Nov. 3, 1959 E. R. GUTZMER 2,911,347

PLATING RACK

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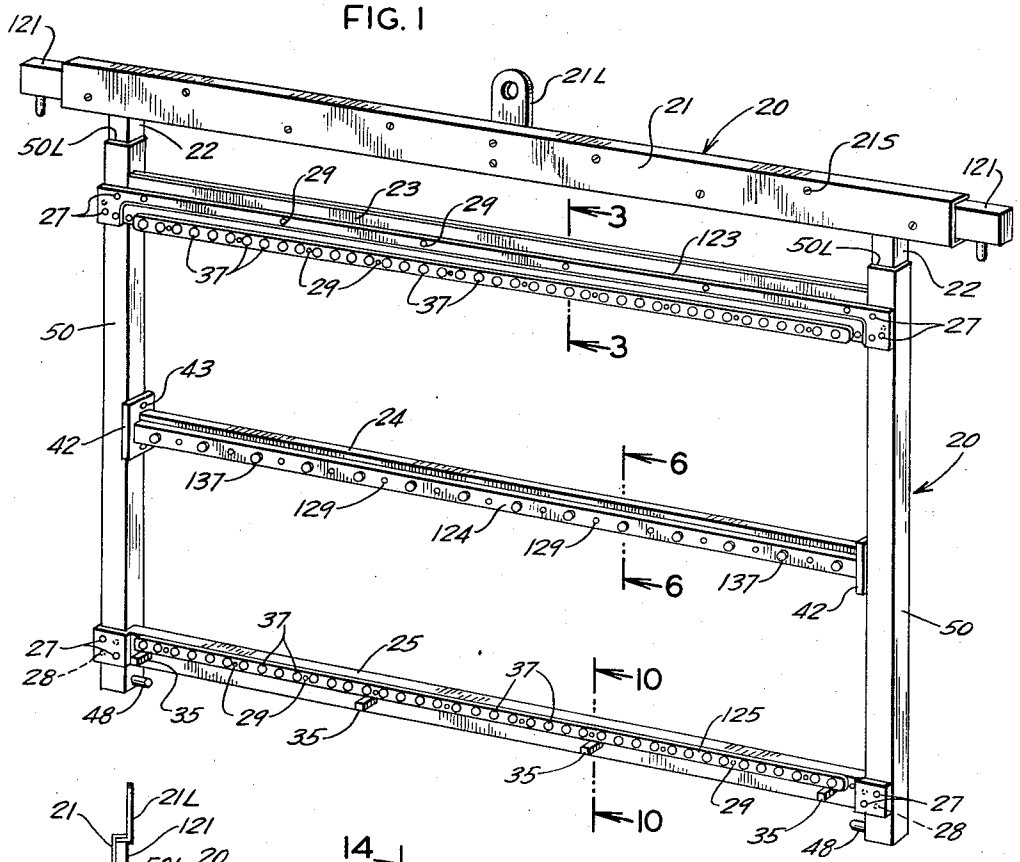
FIG. 1



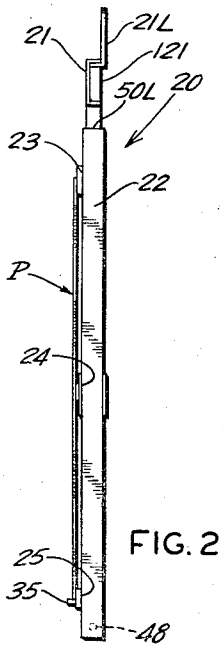


FIG. 2

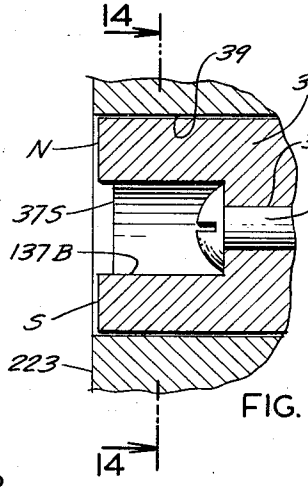


FIG. 13

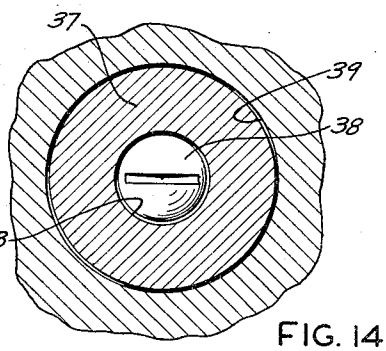


FIG. 14

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PLATING RACK

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FIG. 3

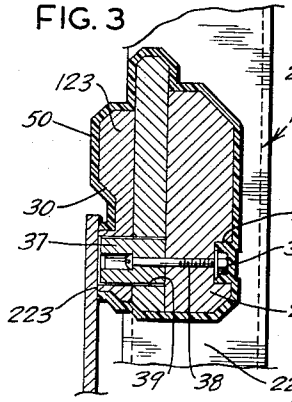


FIG. 4

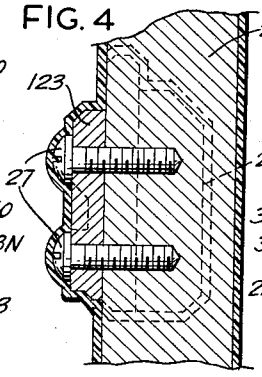
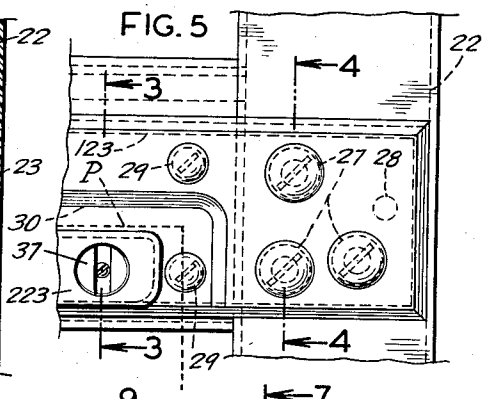


FIG. 5



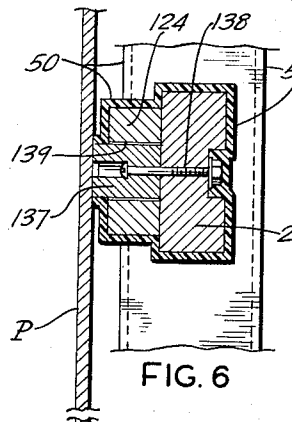


FIG. 6

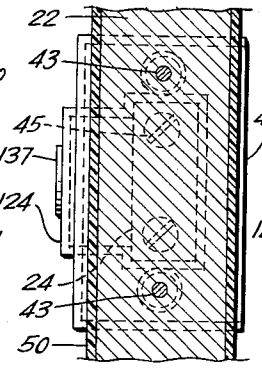


FIG. 7

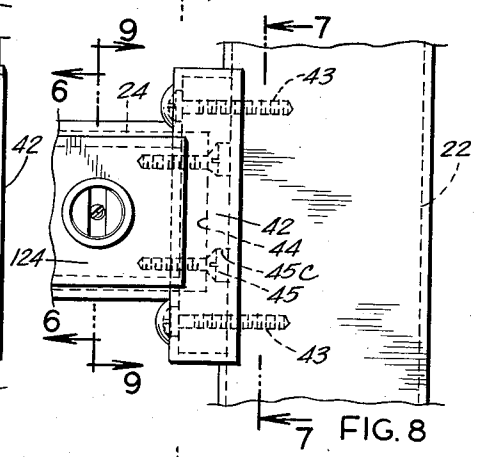


FIG. 8

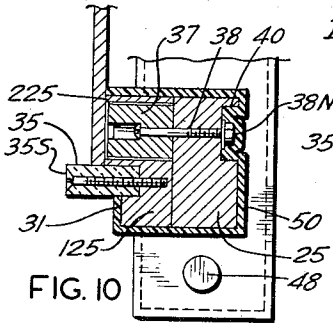


FIG. 10

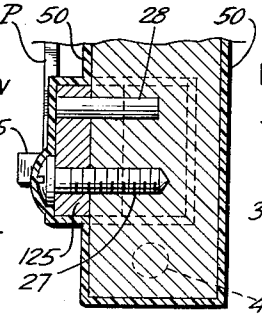


FIG. 11

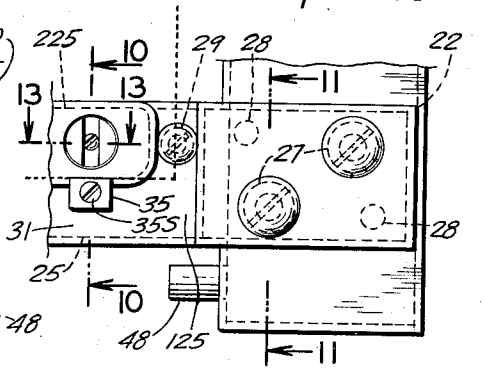


FIG. 12

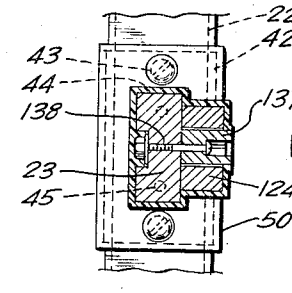


FIG. 9

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United States Patent Office 2,911,347 Patented Nov. 3, 1959

2,911,347

PLATING RACK

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Application April 1, 1957, Serial No. 649,804

2 Claims. (Cl. 204—297)

This invention relates to racks and particularly to plating racks that are adapted to support a metal sheet during electroplating operations and during the relating cleaning and washing operations.

Plating racks as heretofore constructed has usually involved quite a number of moving parts such as clamping devices which were of such a character that during the plating operations they tended to be plated to the same extent as the work, thus to involve troublesome problems of maintenance, and in addition, the actuation of such clamping devices between clamped and unclamped relationships involved the expenditure of considerable time. In view of the foregoing, it is an object of the present invention to simplify plating racks so that such plating racks do not involve moveable parts and yet may act to effectually support a metal plate during the plating and related operations. More specifically, this invention is concerned with the supporting of ferrous metal plates, and under the present invention this is accomplished through the use of permanent magnets disposed on the plating rack and effective to hold the ferrous metal plate in position on the rack.

Other and further objects of the present invention are to provide the plating rack in which the weight of the ferrous metal plate is supported by physical means on the plating rack and in which permanent magnets are effective to hold the ferrous metal plate in position on the physical supporting means, and to enable such support of a ferrous metal plate on a plating rack to be accomplished through the use of the minimum amount of permanent magnet means.

Other and further objects of the present invention will be apparent from the following description and claims, and are illustrated in the accompanying drawings, which, by way of illustration, show a preferred embodiment of the present invention and the principles thereof, and what is now considered to be the best mode in which to apply these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the invention.

In the drawings:

Fig. 1 is a perspective view of a plating rack embodying the features of the invention.

Fig. 2 is a right-hand end elevational view of the rack.

Fig. 3 is a fragmentary cross-sectional view at an enlarged scale and taken substantially along the line 3—3 of Fig. 1.

Fig. 4 is a fragmentary cross-sectional view taken substantially along line 4—4 of Fig. 5.

Fig. 5 is a fragmentary front elevational view of the structure shown in Fig. 4.

Fig. 6 is a fragmentary cross-sectional view taken substantially along the line 6—6 of Figs. 1 and 8.

Fig. 7 is a fragmentary cross-sectional view taken substantially along the line 7—7 of Fig. 8.

Fig. 8 is a fragmentary front elevational view of the structure shown in Fig. 7.

Fig. 9 is a cross-sectional view taken substantially along the line 9—9 of Fig. 8.

Fig. 10 is a fragmentary cross-sectional view taken substantially along the line 10—10 of Figs. 1 and 12.

Fig. 11 is a cross-sectional view taken substantially along line 11—11 of Fig. 12.

Fig. 12 is a fragmentary front elevational view of the structure shown in Fig. 11.

Fig. 13 is an enlarged cross-sectional view of one of the permanent magnets taken substantially along the line 13—13 of Fig. 12; and

Fig. 14 is a cross-sectional view taken substantially along the line 14—14 of Fig. 13.

For purposes of disclosure the invention is herein illustrated as embodied in a plating rack 20 that is adapted to carry a large and relatively thin rectangular ferrous metal plate P for immersion in an electroplating bath or an electropolishing bath and to carry the plate during the related washing and treating operations. The rack 20 comprises a horizontal hanger bar 21 with an upstanding central suspension lug 21L, and having a depending rectangular frame structure against one face of which the plate P is to be held as will be described.

The depending frame structure comprises a pair of solid vertical members 22 of high electrical conductivity that extend downwardly from the hanger bar 21 near the ends thereof, and the vertical members 22 are connected at spaced points or levels by upper, intermediate and lower cross members 23, 24 and 25, and it is across the area defined by the cross members 23 and 25 that the plate P is supported.

The hanger bar 21 as herein shown is generally in the form of a channel in which the web is disposed in a vertical plane, and within this channel a conductor bar 121 is secured so as to extend for a short distance beyond each end of the channel, as shown in Fig. 1. These extending ends provide the suspension points where the conductor bars 121 may rest on the current supply stands or brackets of the plating tank, and the conductor bar 121 is held in position within the channel by means of a plurality of screws 21S.

The upper ends of the depending vertical members 22 are in a welded relationship to the conductor bar 121 so that efficient electrical conduction is established between the bar 121 and the vertical members 22, and the circuit is completed to the plate P by means of horizontal conducting members or bars 123 and 125 that are secured respectively on the forward faces of the cross bars 23 and 25. The conductor bars 123 and 125 are connected to the vertical members 22 by means including a plurality of attachment screws 27 and dowel pins 28 thus to establish the desired conductive path to the bars 123 and 125. The bars 123 and 125 are also connected at spaced points to the respective bars 23 and 25 by screws 29, and the bars 123 and 125 have their forward faces milled as at 30 on the bar 123 and as at 31 on the bar 125. The milling operation 30 on the bar 123 thus establishes a narrow contact face 223 along the lower edge portion of the bar 123, and it is against this face 223 that the upper border portions of the plate P are held, as will be described. Similarly, the milling of the lower bar 125 establishes a face 225 along the upper edge of the bar 125 against which the lower border portion of the plate P is to be positioned. It will be noted that the milling 31 on the lower bar 125 is extended to the lower edge of this bar as shown in Figs. 10 and 12, thus to insure rapid drainage of plating solutions and the like from this area of the rack.

Under the present invention the border portions of the plate P are held in firm physical and electrical contact with the faces 223 and 225 by permanent magnet means, and to minimize the size and number of magnets re-

quired, physical means are provided on the lower bar **125** whereby the weight of the plate P is mechanically supported on the rack. Thus, as shown in Figs. 1, 2 and 10 to 12, the lower bar **125** has a plurality of supporting lugs **35** secured thereon just below the lower edge of the face **225** and extending a substantial distance forwardly of such face. As herein shown, the lugs **35** take the form of rigid ceramic insulating blocks that are secured to the bar **125** by screws **35S**. Hence when the rack is in a vertical position, the lower edge of the plate P rests on the several supporting lugs **35** so that the weight of the plate P is supported on the lugs **35**, and the permanent magnetic means act merely to hold the plate P in its vertical position on the rack over-and-above the lugs **35**.

Thus, as will be evident in Fig. 1, the upper and lower contact members **123** and **125** have a plurality of permanent magnets **37** mounted thereon at spaced intervals along the length of these bars, and the magnets **37** are so positioned that when a plate is put into position against the surfaces **223** and **225**, the magnetic attraction of the several magnets **37** will be exerted thereon to hold the plate in position firmly against the contact surfaces. This is preferably accomplished in such a way that the magnets do not form a part of the electrical circuit through to the plate P. Thus, as shown in Figs. 3, 6, 10 and 13, each magnet is of a cylindrical form having a slot **37S** across its forward face so as to provide north and south poles N and S, and the magnet has an axial bore **37B** therethrough which is counterbored at **137B** at the forward end of the magnet. Each magnet is held in place by a bolt **38**, the head of which is located in the counterbore **137B** with the bolt extending through the bore **37B** to fasten the magnet in place. In this connection, it should be noted that each magnet **37** is located in a recessed relation in a complemental bore **39** formed in the bar **123** or **125** with which it is to be associated so that the base or flat end of the magnet **37** rests against the bar **23** or **25** as shown particularly in Figs. 3 and 10. The bolt **38** is, therefore, extended on through the bar **23** or **25** and into a counterbore **40** where a nut **38N** is threaded onto the bolt **38**.

The forward faces of the magnets **37** are disposed just slightly back from the contact face **223** so that the magnetic forces of the magnet are exerted on the plate P, but the current to the plate P follows the preferential path from the face **223** or **225** to the plate. This prevents current flow through the magnets to the plate P.

Having in mind that the width of the plate P is relatively greater and the plate is relatively thin, it is desirable to provide additional magnetic holding means intermediate the top and bottom edges of the plate P. This enables the magnetic forces required along the upper bar **123** to be minimized. Thus, the additional magnetic holding means are provided along the bar **24** and in respect to the bar **24**, the magnetic means are maintained out of the electrical circuit by mounting the bar **24** in an insulating relationship with respect to the vertical members **22**. Thus, as shown in Figs. 1 and 6 to 8, the vertical members **22** have insulating blocks **42** secured on their inner or adjacent faces by means such as cap screws **43**. The adjacent faces of the insulating blocks **42** have sockets or recesses **44** formed therein that are complemental to the opposite ends of the bar **23**, and the ends of the bar **23** are extended into these recesses. In the present instance, the bars are additionally held in the socket **44** by screws **45** that are extended endwise through the block **42** and into the opposite ends of the bar **24**, and the screws **45** are located in a countersunk relation, as shown at **45C**, so that the heads thereof are out of contact with respect to the members **22**. The bar **24** has a mounting or locating bar **124** secured along its forward face by screws **129**, and the bar **124** serves as a mounting or locating means for a plurality of permanent magnets **137** that are similar in form to the magnets **37**. The magnets **137**, however, extend forwardly beyond the forward face of the bar **124** so that the forward faces of the magnets **137** are located in the same place as the contact surfaces **223** and **225**. Similar mounting bolts **38** are utilized to secure the magnets **137** in mounting recesses **139** in the bar **124**. The magnets **137** are thus in actual contact with the plate P, but do not enter into the plating circuit because the entire bar **24** is insulated from the elecrical circuit of the rack. With the rack of the present invention, the usual practice is employed whereby the rack is located in a horizontal position during the loading and unloading thereof and a pair of pivot pins **48** are preferably employed near the lower ends of the members **22** so as to facilitate the manipulation of the rack in shifting it between its vertical position of use and its horizontal loading and unloading position.

The surfaces of the rack **20** that are to be immersed in the plating bath are protected by an insulating layer **50** that is resistant to the acids of the plating bath. Such an insulating layer is applied by dipping the entire rack into the insulating material up to a level such as indicated at **50L** in Fig. 1. The insulating material is then stripped before curing from the pole faces of the magnets **137** and the magnets **37**, and it is also stripped from the contact faces **223** and **225** and from the supporting lugs **35**. The lugs **35**, being of insulating material, are not adversely affected by the acids of the plating bath, while the pole faces of the magnets and the contact faces **223** and **225** are covered and protected by the plate P during the plating operation.

It has been found in use that the rack **20** may be quickly and easily loaded merely by lowering the plate P into the proper position on the supporting surfaces of the rack. It is also found that the rack **20** may be readily unloaded by the application of relatively minor lifting forces to the edges of the plate P so as to separate the plate successively from the magnets along the length of the three cross bars.

When the plate P is in place on the rack, the rack may be lifted to its vertical position, and may be subjected to the usual raising and lowering movements and to the transversing movements between the several working stations of the plating plant, and in this handling of the rack, it is found that the plate P is held effectually upon the rack and in proper electrical contact with the surfaces **223** and **225**.

From the foregoing description it will be evident that the present invention simplifies electroplating operations by reducing the time required for mounting and dismounting the work, and by substantially eliminating upkeep in respect to the plating racks. It will also be apparent that the size and the weight of the magnets that are required is minimized so that the weight of the rack is not excessive, and since there are no moving parts or clamps, the maintenance of the rack is extremely favorable.

Thus while I have illustrated and described a preferred embodiment of my invention it is to be understood that changes and variations may be made by those skilled in the art without departing from the spirit and scope of the appending claims.

I claim:

1. In a plating rack, a frame adapted to be suspended in a vertical plane and providing a plurality of surfaces disposed in a common plane and against which a ferrous metal plate may be located in a working position, support means on said frame projecting beyond said plane in position to underlie the lower edge of such a plate, certain of said surfaces being formed on electrically conductive members and forming part of the plating circuit to such a plate, a plurality of permanent magnets mounted on said conductive members in a recessed relation in said surfaces of said conductive members and having pole faces set back slightly from said plane to hold such a plate against the conductive surfaces while isolating such magnets

from the plating circuit, another frame member mounted in an insulated relation with respect to said conductive members, and other permanent magnets mounted on said last-mentioned frame member and having pole faces constituting certain of said surfaces.

2. In a plating rack, a frame adapted to be suspended in a vertical plane and providing a plurality of surfaces disposed in a common plane and against which a ferrous metal plate may be located in a working position, certain of said surfaces being formed on electrically conductive members and forming part of the plating circuit to such a plate, a plurality of permanent magnets mounted on said conductive members in a recessed relation in said surfaces of said conductive members and having pole faces set back slightly from said plane to hold such a plate against the conductive surfaces while isolating such

magnets from the plating circuit, another frame member mounted in an insulated relation with respect to said conductive members, and other permanent magnets mounted on said last mentioned frame member and having pole faces constituting certain of said surfaces.

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