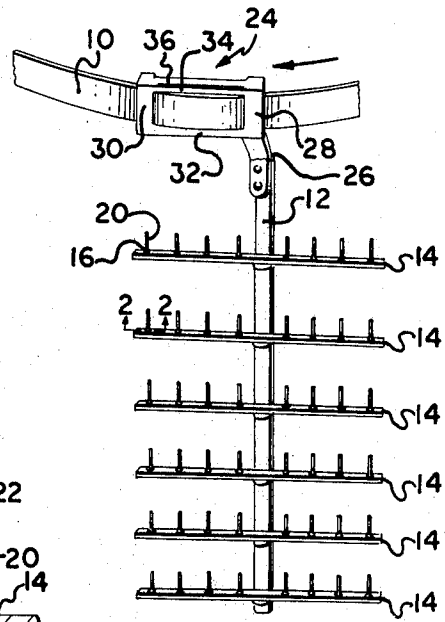
March 10, 1970 F. A. HEARN, JR 3,499,832

ELECTROPLATING RACK

Filed Sept. 11, 1967

FIG. 1



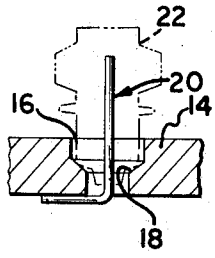


FIG. 2

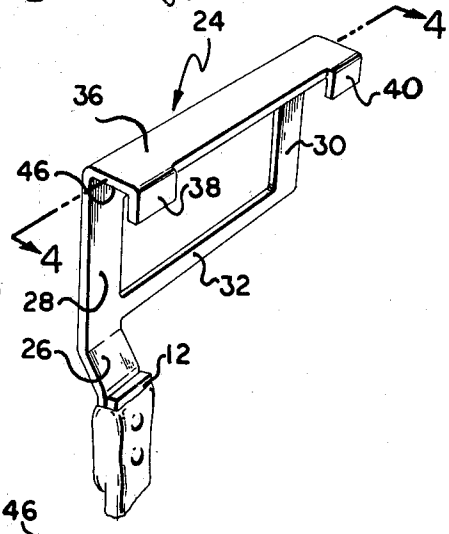


FIG. 3

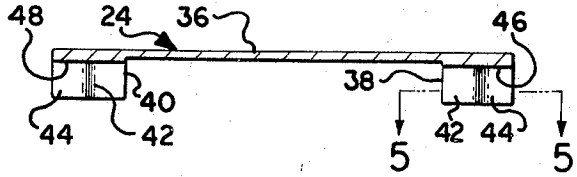


FIG. 4

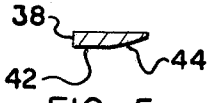


FIG. 5

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ELECTROPLATING RACK

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ABSTRACT OF THE DISCLOSURE

An electroplating rack for supporting hollow objects which may be readily manually carried from place to place and may be satisfactorily supported on the bus bar of an automatic plating system in a fashion to militate against unwarranted swinging movement.

BACKGROUND OF THE INVENTION

Field of invention

A work holder for supporting hollow parts to be plated in an electrolytic bath solution during plating operations as well as during manual transportation of the parts to and from the plating system.

Description of prior art

Electroplating rack assemblies of the prior art are known for supporting hollow parts. However, the known rack assemblies affect a certain amount of "drag-out" of the plating solution when the rack and its associated parts are conveyed, either automatically or manually, from one plating tank to a sequentially disposed plating or cleaning tank. The amount of "drag-out" which occurs, affects the efficiency of the plating solution and also will tend, in certain instances, to upset the chemical balance thereof.

Of particular concern to operators of the semi-automatic or fully automatic plating systems, where the plating rack assemblies are automatically moved sequentially through a number of sequentially arranged treating tanks, in that the rack assemblies do not accidentally bind against the sides of the tanks necessitating a shut down in the production of the system.

SUMMARY

Objects and advantages of the invention may be typically achieved by an electroplating rack assembly for supporting a plurality of hollow parts to be plated wherein the rack assembly is supported by and moved along an electrically conductive rail, comprising a longitudinally extending cathode frame; a plurality of horizontally disposed cross members connected to the frame at spaced intervals therealong, each of the cross members having a plurality of spaced apart apertures formed therein with the longitudinal axes being parallel to the longitudinal axis of the cathode frame, each of the apertures having an annular sidewall provided with an inwardly extending downwardly slanted shoulder portion of a decreased diameter; a locator pin member for each of the apertures of the cross members and extending upwardly above the respective cross member; and a supporting hook-bracket connected to one end of the cathode frame and having a pair of spaced apart contacts to mechanically and electrically make contact with the electrically conductive rail.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and advantages will become apparent from reading the following detailed description of an embodiment of the invention when considered in the light of the accompanying drawings in which:

FIGURE 1 is a perspective view of an electroplating rack assembly incorporating the features of the present invention showing the rack mounted on an electrically conductive supporting rail of an associated automatic plating system;

FIGURE 2 is an enlarged fragmentary sectional view of a portion of the rack assembly illustrated in FIGURE 1 taken along line 2—2 thereof;

FIGURE 3 is an enlarged fragmentary perspective view of the supporting bracket of the rack assembly illustrated in FIGURE 1;

FIGURE 4 is a sectional view of the bracket illustrated in FIGURE 3 taken along line 4—4 thereof; and

FIGURE 5 is a sectional view taken along line 5—5 of FIGURE 4.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, there is shown an electrically conducted bus bar **10** of an associated automatic plating system wherein mechanical means are employed to sequentially move the rack assemblies containing parts to be plated along the bus bar. The bus bar **10** typically has a rectangular cross section of a continuous annular form and is positioned above a plurality of tanks containing cleaning, plating, and washing solutions. The bus bar **10** is provided with means which are programmed to raise and lower the same to enable the rack assemblies supported thereby to be manipulated in a series of cycle each including immersion in a selected solution while the bar is lowered, raising the bar to remove it from the solution, and maintaining the bar elevated while the rack assembly is advanced horizontally along the supporting bus bar to another bath.

The art of producing metallic coatings through the action of an electric current has the purpose of improving appearance, corrosion resistance, hardness, bearing qualities and other properties of the "basis metal" on which the coating is produced. Typical examples of electroplating are: plating of steel with copper, nickel and chromium in the automotive field; plating of steel with cadmium in the automotive parts field; production of tin plated steel for food cans; and the manufacture of silver plated tableware. Significant properties of an electroplated coating are: adherence to the basis metal, thickness, smoothness, porosity, density, hardness, ductility, color, and brightness.

The essential parts of a typical electroplating system are:

(1) the "cleaning bath" which contains a solution effective to remove grease and dirt from the part to be plated;
(2) the "plating bath" which contains a compound of the metal to be deposited;
(3) a source of direct current (D.C.) electricity;
(4) the object or part to be coated (basis metal); and
(5) a sheet or bar of the plating metal.

The negative terminal of the D.C. source is connected to the part to be coated (the cathode), while the positive terminal is connected to the plating metal (the anode). When both of these electrodes are immersed in the plating bath, the following phenomena occur:

(1) the metal ions (positively charged particles produced by the metal salt in the plating bath) migrate to the cathode surface (under the influence of the electric current) and are there transformed to the metallic state and attached to that surface;
(2) the anode metal is dissolved by the action of the current forming new metal ions (which replace those removed at the cathode). Thus, the combination of the plating metal from the bulk form (the anode) to the

form of a coating on the basis metal (the cathode) is achieved.

In principle, the thickness of a plated coating is determined by the time of plating and the current density employed. The latter is expressed in amperes per square foot on the cathode surface. In most baths, however, the current does not produce the theoretical amount of metal deposit; some is lost in the deposition of hydrogen gas along with the metal. The ratio of the actual metal deposit to the theoretical is called the "plating efficiency."

In the automatic production plating systems of the known type, the parts to be plated are initially manually placed on suitable designed rack assemblies; a filled rack assembly is then manually affixed to the electrically conductive bus bar of the system and is transported therealong to a position immediately above a tank containing a suitable cleaning solution and then is automatically lowered into the cleaning solution. After sufficient cleaning cycle, the bus bar is elevated, thereby lifting the rack and the cleaned parts therefrom. The rack, full of clean parts, is then moved along the bus bar to a position immediately above a tank containing the plating bath and then automatically lowered to allow the parts to be plated to be completely immersed in the plating solution. Parts are allowed to remain in the plating solution a sufficient amount of time to allow the desired thickness of plating to be deposited on the parts being plated. Then the bus bar is elevated, thereby lifting the rack and plated parts from the plating bath. The rack full of plated parts is then moved along the bus bar supporting rail **10** to a position immediately above a tank containing a rinsing solution such as water, for example, and then automatically lowered allowing the plated parts to be immersed in the rinsing solution. Then the bus bar supporting rail **10** is again elevated, and the rack assembly of rinsed parts is removed from the bus bar supporting rail and the individual plated parts are removed from the rack assembly.

Once again, specifically referring to the drawings, the rack assembly of the invention consists of longitudinally extending cathode frame member **12**. A plurality of cross members **14** are welded, bolted, or otherwise suitably affixed at spaced intervals to the frame member **12**. It will be understood that the frame member **12** and the cross members **14** are formed of a metal having satisfactory electrical conducting properties, as well as, being resistant to the chemical properties of the various chemical solutions into which they are to be immersed during the plating operation. The duty cycle of these parts may be materially increased by coating at least the frame member **12** with an inert plastic material such as polyvinyl chloride, for example.

Each of the cross members **14** is provided with a plurality of apertures **16** having annular sidewalls and an axis extending substantially parallel to the axis of the frame member **12**. The annular sidewalls defining the apertures **16** are further formed with an inwardly extending downwardly slanting shoulder portion **18** of decreased diameter, as clearly illustrated in FIGURE 2.

Substantially centrally disposed with respect to each of the apertures **16** is a locator pin **20** having a bent over lower end which is welded or otherwise suitably affixed to the under surface of its respective cross member **14**. The upper end of each of the locator pins **20** extends above the upper surface of the respective cross member **14** and is effective to locate a hollow part **22** to be plated on a rack assembly so that the lower end of the part **22** extends into the aperture **16** and rests against the slanted shoulder **18**. It will be appreciated that when the rack assembly with the hollow parts **22** is withdrawn after being immersed in a cleaning, plating, or rinsing bath, the solution will readily drain therefrom due to the configuration of the interior wall of the aperture **16**. The downwardly slanted shoulders **18** millitate against any residue solution being trapped within the aperture **16** and thereby reduce the problems otherwise caused by "drag-out" of the various solutions.

At the uppermost end of the cathode frame **12** of the rack assembly is a supporting hook-bracket **24** having a downwardly depending finger **26** suitably affixed to the cathode frame **12**. The bracket **24** has a main body portion which includes a pair of spaced apart side members **28** and **30**, a lower horizontally extending member **32** interconnecting the lowermost ends of the side members **28** and **30**, and an upper horizontally extending member **34** interconnecting the upper ends of the side members **28** and **30**. The top of the bracket **24** is composed of a horizontally extending section **36** which is at substantially right angles to and coextensive with the member **34**. On the innermost end of the section **36**, there is a pair of spaced apart downwardly depending ears **38** and **40**. The inner surfaces of the ears **38** and **40** facing the member **34** are provided with substantially flat surfaces **42** which terminate in bevelled surfaces **44**. The spacing between the inner surface of the member **34** and the respective flat surfaces **42** of the ears **38** and **40** is slightly larger than the thickness of the bus bar supporting rail **10** to enable a satisfactory sliding engagement therebetween when the rack assembly is positioned in supported relation on the rail **10**.

Further, to enable the bracket **24** to negotiate a curved section of the rail **10**, the open zone defined by the members **28**, **30**, **32**, and **34** is large enough to permit penetration of the curved portion of the rail **10** therein, thereby militating against any binding between the bracket **24** and the rail **10**. Also, the bevelled surfaces **44** of the ears **38** and **40** cooperate with the inner sidewall of the bus bar supporting rail **10** in the curved sections thereof to assure a sliding fit therebetween and to avoid any binding.

The inner or lower surface of the section **36** of the bracket **24** is provided with a pair of spaced apart depending bearing surfaces **46** and **48**, clearly illustrated in FIGURE 4, which actually provide the primary mechanical and electrical contact between the rack assembly and the bus bar supporting rail **10**. By providing the extending surface contact between the bearing surfaces **46** and **48**, the rack assembly is mounted to avoid any vertical swinging of the frame **12** and the cross members **14** during start up or stop of the movement of the rack assembly along the bus bar supporting rail **10**. Also, the open zone defined by the members **28**, **30**, **32**, and **34** provides a means by which the rack assembly may be manually grasped and manually transported during racking or unracking operations.

A further feature of the invention resides in the effect of the aperture **16** and the cooperating shoulders **18** of the cross members **14** which effectively shield the portion of the part **22** which extends into the aperture from any plating deposit. Accordingly, the portion of the part **22** extending within the aperture **16** will not be plated during immersion of the rack assembly within the plating bath.

In accordance with the provisions of the patent statutes, I have explained the principle and mode of operation of my invention and have illustrated and described what I now consider to represent its best embodiment. However, it is to be understood that within the spirit and scope of the appended claims the invention may be practiced otherwise than as specifically illustrated and described.

What I claim is:

1. An electroplating rack assembly for supporting a plurality of hollow parts to be plated wherein the rack assembly is supported by and moved along an electrically conductive rail, the improvement comprising:

a longitudinally extending cathode frame;

a plurality of horizontally disposed cross members connected to said frame at spaced intervals therealong, each of said cross members having a plurality of spaced apart apertures formed therein with the longitudinal axes being parallel with the longitudinal axes of said frame, each of said apertures having an an-

nular sidewall provided with an inwardly extending downwardly slanted shoulder portion of decreased diameter;

a locator pin member for each of the apertures of said cross members and extending upwardly above the respective cross member; and

a supporting hook-bracket connected to one end of said cathode frame, said bracket having a pair of spaced apart contacts to mechanically and electrically make contact with the electrically conductive rail.

2. The invention defined in claim 1 wherein said supporting hook-bracket includes a main body portion having an aperture for the reception of curved sections of the electrically conductive rail.

3. The invention defined in claim 2 wherein said hook-bracket contains downwardly depending ears having the

inner surfaces thereof bevelled to militate against the binding thereof with curved sections of the electrically conductive rail.

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