April 28, 1959 C. RODRIGUEZ 2,883,959

VACUUM PLATING APPARATUS

Filed Aug. 29, 1956 2 Sheets-Sheet 1

FIG. 1.

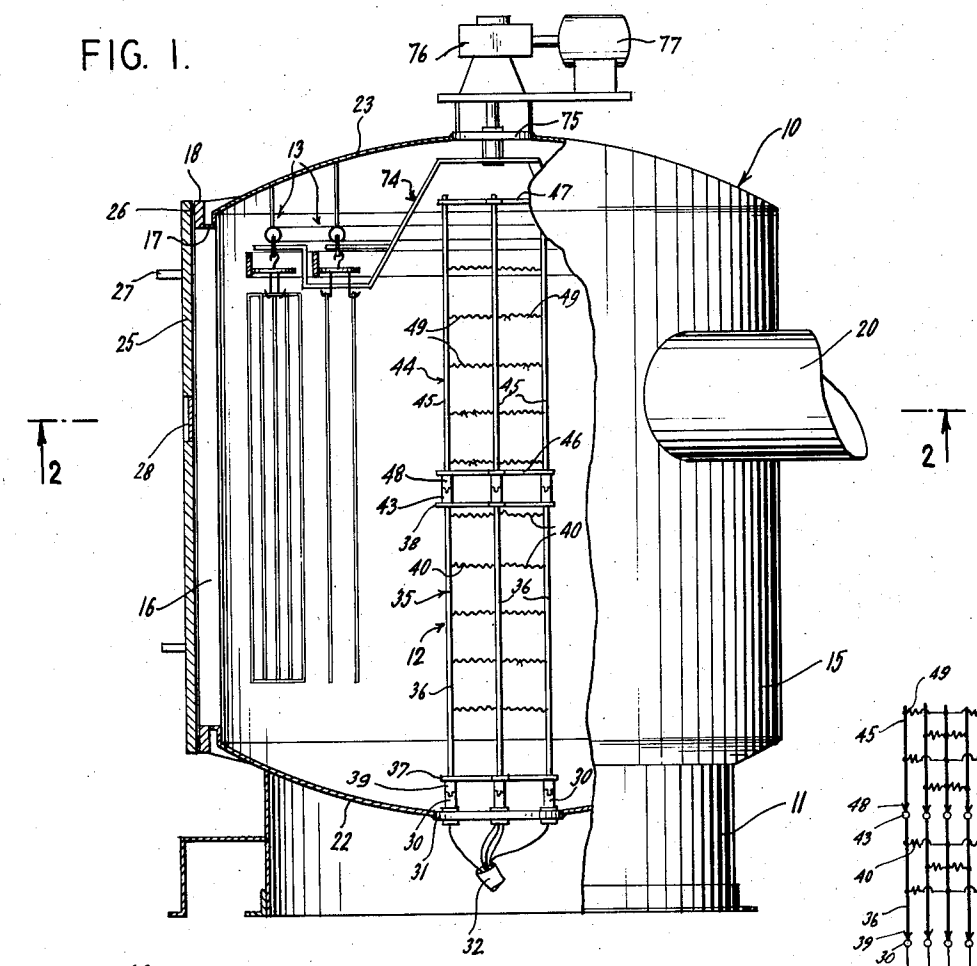


FIG. 5.

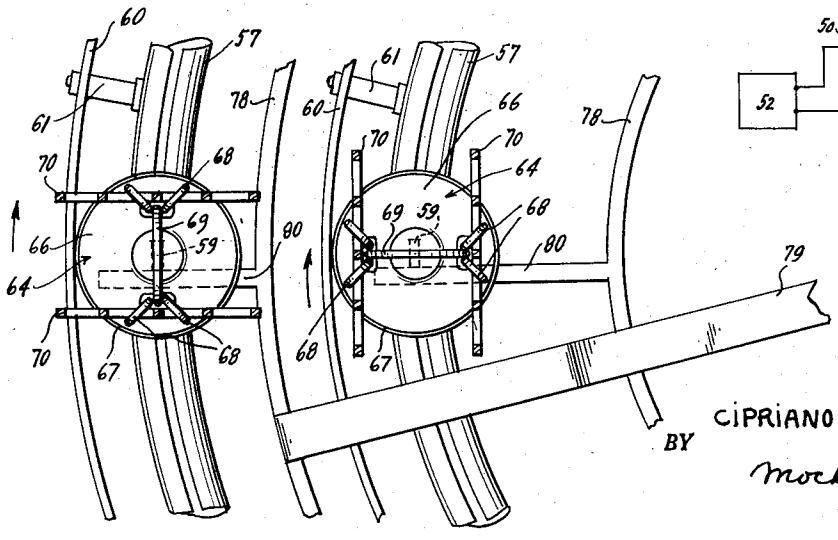


FIG. 4.

INVENTOR.

CIPRIANO RODRIGUEZ

BY Mock & Blum

ATTORNEYS

April 28, 1959 C. RODRIGUEZ 2,883,959

VACUUM PLATING APPARATUS

Filed Aug. 29, 1956 2 Sheets-Sheet 2

FIG. 2.

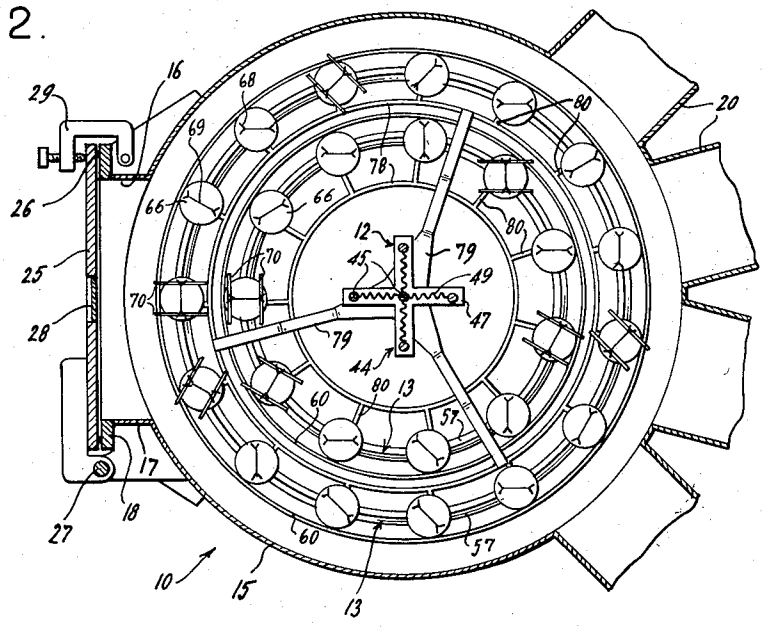
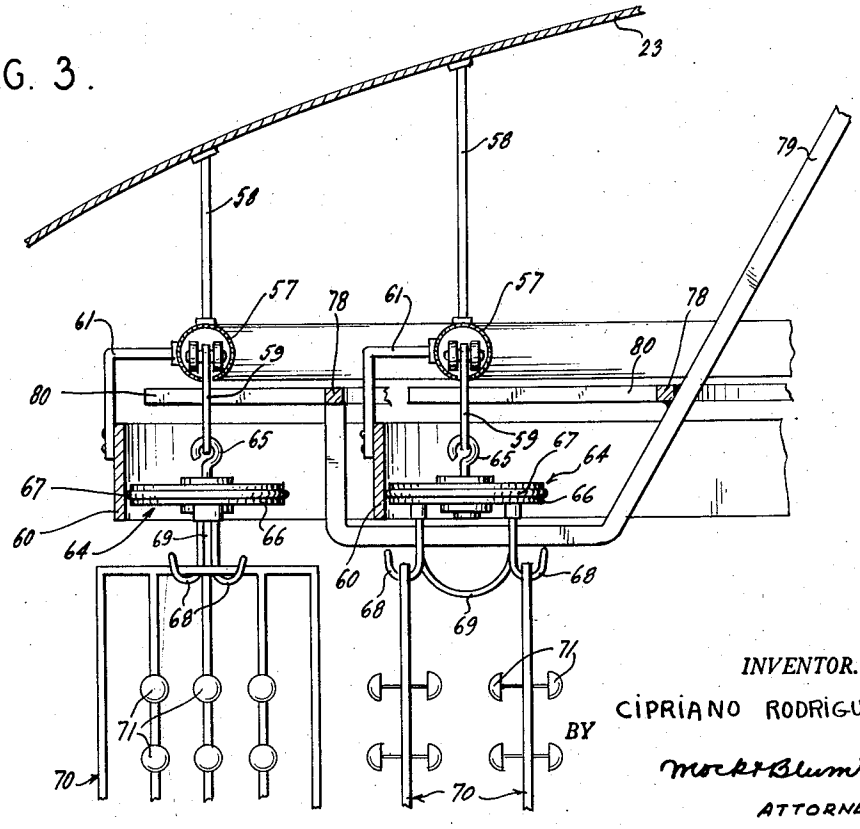


FIG. 3.



INVENTOR.
CIPRIANO RODRIGUEZ
Mock & Blum
ATTORNEYS

United States Patent Office 2,883,959
Patented Apr. 28, 1959

2,883,959

VACUUM PLATING APPARATUS

Cipriano Rodriguez, New York, N.Y., assignor to Micro Metalizing Corporation, New York, N.Y., a corporation of New York

Application August 29, 1956, Serial No. 606,867

3 Claims. (Cl. 118—49)

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

Although the method and apparatus of the present invention have 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 applications and that all such applications are comprehended herein.

As is well known to those versed in the art of plating costume jewelry, economy requires that a great many articles of jewelry be plated simultaneously, and that the period of time required for the plating cycle be kept to a minimum. In prior plating methods and apparatus, considerable time was consumed in the introduction and removal of articles to be plated with respect to the plating chamber, and further, a relatively long period of time was required to sufficiently evacuate the chamber for evaporation plating. As an additional disadvantage, previous plating methods and apparatus did not insure complete and uniform coating of all plated articles.

Accordingly, it is a general object of the present invention to provide a method of plating, and apparatus for use therein, which considerably reduce the time necessary for loading and unloading of the articles in the vacuum chamber, and also reduce the period necessary to obtain an extremely low vacuum in the chamber, to thereby considerably hasten the total plating cycle time and effect considerable savings in costs.

It is another object of the present invention to provide a plating method and apparatus which operate in an efficient manner and insure the production of completely and uniformly plated articles.

It is a further object of the present invention to provide plating apparatus having the advantageous characteristics mentioned in the foregoing paragraphs which is simple in construction and durable in use, and can be manufactured, operated, and maintained at a relatively low cost.

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, and combinations and arrangements of elements and method steps, which will be exemplified in the following description, and of which the scope will be indicated by the appended claims.

In the drawings:

Figure 1 is an elevational view showing the plating apparatus of the present invention in loaded condition, and partly broken away for clarity of understanding;

Figure 2 is a generally horizontal sectional view taken substantially along the line 2—2 of Figure 1;

Figure 3 is a partial sectional elevational view similar

to Figure 1, but somewhat enlarged to illustrate the apparatus in greater detail;

Figure 4 is a partial horizontal view similar to Figure 2, but enlarged for clarity of understanding; and

Figure 5 is a schematic illustration of electrical circuity of the apparatus of the present invention.

Referring now more particularly to the drawings, and specifically to Figures 1 and 2 thereof, there is illustrated therein an upstanding, generally cylindrical vessel **10** supported above a floor surface by a base **11**. Interiorly of the vessel **10**, generally centrally therein, are provided evaporating means **12**; and, extending about the evaporating means interiorly of the vessel are provided conveyor means **13**.

The vessel **10** includes a vertically disposed, generally cylindrical side wall **15** formed in one region with a vertically extending through opening or doorway **16**, which doorway is bounded by a peripheral wall **17** having an outstanding, circumferentially extending flange **18**. Preferably spaced from the doorway **16**, a plurality of relatively large outlet ducts **20** are connected to the vessel side wall **15** for communication between the interior of the vessel and a vacuum pump (not shown), which is preferably of the diffusion type. The lower end of the vessel **10** is closed by an upwardly concave bottom wall **22**, while the upper vessel end is closed by a downwardly concave top wall **23**.

A plate-like closure or door **25** is disposed in closing relation with respect to the side wall opening **16**; and, the opening is sealed by a gasket **26** extending about the outer face of the flange **18** and compressed between the latter flange and the door. The door is mounted along one side for swinging movement about a generally vertical axis, as by hinges **27** between its closed position, as illustrated, and an open position away from the doorway **16**. If desired, a window **28** may be provided in the door **25**; and, closure clamps **29** may be mounted on the wall **17**, remote from the hinges **27**, to releasably secure the door fast in its closed condition.

The evaporator **12** includes a group of five electrical connectors **30**, illustrated as female in Figure 1, and fixedly secured in upstanding relation on a mounting plate **31** centrally in the vessel bottom wall **22**. That is, the five connectors **30** are fixed in upstanding relation on the interior of the bottom vessel wall **22** in a generally rectangular configuration with one connector centrally of the rectangle to define a cross. Electrical conductors **32** extend from the connectors **30** exteriorly of the vessel **10** for connections which will appear more fully hereinafter.

A lower evaporator frame section **35** includes a group of five generally vertically disposed parallel spaced frame members **36** arranged in a cross-like configuration in plan view and fixedly secured together in their spaced relation by lower and upper cruciform shaped end members **37** and **38**. Fixedly secured to and depending from the underside of the lower cross member **37** are five electrical connectors **39** of the male type, adapted for detachable connection, respectively, with the connectors **30**. Extending between each adjacent pair of vertical frame members **36** in a row of vertically spaced, generally horizontally disposed electrically conductive filaments **40**. The filaments **40** of each row are connected together to define an independent electrical circuit, as will appear presently. Projecting upward from the upper side of the upper end frame member **38** of the lower evaporator section **35** are five electrical connectors **43**, which are connected to the rows of filaments **40** in substantially the same manner as the electrical connectors **39**.

Superposed on the upper end of the lower evaporator section **35** is an upper evaporator section **44**, which is

substantially identical to the lower evaporator section. More specifically, the upper evaporator section 44 includes five vertically disposed frame members 45 fixedly secured together in spaced relation by lower and upper frame end members 46 and 47. Five electrical connectors 48 depend from the underside of the lower frame end member 46 for detachable connection, respectively, with the electrical connectors 43; and, vertical rows of horizontally extending filaments 49 are connected between the frame members 45, with the filaments of each row electrically connected together and to certain of the connectors 48 to define separate electrical circuits each operable together with a row of lower section filaments 40.

In Figure 5 is illustrated a schematic diagram of the evaporator 12. It will there be noted that the filaments 49 of each row of the upper evaporator section 44 are connected in parallel with each other, and that the filaments 40 of each row of the lower evaporator section 35 are also connected in parallel with each other. Further, the filaments of each upper section row are detachably connected in parallel with the filaments of each lower section row by the connectors 43 and 48. It will be further observed in Figure 5 that each pair of connectors 30 associated with a respective row of filaments 40 and 49, connect its respective filament row in series with a selector switch 50, and a source of variable current 52. The selector switch 50 includes a plurality of contacts 53, to which the filament rows are respectively connected, and is therefore operable to place any selected filament row across the source 52, independently of the remaining filament rows. It will be appreciated that the filament rows may be electrically energized independently of each other, for purposes appearing presently.

The overhead conveyor 13 may comprise one or more tracks 57 fixedly supported in the upper interior region of the vessel 10, each preferably extending about a closed or endless path passing adjacent to the vessel opening 16. More specifically, the tracks 57 are each of generally circular configuration, being disposed horizontally in concentric relation with respect to each other and fixedly suspended from the vessel top wall by brackets 58. A plurality of underhung carriages or dollies 59 are mounted on each track 57 for free movement there along. That is, the carriages 59 are movable along the tracks 57 about the path thereof toward and away from the vessel opening 16. A generally annular wall or rail 60 extends along each track 57, somewhat below and outward thereof, and is fixedly secured to its respective track by a plurality of angle brackets or fixtures 61.

Suspended below each of the carriages 59 and carried thereby for movement along the respective track 57 about the path thereof, is a rotatable or swivel hanger, generally designated 64. More specifically, each hanger 64 is suspended by a hook 65 from its respective underhung carriage 59, and includes a generally horizontally disposed relatively large disc 66 mounted on the hook 65 for rotation thereabout. That is, each disc or wheel 66 is rotatable about the normally generally vertical axis of its respective hook 65; and further, each wheel 66 is provided with a peripherally circumposed band or tire 67 fabricated of rubber or other suitable frictional material. Each wheel 66 is of such a diameter that its tire 67 normally rests against the adjacent wall or rail 60.

Depending from the underside of each hanger wheel 66 are two pairs of supporting hooks 68, each pair facing outward away from the other pair. Extending between the pairs of supporting hooks 68 of each hanger 64 is a downwardly bowed rigidifying handle 69.

It will now be appreciated that each hanger 64 is movable along its respective track 57 into and out of adjacent relation with respect to the vessel opening 16; and, when a hanger is at its position of movement adjacent to the vessel opening, an operator may readily

manually grasp the handle 69 to turn the supporting hooks 68 in the desired direction. A generally rectangular frame-like rack 70, to which a plurality of articles 71 are detachably secured by any suitable means, may then be quickly and easily placed on or removed from a pair of supporting hooks 68, which procedure when repeated serves to load or unload all of the hangers 64.

In order to effect movement of the hangers 64 about the paths of their respective tracks 59, and also to effect orbital rotation of individual hangers about the generally vertical axis of their respective hooks 65, a rotatable drive means generally designated 74, is provided in the upper interior region of the vessel 10. The drive means 74 is journaled, as at 75 in the top vessel wall 23 and may be connected, as through a speed reducer 76, to a prime mover 77. The drive means proper includes a frame formed of one or more generally horizontally disposed annular members 78, corresponding in number to the number of conveyors 13, and fixedly secured together by a spider 79 which is centrally journaled at 75 for rotation about a vertical axis. More specifically, the annular members 78 are fixedly secured to the arms of the spider 79 at radially spaced points thereof so that each annular member is located concentric with and somewhat inward of its respective track 57. Fixedly secured to and projecting radially outward from each annular member 78 are a plurality of spokes 80. The spokes 80 of each annular member 78 are equally spaced circumferentially about the latter and are preferably equal in number to the carriages 59 of the associated conveyor 13. The spokes 80 are located horizontally in position to engage with the carriages 59, respectively, so as to move the latter along their tracks 57 upon rotation of the spider 79. As the carriages 59 are moved along their respective tracks 57, the hangers 64 suspended from the carriages will also be moved along the paths of the track. Further, the hanger discs 66 will frictionally engage with the adjacent rail 60 to rotate each disc and its affixed hooks 68, thereby causing orbital movement of the carried racks 70.

The plating material may be placed on the evaporator 12 when the evaporator sections 35 and 44 are removed from the vessel 10 by suspending a plurality of generally U-shaped members, fabricated of the plating material, such as aluminum, on the filaments 40 and 49. With the U-shaped aluminum members in position on the filaments, the evaporator sections are then replaced in the vessel in the illustrated condition. Obviously, it is only necessary that the vessel door 25 be opened during removal and replacement of the evaporator sections, which requires a relatively small period of time. The swivel hangers 59 may then be loaded with racks 70, as described hereinbefore, successively moving the unloaded hangers toward the door opening 16 and moving the loaded hangers away from the door opening, until all of the hangers are loaded.

The door 25 is then closed, which hermetically seals the vessel 10, and the vessel is evacuated to at least of mercury, and preferably to of mercury. The switch 50 is positioned to close the electric circuit through a selected row of filaments 49 and 40, and the supply 52 is controlled to heat the filaments and the plating material supported by the filaments. In the low pressure atmosphere of the vessel 10, the plating material will quickly melt and evaporate to form a vapor completely filling the vessel and plating all surfaces exposed interiorly of the vessel. As the plating material supported by the unenergized filaments is not heated sufficiently to melt or evaporate, it remains in solid form.

During evaporation of the plating material, the driving spider 74 is rotated by the prime mover 77 to effect orbital movement of the hangers 64 along their respective tracks 57 and about their respective vertical axis. By this orbital movement of the hangers, complete exposure of

the articles **71** and their uniform coating by the plating material is insured.

The vessel door **25** is then opened for only so long as is necessary to unload and reload the hangers **64**, and the above-described procedure is repeated, by melting and evaporating the plating material carried by another row of filaments. That is, the selector switch **50** is moved to close the electric circuit of a different row of filaments, which filaments are then energized to melt and evaporate their supported U-shaped members.

Subsequent to removal of the plated articles **71** from the vessel **10**, the articles may be spray-lacquered and dried or baked in the conventional manner.

From the foregoing, it is seen that the present invention provides a method and apparatus for plating articles which substantially reduces the plating cycle time, otherwise accomplishes its intended objects, and is well adapted to meet practical conditions of 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 of modification may be made within the spirit of the invention and scope of the appended claims.

What is claimed is:

1. Vacuum plating apparatus comprising an upstanding vessel adapted to be evacuated by a vacuum pump, an openable closure in a side wall region of said vessel extending generally vertically therewithin approximately between the lower and upper vessel ends, means located centrally of said vessel for evaporating a plating material in said vessel, a plurality of hangers mounted in said vessel adjacent to the upper end thereof for movement along a closed path about said evaporating means and past said closure and for independent rotation about respective generally vertical axes, said hangers being disposed at different horizontal distances from said evaporating means, and means for effecting said movement of said hangers, whereby articles to be plated are adapted to be quickly and easily loaded on and unloaded from said hangers when the latter are in their position of movement adjacent said closure, and said articles are adapted to be rotated with said hangers during plating to insure uniform and complete coating by the plating material.

2. Apparatus according to claim 1, said closure comprising a door hinged to said vessel for swinging movement about a generally vertical axis.

3. Apparatus according to claim 1, said evaporating means comprising an open frame removably mounted in said vessel, a plurality of vertical rows of generally horizontal filaments connected in said frame with the filaments of each row connected in a separate electrical circuit, said filaments being adapted to hold the plating material for heating and evaporation, whereby the plating material held by each row of filaments is adapted to be individually evaporated.

References Cited in the file of this patent

UNITED STATES PATENTS

822,578	Burdick	June 5, 1906
1,072,705	Destribats	Sept. 9, 1913
2,373,823	Gold	Apr. 17, 1945
2,414,406	Colbert et al.	Jan. 14, 1947
2,453,801	Mattern	Nov. 16, 1948
2,522,272	Johnson et al.	Sept. 12, 1950
2,532,971	Van Leer et al.	Dec. 5, 1950
2,544,806	Ransburg	Mar. 13, 1951