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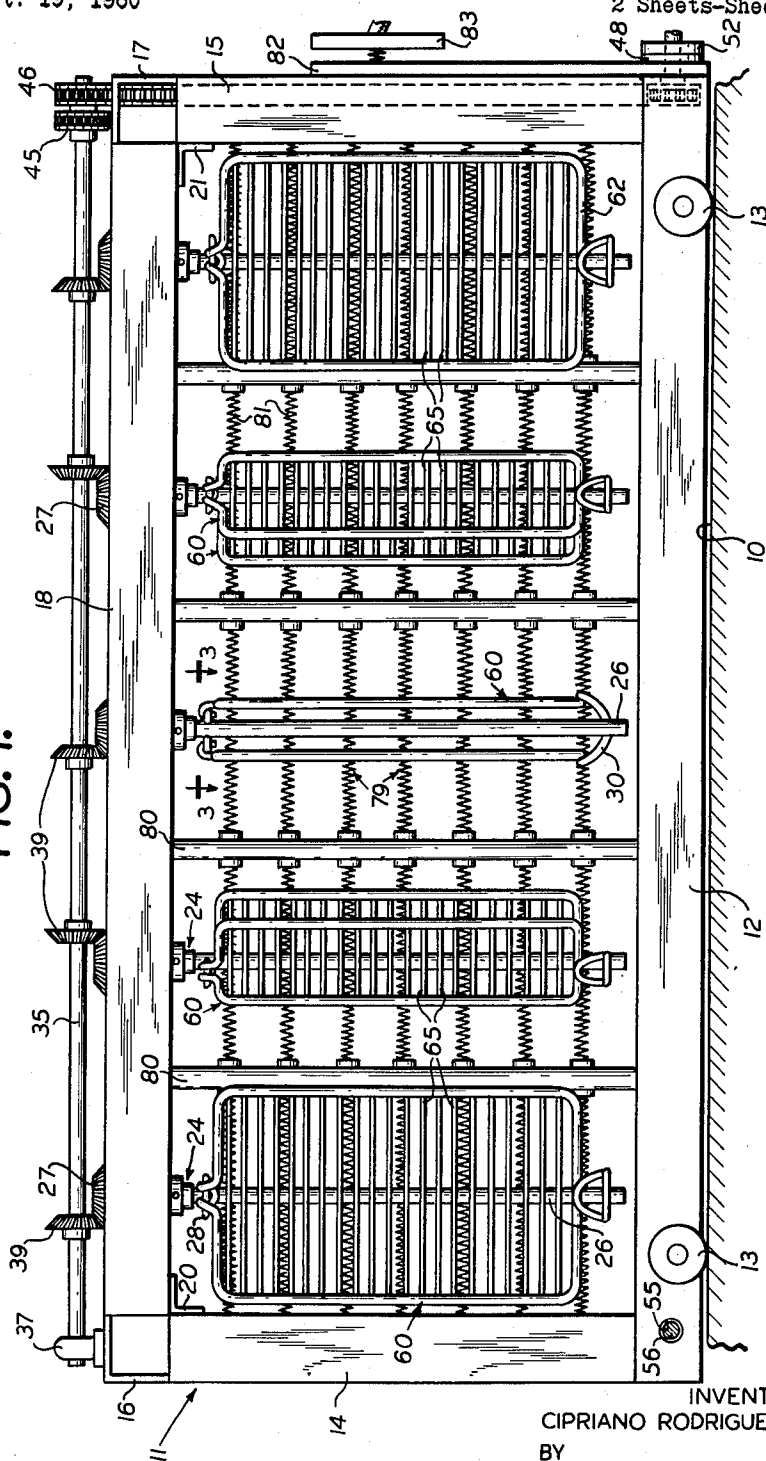
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APPARATUS FOR THE EVAPORATION PLATING OR COATING OF ARTICLES

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2 Sheets-Sheet 1

FIG. 1.



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2 Sheets-Sheet 2

FIG. 2.

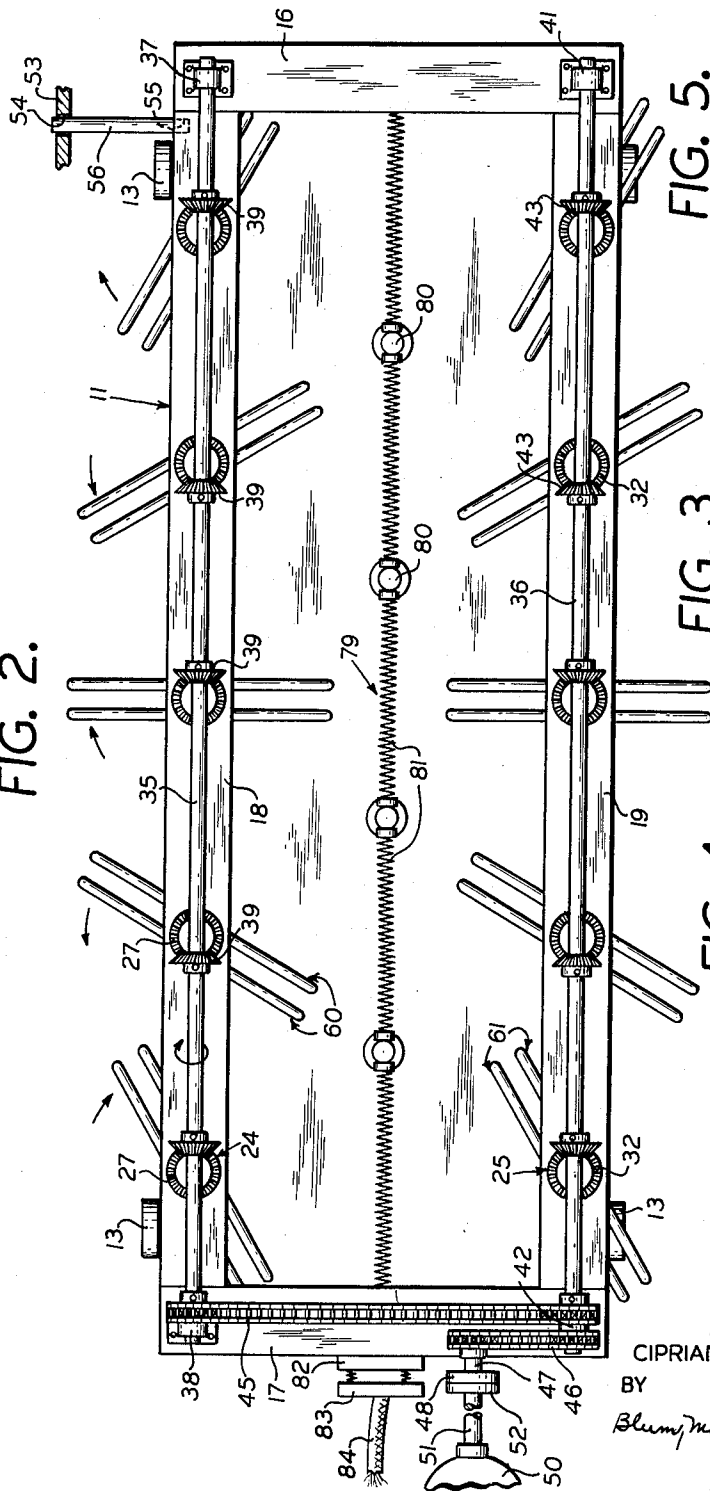


FIG. 5.

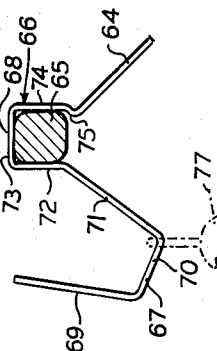


FIG. 3.

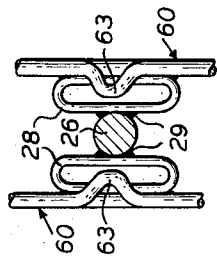
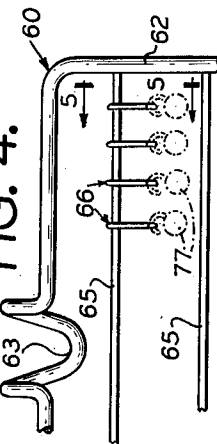


FIG. 4.



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10 Claims. (Cl. 118—500)

This invention relates generally to new and improved apparatus for plating articles, and is especially concerned with apparatus for the evaporation plating or coating of articles.

While the apparatus of the present invention has been primarily developed and employed in connection with the plating of costume jewelry and similar metal articles, and will be described hereinafter with particular reference thereto, it is understood that the invention is capable of many varied applications, all of which are intended to be comprehended herein.

As is well known to those versed in the art of plating costume jewelry, it is economically necessary to plate a great many articles of jewelry simultaneously and to absolutely minimize the time requirements of the plating cycle, including sufficient evacuation of the vacuum chamber for evaporating plating, and labor involved in loading and unloading the articles being plated. An additional difficulty inherent in most prior art apparatus of the instant type is that of obtaining uniform coating or plating of all the plated articles.

It is a general object of the present invention to provide apparatus for vacuum plating a multitude of articles at one time which considerably reduces the period required for the plating cycle and labor incident thereto, insures uniform plating of all articles being plated, and otherwise effectively overcomes the above-mentioned difficulties.

It is another object of the present invention to provide apparatus for use in evaporation plating having the advantageous characteristics mentioned in the preceding paragraph, which apparatus is simple, durable and inexpensive in construction, and which can be more quickly and easily operated to achieve substantial savings in plating costs.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings, which form a material part of this disclosure.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, which will be exemplified in the construction hereinafter described, and of which the scope will be indicated by the appended claims.

In the drawings:

FIG. 1 is a side elevational view showing the evaporating plating apparatus of the present invention in an operative condition of use, partially illustrating a vacuum chamber;

FIG. 2 is a top plan view of the apparatus of FIG. 1;

FIG. 3 is a partial sectional view taken substantially along the line 3—3 of FIG. 1, somewhat enlarged;

FIG. 4 is a fragmentary elevational view showing an article-holding rack of the present invention; and

FIG. 5 is a sectional view taken substantially along the line 5—5 of FIG. 4, somewhat enlarged, to illustrate an individual article-supporting element on the rack.

Referring now more particularly to the drawing, and specifically to FIGS. 1 and 2 thereof, the floor or bottom wall of a vacuum chamber is designated 10; and, a carrier vehicle, generally designated 11, is shown in position on the vacuum-chamber floor 10.

The carrier vehicle 11 is of an elongate, open-frame-

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work, rectangular bottom wall 12 having ground-engagable rolling means or wheels 13 at its corners. At opposite ends of the vehicle 11, on the bottom wall 12, are upstanding end members or frames 14 and 15, having respective laterally extending top pieces 16 and 17. A pair of parallel spaced, longitudinally extending, elevated side pieces or frame members 18 and 19 extend between the top end pieces 16 and 17, being secured thereto by any suitable means, such as angle brackets 20 and 21. The open-framework vehicle 11 is thus rollable into and out of a vacuum chamber, say on the floor, tracks, or the like, but may be movable by any suitable means, say overhead-suspension or otherwise.

Journaled in and depending from each of the longitudinal side pieces or frame members 18 and 19 are a series of depending hangers 24 and 25. That is, a plurality of depending hangers 24 are carried by the frame member 18, depending generally vertically therefrom and located in generally horizontal alignment longitudinally of the frame member. Similarly, the hangers 25 depend generally vertically from the frame member 19 and are located spaced therealong in alignment with each other longitudinally of the carrier vehicle. The hangers 24 each include a generally vertically disposed elongate member or shaft 26 having its upper region journaled in the frame member 18 and provided above the latter with motion-transmission means, such as a bevel gear 27. The lower end of shaft 26 may be free.

Fixed to each shaft 26, in the upper region thereof, beneath its associated frame member 18 may be one or more receivers or loops 28. As best seen in FIG. 3, a pair of generally horizontally disposed, parallel receivers or loops 28 are fixedly secured, as by welding 29 to opposite regions of the depending rotary element or shaft 26, extending generally tangential to the latter. Spaced below each of the upper receivers 28, carried by the lower region of each shaft 26, is a lower receiver 30. The lower receivers 30 are also fixed to the shafts 26 by any suitable means, and preferably extend generally outward and upward from their respective shafts, as may be seen in FIG. 1.

The hangers 25 of frame member 19 may be similar in all respects to the hangers 24 of frame member 18, including depending vertically disposed shafts journaled at their upper regions in the frame member 19 and carrying upper and lower pairs of receivers similar to the upper receivers 28 and lower receivers 30. Also, the hangers 25 may be provided on their upper ends with motion-transmitting means 32, such as bevel gears similar to the bevel gear 27. Hence, although the hangers 25 depending from the frame member 19 are hidden in the drawings, the construction thereof may be substantially identical to that of the hangers 24, so that further detailed illustration and description is unnecessary.

Suitable power-transmission means is mounted on the vehicle 11 for effecting rotation of the hangers 25 in timed relation with respect to each other. The power-transmission means may include a pair of parallel spaced, longitudinal shafts extending horizontally along and respectively over the frame members 18 and 19, as at 35 and 36, respectively. The shaft 35 may be journaled at its opposite ends by pedestal bearings 37 and 38 respectively upstanding from the end pieces 16 and 17, to extend over the several bevel gears of the hangers 24. Keyed to the shaft 35, at spaced locations therealong, are a plurality of additional bevel gears 39 each in meshing engagement with a respective bevel gear 27. It may be observed that the bevel gears 39 are arranged successively on opposite sides of their respective bevel gears 27 for effecting opposite angular motion of successive hangers 24 upon rotation of the countershaft 35. Thus, alternate hangers 24 rotate in one direction of

angular motion, while the remaining or intermediate hangers 24 rotate in the opposite angular direction.

The countershaft 36 over the frame member 19 is similarly journaled at its opposite ends by bearings 41 and 42 upstanding respectively from the end members 16 and 17, while a plurality of bevel gears 43 are keyed to the shaft 36 for respective meshing engagement with the bevel gears 32 for rotating successive hangers 25 in opposite angular directions.

A drive connection or chain 45 may couple the shafts 35 and 36 for simultaneous rotation, and an additional chain 46 may extend between one of the shafts 35 and 36 to a stub shaft 47 projecting longitudinally outward from the vehicle end member 17. A clutch element 48 may be carried on the projecting end of the stub shaft 47.

A motor assembly or drive 50 is fixed relative to the vacuum chamber, and includes a shaft 51 projecting into the vacuum chamber and having a clutch element 52 on its projecting end for interengagement with the clutch element 48 when the carrier vehicle 11 is moved into the vacuum chamber. Thus, from the drive 50, power is transmitted through the shaft 51, interengaging clutch elements 52 and 48, belts or chains 46 and 45 to the countershafts 35 and 36 for rotating the several hangers 24 and 25. To insure that the carrier vehicle 11 is properly located within the vacuum chamber, a wall 53 of the vacuum chamber is provided with an opening 54 adapted to register with a hold 55 in the carrier vehicle when the latter is properly within the chamber. A bolt or rod 56 may be inserted through the chamber-wall opening 54 and into the vehicle hole 55 to maintain proper positioning of the vehicle. Of course, the bolt 56 is readily removable for withdrawal of the vehicle from the vacuum chamber, which withdrawal disengages the clutch elements 48 and 52.

A plurality of generally planar article-holding racks 60 and 61 are removably carried by the hangers 24 and 25, respectively. More particularly, a pair of article holding racks 60 is suspended generally vertically and in parallelism with each other on each hanger shaft 26, while a pair of racks 61 is suspended from the shaft of each hanger 25. The racks 60 and 61 may all be substantially identical, each including a generally rectangular, open, planar frame 62, see FIGS. 3 and 4, which may be bent of wire or rod stock. The upper end of each frame 62 is provided medially thereof with a generally U-shaped engaging member 63 offset out of the plane of the frame and removably insertible downward into an upper receiver 28. In this manner, the upper receivers 28 serve to suspend the racks on opposite sides of each hanger shaft. With the engaging part 63 of a rack 60 in an upper receiver 28, the lower end of the suspended rack is engageable inward of the nether, lower receiver 30, see FIG. 1, so that the rack is effectively maintained in vertical disposition on its respective hanger.

The racks each include a plurality of generally horizontally disposed, vertically spaced elongate support members or rods 65 extending laterally between and fixedly secured to opposite sides of the respective frame 62. The support members 65 are preferably fabricated of noncircular wire or rod stock, such as the rounded polygonal or square cross section shown in FIG. 5.

A plurality of article-supporting elements 66 are adapted to be removably engaged on and supported by the supporting members 65, the article-supporting elements carrying articles to be plated. A preferred form of article-supporting element is shown in FIG. 5, the element being advantageously fabricated of a single elongate piece of stiff resilient material, such as wire, and bent to define a generally upwardly facing hook portion 67, and a downwardly facing generally U-shaped clip portion 68 extending from one end of the hook portion for engagement over a supporting member 65.

A finger-grasping portion 64 may extend from the clip portion 68 remote from the hook portion 67.

More particularly, the upwardly facing hook portion 67 includes a generally upstanding region 69 terminating in a free upper end. From the lower end of the upstanding region 69, and in angular relation with respect to the latter, extends a lower hook region 70 which declines inward away from the upstanding region 69. An inner hook region 71 extends obliquely upward and inward from the lower end of the lower region 70, in angular relation with respect to the latter, so that the juncture of the lower region 70 and inner region 71 defines the lowermost point of the hook portion 67. From the upper end of the inner hook region 71 extends an upstanding leg 72 of the U-shaped clip portion 67 in bearing engagement with one side of the support member 65. The bight or medial region 73 of the clip portion 68 extends from the upper end of the leg 72 across the supporting member 65, from which depends the other leg 74 of the clip portion in bearing engagement with the opposite side of the support member. Thus, the clip portion 68 is in snug frictional engagement with the support member to maintain the article-supporting element in its illustrated relation.

From the lower end of the clip-portion leg 74 extends a bent-detent region 75 adapted to snap engage beneath the support member 65; and, from the detent region 75 extends the finger-grasping portion 64. The grasping extension 64 preferably extends obliquely downward and away from the support member 65 for convenient manual access.

It will now be readily understood that the racks 60 and 61 are adapted to be quickly and easily loaded with a plurality of articles 77 to be plated, by mere snap engagement and disengagement of the article-supporting elements 66 with respect to the support members 65, the articles 77 being removably maintained in proper position on the hook portions 67 of the article-supporting elements 66.

Also, it is apparent that the loaded racks 60 and 61 are quickly and easily attachable to and detachable from the hangers 24 and 25 by mere removable engagement of the lower rack regions in the lower receivers 30, and removable engagement of the engaging parts 63 in the upper receivers 28.

Also provided on the carrier vehicle 11 may be evaporator means, generally designated 79. The evaporator means is preferably located centrally of the vehicle 11, along a longitudinal center line thereof, equally spaced between the rows of hangers 24 and 25. In particular, the evaporator means may include a plurality of generally vertically disposed supporting standards 80 arranged in alignment longitudinally of the vehicle 11, and carrying therebetween a plurality of horizontal, vertically spaced filaments 81. An electrical-connection element 82 for energizing the filaments 81 may be provided on the end member 17 of the vehicle 11; and, a mating electrical-connection element 83 may be fixed interiorly of the vacuum chamber and connected, as by electrical-conductor means 84 to a source of electrical supply. Upon movement of the vehicle 11 into the vacuum chamber, and properly positioned therein, the electrical-connection elements 82 and 83 are engaged to permit energization of the evaporator filaments 81, which engagement is severed upon removal of the vehicle from the vacuum chamber.

During the actual plating operation, the plating material is evaporated throughout the vacuum chamber, while the hangers 24 and 25 are rotated to carry their racks 60 and 61 and the articles supported thereon. By the symmetrical relationship of hangers 24 and 25 with respect to the evaporating means 79, and complete rotation of the hangers, uniform plating is assured. Also, economy in space, which is extremely important in the maintenance of a sufficiently low vacuum, is achieved by

the unique arrangement of hangers and their timed relative movement. Thus, the racks 60 carried by adjacent hangers 64 are timed to rotate in an intermeshing relationship without interfering with each other. For example, the opposite angular direction of rotation of adjacent hangers 24 permits the racks 60 to pass through the same or common space to achieve a high degree of compactness and minimize the vacuum-chamber volume required per unit volume of plated articles.

From the foregoing, it is seen that the present invention provides apparatus for use in vacuum plating which fully accomplishes its intended objects and is well adapted to meet practical conditions of manufacture, maintenance and use.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be made within the spirit of the invention and scope of the appended claims.

What is claimed is:

1. Apparatus for supporting articles being vacuum plated, said apparatus comprising a carrier vehicle for movement into and out of a vacuum chamber, a plurality of hangers mounted on said vehicle for rotation about generally vertical axes, article-holding racks removably depending from said hangers, and transmission means interconnecting said hangers for rotating the latter in timed relation, said hangers each comprising a depending rotary element, an upper receiver for supporting engagement with one of said article-holding racks, and a lower receiver for retaining engagement with said one article-holding rack.

2. Apparatus for supporting articles being vacuum plated, said apparatus comprising a carrier vehicle for movement into and out of a vacuum chamber, a plurality of hangers mounted on said vehicle for rotation about generally vertical axes, transmission means interconnecting said hangers for rotating the latter in timed relation, article-holding racks removably depending from said hangers, said racks each comprising a normally vertical frame having a plurality of vertically spaced horizontally extending support members, and an engaging member on each of said racks for separable connection to a respective one of said hangers to be supported thereby, and a plurality of article-supporting elements removably carried by each of said racks, said article-supporting elements each comprising an elongate stiff resilient member including a normally upwardly facing hook portion having a free end for engagement through an article to be supported, a normally downwardly facing generally U-shaped clip portion extending from the other end of said hook portion for frictional engagement over a support member, and an extension on said clip portion for manual grasping to facilitate placement and removal of said clip portion with respect to said support member.

3. Apparatus for supporting articles to be vacuum plated, said apparatus comprising an open-framework vehicle for movement into and out of a vacuum chamber, a series of vertically disposed hangers mounted on said vehicle for rotation about vertical axes, a plurality of generally planar article-holding racks removably carried in generally vertical disposition by said hangers for rotation therewith, and transmission means connecting said hangers together for rotation in timed relation with adjacent hangers rotating in opposite angular directions for intermeshing of said racks without interference therebetween.

4. Apparatus according to claim 3, said hangers each comprising a generally vertically disposed rotary shaft mounted in said vehicle and connected in driven relation with said transmission means, and upper and lower re-

ceivers on said shaft for removably retaining racks in vertical disposition on said shafts for rotation therewith.

5. Apparatus according to claim 4, said racks each comprising an open generally planar frame, a plurality of vertically spaced generally horizontal support members extending across said frame, and engaging means on said frame for detachable connection to said receivers.

6. Apparatus for supporting articles to be vacuum plated, said apparatus comprising an elongate open framework, means mounting said framework for longitudinal movement into and out of a vacuum chamber, evaporating means carried by said framework centrally thereof, a plurality of hangers mounted on said framework for rotation about respective vertical axes and located on opposite sides of said evaporating means, upper and lower receivers on said hangers for rotation therewith, article-holding racks removably engaged with said receivers, and transmission means connected to said hangers for rotating the latter in timed relation.

7. Apparatus for supporting articles to be vacuum plated, said apparatus comprising an open rack having a plurality of generally horizontal support members, and a plurality of article-supporting elements removably carried by each of said support members, said article-supporting elements each being fabricated of an elongate stiff resilient element and comprising a normally upwardly facing hook portion having a free end for engagement through an article being supported, a normally downwardly facing generally U-shaped clip portion extending from the other end of said hook portion for frictional engagement over a support member, and an extension on said clip portion for manual grasping to facilitate placement and removal of said clip portion with respect to said support member.

8. Apparatus according to claim 7, said support members each being of non-circular cross-sectional configuration, and said clip portions each being configured for conforming and non-rotating engagement over said support members.

9. Apparatus according to claim 8, said hook portions each having an upstanding free-end region, a lower region extending obliquely downward from the lower end of said upstanding free-end region, and an inner region extending obliquely upward from the lower end of said lower region to said clip portion.

10. Apparatus for supporting articles being vacuum plated, said apparatus comprising a carrier vehicle for movement into and out of a vacuum chamber, a plurality of hangers mounted on said vehicle for rotation about generally vertical axes, article-holding racks removably depending from said hangers, said racks each including generally horizontal supporting members, transmission means interconnecting said hangers for rotating the latter in timed relation, and a plurality of article-supporting elements removably carried by each of said racks, said article-supporting elements each comprising an elongate stiff resilient member including a normally upwardly facing hook portion having a free end for engagement through an article to be supported, a normally downwardly facing generally U-shaped clip portion extending from the other end of said hook portion for frictional engagement over a support member, and an extension on said clip portion for manual grasping to facilitate placement and removal of said clip portion with respect to said support member.

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