METHOD OF MAKING MIRROR-LIKE FINISHES ON METAL MASTERS

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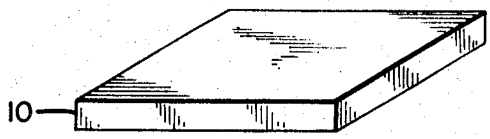

Fig. 1

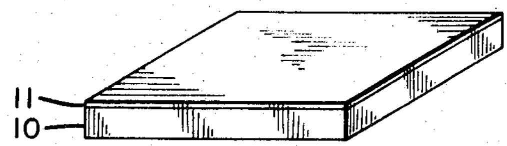

Fig. 2

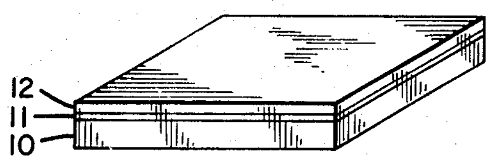

Fig. 3

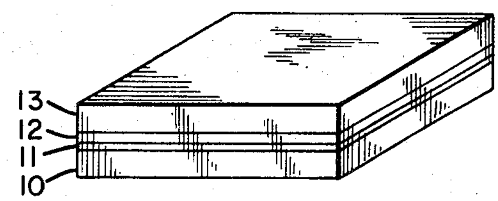

Fig. 4

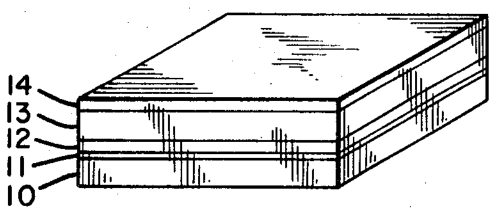

Fig. 5

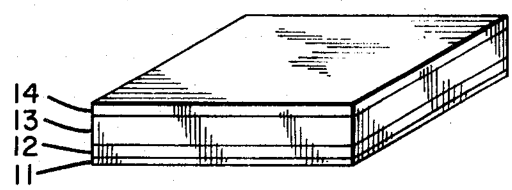

Fig. 6

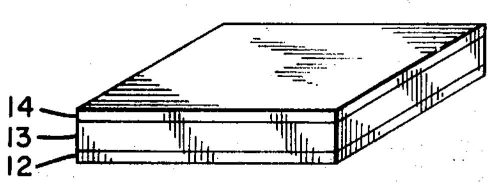

Fig. 7

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METHOD OF MAKING MIRROR-LIKE FINISHES ON METAL MASTERS

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ABSTRACT OF THE DISCLOSURE

A method for producing an optical or mirror-like finish on a metallic master by electroforming the metal master on a glass surface.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates generally to the method of producing finishes and, more specifically, to the method of producing a metal base having a mirror-like or optical finish through electroforming techniques.

Description of the prior art

The method of producing metallic screens or perforated metal sheets, oftentimes called mesh, having any particular number of openings per square inch is well known in the art. Typically, prior art methods of producing screen or mesh of this type is as follows: a metal plate of sufficient thickness and required size is prepared with a clean surface suitable for electroplating. Copper is preferred as the metal plate because of its good electrical and heat conductivity. One face of the copper plate is plated with nickel in a Watts bath according to conventional procedure. Nickel of approximately $\frac{1}{1000}$ of an inch is ordinarily sufficient although a thicker nickel plate may be desirable in some cases. The nickel surface is then ground substantially flat using optical grinding powders in a lapping machine. This produces a substantially fine grain structure suitable for coating and contact printing necessary to the formation of screen or mesh thereon.

In the next step the fine grain nickel surface is coated with a light sensitive emulsion solution of uniform thickness, preferably having a shellac base. The common "cold top enamel" used in the photoengraving industry has been used with excellent results for this coating. It may comprise an aqueous solution or emulsion of shellac, ammonium carbonate and ammonium bichromate with ammonium hydroxide added. Preparatory to the application of this liquid, the nickel coated copper plate should be chilled. The required thickness of the coating of enamel can be obtained by flowing the light sensitive solution or emulsion to and over the surface to be coated while the copper is held in steeply inclined or substantially vertical position as the liquid is distributed along the upper edge of the copper plate. When the surface has been coated, the liquid supply is shut off. The copper plate is then retained in its upright steeply inclined position while the coating liquid is allowed to solidfy substantially at room temperature. After the emulsion has had a chance to dry, the master printing plate carrying the image of the desired design usually in the form of fine, opaque lines, is used to contact print onto the copper plate. After exposure to suitable actinic light source the image on the matrix plate is developed by the application of a suitable developer, for example, alcohol containing a suitable dye. The unexposed portion light sensitive coating is then removed and the water is applied in the conventional manner to remove the developer, leaving on the nickel surface those portions of the coating which have been rendered insoluble by exposure to an actinic light of the required intensity. Thus, there is left a fine rib or mesh type of structure which is exposed. This surface is then electrodeposited with a layer of stainless steel or the like to produce a mesh screen on the nickel coated copper surface. The mesh screen is then stripped from the nickel coated copper plate.

The present invention herein is concerned with the production of the nickel coated copper surface on which the electrodeposition of the mesh occurs. The smoothness or fineness of the finish on the nickel surface has a direct effect on the quality of the mesh and the ease in pulling the mesh off from the copper plate. If the nickel coated copper surface is smooth the mesh pulls off quite readily while if the surface is rough the mesh will tear as it is stripped from the nickel coated copper plate. The present invention overcomes the costly prior art procedure of lapping, polishing and grinding the metallic-like surface and then the electrodeposition of the nickel thereon, by electroforming a base material on top of a smooth glass surface and then removing the glass surface. Oftentimes, it is not only desired that the surface be smooth but that it also be flat. If a fine material were to be deposited on a metal plate to produce a smooth finish, the surface would not be flat or the electrodeposition of metals tends to cause the edges to plate higher than the center thus creating a bowl-shaped appearance. In the present method this bowl-shaped appearance is eliminated as the surface that is produced is a mirror image in both smoothness and flatness of the glass plate.

Also, even if the metallic surfaces are polished or lapped, they still retain fine surface scratches which can have detrimental effect on the product to be plated onto the metal face plate. These fine scratches do not exist on a glass surface as the smoothness of the surface is generally dependent upon the cooling process and not the aomunt of lapping and polishing done to the surface.

BRIEF SUMMARY OF THE INVENTION

Briefly, the invention comprises a method for producing a metallic base plate of optical smoothness which does not require conventional polishing, grinding or lapping techniques through the process of electroforming a metal base plate onto a piece of silver coated glass.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 through 7 show the various steps in producing an optically smooth base plate suitable for forming a backing plate for electroforming mesh thereon.

BRIEF DESCRIPTION OF THE PREFERRED METHOD

Referring to FIG. 1, there is shown a piece of glass which is designated by reference numeral **10**. Glass **10** has a flat top surface **10***a* having a smooth finish. The glass material is selected for its smoothness and because it lacks the coarse grain structure found in most metals. As glass **10** cannot be electroplated, it is necessary to prepare surface **10***a* in some manner so as to make it suitable for electrodepositing a metallic material thereon.

Referring to FIG. 2, there is shown a very thin layer of silver **11** which has been deposited on top of glass **10**. This layer of silver may be applied by evaporation techniques or the like. The purpose of this layer of silver is to provide a conductive base of electrodepositing additional material on top of glass surface **10***a*. The thin layer of silver is also stress free so as to produce a smooth surface to electrodeposit thereon. Typically, before the silver solution is placed on top of the glass, the surface can be made chemically clean to produce a better surface for the silver to adhere to by cleaning the glass with a solution such as stannous chloride.

In the next step, a base material **12** is electroformed on top of the silver **11** to desired depth to give it the proper strength and rigidity. Typically, this may be a sheet of nickel of approximately 2/1000 inch in thickness. The nickel serves as a backing that will allow the mesh to be eventually stripped free from the backing plate. Also, the nickel prevents and retards oxidation when it is eventually used as the exposed plating surface for the mesh.

After the nickel layer **12** has been deposited on top of the silver layer **11**, a layer of copper **13** is electrodeposited on top of the nickel. Typically, the layer of copper may be approximately 30/1000 inch in thickness which provides the desired strength and rigidity to hold a plate rigid. The use of a copper layer **13** is preferred because it has good thermal and electrical conductivity. However, other materials could also be used.

FIG. 5 shows an additional 2/1000 layer of nickel **14** electrodeposited on top of copper layer **13**. The layer of nickel **12** has the additional feature of depositing very evenly and smoothly on top of the silver coated glass. Thus, the surface layer of nickel **12** will clearly conform to the surface of the glass **10**. In some applications it would not be necessary to deposit the nickel layer on top of the silver. This would be true where the present method is to be followed by a number of subsequent electrodepositing steps. However, for purposes of forming a matrix for a mesh plate, it is desirable to use a nickel surface because it prevents oxidation from occurring on the surface of the metal.

Referring to FIG. 6, the layer of glass **10** has been removed through a suitable etchant such as hydrofluoric acid or the like. This leaves the exposed silver surface adjacent the nickel surface **12**. In the next step, the silver solution is washed off leaving the nickel surface **12** exposed. This lower surface **12** of nickel is a mirror image of the surface of the original glass master **10**. It has been found that the nickel surface **12** is as smooth as the original surface of glass **10**. In addition, surface **12** is as flat as the original glass plate **10**. The base plate can be subjected to the aforedescribed step to produce a mesh or mesh-like material.

Although the preferred method has been described in relation to preparing a smooth surface for making mesh, it will be apparent that the method can be used with a variety of different tasks where it is desired to have an optically smooth metallic surface.

I claim:

1. The method of making a flat smooth surfaced base plate for electrodeposition thereon comprising the steps of:

(a) coating a smooth surface glass member with an electrically conductive layer;

(b) electrodepositing a layer of base material on the conductive layer;

(c) etching away the smooth surface glass member from the electrically conductive layer;

(d) removing the electrically conductive layer from the electrodeposited layer of base material;

(e) forming a resist pattern on the base material for electrodeposition therebetween;

(f) electrodepositing material between the resist on said base material; and

(g) stripping said electrodeposited material from said base material.

2. The method of claim **1** wherein the step of coating the smooth surfaced glass member comprises applying a silver material over the glass member.

3. The method of claim **1** wherein the step of coating the smooth surface glass member comprises depositing a layer of stress free material on the smooth surfaced glass member.

4. The method of claim **1** wherein a first layer of nickel is electrodeposited to the electrically conductive layer.

5. The method of claim **4** including the step of electrodepositing a second layer of nickel on top of the base material.

6. The method of claim **4** wherein the step of electrodepositing a layer of base material on top of the conductive layer includes electrodepositing a layer of copper.

7. The method of claim **6** wherein the electrodeposition of material between the resist forms a mesh.

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