

Design considerations for racking metal products in electrochemical solutions

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Abstract

Electrochemical treatment is one of the most important processes used in completing and finishing the surface of the product to improve the aesthetic and phenotypic properties of it. This process gives a distinct impression to the consumer because of its high gloss, as it is sometimes used to prepare the surface of the product for electroplating.

Plating racks are also the starting point of any electrochemical processes, where the parts to be processed are suspended in suitable metallic units covered with a layer of plastisol to undergo degreasing, cleaning, painting, rinsing, drying and polishing cycles. It is preferable to use plating racks with large, complex or fragile parts, or which requires high-quality surface finishing. The best and most effective results can be achieved for electrochemical processes when plating racks are specifically created for each design of each part. Therefore, the design considerations of plating racks must be taken into account to ensure the success of the parts which require electrochemical processes, the good design of products plating racks in a way that suits the product shape improves treatment quality and reduces time and cost.

Keywords

Design considerations - Electrochemical treatment – Plating racks.

Statement of Problem

The research problem lies in the difficulty of suspending some geometrical shapes, especially spherical and cylindrical cylinders in electrochemical treatment solutions, because there are no specific design considerations for the plating racks used in the treatment process.

Purpose

It is an analytical study to know plating racks, their dimensions and the method of building them. Furthermore, it aims at knowing the process of arranging and suspending products on them in order to put design considerations for plating racks, and knowing the factors that affect the design and construction of plating racks and applications that require special plating racks.

Research Hypotheses

The development of design considerations for plating racks leads to:

- Facilitating the process of operating products in electrochemical solutions
- Obtaining excellent results for electrochemical processes through the optimal use of plating racks.

Research Introduction:

The design plays an important role in ensuring the efficient production of the electrochemically treated parts, so that they perform their function satisfactorily. Since the plating racks are considered the starting point of any electrochemical process, it is therefore important to identify the design considerations for the plating racks that affect the quality of the electrochemical treatments, the quality of the surface finishing, and identification and the main difficulties facing these operators, and how to overcome them, or at least to reduce them significantly.

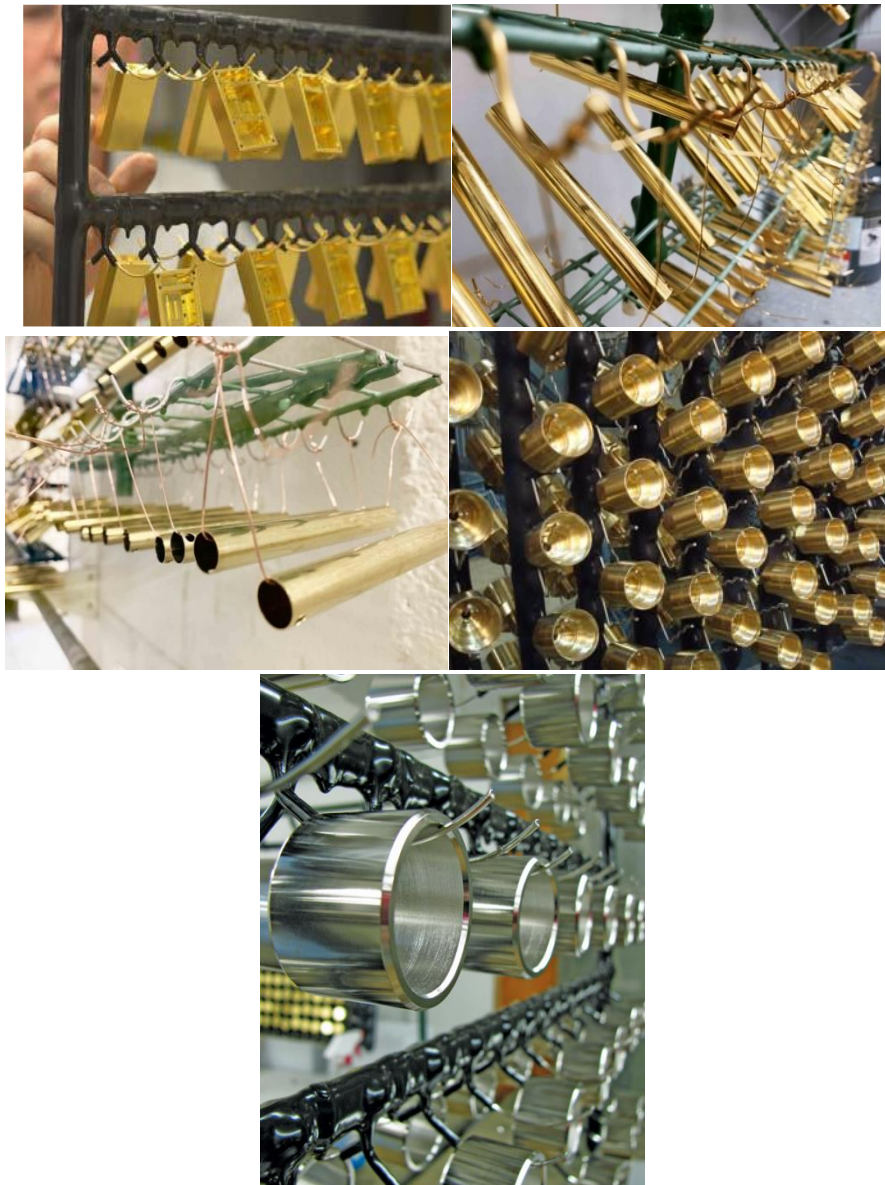
The plating racks design has an important role in electrochemical processes, as it helps in obtaining a product with good appearance and satisfactory functional performance. The importance of this role in the process of coating with precious metals such as gold is confirmed, as the value of the metal here makes it important that its deposition should be as regular as possible to achieve the determined criteria of thickness, which is highly demanded. Noteworthy, thickness should not be excessive by all means at any stage to reach accuracy at the lowest cost and to achieve uniformity in the sedimentation layer as much as possible. Attention must be paid to the suitability of the plating racks for the shape of the product and the correct suspension of the product.

The designer must cooperate with the paint specialist during the design stage to avoid difficulties in hanging the product appropriately, resulting in defects that may be expensive to overcome, and be the cause of an unsatisfactory product and result in a high product rejection rate.

- General design considerations for the manufacture of plating racks:

- 1- They should be designed to hold work pieces in a suitable position for plating uniformly on significant surfaces and to simplify easy racking and picking.
- 2- They should be manufactured using a highly conductive material like copper or aluminum, and have sufficient cross section to carry the current load without overheating.
- 3- It is better to use welding in the structural composition of fixtures rather than screws.
- 4- All areas not contacting the part or the buss bars should be coated with plastisol to prevent corrosion and bath contamination.
- 5- Work pieces with protruding sections should be racked so that the parts shield each other. If this is not possible, a current "thief" or "robber" should be used to reduce the current density at the high points. Another option is to use a shield to prevent high current on edges.
- 6- Electrical contact with the part should be made on a non-significant surface.
- 7- The plating rack tips should be rigid enough to hold work pieces securely and maintain positive electrical connection.
- 8- To minimize solution losses due to drag out, and to prevent cross-contamination of solutions, the work should be hung as nearly vertical as possible, with the lower edge of the work tilted from the horizontal to permit runoff at a corner. When recessed areas cannot be racked to allow

proper runoff, provision should be made for drain holes in the fabrication of the piece, or simply tilt the rack when it is being withdrawn from the solution.

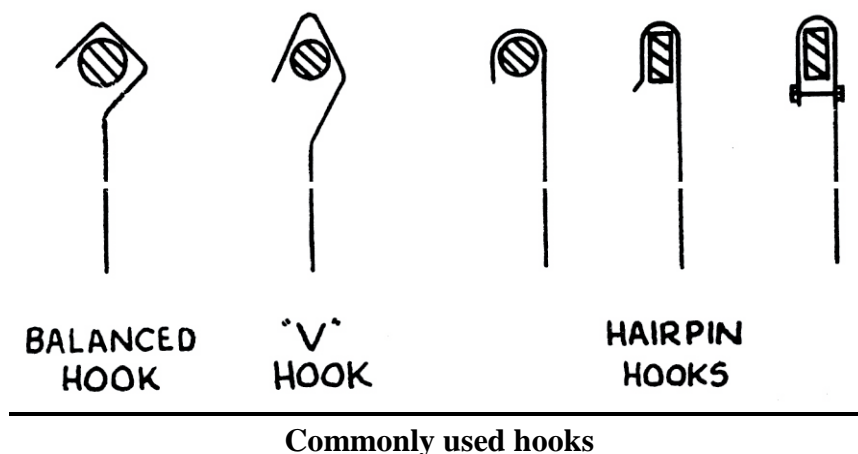


The arrangement of products placement on the plating rack

– **Advantages & Disadvantages of Plating Racks:**

Advantages & Disadvantages of Plating Racks	
Advantages	Disadvantages
Parts can be fixtured in any orientation to achieve a better finishing.	Much higher handling costs as every individual part must be placed on the rack, one at a time
Accommodation of any geometrical or complex shape that suits weak (fragile) parts	Low load sizes or productivity

Racks are usually cheaper and simpler than barrels.	"Rack marks" often occur
Racking orientation can be manipulated to achieve certain requirements.	Plating rack tips need to be stripped periodically.
Infinitely customizable.	Blind holes often present problems.



Results & Discussion:

- 1- Attention to proper design of product racking is the most important step in the success of electrochemical processes.
- 2- Many electrochemical process problems can be avoided by securely fixing products on suitable plating racks that allow for proper electrical connection and product stabilization during the transfer of plating racks between tanks of the electrochemical treatment line.
- 3- Racks and hooks should be designed such that their cross section is sufficient to carry current without excessive heat gain, which may cause early separation of the plastisol racks covering.
- 4- Constant maintenance of the plating racks and constant checking of hook cleaning increase the life of the plating racks for a longer period, which compensates for their high cost.
- 5- It must be taken into account when designing the plating racks that the joints (welding position) are as little as possible because increasing them increases the resistance to electric current.
- 6- The use of replaceable rack tip is economical since in the event of damage there will be no need to repair the entire rack; only the tip will be replaced.

Recommendations:

- 1- More research on the plating racks for electrochemical processes should be made because of their importance as the plating racks are the beginning of any electrochemical process.
- 2- Attention should be paid to studying and designing the custom racking products.
- 3- There is a necessity to link academic studies to surface treatment techniques, and to seek to benefit from scientific research.

4- The designer must be familiar with the design considerations of the plating racking, in order to take into account how to hang since the beginning of the design, and to avoid many technical problems of electrochemical processes.

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