



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 602 508 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.12.2005 Bulletin 2005/49

(51) Int Cl.7: **B42D 15/00, B42D 15/10**

(21) Application number: **04291408.5**

(22) Date of filing: **04.06.2004**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PL PT RO SE SI SK TR**
Designated Extension States:
AL HR LT LV MK

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(54) **Process and apparatus for manufacturing a "hologram-like" device fixed on an object**

(57) A simple, economical and fast process for manufacturing a "hologram-like" device fixed on an object and an apparatus for carrying out said process, wherein the process comprises the steps of preparing a micro-engraved die having a pattern thereon by using the proven technologies in the semicon industry such as photo-

lithography, positioning a foil between the micro-engraved die and said object, and pressing the micro-engraved die against the foil either manually or automatically by using a hot stamping machine, whereby said pattern will be stamped on the foil to obtain said "hologram-like" device and whereby said "hologram-like" device is fixed on said object.

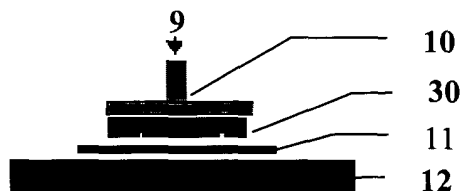


Fig. 3

Description

Background of the invention

Field of the invention

[0001] The present invention generally relates to a process and an apparatus for manufacturing a "hologram-like" device fixed on an object.

Background Art

[0002] Counterfeiting and falsification affect almost every area of economical and social life today. Holograms are presently the most frequently used anti-counterfeiting technique for brand protection and ID document security. They have been proving their efficiency daily since the beginning of the 1980's. Many well-known international brands are also using holograms to authenticate their products.

[0003] "Hologram" is commonly used as a generic term for DOVIDs (Diffractive Optical Variable Image Devices). All the products classified as DOVIDs present an image which changes colors when tilted at various angles. This essential characteristic makes the image impossible to be copied or imitated by traditional printing and graphic software. However, only a few products benefit from holograms to materialize the authenticity, because hologram foils are expensive, complicated to manufacture and therefore are only mastered by a few companies. In addition, hologram foils have a long lead time and are usually supplied with a mandatory minimum volume (minimum quantity by a purchasing order). To summarize, hologram foils are rare, expensive and difficult to source. For certain products, for example, vouchers and entry tickets, they account for a significant amount of total cost of the product. Using holograms to differentiate one product from another is a really expensive way.

Summary of the invention

[0004] It is therefore an object of the invention to provide a simple, economical and fast process for manufacturing a "hologram-like" device and an apparatus for performing said process.

[0005] This object is achieved according to the present invention by a process for manufacturing a "hologram-like" device fixed on an object as defined in claim 1 and by an apparatus for performing said process as defined in claim 15. Advantageous embodiments are claimed in dependent claims 2 to 14 and 16 to 23.

[0006] According to a preferred embodiment of the invention, a "hologram-like" device fixed on an object can be manufactured by steps of preparing a micro-engraved die having a pattern thereon by using the proven technologies in the semicon industry such as photolithography, positioning a foil between the micro-en-

graved die and said object, and pressing the micro-engraved die against the foil either manually or automatically by using a hot stamping machine, whereby said pattern will be stamped on the foil to obtain said "hologram-like" device, and said "hologram-like" device is fixed (glued for example) on said object.

[0007] According to another preferred embodiment of the invention, said micro-engraved die can be made of metal or silicon. It may be a wheel. In this case, patterns engraved on the wheel will be stamped on the foil by rolling the wheel.

[0008] According to a further preferred embodiment of the invention, said micro-engraved die can be mounted on the hot stamping head of a hot stamping press or machine to make use of the hot stamping technique.

[0009] In one preferred embodiment of the invention, said micro-engraved die is produced by photolithography and etching techniques, wherein a wet chemical or an ion plasma etching process can be applied for the etching process.

[0010] One important aspect of the invention is that a pattern such as a firm logo to be engraved on the die is scanned and an electronic file containing the pattern is created by means of standard graphic tools from the art and printing industry, so that the pattern can be easily reproduced through said electronic file. Micro-lines, hidden images etc. can be added into such an electronic file. In such a manner, the anti-counterfeiting capabilities of the "hologram-like" device in form of a fine line foil is further enhanced and it makes the device to become a real brand protection. In addition, it offers an unbeatable flexibility in terms of foil colors, shapes and images in a very short cycle of time. Consequently, the invention brings a solution to satisfy the customer requirement about customized holograms

[0011] The pattern as well as the micro-structures contained in the electronic file can be outputted onto a film by means of an image device. The film with the pattern thereon can be used as a mask to expose a die coated with photoresist with UV light in order to produce the micro-engraved die.

[0012] Alternatively, said electronic file can also be used to directly activate a reactive ion plasma etching process to engrave the die.

[0013] As a result, it will be possible to satisfy the customer's requirements about customized "holograms" in time, since the cost and delivery time are major obstacles to do so with the standard hologram solution available up to now.

[0014] Another important aspect of the invention is an apparatus for manufacturing a "hologram-like" device fixed on an object combining the proven machines in the semicon industry for photolithography and the proven technologies of hot stamping in the hologram industry. This makes it possible to do small batches of products with a unique outlook. This contrasts with conventional holograms where it is generally required to buy hundreds of thousands of identical holograms and to keep

them in a warehouse.

[0015] Due to the economical aspect of the inventive process and apparatus for manufacturing the "hologram-like" device, an object such as a smart card with "hologram-like" device fixed thereon can be economically manufactured, but still has a high level of security.

[0016] Also, the invention allows extending the use of the "hologram-like" device to purely aesthetic purposes. As the color of the foil, the size and image of a logo can easily be adapted and delivered in approximately two weeks compared to the standard six months for a real multi-layer hologram, there is no more an economical or timing obstacle.

[0017] The "hologram-like" device such as a fine-line foil has a plurality of applications. For each of the applications, there is a possibility to use only the aesthetic advantage or to combine it with strong security features. If security features are used, the standard precautions well-known in bank note printing or smart card industry have to be applied to secure the data processing (creation of micro-structure, hidden image process, electronic file generation, data transfer etc.) and the use, transport and storage of the finished dies with the full micro-structure.

[0018] The first application of the fine line foil is for the differentiation and security enhancement of credit and smart cards. The credit card and smart card are products with high security and differentiation requirements. The card conveys the image of the card issuer and is often a device involved in financial transactions or identity certification. For these reasons, it has to be nice, unique and authentic. The physical security will be the main driver for bank and payment cards, identity cards and access control cards. The aesthetic characteristics will be enhanced for game cards, internet cards and all types of cards used by people and not related to physical controls.

[0019] The second application of the fine line foil is for the differentiation and security enhancement of official documents. Paper identity cards, passports, legal documents etc. could benefit from the fine-line foil by offering the intrinsic security characteristics and the possibility to apply a specific shape or content (including hidden images) to a type of document or related to the individual emitter (agency, bureau etc.).

[0020] The third application of the fine line foil is for the differentiation and security enhancement of secure papers. From the simple entry ticket to the sophisticated bank note, the fine-line foil combined with other security features (hologram, optical devices, optic inks etc.) can increase the security and play the differentiation factor in order to increase the value of the product.

[0021] The fourth application of the fine line foil is for the differentiation and security enhancement of brand production. Easy to manufacture, easy to stamp or glue on products, the fine-line foil process allows adding on products a relevant brand protection. It allows all products, but not only luxury products, to benefit from a high-

er image and good brand protection.

Brief description of the drawings

[0022] The foregoing and other objects, aspects and advantages of the invention will be better understood from the following detailed description of a preferred embodiment of the invention with reference to the drawings, in which:

- Fig. 1 is a schematic illustration of the photolithograph technique used in the present invention,
- Fig. 2 is a schematic illustration of the reactive ion etching technique used in the present invention,
- Fig. 3 is a schematic illustration of the manufacturing process according to the invention,
- Fig. 4 is a schematic illustration of a micro-engraved die.
- Fig. 5 is a schematic illustration of the Axalto logo on a credit card.

Detailed description of a preferred embodiment of the invention

[0023] Referring now to the drawings, Fig. 1 illustrates photolithographic technology. The steps involved in the manufacturing of a micro-engraved die for a foil with micro-structures are die cleaning, photoresist application, soft-baking, mask alignment, exposure and development, and hard-baking.

[0024] In the first step, a die 3 is cleaned, for example, with some alcohol to remove particular matters on the surface. After cleaning, photoresist coating 2 is applied to the surface of the die 3. High-speed centrifugal whirling of the die is one of the methods for applying photoresist coating 2. This technique, known as "spin-coating", produces a thin uniform layer of photoresist on the die surface.

[0025] There are two types of photoresist: positive and negative. For positive resists, exposure to the UV light changes the chemical structure of the resist so that it becomes more soluble in the developer. The exposed resist is then washed away by the developer solution, leaving windows of the bare underlying material. This mask, therefore, contains an exact copy of the pattern which is to remain on the die. Negative resists behave in just the opposite manner. Exposure to UV light causes the negative resist to become polymerized and more difficult to dissolve. Therefore, the negative resist remains on the surface, whenever it is exposed and the developer solution removes only the unexposed portions. Masks used for negative photoresists, therefore, contain the inverse of the pattern to be transferred.

[0026] After applying photoresist coating on the die, the coated die is soft-baked on a hot plate in order to remove all of the solvents from the photoresist coating. Over soft-baking and under soft-baking are to be avoid-

ed.

[0027] The next step is to align a mask 1 which has the desired pattern incorporated with micro-structures therein with the die using a mask aligner. Once the mask has been accurately aligned with the die, the photoresist is exposed through the pattern on the mask with a high intensity ultraviolet light 4, and developed subsequently.

[0028] The final step in the photolithographic process is hard-baking. This step is necessary in order to harden the photoresist and improve adhesion of the photoresist to the die surface.

[0029] Referring now to Fig. 2, there is illustrated a reactive ion etching (RIE) technique used in the present invention. The photoresist coating 2 shows a pattern 7 after development. An etchant plasma 6 is produced by glow discharging a relatively inert gas 5. The plasma 6 diffuses to a surface 8 which is to be etched. Plasma ions sputter material of the die, as they hit its surface 8, and react with the die material. Thus, the die is etched with RIE by sputtering and chemical reaction. To ensure vertical, smooth walls, it is necessary to exert tight control over the pressure and flow rate of inert gas 5, the power level of the plasma apparatus and the process time.

[0030] Besides the reactive ion etching technique, the wet chemical etching technique can also be utilized. The chemical or plasma etching process allows micro structures with less than 50 micrometers line width.

[0031] After etching the die 3, a die with micro structure or a micro-engraved die 30 is produced as schematically shown in Fig.4.

[0032] Now referring to Fig. 3, there is illustrated a process for manufacturing a "hologram-like" device such as a fine line foil 20. A stamping press 9 is either a manual stamping press with an adapted fixation for an object such as credit cards or an automatic stamping press. In the latter case, the micro-engraved die 30 is mounted on the hot stamping head 10 of a standard hologram or signature panel deposit machine. A foil, for example a standard metallic foil 11, is put on an object 12 which is desired to be equipped with anti-counterfeiting features, such as credit cards, vouchers, identity cards and so on. The machine carries the object 12 from an entry to the hot stamping press. When the micro-engraved die 30 is pressed against the standard metallic foil 11, the foil is stamped on the object 12. This stamped metallic fine line foil 20 adds to the object 12 not only the aesthetic, but also security features engraved on the foil. Then the finished product is carried back to the output magazine. For example, MM3000 or MM6000 Kurz for hot stamping used for credit card hologram or signature panel deposit is used. A machine like the MCC1 from Kurz would use a micro-engraved wheel pressed/rolled against the metallic foil 11 to obtain the same effect.

[0033] A logo is embossed on an object for example credit or smart card by adjusting properly the pressure and the temperature communicated by the hot stamping

press to the die/foil/object system. Fig.5 shows a schematic illustration of the Axalto logo on a credit card.

[0034] A typical value for the temperature is 170 to 210° C with a pressure from a couple of grams to several tens of kilograms depending on the material of the object (paper, plastic, textile etc.) and its fragility.

[0035] It can be seen from the above description that the invention generally employs proven technologies in the semicon industry and the already existing hologram or signature panel deposit processes and machines.

[0036] Usually a logo can be scanned and an electronic file containing the pattern of a logo can be created. This electronic file can be edited to include some micro-structures such as micro-lines and hidden images by using techniques from the bank note industry and specific software. The image contained in the electronic file can be outputted on a film by using a standard image device. This film can be used as a mask to manufacture a micro-engraved die by using an etching process. Alternatively, the electronic file can be used directly to activate a reactive ion plasma etching process to engrave a die. In such a way, any logo can be easily modified electronically by putting some micro-structures as fine lines for example in the logo.

Claims

1. A process for manufacturing a "hologram-like" device (20) fixed on an object (12), comprising the steps of:

- a) preparing a micro-engraved die (30) having a pattern (7) thereon,
- b) positioning a foil (11) between the micro-engraved die (30) and the object (12), and
- c) pressing the micro-engraved die (30) against the foil (11),

whereby the pattern (7) will be stamped on the foil (11) to obtain the "hologram-like" device (20), and whereby the "hologram-like" device (20) is fixed on the object (12).

2. The process of claim 1, wherein step a) comprises the steps of:

- a1) coating one surface of a die (3) with photoresist,
- a2) interposing a mask (1) with the pattern (7) between an UV light source (4) and the coated die (3),
- a3) exposing the pattern on the mask (1) onto the coated die with the UV light, and
- a4) engraving the exposed pattern (7) on the die (3) by an etching process.

3. The process of claim 2, wherein a reactive ion plas-

ma etching process and/or a wet chemical process are/is applied in step a4).

4. The process of any one of the previous claims, the micro-engraved die (30) is pressed against the foil (11) by means of a hot stamping press. 5
5. The process of any one of the previous claims, wherein the micro-engraved die (30) is pressed against the foil (11) either manually or automatically. 10
6. The process of claim 2 or 3, wherein the pattern (7) to be engraved on the die (3) is scanned and an electronic file containing the pattern (7) is created, whereby the pattern (7) can be easily reproduced through the electronic file. 15
7. The process of claim 6, wherein security features like micro-lines, hidden images are added into the electronic file to enhance its anti-counterfeiting capabilities. 20
8. The process of claims 6 or 7, wherein the pattern (7) contained in the electronic file is outputted onto a film by means of an image device. 25
9. The process of claim 8, wherein the film with the pattern (7) thereon is used as the mask (1) to engrave the die (3). 30
10. The process of claims 6 or 7, wherein the electronic file is used to directly activate a reactive ion plasma etching process of to engrave the die (3).
11. The process of any one of the previous claims, wherein the micro-engraved die (30) is a wheel. 35
12. The process of any one of the previous claims, wherein the micro-engraved die (30) is made of metal or silicon. 40
13. The process of any one of the previous claims, wherein the foil (11) is a standard metallic foil.
14. The process of any one of the previous claims, wherein the foil (11) is glued on the object (12). 45
15. An apparatus for manufacturing a "hologram-like" device (20) fixed on an object (12), comprising: 50
 - a) means for preparing a micro-engraved die (30) having a pattern (7) thereon,
 - b) means for positioning a foil (11) between the micro-engraved die (30) and the object (12), and
 - c) means for pressing the micro-engraved die (30) against the foil (11), 55

whereby the pattern (7) will be stamped on the foil (11) to obtain the "hologram-like" device (20), and whereby the "hologram-like" device (20) is fixed on the object (12).

16. The apparatus of claim 15, wherein the means a) comprises:
 - a1) means for coating one surface of a die (3) with photoresist,
 - a2) means for interposing a mask (1) with the pattern (7) between an UV light source (4) and the coated die (3),
 - a3) means for exposing the pattern on the mask (1) onto the coated die with the UV light, and
 - a4) means for engraving the exposed pattern (7) on the die (3) by an etching means.
17. The apparatus of claim 16, wherein the etching means are a reactive ion plasma etching means and/or a wet chemical etching means.
18. The apparatus of any one of the previous claims 15 to 17, wherein the means for pressing the micro-engraved die (30) against the foil (11) is hot stamping means.
19. The apparatus of any one of the previous claims 15 to 18, wherein the means for pressing the micro-engraved die (30) against the foil (11) are either a manual or an automatic means.
20. The apparatus of any one of the previous claims 15 to 19, wherein the micro-engraved die (30) is a wheel.
21. The apparatus of any one of the previous claims 15 to 20, wherein the micro-engraved die (30) is made of metal or silicon.
22. The apparatus of any one of the previous claims 15 to 21, wherein the foil (11) is a standard metallic foil.
23. The apparatus of any one of the previous claims 15 to 22, wherein the foil (11) is glued on the object (12).

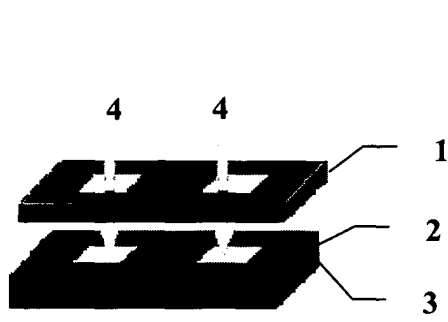


Fig. 1

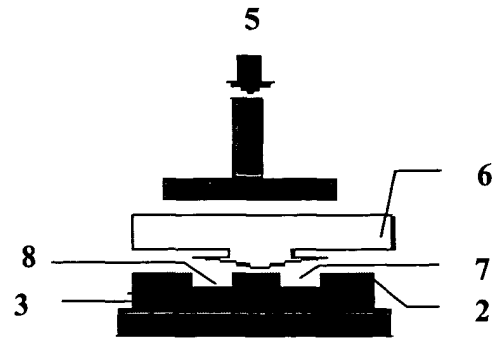


Fig. 2

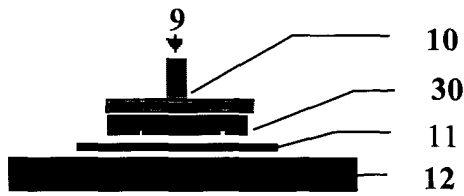


Fig. 3

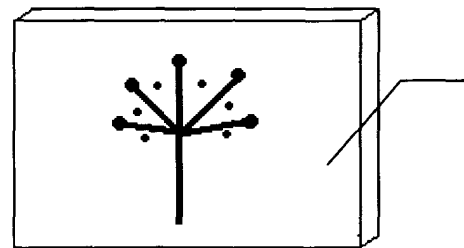
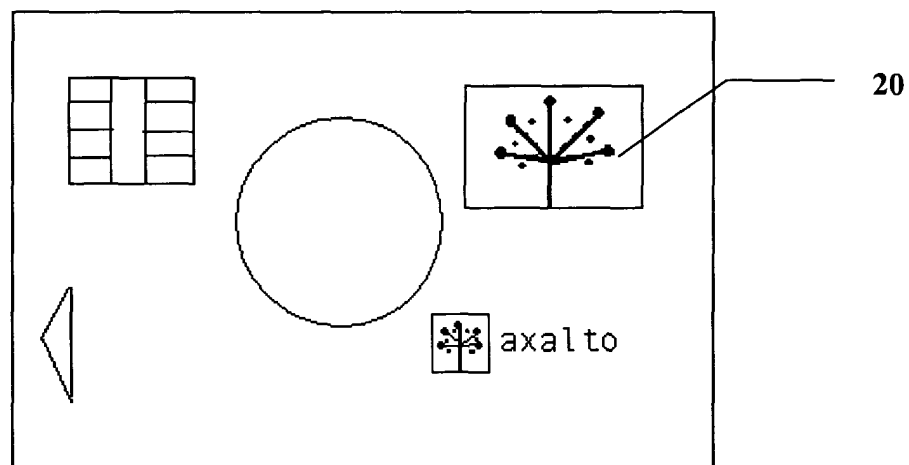


Fig. 4

Fig. 5





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EUROPEAN SEARCH REPORT

Application Number
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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