the surface **70** of the bar **66** so that the edges **72** and **74** of the strip are spaced from the corresponding longitudinally extending edges **76** and **78** of the bar **66** a substantial distance. This spacing is substantially greater than the thickness of the strip **68**, which thickness is somewhat exaggerated in FIG. 4 and may be, for example, on the order of two thousandths of an inch or less.

During a plating operation, a portion of the plating metal will be deposited on the strip **68** of the contact element **62**. However since the strip is very thin as compared with its width, the depositing of the metal on the strip will be minimized when related to the area of the strip presented for contact with the workpieces and increased efficiency in the plating operation obtained thereby. Furthermore, it is important to note that in the event there is some build up of plating material on the edges **72** and **74** of the thin strip, such deposits of the plating material will overlie and substantially abut the exposed marginal portions of the surface **70** so that there is no possibility of any of the workpieces being processed catching beneath the deposits of plating material or, in other words, between the deposits and the surface **70**. Thus the construction of the contact element **62** is such that any build up or deposits of plating material which may occur on the strip **68** will not form any laterally projecting lips, flanges or the like beneath which workpieces may be caught. This feature has proved to be of substantial significance when the workpieces being processed are very small. Since the construction of the contact element precludes the undersirable catching of the workpieces, unloading of the barrel is greatly facilitated and the overall efficiency of the apparatus is promoted.

As previously indicated, each of the contact elements **62** overlies and abuts the inner surface of an associated rib member **34**. The contact elements are removably secured in position and electrically connected with the rods **58** by screws **80**. As shown best in FIG. 3, each of the screws **80** has a shank portion **81** which extends through an aperture **82** in its associated contact element and then aligned aperture **84** in the rib and is threaded into an aperture **86** in an associated rod **58**. Each screw **80** includes an enlarged head portion **88** presenting a shoulder **90**. When the screw is tightened as shown in FIG. 3, the shank portion **81** of the screw is placed under tension and the surface or shoulder **90** is drawn tightly against the strip **68** while the threads on the end of the shank portion are drawn tightly against the complementary threads on the rod **58** so as to insure proper electrical contact between the elements.

The head portion **88** of each of the screws **80** is threaded as shown in FIG. 3 and an enlarged cap element **92** is turned onto the head portion **88**. The cap element **92** serves to protect the head portion **80** against the deposit of plating material thereon and also serves as a beater or mechanical agitator within the barrel for stirring up the mass of workpieces being processed and preventing the workpieces from sticking together whereby to promote more efficient and uniform plating action.

As shown in FIG. 1, each of the contact elements has a length substantially less than its associated rib member whereby opposite ends of the contact elements **62** are substantially spaced from the inner surfaces of the opposite barrel end members **30** and **32**. This eliminates any possibility of workpieces becoming lodged and caught between the ends of the contact elements and the barrel end members.

In the embodiment shown, each of the contact elements **62** is provided with five equally spaced apertures **82** through which screw members **80** are inserted. If desired, at least one of the screw members could be omitted or, conversely, additional screw members could be provided for aiding in securing the contact element to the rib. As previously indicated, the bar **66** of each contact element may be formed of plastic or other insulating material and is relatively thick. This thickness is much greater than the thickness of the metal or copper strip **68** and provides the contact element with strength and rigidity so that the portions of the contact element between the screws will remain flat against an associated rib member for preventing workpieces from becoming caught between the contact elements and the rib members.

While the preferred embodiment of the present invention has been shown and described herein, it is obvious that many details may be changed without departing from the spirit and scope of the appended claims.

The invention is claimed as follows:

1. In an electroplating barrel having sidewall members and endwall members, the combination comprising an electrical conductor connectable with a source of electrical energy and embedded in one of said wall members, elongated electrical contact means removably extending along an inner surface of said one wall member and including a metal contact element, and a plurality of spaced screw members each having a shank extending through said metal element and threaded into said conductor for electrically connecting said conductor and said metal element, each of said screw members including an enlarged head portion overlying and abutting said metal element, and a plurality of enlarged cap members of insulating material respectively assembled over and connected with said screw member head portions for mechanically agitating workpieces within the barrel during an electroplating operation and for protecting said head portions against the deposit of plating material thereon.

2. An electroplating barrel comprising opposite endwall members and sidewall means extending therebetween, said sidewall means including a plurality of rib members extending between and secured to said endwall members and side panels disposed between and connected with said rib members, a plurality of electrical conductor elements embedded in one of said endwall members and extending radially of said one endwall member from a central portion thereof to positions in alignment with said rib members, means for connecting radially inner ends of said conductor elements with a source of electrical energy, elongated electrical conducting rods embedded in each of said rib members and respectively electrically connected with outer ends of said conductor elements, elongated bars of electrical insulating material respectively removably disposed along inner surfaces of said rib members, thin strips of metal having a thickness which is small as compared to said bars, said strips being respectively bonded to inwardly facing surfaces of said bars, and a plurality of spaced apart screws having head portions abutting each of said strips and shank portions extending through said strips and associated bars and threaded into said rods for electrically connecting said rods with said strips and removably securing said bars against said rib members, said strips respectively having opposite longitudinal edges spaced substantially inwardly from opposite longitudinal edges of their respective associated bars, said strips having a sufficiently small thickness for preventing a deposit of plating material over said edges in a manner which might catch and retain workpieces being processed.

3. A combination, as defined in claim **2**, wherein each strip is adhesively bonded to its associated bar.

4. A combination, as defined in claim **2**, wherein each head portion of said screw includes thread means thereon, and said combination including an enlarged cap member of insulating material threaded onto each screw head portion.

5. In an electroplating barrel, contact means comprising an elongated relatively thick and rigid bar of insulating material having a predetermined width, a thin strip of metal having a thickness which is small as compared

to said bar, said strip being secured to said bar to provide an electrical contact, said strip having a width less than said predetermined width and being disposed with longitudinal edges thereof spaced substantially inwardly from longitudinal edges of said bar, said strip having a sufficiently small thickness for preventing a deposit of plating material over said edges in a manner which might catch and retain workpieces being processed, a plurality of screw means spaced along said contact means for securing said contact means to an associated electrical conductor, each of said screw means having a head portion in an abutting engagement with said strip, and a cap means formed of an insulating material connected to each of said screw means to cover the head portion of said screw means for mechanically agitating workpieces within the barrel during an electroplating operation and for protecting said head portions against the deposit of plating material thereon.

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