(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 287 746**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **87810255.7**

(22) Date of filing: **22.04.87**

(51) Int. Cl.4: **C25D 1/10 , G04B 45/00 , B44C 1/20 , B44F 1/00**

(43) Date of publication of application:
26.10.88 Bulletin 88/43

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

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

(57) The method of producing a decorative surface structure comprises the steps of making a metallic master model of the required surface where a macroscopic relief is combined with one or more elements carrying a macroscopic relief pattern in the form of holographic or diffracting structures, forming a casting of the surface of the 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.

In the decorative surface structure formed by the master model and casting steps described, the application of the thin conducting layer provides the decorative effect, and the casting with its conducting layer provides the decorative surface structure.

A thus decorated surface, for example a watch face, has an improved quality and range of decorations as well, utilizing an economic method of mass-production.

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A method for producing a decorative surface structure with holographic or diffraction pattern

For many products it is desirable to enhance a surface by means of printing, engraving or mechanical machining to achieve a decorative or utilitarian effect. As an example of such an enhanced surface we here consider a watch face.

It is known that watch faces can be produced by traditional methods of printing and engraving onto plane surfaces. It is also known that enhancement of such a product can be obtained by the application of special coatings - for example gold - by galvanic or vacuum deposition.

It is further known that 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 todays 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.

It is the object of the present invention to improve the quality and the range of the decoration of surfaces.

This object is attained, according to the invention, by combining the electroforming process used to manufacture a watch face as described above, with the presence over all or part of the required surface of holographic or diffractive patterns in the form of micro relief structures.

A method will be described below by way of an example for producing decorated surfaces.

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 suface 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. This polymer variation of the product is also included within the spirit of this invention.

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 en-

graving 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 forming decorative surface structure by making a metallic master model of the required surface where a macroscopic relief is combined with one or more elements carrying a macroscopic relief pattern in the form of holographic or diffracting structures, forming a casting of the surface of the 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.

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

3. A decorative surface structure formed by the master model and casting steps described in 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. The metallic master model of the required decorative surface structure made according to claim 1 or 2 where the macroscopic relief regions 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 wave-fronts on a suitable photosensitive recording medium.

5. A decorative surface structure according to claim 3 in the form of a watch face.

6. A decorative surface structure according to claim 3 which provides the decorative part of a piece of jewelry.

7. A decorative structure according to claim 3 in the form of a medallion or coin.

8. The surface structure made according to claim 1 or 2 where the role of the holographic or diffractive elements incorporated into the surfcace is to provide a security feature to guard against the simulation of a similar surface by conventional printing or non-holographic or non-diffractive finishing methods.

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EUROPEAN SEARCH REPORT

Application Number

EP 87 81 0255

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Y	US-A-3 867 264 (B.A. CARSON) * Column 1, line 20; claim 1; figure 1 * * Column 6, lines 38-46 *	1 2	C 25 D 1/10 G 04 B 45/00 B 44 C 1/20 B 44 F 1/00
Y	EP-A-0 175 460 (DR. JOHANNES HEIDENHAIN GmbH) * Claims 1,3 *	1	
A	XEROX DISCLOSURE JOURNAL, vol. 7, no. 6, November/December 1982, pages 379-380; C.J. KRAMER: "Replication of diffraction gratings by embossing techniques" * Paragraph 1 *	1	
A	FR-A-2 086 223 (PATEK PHILIPPE S.A.) * Claims 1,4 *	5	
A	US-A-4 184 700 (D.L. GREENAWAY) * Claims 3,4 *	8	
A	CH-A- 601 500 (LISS S.A.) * Claim 1; column 1, line 65 *		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

G 04 B
G 02 B
B 44 C
B 44 F
C 25 D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	03-12-1987	MCCONNELL C.H.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
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EPO FORM 1503 03.82 (P0401)