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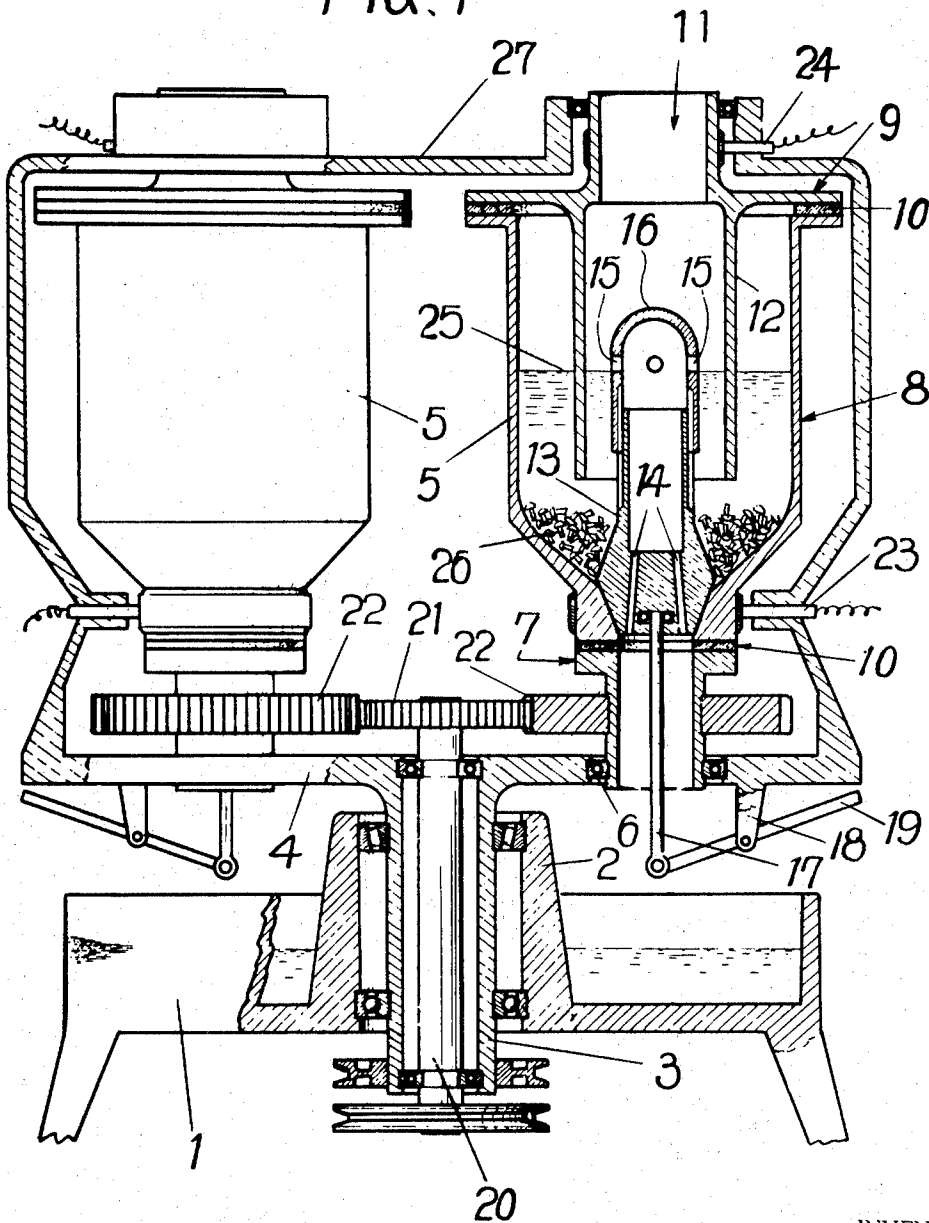
KAZUYA HOJYO
APPARATUS FOR AUTOMATICALLY ELECTROPLATING
VARIOUS ARTICLES WITH CHROMIUM

3,425,926

Filed July 27, 1965

Sheet 1 of 2

FIG. 1



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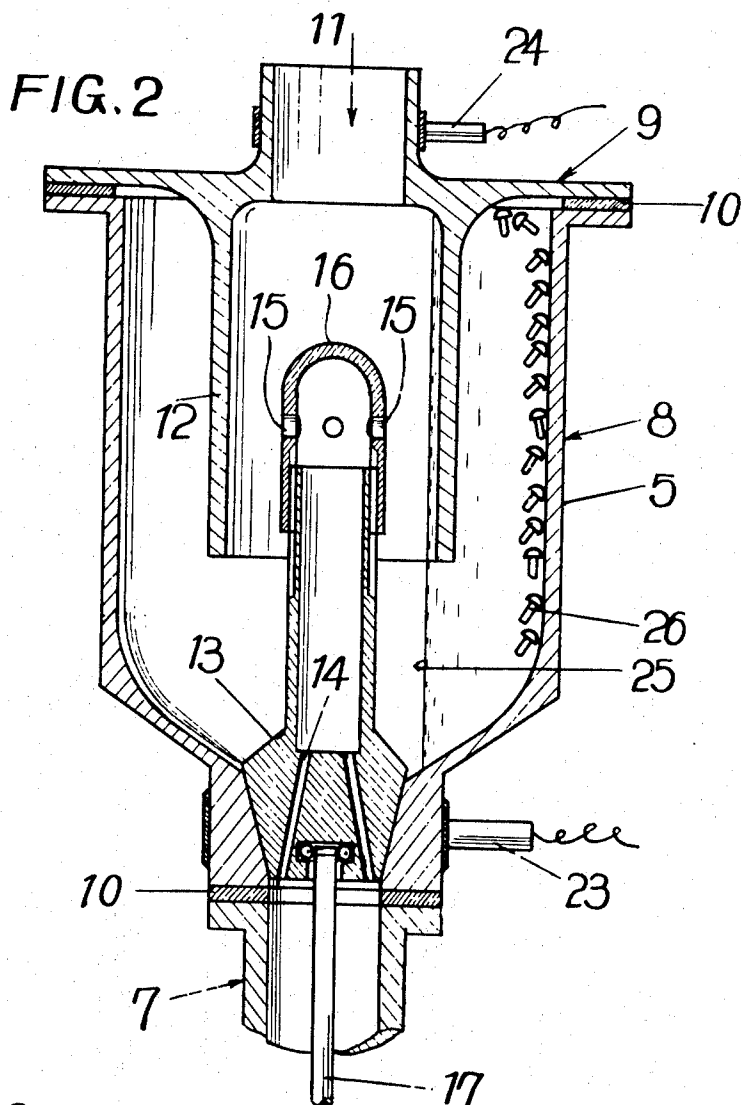
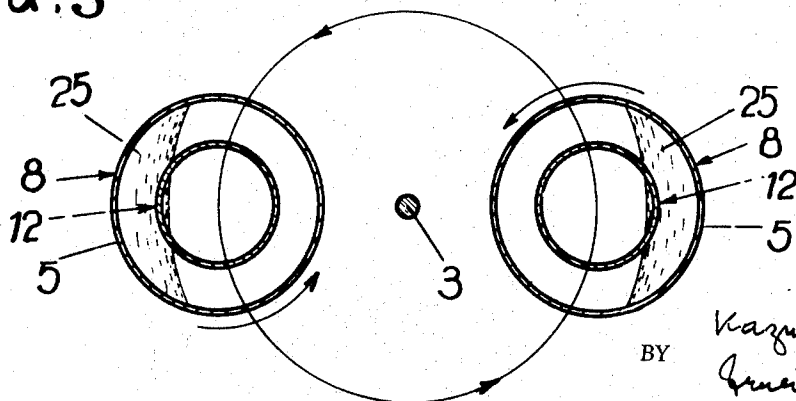


FIG. 3



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APPARATUS FOR AUTOMATICALLY ELECTROPLATING VARIOUS ARTICLES WITH CHROMIUM

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10 Claims

ABSTRACT OF THE DISCLOSURE

An automatic electroplating apparatus for various small articles comprising at least one electrolytic tank having an outer wall constituting a cathode and vertically oriented defining a vertical tank axis; an anode member disposed within each of the at least one electrolytic tank and spaced from the walls defining an article receiving region therebetween, means for orbiting the at least one electrolytic tank in a circular orbit about a central vertical axis parallel to and spaced from the vertical tank axis, for generating a centrifugal force on the articles in the article region causing the articles to press against the outer wall and the at least one electrolytic tank, and means for individually revolving each of the at least one electrolytic tank about its vertical tank axis whereby the articles are uniformly and evenly coated by movement on the outer wall of the tank due to its movement relative thereto.

The present invention relates to an apparatus for automatically electroplating various articles with chromium, in general, and to an apparatus for automatically electroplating with chromium by advantageously utilizing centrifugal force which is generated when a physical solid makes a circular motion of a certain angular velocity.

A chromium plating electrolytic tank according to the present invention revolves in an orbit of the above-mentioned circular motion, while the tank itself rotates sufficiently slow so as not to impede the centrifugal force generated by its revolution, so that the articles which are placed into the tank to be electroplated with chromium are pressed against the wall of the tank to automatically form a uniform film of chromium on their surfaces.

Heretofore various methods of electroplating a large quantity of small articles with chromium with the aid of a basket, a net or a barrel have been utilized. However, these methods have several shortcomings because in these methods the plated articles are pressed against the negative pole only by gravity. For instance, because of variations in the density of electrolyte, the gravity force on the articles to be plated and the like, there is every probability that the plating film on their surface is substantially lacking in uniformity. Consequently highly special care of the electrolyte and advanced plating techniques and skill are required in these methods. In addition, these methods are not satisfactory from the standpoint of productivity of labor required in these methods. Consequently the automation of electroplating with chromium is in the last analysis dependent upon the means of making the articles press closely against the negative pole.

In view of the above-mentioned shortcomings of the conventional methods, it is an object of the present invention and it has been conceived as a result of various investigations, that such shortcomings can be overcome by utilizing centrifugal force and to provide an apparatus in accordance with the present invention, capable of automatically electroplating, with chromium, a larger quantity of small articles in a short time.

It is another object of the present invention to provide an automatic electrolytic apparatus for various small arti-

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cles comprising an electrolytic tank and an inner wall member therein between which the articles are received and means for orbiting the tank about a central vertical axis and means for rotating the tank about its own axis whereby the articles are uniformly and evenly actuated.

With these and other objects in view which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawings, in which:

FIGURE 1 is an elevation of the apparatus designed in accordance with the present invention with a portion in vertical section;

FIG. 2 is an enlargement of the vertical section of FIG. 1; and

FIG. 3 is the schematic plan view of the apparatus.

Referring now to the drawings and in particular to FIG. 1, a bearing part 2 is provided vertically in the center of a base 1 and a shaft 3 is axially supported by the bearing part 2. On the upper end of the shaft 3, a table 4 is fixed having a horizontal surface. When the shaft 3 is rotated within the bearing part 2 by means of an electric motor (not illustrated), the table 4 provided over the base 1 will undergo a circular motion at a certain speed.

Above the table 4 is eccentrically provided chromium plating electrolytic tanks 5 through the intermediary of a bearing 6, so that the tanks 5 can revolve around the shaft 3 due to the above-mentioned circular motion of the table 4.

The tank 5 comprises a cylinder with its lower part tapering off to the end. It is composed of a discharge opening part 7 axially supported by the table 4, the body of negative pole 8 and the cover part of a positive pole 9, and due to insulating packings 10, 10 interposed between the body of the negative pole 8, the discharge opening part 7 and the cover part of the positive pole 9, these parts are insulated from each other.

The cover 9 has an opening in the center, which forms an inlet port 11 for the articles to be plated, and in connection with the inlet port 11 a pipe part 12 hangs downwardly. In the discharge port in the lower part of the tank 5 is inserted from above in its interior, a stopper 13 for preventing an electrolyte 25 from leaking. Two passages 14, 14 are provided in the stopper 13 extending from its upper end to its lower end, so that an excessive quantity of electrolyte may be discharged therethrough. On the upper part of the stopper 13 is preferably placed a cap 16 provided with discharge ports 15, 15 of the electrolyte, so that the level of the electrolyte may be controlled by moving the cap 16 upwardly and downwardly. The stopper 13 can be opened by a push bar 17, which is loosely inserted into the stopper from below, pushing up the stopper. The lower end of the push bar 17 is pivotally articulated to a lever 19 which is pivotally mounted on a supporting leg 18 hanging down from the table 4, so that the stopper may be opened and closed by swinging the lever 19. The tank 5 can be filled with the electrolyte and the articles, together placed therein through the inlet port part 11 and discharged through the outlet by opening and closing the stopper 13.

In order to cause the electroplating tank 5 to rotate itself, while revolving around the shaft 3, a shaft 20 for turning the tank about its own axis is disposed in the interior of the shaft 3, and firmly at the upper end of the shaft 20, to a pinion 21. The pinion 21 meshes with gears 22, 22, which are fixed around the drums of the tanks 5, 5, engaging with each other.

As the shaft 20 is run slowly by a power source other than that which operates the shaft 3, the tanks 5, 5 rotate individually about their own vertical axis during their revolving orbit, due to the gearing of the pinion 21 and the gears 22, 22, at a speed which does not impede

the centrifugal force generated by the revolution of the tanks.

Referring now again to the drawings, and more particularly to FIGS. 2 and 3, a minus electrode 23 is brought into contact with the cathode body 8, while the plus electrode 24 comes into contact with the anode cover 9. Screws 26 are shown as examples of articles to be plated. A frame 27 rotates together with the table 4 and this frame serves to support the tank 5 at its upper part so as to prevent the latter from falling downwardly. While the tanks 5, 5, respectively revolve on the circular orbit having the shaft 3 as their center and simultaneously rotate individually slowly centering around their axis at their moving position on the orbit, the revolving or orbiting speed of the tanks 5, 5 is greater than their individual axis rotating speed. As a result, by the action of the centrifugal force centering around the shaft 3, the electrolyte 25 forms a vertical surface upon the orbit side most remote from the shaft 3 and having the largest radius. It is preferable to form a bowl-shaped sloping part from the bottom surface of the tank 5 up to its side wall. As shown in FIGURE 1, the articles 26 such as, for instance, the screws having diameters ranging for example, from 1 mm. to 10 mm. and which fill the bottom part of the tank 5, slide up the sloping part by the action of the centrifugal force, so that they closely press against the pipe wall of the cathode body 8.

The electric current flows in the electrolyte 25 which contacts both electrodes of the anode cover part 9 and the cathode body 8 and, by the strong close adherence of the articles 26 to the cathode body 8, the chromium in the electrolyte can be separated upon the surface of the articles 26.

Since the articles to be plated by the automatic chromium electroplating apparatus according to the present invention are pressed strongly against the surface of the cathode by the action of the centrifugal force, the contact of the articles with the cathode can be steadily maintained and there is no need of hanging up the articles as in the conventional methods, so that a large quantity of the articles can be plated most efficiently. In addition, inasmuch as the articles themselves rotate on their revolving orbit at a slow speed so as not to impede the centrifugal force generated by their revolution, the articles can be stirred up inside the tanks respectively, so that a uniform plating film is formed upon the surface of the articles.

I claim:

1. An automatic electrolytic apparatus for various small articles comprising
 - at least one electrolytic tank including an outer member and vertically oriented defining a vertical tank axis,
 - an inner member disposed within said at least one electrolytic tank spaced from said outer member defining an article receiving region therebetween for said various small articles,
 - one of said members constituting an anode, the other of said members constituting a cathode, means for orbiting said at least one electrolytic tank in a circular orbit about a central vertical axis parallel to and spaced from said vertical tank axis for generating a centrifugal force on said articles in said article receiving region causing said articles to press against said outer member of said electrolytic tank, and means for individually revolving each of said at least one electrolytic tank about its vertical tank axis whereby said articles can be uniformly and evenly coated by movement on said outer member of said electrolytic tank due to its movement relative thereto.
2. The apparatus, as set forth in claim 1, wherein said outer member is said cathode, and said inner member is said anode.
3. The apparatus, as set forth in claim 2, wherein said article receiving region is adapted to receive

an electrolyte containing chromium, whereby chromium is uniformly and evenly plated on said articles.

4. The apparatus, as set forth in claim 2, wherein said outer member is substantially cylindrical.
5. The apparatus, as set forth in claim 4, wherein said outer member has a frustoconical bottom.
6. The apparatus, as set forth in claim 2, wherein said inner member is a cylindrical pipe.
7. The apparatus, as set forth in claim 6, wherein said outer member defines a central discharge port at the bottom thereof, a stopper member releasably disposed in said discharge port, a tubular cap closed at one end and vertically slidably disposed against said stopper member, said stopper member having passages extending substantially vertically and therethrough, and said cap having discharge ports formed on the sides thereof in liquid communication with said passages for controlling the level of electrolyte.
8. The apparatus, as set forth in claim 1, wherein said means for orbiting comprises, a base having a bearing part, a shaft rotatably mounted in said bearing part and defining said central vertical axis, a table having a horizontal surface fixed to an upper end portion of said shaft, means for supporting said at least one electrolytic tank on said table spaced from said central vertical axis, and means for turning said shaft.
9. The apparatus, as set forth in claim 8, wherein said shaft is a hollow shaft, said means for individually revolving each of said at least one electrolytic tank comprising, an inner shaft provided inside said hollow shaft and rotatably disposed relative said hollow shaft for independent rotation, a pinion fixed to the upper portion of said inner shaft, said means for supporting said at least one electrolytic tank on said table constituting a rotatable bearing support, circular gear means secured to said at least one electrolytic tank and meshing with said pinion, and means for turning said inner shaft.
10. The apparatus, as set forth in claim 1, wherein said means for orbiting said at least one electrolytic tank and said means for individually revolving each of said at least one electrolytic tank cooperatively adapted such that said revolving is at a speed which does not impede said centrifugal force generated by said orbiting.

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