April 18, 1967

J. NOVITSKY

3,314,877

PLATING AND ANODIZING RACK

Filed Aug. 29, 1963

3 Sheets-Sheet 1

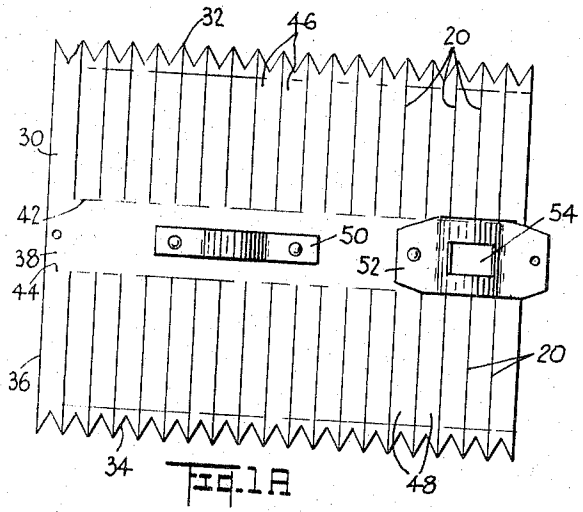


FIG. 1A

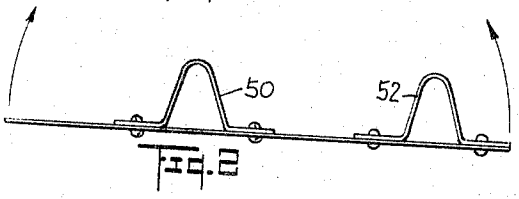


FIG. 2

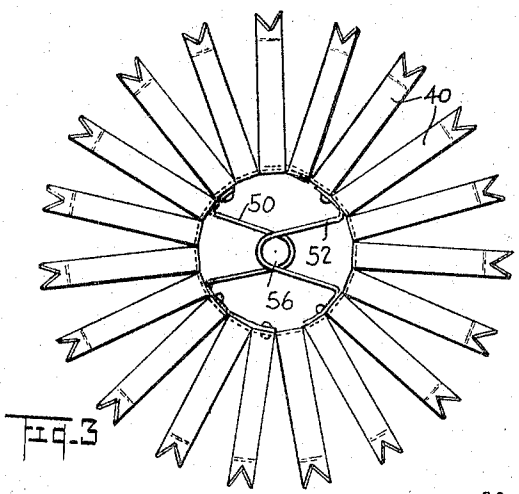


FIG. 3

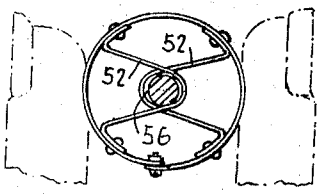


FIG. 4

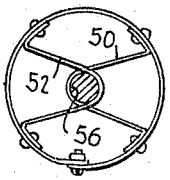


FIG. 5

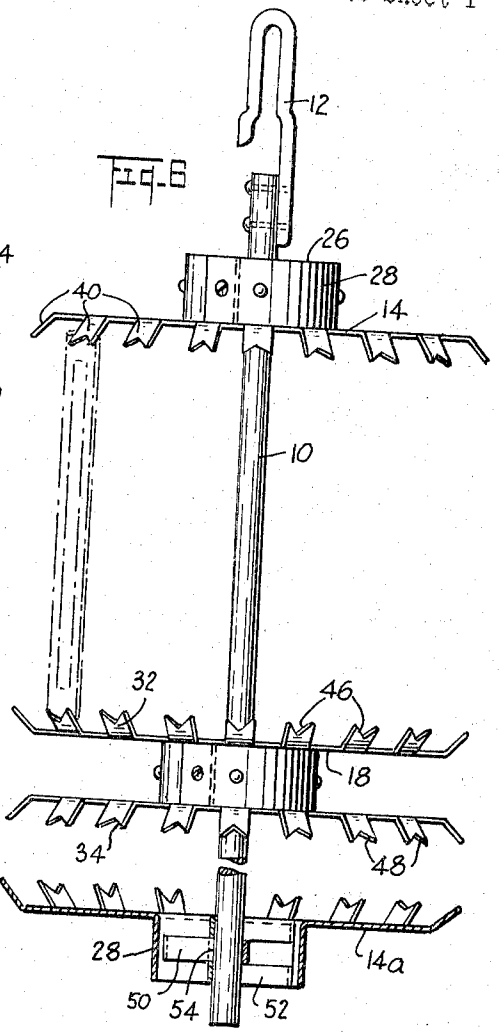


FIG. 6

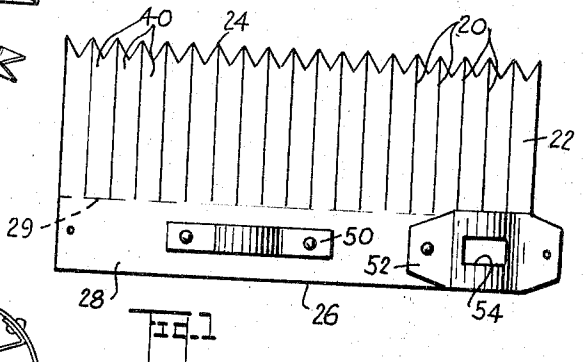


FIG. 1

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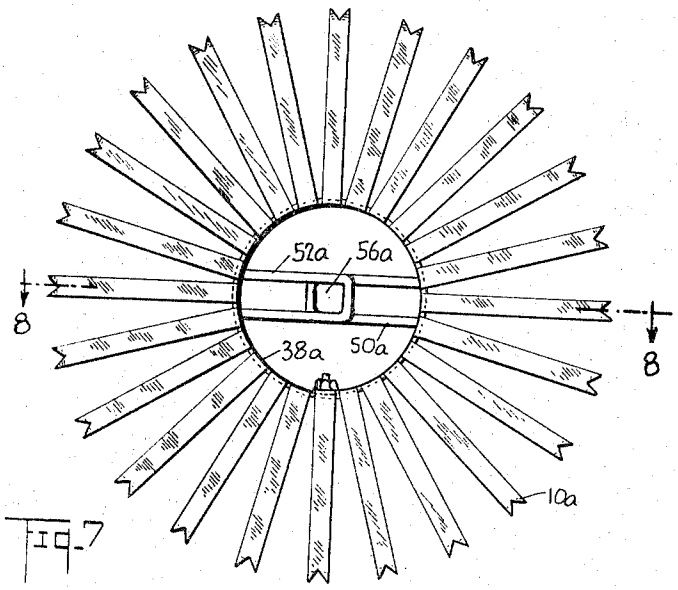


Fig. 7

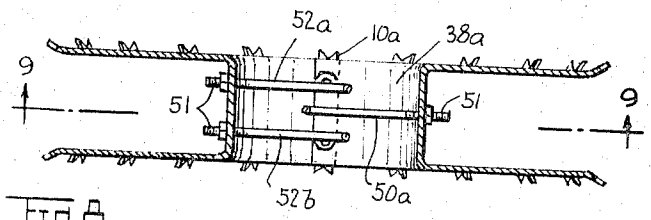


Fig. 8

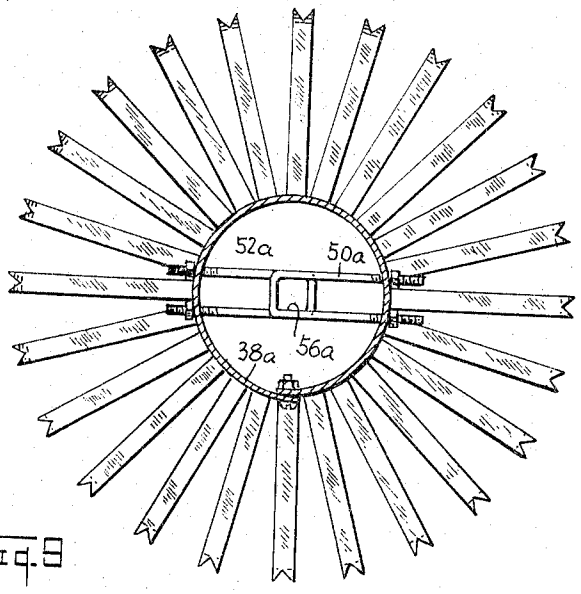


Fig. 9

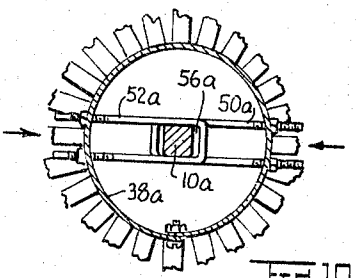


Fig. 10

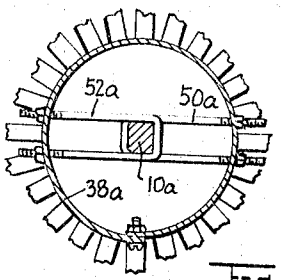


Fig. 11

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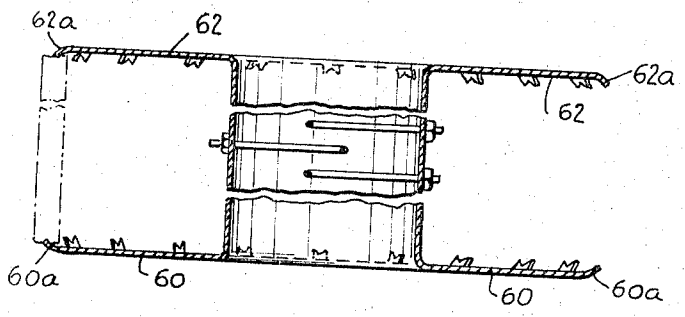


Fig. 12

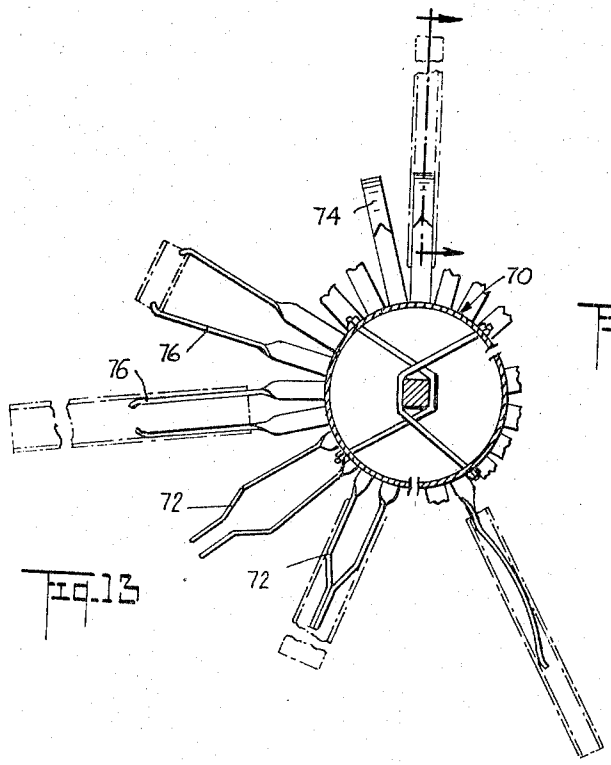


Fig. 13



Fig. 14

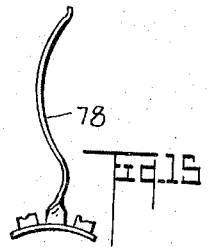


Fig. 15

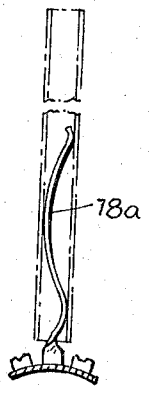


Fig. 16

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United States Patent Office 3,314,877 Patented Apr. 18, 1967

3,314,877

PLATING AND ANODIZING RACK

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Filed Aug. 29, 1963, Ser. No. 305,459
2 Claims. (Cl. 204—297)

The present invention comprises a novel rack for mounting articles to be plated or anodized and the method for manufacturing such a rack.

Heretofore, anodizing racks have been relatively costly to manufacture and have had very short operational lives due to mechanical failures, as will hereinafter be described.

The process of anodization may be simply described thusly. The article to be anodized is placed in an acid bath such that when a current is passed through the bath using the article as an anode, the surface of the article is oxidized. The surface oxide is porous, allowing dyes from subsequent processes such as dipping or spraying to penetrate the oxide. Still later processes seal the oxide surface, such that the dye is permanently impregnated both mechanically and chemically into the surface of the article.

It is to be noted that, insofar as the article to be anodized is the anode of the acid bath oxidation, the supporting means for the article, i.e., the rack, may be included in the electric circuit as a conductor.

One method of manufacturing racks heretofore has been to stamp holders from circular disks of sheet metal, such as titanium, and to suspend the holders in such manner as may be desirable for immersing them and the articles they hold into the baths. Such a manufacturing method is expensive in that various light and heavy punch presses are required, a different die being needed for each size and configuration of holder desired. Furthermore, due to waste of material, the circular disks are more expensive than more common shapes such as rectangular sheets or strips.

Sheet metal, by reason of the conventional rolling mill method of manufacture, is provided with a grain structure in which the grain runs or flows in one direction. The mechanical properties of sheet metal may vary with the relative direction of flow of the grain. Such mechanical properties as tensile and compressive strengths, ductility, impact toughness and hardness may vary from directions parallel to the grain flow to directions perpendicular to the grain flow, known as cross grain flow.

The disk of metal employed in the manufacturing process above described has its grain flow in one direction. The holder stamped therefrom has radially extending fingers, some with longitudinal grain flow, most with cross grain flow. The fingers having cross grain flow are structurally weaker than the fingers having longitudinal grain flow, and are more prone to mechanical fatigue and rupture.

Accordingly, an object of the present invention is to provide plating and anodizing racks which are very durable and fatigue resistant, and have rates of wear which are uniform throughout each rack.

Another object of the present invention is the provision of a unique method of making such plating and anodizing racks, wherein generally circular work holders are made not from disk shaped blanks but rather from rectangular sheets or strips, thereby effecting a substantial saving in material.

A further object of this invention is the provision of a rack-making method which utilizes only a single die or a relatively small number of dies to produce plating and anodizing racks of various sizes and work-holding capacities.

In the drawing:

FIGURE 1 is a plan view of a single row holder after cutting and before bending.

FIGURE 1A is a plan view of a double row holder after cutting and before bending.

FIGURE 2 is a bottom view of the holder shown in FIGURE 1.

FIGURE 3 is a top view of a holder having a spring clamp.

FIGURE 4 is a view of the spring clamp in its compressed configuration.

FIGURE 5 is a view of the clamp of FIGURE 4 in its uncompressed configuration.

FIGURE 6 is a side view of an anodizing rack showing one holder in cross-section and showing an article to be anodized in phantom mounted thereon.

FIGURE 7 is a top view of a holder having a U-bolt clamp.

FIGURE 8 is a sectional view taken along line 8—8 of FIGURE 7.

FIGURE 9 is a sectional view taken along line 9—9 of FIGURE 8.

FIGURE 10 is a view of the U-bolt clamp in its unclamped configuration.

FIGURE 11 is a view of the U-bolt clamp in its clamped configuration.

FIGURE 12 is a vertical section through a further modification of the present invention, showing cooperative upper and lower work-engaging fingers on the same holder.

FIGURE 13 is a fragmentary plan view of still another embodiment of the invention, showing various forms of work-engaging fingers.

FIGURE 14 is a sectional view showing one of said work-engaging fingers engaging a tubular work piece.

FIGURE 15 is a fragmentary plan view of another type of work-engaging finger.

FIGURE 16 shows the same finger supporting a tubular work piece.

Referring to the drawing, the rack comprises a main supporting bar **10**, which may be circular or rectangular in cross-section, holders of varying types mounted in spaced relation along bar **10**, and a mounting hook **12** fastened at or integral with, the upper end of said bar. Holders such as **14** and **14***a* are herein referred to as single row holders, and holders such as **18** are herein referred to as double row holders.

These holders are manufactured in the following manner: A rectangular sheet of metal having the grain flow parallel to two of its sides is used. Slits **20** are formed in such sheets parallel to the grain flow thereof, and in spaced relation to each other. For a single row holder, one row **22** of slits **20** is required, each slit **20** extending from one edge **24** of its sheet toward, but not meeting, the opposite edge **26** thereof.

An uncut strip **28** is thereby formed along said opposite edge **26**. (See FIGURE 1.) Clamping means, as will hereinafter be described, are fastened to one side of the sheet along uncut strip **28**. The sheet is then bent along line **29** which joins the ends of slits **20** with uncut strip **28** into an L-shape such that the interior angle formed thereby is approximately, but not necessarily, 90 degrees and said clamping means are disposed within the exterior angle formed thereby. Uncut strip **28** is then bent and fastened into a cylinder such that said clamping means are on the interior wall thereof. In so bending, row **22** fans out such that slits **20** open up and fingers **40** extend radially outward from cylindrical strip **28**. Single row holder **14** is thus formed.

For a doube row holder, two rows of slits **20** are required, one row **30** of slits **20** extending from one edge

32 of the sheet some fraction of the way towards the opposite edge 34 thereof and the second row 36 of slits 20 extending from said opposite edge 34 some fraction of the way towards said first edge 32, leaving an uncut strip 38 across the center of the sheet. (See FIGURE 1A). Clamping means as will hereinafter be described are fastened to one side of the sheet along uncut strip 38. The sheet is then bent along lines 42 and 44 which join the ends of slits 20 in rows 30 and 36 respectively to uncut strip 38 in such manner as to form a U-shape wherein each of the interior angles formed thereby is approximately, but not necessarily, 90 degrees and said clamping means are on the outside of the U. Uncut strip 38 is then bent and fastened into a cylinder such that said clamping means are on the interior wall thereof. In so bending, rows 30 and 36 fan out, slits 20 open up, and fingers 46 and 48 extend radially outward from cylindrical strip 38. Double row holder 18 is thus formed.

The clamping means for both single row holder 14 and double row holder 18 comprise two flanged, generally U-shaped clamp members, one of such clamp members 50 being relatively narrow and the second of such clamp members 52 being relatively wide. The yoke portions of clamp members 50 and 52 may be arcuately shaped and their sides or arms relatively flat. Each arm is bent laterally outwardly at its end portion to form a flange. Wide clamp member 52 has a slotted aperture 54 formed therein, said aperture 54 being wide enough to permit passage therethrough of the narrow clamp member 50.

Clamp members 50 and 52 are affixed to uncut strip 28 for a single row holder and to uncut strip 38 for a double row holder. When uncut strips 28 and 38 are bent and fastened into cylinders, clamp members 50 and 52 are on the inside thereof in such opposed orientation that the arcuate yoke portion of narrow clamp member 50 passes through aperture 54 and, in conjunction with the circular portion of wide clamp member 52, forms a closed, generally circular, longitudinal passageway 56. The diameter of passageway 56 in its relaxed condition is slightly less than the diameter or other cross-sectional dimensions of supporting bar 10.

The work holder may be mounted on supporting bar 10 by inserting said bar into passageway 56. Cylindrical strip 28 or 38 is squeezed between the fingers to force narrow clamp member 50 further into aperture 54 (see FIGURE 4) thereby enlarging passageway 56 to provide clearance for supporting bar 10. After insertion of supporting bar 10, cylindrical strip 28 or 38 is released. It thereupon resumes its generally cylindrical configuration and draws clamp members 50 and 52 outwardly to their FIGURE 5 positions wherein they firmly grip supporting bar 10.

It is apparent that the holders may be moved at will to any position along supporting bar 10 by simply squeezing cylindrical strip 28 or 38 to disengage the clamp members from the bar, sliding the holder along supporting bar 10 to the desired position, and finally releasing cylindrical strip 28 or 38, as the case may be. Similarly may such holder be removed from supporting bar 10.

It is also apparent that all possibility of cross gain failure has been eliminated in plating and anodizing holders made as above described. Since slits 20 are parallel to the grain flow fingers 40, 46 and 48 will also be parallel to the grain flow, that is, the grain flow will run longitudinally of each finger 40, 46 and 48. Consequently, when fingers 40, 46 and 48 extend radially outwardly from cylindrical strip 28 or 38, as the case may be, the grain flow is also radial.

The tips of fingers 40, 46 and 48, although herein shown in a single configuration, may be cut and shaped to any desired configuration and bent or twisted in any desired direction. The cutting, shaping and bending may be performed by any conventional methods. Stamping, slitting, and forming methods are illustrative. See FIGURE 12 wherein other work-holding shapes are illustrated. FIGURE 12 also shows how a single holder may be formed with opposing fingers adapted to engage the work pieces between them. In the other forms of this invention, two separate work holders are required to support the work pieces. The modification of FIGURE 4 shows that this can be done by a single work holder having appropriately spaced, oppositely aligned work-holding fingers. In this illustrated form of the invention, the lower fingers 60 are bent upwardly at their respective end portions to form work-engaging ends 60*a*, while upper fingers 62 are bent downwardly at their respective end portions to form work-engaging ends 62*a*. Many modifications of this idea or principle may be had within the framework of this invention.

Mounting hook 12 is essentially of inverted U-shape and can be easily slipped on and off a support such as a horizontal bar, rail or conveyor.

An alternative clamping means is provided when a stronger grip about supporting bar 10 is desired, or when the thickness or rigidity of the material of cylindrical strip 28 or 38 precludes flexing in the manner described. Three U-bolts 50*a*, 52*a* and 52*b* are positioned transversely within cylindrical strip 38*a* such that U-bolts 52*a* and 52*b* are in spaced parallel relation one above the other, and U-bolt 50*a* is positioned oppositely and between said U-bolts 52*a* and 52*b*. A longitudinal passageway 56*a* is formed by the yoke portions of said U-bolts 50*a*, 52*a* and 52*b*.

U-bolts 50*a*, 52*a* and 52*b* are positioned with their threaded portions extending outwardly through holes formed in cylindrical strip 38*a*. Nuts 51 are applied to said outwardly extending threaded portions of said U-bolts. As the nuts are tightened, U-bolt 50*a* on the one hand, and U-bolts 52*a* and 52*b* on the other hand, are drawn outwardly from each other in opposite directions. Supporting bar 10*a* in passageway 56*a* is thereby gripped tightly by the yoke portions of said U-bolts 50*a*, 52*a* and 52*b*. Loosening the nuts causes the said yoke portions to disengage the supporting bar, thereby releasing the holder therefrom.

The cross-sectional shape of supporting bar 10 is shown to be circular and that of supporting bar 10*a* is shown to be rectangular, but any suitable cross-sectional shape may be utilized. The shapes of the yoke portions of clamp members 50 and 52 and of U-bolts 50*a*, 52*a* and 52*b* may be modified accordingly, if desired.

Each supporting bar 10, 10*a* may have mounted thereon a plurality of spaced single row holders or double row holders or combinations of single and double row holders to accommodate the size, configuration and number of articles to be anodized or plated.

The foregoing is illustrative of preferred forms of this invention, and it will be understood that these preferred forms may be modified and other forms may be provided within the board spirit of the invention and the broad scope of the claims.

Illustrative of the various modifications of the present device which are encompassed within the scope of the invention are those shown in FIGURES 12 to 16, inclusive. For example, FIGURE 12 shows a work holder having lower fingers 60 and upper fingers 62 arranged in parallel horizontal planes. Fingers 60 are provided with end portions 60*a*, and and fingers 62 are provided with end portions 62*a*, and it will be noted in FIGURE 12 that these respective end portions are bent toward each other to engage a work piece between them.

FIGURES 13 to 16 illustrate various forms and shapes of work-engaging fingers, all mounted on a common collar 70, which is secured in the manner hereinabove described to a vertical supporting bar. Thus, fingers 72 are bent toward each other at their outer ends for insertion into a tubular work piece. These are spring fingers which are squeezed together to receive a tubular work piece and which exert an outward spring action to engage and hold such work piece.

Fingers 76 are also bent inwardly at their outer ends and may be inserted into a tubular work piece. Alternatively, they may be spread outwardly to engage a work piece between them. These two portions are illustrated in FIGURE 13. Fingers 74 are bent backwardly upon themselves and may also be inserted into a tubular work piece. See FIGURE 14. Alternatively, since they are generally hook-shaped, they may be used as hook elements to support a work piece in hanging relationship.

Fingers 78 are bowed springs, as illustrated in FIGURE 15. When a tubular work piece is mounted upon them, they tend to straighten out to accommodate themselves to the inner cross-sectional dimensions as illustrated in FIGURE 16. A spring action is thereby exerted upon the inner wall or walls of the work piece, to hold it in place.

As has above been indicated, these forms and shapes are purely illustrative of the many kinds of work-holding fingers which may be utilized in the plating and anodizing racks herein described and claimed.

What is claimed is:

1. A rack for supporting articles to be anodized or plated, comprising:

a supporting bar,

a hook for suspending said supporting bar from above,

a plurality of holders for the articles to be anodized or plated, each holder having a generally cylindrical central portion and fingers radiating outwardly from at least one end of said cylindrical central portion, said fingers being adapted to engage and support the articles to be anodized or plated each holder being formed from a single piece of conductive material, the grain flow of which, in the cylindrical central portion thereof, is parallel to the longitudinal axis of said cylindrical central portion and the grain flow in each finger thereof is parallel to the longitudinal dimension of such finger, and

clamping means connected to said cylindrical central portion of each holder for mounting the holders on said supporting bar, said clamping means comprising:

a relatively narrow U-shaped clamp member mounted on the inside of said cylindrical central portion, and

a relatively wide, flanged U-shaped clamp member mounted on the inside of said cylindrical central portion disposed oppositely said narrow clamp member, said wide clamp member having an aperture in the base of the U-shaped portion to receive and pass the yoke of said narrow clamp member such that a passageway parallel to the longitudinal axis of the cylindrical central portion is formed, said passageway being alternately enlarged to pass therethrough said supporting bar and reduced to grip said supporting bar by respectively squeezing and releasing said cylindrical central portion.

2. A rack for supporting articles to be anodized or plated, comprising:

a supporting bar,

a hook for suspending said supporting bar from above,

a plurality of holders for the articles to be anodized or plated, each holder having a generally cylindrical central portion and fingers radiating outwardly from at least one end of said cylindrical central portion, said fingers being adapted to engage and support the articles to be anodized or plated, each holder being formed from a single piece of conductive material, the grain flow of which, in the cylindrical central portion thereof, is parallel to the longitudinal axis of said cylindrical central portion and the grain flow in each finger thereof is parallel to the longitudinal dimension of such finger, and

clamping means connected to said cylindrical central portion of each said holder for mounting the holders on said supporting bar, said clamping means comprising:

two U-bolts mounted within said cylindrical central portion in longitudinal alignment with each other having their threaded portions passing through said cylindrical central portion and having their nuts mounted thereon on the outside of said cylindrical central portion, and

a third U-bolt mounted within said cylindrical central portion disposed oppositely of and between said two longitudinally aligned U-bolts having its threaded portion passing through said cylindrical central portion and having its nuts mounted thereon on the outside of said cylindrical central portion such that a passageway parallel to the longitudinal axis of the cylindrical central portion is formed, said passageway being alternately enlarged to pass therethrough said supporting bar and reduced to grip said supporting bar by respectively loosening and tightening the nuts of said U-bolts.

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