

April 23, 1968

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3,379,632

ELECTROLYTIC APPARATUS

Filed March 10, 1964

2 Sheets-Sheet 1

FIG. 1

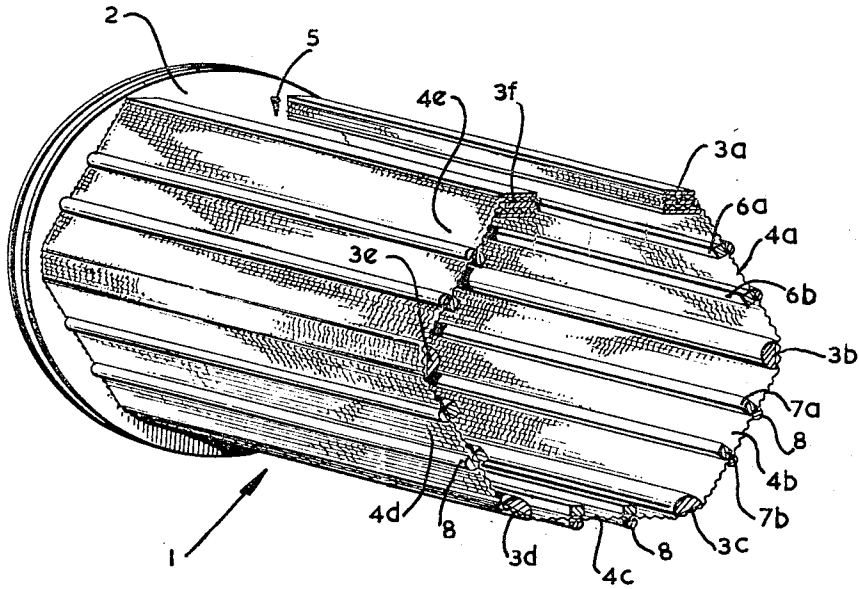
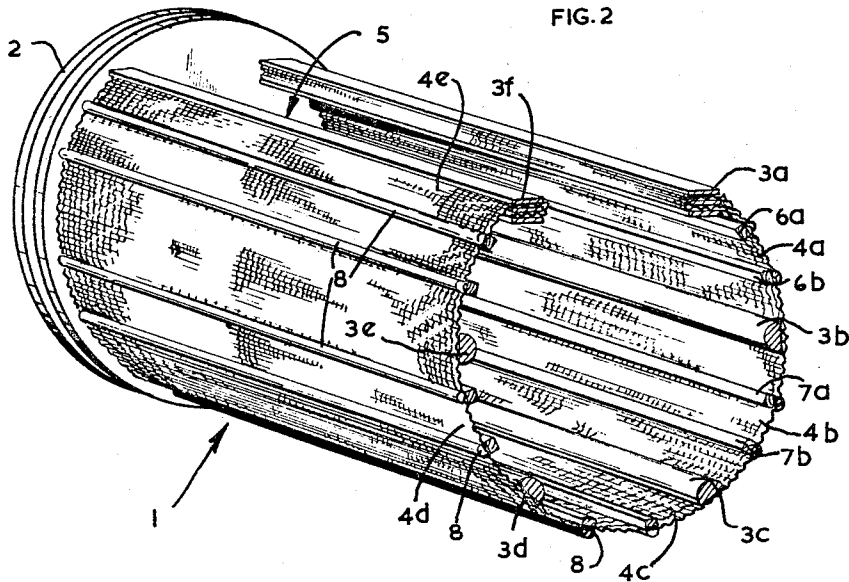


FIG. 2



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2 Sheets-Sheet 2

FIG. 3

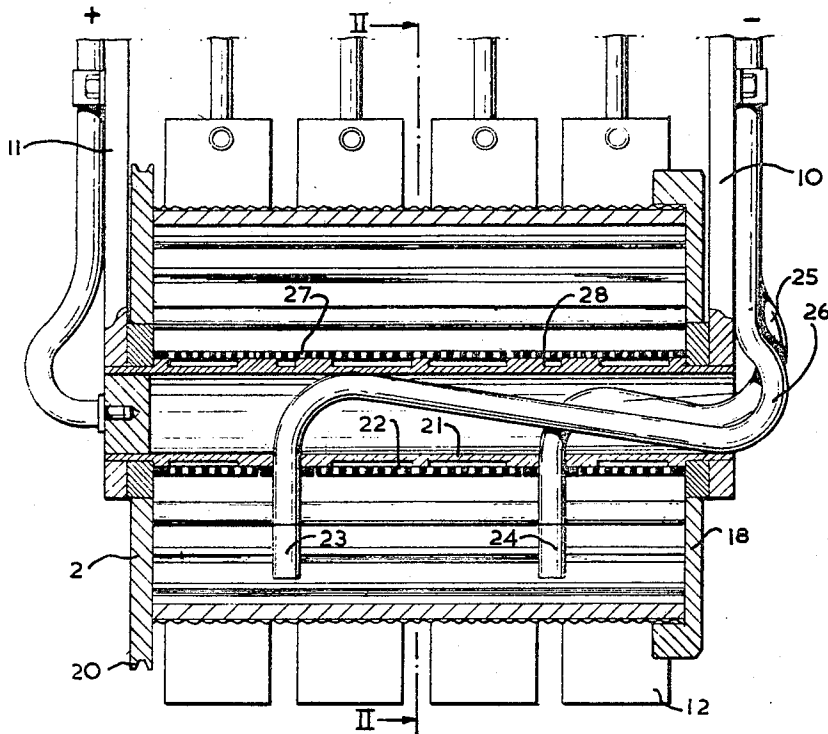
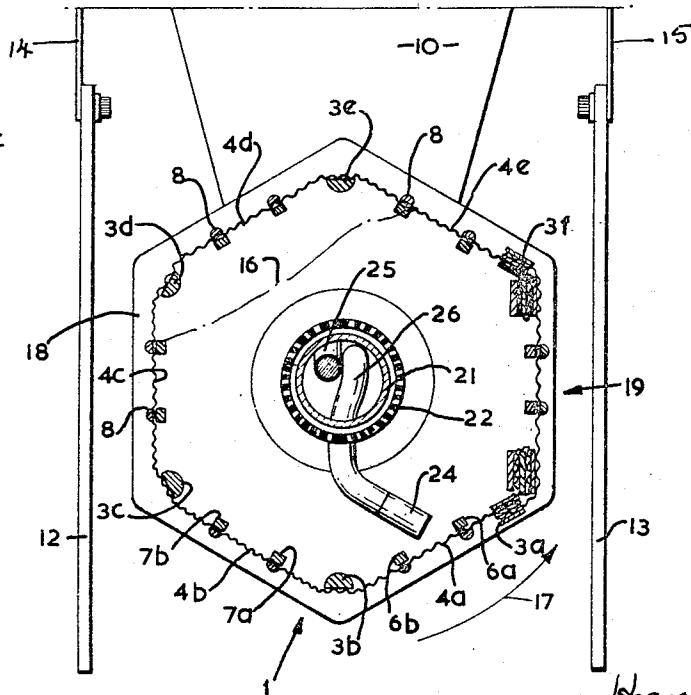


FIG. 4



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1

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ELECTROLYTIC APPARATUS

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H 48,489

6 Claims. (Cl. 204—213)

This invention concerns improvements in or relating to electrolytic apparatus.

It is already well known that small metal or metallic parts such as bolts, screws and so on, can be electroplated in bulk by a technique generally referred to as barrel plating, in which the load of small metal parts is placed within a tumbling barrel or drum which is rotated in the plating electrolyte. The electrolytic deposition of a plating upon the metal parts is then effected by creating an electrical potential field within the electrolyte thus causing ions from the electrolyte to plate out upon the surface of the parts and form metallic coating layers thereon.

Known types of barrel or container, within which the load of metallic parts is carried, are made of plates of a relatively strong material usually a synthetic resin, perforated to allow electrolyte to flow through the barrel. As will become apparent barrels of this type however have certain disadvantages.

Other alternative materials have therefore also been considered, for instance, resin coated wire mesh, resin coated textiles, or textiles made of a synthetic resin fibre. However, these last wall materials suffer from the disadvantage that they are rapidly abraded by the barrel load as it is rotated during plating. The metal parts which make up the load tend to slide over the wall surfaces, and thus wear away the walls themselves with these alternative materials. Wall replacement therefore has to be so frequent that the perforated synthetic resin plates, despite their greater initial cost, are the least expensive in the long run.

Nevertheless, barrel walls formed of wire mesh or textile materials are not only initially cheaper, but also have other important advantages over perforated synthetic resin plates. Thus, firstly the output voltage of the rectifier or power source needed to create the required potential gradients across the cell can be significantly lower than when perforated plates are used. Secondly, the current flow is more uniform, since, with walls made of perforated resin plates, in which the holes occupy a minority of the total walls area, there will be regions adjacent the holes of high current density and thus excessive metal deposition, and vice versa, whereas with walls of, say, wire mesh, the current is not only less impeded but is more uniform over the complete immersible barrel/load surface. Thirdly the surface roughness of wire mesh or even coated textile walls promotes intermixing of the load, by preventing the metal parts sticking to the wall surface. Fourthly, the concentration and temperature of the electrolyte within the barrel can be regulated better with mesh or textile walls, because these are almost completely permeable to the electrolyte.

For all the above reasons the use of these alternative materials is advantageous. In addition, the tensile strength of these materials is entirely satisfactory, and they withstand the temperatures and acid or alkaline conditions encountered in electroplating processes of this type. The only difficulty associated with their use is their abrasion resistance, as previously indicated.

It is therefore the object of this invention to provide means whereby abrasion of the barrel walls can be re-

2

duced, and thus the walls may economically be made of resin coated wire mesh or textiles made from a synthetic fibre or similar material.

According to the present invention there is provided a generally-cylindrical rotatable barrel for use in barrel-plating apparatus, comprising two end-plates disposed substantially normal to the barrel axis, means for mounting said end plates for rotation about said axis, a plurality of strut members extending between and fixedly mounted upon said end plates, a foraminous external barrel wall mounted about said strut members and formed of a non-conductive woven-filament material, means defining an opening in said barrel structure for loading and unloading the barrel, a cover member detachably secured to close said opening, and a plurality of rib members disposed against said wall within said barrel and extending longitudinally thereof, so that upon rotation the barrel load adjacent the wall is held substantially at rest relative thereto.

It will be appreciated that the wall abrasion caused by the sliding friction of the metal parts over the inside of the barrel surface is substantially eliminated by the rib members. Consequently the construction of this invention makes it possible to employ walls formed of non-conductive woven-filament materials, such as synthetic resin coated wire mesh or textiles formed either of synthetic resin man-made fibers or even ordinary textile materials coated with synthetic resin, and thus to achieve the previously explained advantages, without suffering the economic drawbacks previously encountered due to abrasion.

As just indicated the woven filament material can be of various kinds but is preferably resin-coated wire mesh. The end plates may be of any conventional kind, and the means for rotatably mounting them can conveniently be journal bearings disposed about an axial electrode. The strut members preferably are arranged parallel to the axis of the barrel and are conventionally mounted around the periphery of substantially circular end plates. The cross-section of the barrel may be circular or polygonal. In the preferred construction six strut members are disposed symmetrically about the axis. The foraminous external barrel wall may comprise individual sheets whose edges are mounted upon the respective strut member but it is more advantageous to envelop the strut members in a single sheet of material which may then be secured to the respective strut members, most conveniently by means of a lath disposed externally of the barrel wall and secured through the foraminous material to the strut member. Equally the rib-members, whose ends are desirably mounted upon the end plates can be secured to the wall by similar external laths. Instead of or in addition to these means of supporting the rib members against the inside of the wall is possible to employ circular or polygonal hoops disposed with the barrel which together with the rib members constitute a generally-cylindrical grid structure.

The opening in the barrel can be provided in one of the end plates but is most conveniently disposed along one side of the generally cylindrical structure, thus in the case of a hexagonal or other polygonal drum it can constitute the whole of one face, between two adjacent strut members. The cover member is of course a plate of corresponding shape adapted to fit over the opening and be secured in position by wing nuts co-operating with bolts, or in any other suitable way.

The rib members or some of them may be mounted upon the strut members, or indeed the strut members may have radially inwardly extending projections integrally formed thereon which function as rib members.

This is especially suitable where a barrel of circular cross-section is provided. In general however it is preferred to employ a greater number of rib members than strut members, and anyway with polygonal-section drums the rib members serve their function best when disposed intermediate the strut members and hence on the flat wall sections intermediate the strut members. It is therefore preferred to dispose at least one, preferably two and if desired three or more rib members between each adjacent pair of strut members.

The invention lies primarily in the barrel, but for details of the whole electroplating operation and the apparatus employed therein, reference may be made to our co-pending application Ser. No. 347,613 which describes a preferred form of apparatus and process in which the present invention can be employed.

The invention will now be more fully described though by way of illustration only, with reference to the accompanying drawings, in which:

FIGURE 1 is a perspective part cut-away view of a barrel in accordance with the present invention.

FIGURE 2 is a view similar to that of FIGURE 1, but of an embodiment of apparatus according to the present invention showing a barrel with a circular rather than hexagonal cross-section.

FIGURES 3 and 4 show an electroplating apparatus with an embodiment of the barrel of this invention as shown in FIGURE 1 mounted therein.

Referring to the drawings, the barrel generally indicated 1 comprises an end plate 2 and another (not shown) interconnected by six strut members 3a, 3b, 3c all the way to 3f, disposed symmetrically about the barrel axis and parallel thereto, with their ends fixedly mounted at the periphery of the end plates.

The wall sections 4a, 4b, 4c, 4d and 4e extend between the pairs of strut members 3a-b, 3b-c and so on. Between strut members 3f and 3a the wall sections is omitted, and the opening generally indicated 5 permits the barrel to be loaded and unloaded, being closed when the barrel is in use by a cover member (not shown).

Each of the strut members 3a etc. is so formed as to provide an inwardly radially extending projection which itself also constitutes a rib member. Additionally between each adjacent pair of strut members (and also upon the cover member between its edges) there are mounted two rib members, 6a, 6b and 7a, 7b, and so on, also disposed parallel to the barrel axis and with their ends fixedly secured to the end plates.

The wall sections 4a, 4b etc. are formed of a single sheet of synthetic fibre textile material one of whose ends is secured to the strut member 3a, which passes successively around the outside of rib members 6a and 6b, strut member 3b, rib members 7a and 7b, and so on until it reaches strut member 3f to which its end is secured. The sides of the sheet are in contact with and can be secured to the endplates. The cover member equally is formed of a framework along which rib members are disposed and which is covered with a similar synthetic fibre textile material sheet.

In order firmly to secure the sheet of synthetic fibre textile material to the rib members 6a, 6b, 7a, 7b and so on, laths 8 are mounted externally of the barrel and run along its outside against the ribs to which they are secured through the synthetic fibre textile material sheet by means of screws or the like.

FIGURE 2 is an embodiment similar to FIGURE 1, but with circular rather than hexagonal cross-section, and the reference numbers in FIGURE 2 refer to parts similar to those in FIGURE 1.

Referring now to FIGURES 3 and 4, it will be seen that the barrel generally indicated 1 is carried upon support arms 10, 11 and immersed wholly or partially in an electrolyte (not shown) between soluble anodes 12, 13 which are detachably secured to bus-bars 14, 15. Within the barrel 1 there is a load of small metallic parts sche-

matically indicated at 16, which, upon rotation of the barrel in the direction indicated by arrow 17, assumes a distribution within the barrel somewhat as indicated.

The barrel 1 comprises hexagonal end plates 2 and 18 between which extend wall sections 4a etc. defining the outer periphery of the barrel. The wall on one face of the barrel periphery takes the form of a detachable cover 19 through which the load can be charged into barrel 1, or removed therefrom.

The edge of end plate 18 is provided with gear teeth 20 (or can be grooved to constitute a pulley wheel for a belt drive) which can be driven (by means not shown) to rotate the barrel 1 about the tubular axis 21, carried by support arms 10 and 11, upon which the barrel is rotatably mounted. The tubular axis 21 is connected directly to the positive pole of a direct current source (not shown), which is conveniently a rectifier. The tubular axis 21 thus serves as an anode, and is surrounded by a perforate synthetic resin or the like material sheath 22 whose ends are fixedly secured to end plate 2 and 18 and rotate therewith about axis 21, preventing the load within barrel 1 from directly contacting the anode 21.

Within the barrel 1, thus between its outer wall, Section 4a, etc. and the sheath 22, and in direct contact with the load, there are arranged cathodes 23, 24 which are connected via insulated leads 25, 26 with the negative pole of the rectifier or other current source. These insulated leads 25 and 26 respectively both pass through apertures in the tubular anode 21 and overlying insulating tube sections 27 and 28.

I claim:

1. Electrolytic apparatus for bulk electroplating of a mass of small metal parts, comprising a container for plating electrolyte;
 - a generally cylindrical rotatable barrel for containing such mass of parts,
 - said barrel having two end plates disposed substantially normal to the barrel axis;
 - means for mounting said end plates for rotation about said axis;
 - a plurality of strut members extending between and fixedly mounted upon said end plates;
 - a foraminous external barrel wall mounted about said strut members and formed of a non-conductive woven-filament material;
 - means defining an opening in said barrel structure for loading and unloading the barrel;
 - a cover member detachably secured to close said opening;
 - a plurality of rib members disposed against said wall within said barrel and extending longitudinally thereof, so that upon rotation the barrel load adjacent the wall is held substantially at rest relative thereto;
 - at least one first electrode disposed within the barrel;
 - a perforate non-conducting sleeve closely surrounding said first electrode and shielding same from direct contact with said mass within said barrel;
 - at least one second electrode between said perforate non-conducting peripheral wall and said perforate non-conducting sleeve for contacting said mass within said barrel;
 - at least one soluble third electrode located in said container outside of said barrel; and
 - electrical connections to said electrodes.
2. Apparatus as claimed in claim 1, wherein said foraminous barrel wall is formed of a non-conductive woven-filament material selected from the group consisting of synthetic resin coated wire mesh, textiles formed of synthetic resin, textiles formed of man-made fibres, and ordinary textile materials coated with synthetic resin.
3. Apparatus as claimed in claim 1, wherein a plurality of rib members are interposed between each adjacent pair of strut members and in contact with the fabric mesh.
4. Apparatus as claimed in claim 1, wherein said strut members are arranged parallel to the axis of said barrel

5

and mounted substantially around the periphery of substantially circular end plates.

5. Apparatus as claimed in claim 4, in which said barrel is substantially hexagonal in cross-section.

6. Apparatus as claimed in claim 4, wherein said barrel is substantially circular in cross-section. 5

6

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10

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