

# United States Patent

Mattia

[15] 3,671,405

[45] June 20, 1972

## [54] METHOD OF ELECTROFORMING ON SURFACES HAVING PROJECTIONS

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[22] Filed: Dec. 7, 1970  
[21] Appl. No.: 95,548

[52] U.S. Cl. ....204/4, 204/23, 204/DIG. 7  
[51] Int. Cl. ....C23b 7/00, C23b 5/00  
[58] Field of Search.....204/DIG. 7, 9, 23, 4

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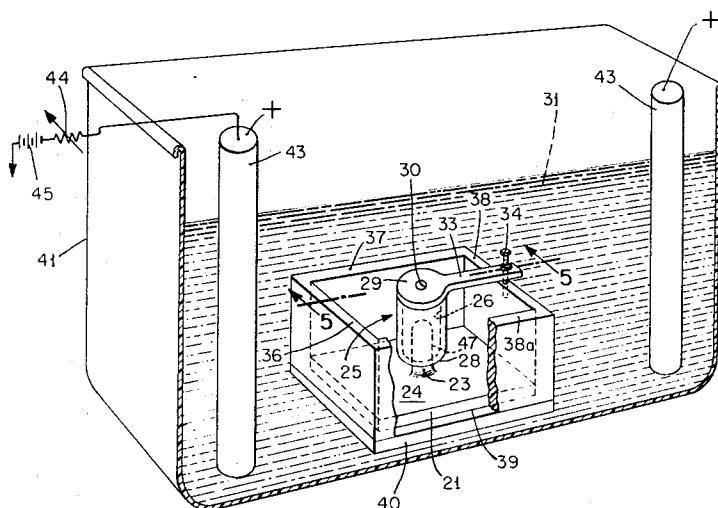
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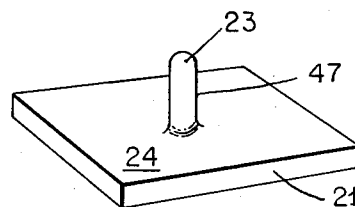
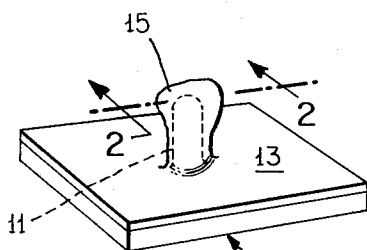
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## ABSTRACT

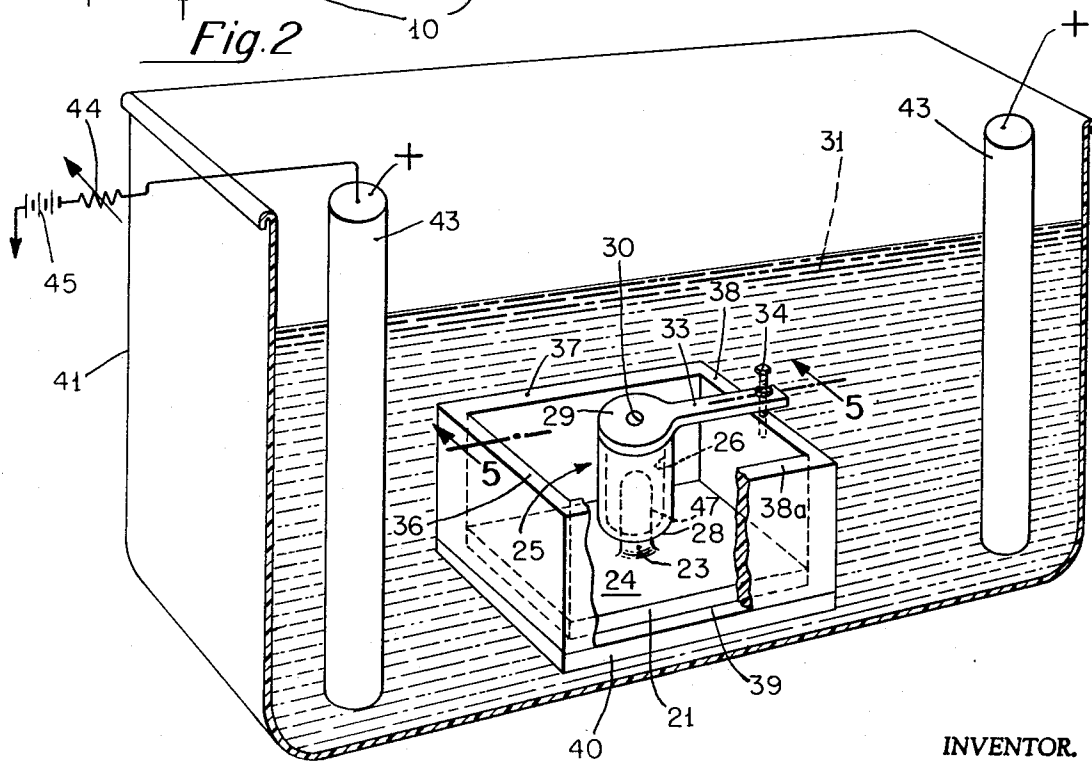
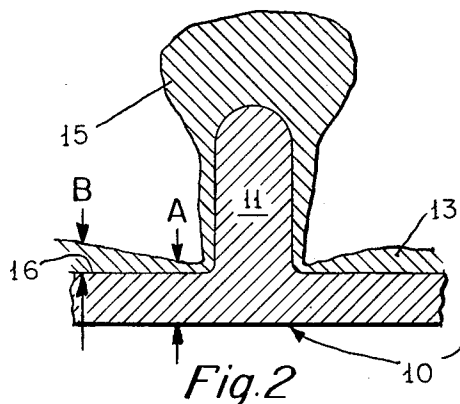
A method of electroforming on surfaces having relatively high projections by providing a shield of electrically non-conductive material to encircle a portion of the length of the projection and thereafter periodically raising the shield at a rate corresponding to the rate of deposition on the projections.

3 Claims, 5 Drawing Figures





PRIOR ART



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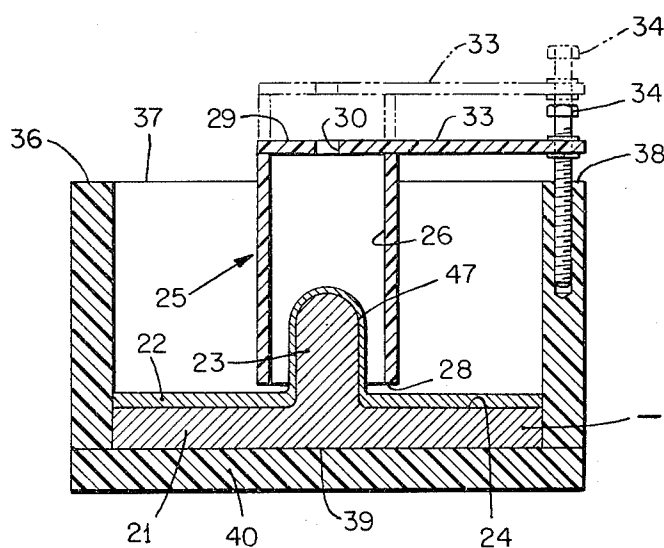


*Fig. 5*

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## METHOD OF ELECTROFORMING ON SURFACES HAVING PROJECTIONS

Heretofore it has been found that when depositing metal such as nickel on surfaces having relatively high projections excessive build-up of deposited metal will occur on the free end of the projections. This build-up alters the current flow in the bath material and thereby prevents the desired thickness of metal deposit in areas adjacent the base of the projections. Various techniques have been tried to obtain the desired thickness of metal on these surfaces, such as periodic reverse plating and thieving, but these techniques have been found to be unsuccessful.

Accordingly it is the principal object of this invention to provide an improved method of electrodeposition on a surface having relatively high projections which avoids one or more of the disadvantages of prior art methods.

It is still another important object of this invention to provide an improved method of uniformly electrodepositioning on a surface having relatively high projections without producing low spots of insufficient thickness of deposit around the base of the projections.

In accordance with the invention a method of uniformly electrodepositioning metal on a surface having relatively high projections which method comprises providing a shield to encircle the projection along a portion of its length with said shield being spaced along said surface, electrodepositioning the surface and said projection with the shield in place, and thereafter moving said shield along the length of the projection away from said surface at a rate commensurate with the electrodeposition rate.

For a better understanding of the invention together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawing.

In the drawing,

FIG. 1, prior art, is a perspective elevational view showing a part with a projection having a layer deposited thereon;

FIG. 2 is a sectional view taken along the lines 2—2 of FIG. 1 showing the projection in section;

FIG. 3 is a perspective view of a part having a projection extending upwardly therefrom;

FIG. 4 is a view partially schematic showing the part having a shield about the projection in the presence of a bath solution enabling deposition on the part;

FIG. 5 is a sectional view taken along the lines 5—5 of FIG. 4 and showing the shield around the projection in cross section.

Referring now to FIGS. 1 and 2 of the drawing there is shown a prior art arrangement in which a part 10 having an upstanding projection 11 has electrodeposited thereon a layer of metal 13 such as nickel. As seen in FIG. 2 the thickness of the deposited layer is non-uniform, being much thinner at location A than at location B. Moreover the top of the projection 11 develops a mushroom type head 15 which greatly interferes with the laying down of a layer of uniform thickness adjacent the base of the projection upon top surface 16 of the part 10.

In order to avoid the non-uniform build-up of layer thickness of electrodeposited material on a part, reference is now had to FIGS. 3 and 4 wherein a part 21 having a projection 23 extending upwardly from surface 24 is provided. In accordance with the method of the present invention, a cylinder shield member 25 is supported over the projection 23. The inside surfaces 26 of the wall of the cylindrical member is spaced concentrically from the external surfaces of the projection 23, while the bottom edge 28 of the cylindrical member is spaced from the surface 24 of member 21. The cylindrical member 25 which is of electrically non-conductive material includes a top wall 29 which has a small aperture 30 in line with the axis of the projection 23. The small aperture allows

air to escape as the cylindrical member is lowered into the electro-forming bath 31 and also allows gas to escape during electrodeposition of the metal. The top wall of the cylinder further includes an arm 33 mounted on a screw 34 so as to move axially with said screw. A plurality of electrically non-conductive upstanding plates 36, 37, 38 and 39 engage the edge surfaces of plate member 21 to provide uniformity of deposition adjacent its edges, while plate member 40 of electrically non-conductive material is applied to the bottom face 39 of the plate member 21 to prevent deposition of metal on the under surface of the plate 21.

In the present instance the electrodeposition apparatus is shown as comprising a tank 41 of electrically non-conductive material which contains the aforementioned electrolytic bath solution 31, which in the present instance may be a nickel sulfamate bath. Anodes 43 shown immersed in the fluid may be of depolarized nickel and connected to a current source such as a battery 45. The circuit may be a variable resistor 44 for varying the current through the bath. The part to be plated 21, shown in FIG. 5 may be of stainless steel and is in turn connected to the negative pole of the battery.

In operation as the electrical circuit through the bath 31 is activated, deposition of metal occurs on the top surface 24 of part 21 as well as around the external surface 47 of projection 23. However since the cylindrical shield 26 restricts the electron flow through solution interiorly of the cylinder 25, deposition occurs on the external surface 47 of the projection 23 at a low rate and maintains the surface 47 active. The presence of the shield 25 however precludes the build-up of an enlarged mushroom type head 15 as seen in FIG. 1. When the thickness of the deposited layer on surfaces 24 and 47 reaches a predetermined thickness, screw 34 may be turned a desired amount to raise sleeve 25 an extent to permit further deposition on the base portion of projection 23 and on surface 24 adjacent the base of the projection. In this manner a uniform build-up of material is applied to the projection as well as on surface 24. Since the part 21 is of stainless steel, the same has a passive film hence the separation of the electrodeposited layer may be readily accomplished.

While there has been described what at present is considered to be the preferred embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention.

What is claimed is:

1. A method of coating a surface of an object having a main portion and a projecting portion extending therefrom, comprising the steps of inserting said object in an electrodeposition bath solution, providing an electrically non-conductive cylindrical member to surround said projecting portion along its length except for an area adjacent said main portion of said object, providing said cylindrical member with a closure plate aligned with said projecting portion to restrict the current path around said projecting portion to prevent excessive build-up of electrodeposited material along the length of the projecting portion surrounded by said member, and concentrating a plating operation at said area at which said projecting portion joins said main portion of said object.

2. In the method of coating a surface of an object having a projecting portion as set forth in claim 1 including the step of providing said closure plate with an aperture aligned with the axis of said projecting portion to enable escape of gas during electrodeposition on said projecting portion.

3. In the method of coating a surface of an object having a projecting portion as set forth in claim 2 including the step of providing arm means for supporting said cylindrical member, and the step of providing means to move said arm means and said cylindrical member along the axis of said cylindrical member.

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