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(54) A method for producing a decorative surface structure with holographic or diffraction pattern.

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(56) References cited:
EP-A- 0 175 460
CH-A- 601 500
FR-A- 2 086 223
US-A- 3 867 264
US-A- 4 184 700

XEROX DISCLOSURE JOURNAL, vol. 7, no. 6,
November/December 1982, pages 379-380; C.J.
KRAMER: "Replication of diffraction gratings by
embossing techniques"

The file contains technical information submitted after
the application was filed and not included in this
specification

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Description

The present invention relates to a method for producing a decorative surface structure, comprising the steps of forming a casting of the surface of a master model in a suitable polymeric material, applying a thin conducting layer to the surface of the casting, and then electroforming the polymeric casting to produce a metallic replica of the desired surface. Such a method is known for example from the CH-A 601 500, wherein items such as a watch face can be produced by an electroforming process whereby a master model of the watch face is made – commonly in metal –, plastic copies of this master are produced by a process such as casting, and subsequent electroformed metal copies are made from the plastic intermediate. This electroforming process allows considerable product enhancement because relief information (for example raised numerals) can be incorporated into the master model, and are thus also copied onto the subsequent electroform.

It is also known that decorative effect and surface enhancement can be achieved by means of certain types of hologram and diffractive pattern. The so-called embossed hologram, and a multiplicity of decorative diffraction foils use the presence of a micro-relief structure on a surface to create a surface enhancement which is based on optical diffraction and not on the properties of coloured inks, pigments etc. Such embossed surfaces may be further enhanced by the application of a thin metal layer (for example vacuum coated aluminium). Products such as the embossed hologram and diffraction foil are available in today's marketplace in the form of thin plastic foils which have been embossed using a suitably made embossing master carrying the diffractive information as a surface relief structure, see for example US-A 4 184 700.

From the US-A 4 867 264 is also known an electroforming process for duplicating the surface contour of a master form.

The EP-A 175 460 discloses a method of manufacturing a diffraction grating, utilizing specially adapted steps for it, wherein the master is also a grating.

It is the object of the present invention to improve the quality and the range of the decoration of surfaces, mainly by improving the structure of the master model. This object is attained by the method disclosed in the claims.

The method according to the invention will be described below by way of an example for producing decorated surfaces, in particular of a watch face.

First, a holographic or diffractive relief pattern is formed in a metal surface whereby this step may itself involve producing an electroformed copy of a holographic or diffractive relief pattern recorded using laser technology on a photosensitive surface.

All or parts of this metal relief pattern are then incorporated into a master model of the finally required watch face. In general, this master model will also include non-holographic or non-diffractive areas and elements to provide macroscopic relief effects and surface texturing, and utilitarian features

such as apertures for the date wheel and driving axles for the hands. Several different holographic or diffractive elements may be incorporated into different areas of the same watch face.

Castings in a polymer system are produced of the master model surface.

These castings are coated with a suitable electrically conducting layer, preferentially less than 100 nm, and then in a suitable holder, are electroformed to provide replicas of the original master model surface. It is convenient and economic to use copper as the electroforming metal.

The electroformed watch faces are then finished by applying a further decorative layer to the replica surface, for example of gold in a thin layer of less than 100 nm and various metal finishing operations such as stamping to the final size and machining the rear surface if necessary.

The resultant watch face being made of metal is inherently very stable and the final quality depends essentially upon the care and precision which was exercised in the origination of the initial master model. Only one master model is required for the production of large numbers of identical replicas.

It is of course also possible to use the result of the casting process, a polymer replica of the master model surface, directly as the enhanced surface in the final product. If this course is adopted then the master model must be constructed to be the "negative" of the desired final surface. A suitable decorative finish can then be applied to the surface of the polymer casting, for example a vacuum evaporated gold layer, and final operations such as stamping to size or trimming can be performed. Again, a series of replicas can be made from a single model, but the final result will be less stable both mechanically and thermally than the metal version described above.

The invention described here is not limited to watch faces, but includes metal surfaces where an enhancement is required. As an additional feature the technology described here provides a security feature which can protect the surface of an object into which such a surface is intimately combined, against simulation by conventional printing or engraving methods.

The technology can be applied to costume jewelry to provide product enhancement, to medals and coin-like items where the inclusion of holographic or diffractive surface elements can provide both enhancement and proof of authenticity, and to general metal objects which can be produced using an electroforming technique and which can be enhanced by the inclusion of holographic and diffractive effects.

Claims

1. A method for producing a decorative surface structure, comprising the steps of forming a casting of the surface of a metallic master model in a suitable polymeric material, applying a thin conducting layer to the surface of the casting, and then electroforming the polymeric casting to produce a metallic replica of the desired surface, characterized in that said metallic master model is formed by combin-

ing a macroscopic relief pattern with one or more elements carrying a microscopic relief pattern in the form of holographic or diffracting structures.

2. The method of claim 1 to which an additional thin metallic layer such as gold is applied to the finished product to enhance the decorative effect.

3. A method for producing a decorative surface structure according to claim 1, where the application of the thin conducting layer provides the decorative effect, and the casting with its conducting layer provides the decorative surface structure.

4. A method for producing a decorative surface structure according to claim 3 in the form of a watch face.

5. A method for producing a decorative surface structure according to claim 3 which provides the decorative part of a piece of jewelry.

6. A method for producing a decorative surface structure according to claim 3 in the form of a medalion or coin.

7. The method for producing a surface structure made according to claim 1 or 2 wherein the holographic or diffractive elements incorporated into the surface are provided with a security feature to guard against the simulation of a similar surface by conventional printing or non-holographic or non-diffractive finishing methods.

8. A method for producing a decorative surface structure according to claim 1 or 2, where the macroscopic relief regions of the metallic master model have been formed by conventional machining operations, and the holographic or diffracting elements are themselves in the form of an electroformed replica of an optically recorded holographic or diffractive microscopic relief structure recorded using the interference between coherent wavefronts on a suitable photosensitive recording medium.

Revendications

1. Procédé pour la production d'une structure superficielle décorative, comprenant les étapes de former un moulage de la surface d'une maquette originale dans un matériau polymère approprié, d'appliquer une couche conductrice mince à la surface du moulage, et puis d'électroformer le moulage polymère pour produire une réplique métallique de la surface désirée, caractérisé en ce que ladite maquette originale est formée en combinant un dessin en relief macroscopique avec un ou plusieurs éléments portant un dessin en relief microscopique en forme de structures holographiques ou diffractives.

2. Procédé selon la revendication 1, dans lequel une couche mince additionnelle telle que de l'or est appliquée au produit fini pour rehausser l'effet décoratif.

3. Procédé pour la production d'une structure superficielle décorative selon la revendication 1, où l'application de la couche conductrice mince fournit l'effet décoratif, et le moulage avec sa couche conductrice fournit la structure superficielle décorative.

4. Procédé pour la production d'une structure superficielle décorative selon la revendication 3 en forme d'une face de montre.

5. Procédé pour la production d'une structure superficielle décorative selon la revendication 3 qui fournit la partie décorative d'une pièce de bijouterie.

6. Procédé pour la production d'une structure superficielle décorative selon la revendication 3 en forme d'un médaillon ou d'une pièce de monnaie.

7. Procédé pour la production d'une structure superficielle réalisée selon la revendication 1 ou 2, dans lequel les éléments holographiques ou diffractifs incorporés dans la surface comportent un motif de sécurité pour prévenir la simulation d'une surface similaire par impression conventionnelle ou par des méthodes de finition non-holographiques ou non-diffractives.

8. Procédé pour la production d'une structure superficielle décorative selon la revendication 1 ou 2, où les zones en relief macroscopique de la maquette originale métallique ont été formées par des opérations d'usinage conventionnelles, et les éléments holographiques ou diffractifs eux-mêmes ont la forme d'une réplique électroformée d'une structure holographique ou diffractive microscopique en relief enregistrée optiquement en utilisant l'interférence entre les fronts d'onde cohérents sur un médium d'enregistrement photosensible approprié.

Patentansprüche

1. Verfahren zur Herstellung einer dekorativen Oberflächenstruktur, folgende Schritte umfassend: Herstellung eines Abgusses der Oberfläche eines Originalmodells aus einem geeigneten Polymermaterial, Aufbringen einer dünnen leitenden Beschichtung auf die Oberfläche des Abgusses und anschließende Galvanoformung des Polymerabgusses zur Herstellung einer Metallnachbildung der gewünschten Oberfläche, dadurch gekennzeichnet, dass das Originalmodell aus Metall aus einer Kombination eines makroskopischen Reliefmusters mit einem oder mehreren Elementen mit einem mikroskopischen Reliefmuster in Form von holographischen oder beugenden Strukturen zusammengesetzt ist.

2. Verfahren nach Anspruch 1, bei welchem zur Verstärkung der dekorativen Wirkung eine zusätzliche Metallbeschichtung wie Gold auf das Fertigprodukt aufgebracht wird.

3. Verfahren zur Herstellung einer dekorativen Oberflächenstruktur nach Anspruch 1, wobei die dekorative Wirkung durch das Aufbringen der dünnen leitenden Beschichtung entsteht und der Abguss mit der leitenden Beschichtung die dekorative Oberflächenstruktur ergibt.

4. Verfahren zur Herstellung einer dekorativen Oberflächenstruktur nach Anspruch 3 in Form einer sichtbaren Uhrenfläche.

5. Verfahren zur Herstellung einer dekorativen Oberflächenstruktur nach Anspruch 3 in Form eines Medaillons oder einer Münze.

7. Verfahren zur Herstellung einer Oberflächenstruktur nach Anspruch 1 oder 2, wobei die in der Oberfläche befindlichen holographischen oder beugenden Elemente Sicherheitsmerkmale aufweisen, um der Nachahmung einer ähnlichen Oberfläche durch herkömmliche Druckverfahren oder

durch nicht holographische oder nicht beugende Fertigungsverfahren vorzubeugen.

8. Verfahren zur Herstellung einer dekorativen Oberflächenstruktur nach Anspruch 1 oder 2, bei welchem die Teile des Originalmodells aus Metall mit makroskopischem Relief mit herkömmlichen Bearbeitungsverfahren hergestellt werden und die holographischen Elemente oder Beugungsbilder ihrerseits galvanogeformte Nachbildungen einer unter Benützung der Interferenz zwischen kohärenten Wellenfronten auf einem geeigneten lichtempfindlichen Aufzeichnungsmedium optisch aufgezeichneten holographischen oder beugenden mikroskopischen Reliefstruktur sind.

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