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APPARATUS FOR ELECTROPLATING

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Fig. 1.

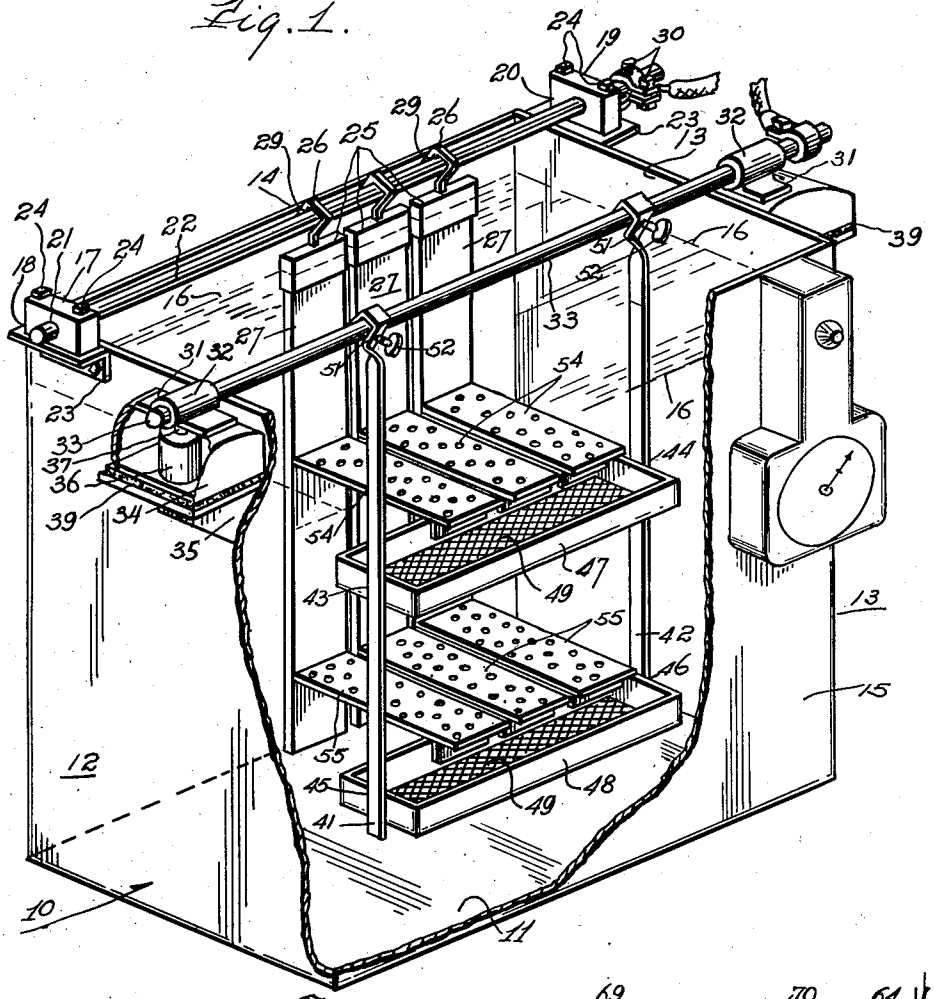
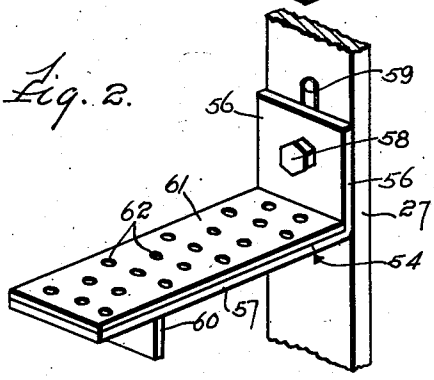


Fig. 2.



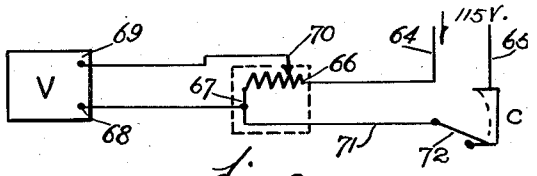


Fig. 3.

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APPARATUS FOR ELECTROPLATING

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5 Claims. (Cl. 204—223)

The present invention relates to methods and apparatus for electroplating and is particularly concerned with the provision of improved methods and apparatus for vibrating the work mechanically while the work is submerged in the electroplating bath.

One of the objects of the invention is the provision of an improved apparatus for electroplating in which the articles to be electroplated are carried by one or more baskets of electrically conducting material which baskets are in electrical connection with the cathode so that the contents are subjected to an electroplating current, and in which the apparatus is provided with means for mechanically vibrating the baskets in such manner that the work pieces are turned over continuously or at frequent intervals so that all parts of the work pieces will be uniformly coated with the electroplating material.

Another object of the invention is the provision of an improved method of electroplating which involves the support of the work pieces in metal baskets carried by cathodes in the electroplating bath and the passage of current through the bath by means of anodes which overhang or overlie the work pieces so as to be in position to distribute the current uniformly over all of the work pieces in the basket, and in which the baskets are subjected to mechanical vibration so that all of the work pieces are turned over and over and all parts of the work pieces are uniformly electroplated.

Another object of the invention is an improved method of the class described in which the apparatus is subjected to vibration for a very short period of time sufficient to turn over the work pieces and thereafter the vibration is shut off and the work pieces are permitted to lie still in electrical contact with the baskets of the cathode supporting them so that the electroplating may be carried on uniformly during the latter period which extends for a longer time.

Another object of the invention is the provision of an improved apparatus of the class described involving an electroplating tank, an anode and a cathode and work supporting baskets in which there is means provided for vibrating the baskets over a short period of time and in which the amplitude of the vibration may be varied and timed by means of a rheostat and a timing clock.

Another object of the invention is the provision of an improved form or construction of anode in which the anode plates depend from a hook into the bath adjacent baskets for supporting the work and each anode plate has laterally projecting extension for overlying the basket and distributing electric current over an area that insures uniform electroplating of all of the pieces of work in the basket.

Other objects and advantages of the invention will be

apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the single sheet of drawings accompanying this specification,

Fig. 1 is a diagrammatic view in perspective showing an electroplating apparatus embodying the invention;

Fig. 2 is a fragmentary view in perspective of a part of an anode showing the structure that overlies the basket carried by the cathode;

Fig. 3 is a wiring diagram for the controlling apparatus.

Referring to Fig. 1, 10 indicates the tank for the electroplating bath which may be constructed of any suitable material such as metal provided with a coating of plastic for preventing acid from attacking the tank. The tank is preferably rectangular having a bottom 11, end walls 12 and 13, and side walls 14 and 15. The level of the electroplating bath is indicated at 16.

At one side the tank is provided with insulating blocks 17, 18, 19 and 20, taking the form of bearings with a through bore 21 for receiving a copper rod 22 which serves as a bus bar. The blocks 17—20 may be secured to brackets 23 by through bolts 24. The bus bar 22 is adapted to support a plurality or a multiplicity of anodes 25, each of which comprises an upper hook 26, a supporting body 27 and a depending plate of suitable material such as lead.

The hooks 26 have upper V-shaped portions 29 which are triangular in cross section engaging the bus bar with a sharp edge for a good contact. Bus bar 22 is provided with suitable through bolt connector 30 for connection to the source of electroplating current.

Additional brackets 31 are carried by the end walls 12 and 13 at their upper edges for supporting the bearings 32 which carry a copper shaft 33 of cylindrical shape, adapted to serve as a second bus bar. Bracket 31 at the right end is carried by the side wall 13 but the bracket 31 at the left end is carried by a vibrator housing 34 which itself is supported upon an angle bracket 35.

The housing 34 contains an electrical solenoid coil 36 which extends vertically and the coil surrounds a sliding metal plunger 37 which vibrates back and forth responsive to the alternating current that is impressed on the coil 36. The plunger may have springs at its ends for reducing the noise and the vibration of the plunger 37 causes the bus bar 33 to vibrate at a frequency which depends on the frequency of the alternating current. For example, with 60 cycles per second current the vibrations would be 3600 vibrations per minute. The housing 34 is preferably supported upon a shock absorbing rubber cushion 39 and the bearing 32 is supported upon a shock absorbing cushion 40 to prevent the vibration from being transmitted to the tank 10.

The bus bar 33 supports a pair of depending bars 41 and 42 of copper which are welded or otherwise secured at 43, 44, 45 and 46 to a pair of copper screen baskets 47 and 48. Each basket has its ends welded or brazed to the two bars 41, 42. Each basket has a bare wire bottom 49 and the side walls of the baskets are covered with an insulating plastic covering of plastisol. The plastisol also covers the bars 41, 42 up to the V-shaped hooks 50, which are left bare and which engage about the copper rod 33.

Each hook has a threaded bore 51 on its lower side and a threaded set screw 52 clamping the hook on the bus

bar 33. The purpose of the set screw is to clamp the hook on the vibrating bus bar 33 so that the baskets will be vibrated with it.

The articles to be electroplated are placed on the bottoms 49 of the baskets 47 and 48 to be in electrical connection with the bus bar 33, which has an electrical connector bolt 53 for connection to the source of electroplating current.

Each anode 25 is provided with a pair of horizontally extending shelves or extensions 54, 55 of the type shown in Fig. 2 for carrying the electric current to a point in the bath directly above the articles to be electroplated. The shelves or extensions 54, 55 insure a uniform electric current distribution from basket to extension and through all of the work pieces. In another embodiment of the invention the hooks may be loosely mounted on the rod and the work electrically connected by a cable and battery clamp.

Referring to Fig. 2, this figure shows the details of construction preferred for the extensions 54 and 55 on the anodes. The extension 54, for example, has an angular shape with a vertical flange 56 and a horizontal flange 57. The vertical flange 56 has a through bore for a bolt 58 passing through a slot 59 in the depending anode 23 and secured with a nut. This permits the overhanging extension 54 of the anode to be adjusted up and down close to small pieces of work and further away from larger pieces of work to secure a uniform distribution of current and uniform electroplating. Each extension has its horizontal portion 57 provided with a depending fin 60 for aiding in the distribution of current.

The horizontal portion 57 is covered on its upper side with a non-conductive plastic coating 61 sold under the trade name of "Tygon." This prevents the acid from attacking the top of this plate. The horizontal portion 57 and the coating 61 are provided with a multiplicity of through holes 62 for permitting the bubbles of oxygen that form on the lower side of this plate to escape to the top of the electroplating bath.

Referring to Fig. 3, this is a wiring diagram in which 64 and 65 indicate the 115 volt, 60 cycle supply line, one line of which is connected to one end of the rheostat 66, the other end 67 being connected to the vibrator at 68.

The other terminal 69 of the vibrator has an adjustable contact 70 engaging the rheostat R for adjusting the amount of voltage applied to the vibrator. This regulates the amount of force supplied to the vibrating bus bar 33 and varies the amplitude of the vibration. The other terminal 67 of the rheostat is connected by conductor 71 to a switch arm 72 of a timing clock C. This timing clock may be so arranged that it turns on the vibrator for five or six seconds to turn over the work pieces and then turns off the vibrator for about 25 to 30 seconds to permit the electroplating to go on steadily. The time periods just stated are by way of example only, as they may be varied by trial and error to secure the best results.

The operation of the present methods and apparatus is as follows:

The baskets are filled with articles to be electroplated. The horizontal portions of the anodes are adjusted above them to the best position for uniform current distribution. Current is turned on through the electroplating bath. Thereafter while the electroplating current is turned on, the vibrator is operated for a short period of time such as 5 seconds and then turned off for a longer period of time such as 25 seconds. Experience has shown that this secures the most uniform coating of electroplating on the work pieces in a minimum amount of time.

It will thus be observed that we have invented an improved electroplating apparatus in which the articles to be electroplated are vibrated in order to turn them over and bring all parts of each work piece into position to be plated uniformly. Our method preferably includes periodic vibration and periodic times for electroplating without vibration to secure the best results.

While we have illustrated a preferred embodiment of our invention, many modifications may be made without departing from the spirit of the invention, and we do not wish to be limited to the precise details of construction set forth, but desire to avail ourselves of all changes within the scope of the appended claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States, is:

1. An electroplating apparatus comprising a tank for electrolyte, a bus bar having electrical connections to carry current to anodes, said bus bar extending across the top of the tank, near one side wall of the tank, a plurality of anodes depending from said anode bus bar, each anode comprising a depending plate having a hook at its upper end mounted on the bus bar, and each anode having a horizontally extending plate carried by the anode to extend over the work pieces to assure uniform current distribution through the electrolyte to them, a cathode bus bar carried by the top of said tank and supported at its ends by an electric vibrator carried by the tank by means of resilient cushions to permit free vibration of the latter bus bar, a work supporting tray comprising a pair of vertically extending bars having hooks at their upper ends mounted on said vibrating bus bar and having means for securing the hooks to the latter bus bar to prevent relative motion, the work supporting tray comprising a rectangular member, the end walls of which are secured to said vertical bars to support the tray beneath the horizontal plates of the anodes, said tray having a mesh bottom for free access of electrolyte through the bottom to the work pieces carried thereby, the said horizontal plates being provided with a multiplicity of apertures for discharging upwardly bubbles of gas formed on the lower side of said horizontal plates during the electroplating operation, a source of energization of alternating current for said electric vibrator, including an electric circuit, said electric circuit also including an electric timing device adapted to repeatedly turn on the electric vibrator for a sufficiently short period of time to change the positions of the pieces and adapted to repeatedly turn off the electric vibrator over a longer and major period of time during which most effective electroplating takes place.

2. An electroplating apparatus comprising a tank for electrolyte, an anode bus bar having electrical connections to carry current to an anode, said anode bus bar extending across the top of said tank, an anode depending from said anode bus bar and electrically connected therewith, said anode comprising a depending plate, and said anode having a horizontally extending plate carried by the anode in the electrolyte, a cathode bus bar carried by the top of said tank and supported by an electric vibrator mounted on the tank on a resilient cushion to permit free vibration of the cathode bus bar, a work supporting tray depending from said cathode bus bar and secured thereon to prevent relative motion between the tray and cathode bus bar, said horizontally extending plate being located to extend over work pieces in the tray to assure uniform current distribution through the electrolyte to the work pieces, and said tray being supported beneath the horizontal plate of the anode and parallel thereto, said tray having an apertured bottom for free access of electrolyte through the bottom to the work pieces carried thereby, the said horizontal plate being provided with a multiplicity of apertures for discharging, upwardly, bubbles of gas formed on the lower side of said horizontal plate during the electroplating operation, a source of electrical energization for said electrical vibrator, including an electric circuit, said electric circuit including an electric timing device adapted to turn on repeatedly the electric vibrator for a sufficiently short period of time to change the positions of the pieces, and adapted to turn off repeatedly the electric vibrator over a longer and major period of time during which most effective electroplating takes place.

3. An electroplating apparatus according to claim 2,

in which the said trays are rectangular and provided with a bare wire mesh bottom and with side walls, said side walls being covered with an insulating plastic composition.

4. An electroplating apparatus according to claim 2, in which a plurality of the anodes are mounted on hooks on the anode bus bar and the horizontally extending plates on the anodes are provided with a vertical attaching flange having a bolt and a nut, the bolt extending through a vertical slot in the depending plate of each anode for vertical adjustment of the horizontal plates.

5. An electroplating apparatus according to claim 4, in which the tops of the horizontal plates are covered with an insulating plastic coating, preventing acid from attacking that side of the plate.

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