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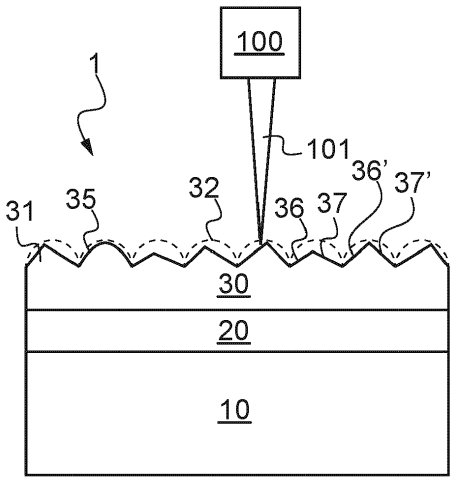
(71) Applicant: **IDEMIA France**
92400 Courbevoie (FR)

(72) Inventors:
- **SIARHEYEVA, Olga**
  92400 COURBEVOIE (FR)
- **DURIEZ, Christophe**
  92400 COURBEVOIE (FR)

(74) Representative: **Santarelli**
49, avenue des Champs-Elysées
75008 Paris (FR)

(54) **MANUFACTURING METHOD OF A SECURITY DOCUMENT, AND SECURITY DOCUMENT THUS OBTAINED**

(57) Manufacturing method of a security document (1), comprising a personalization step (E2) which comprises a reshaping step in which a surface (32) of the security document (1) is reshaped; and security document comprising a top layer (30) comprising at least two lenses (31, 38) for providing a viewing angle dependent image and/or color changing effect, in which at least corresponding flanks (36,36', 37,37') of the at least two lenses (31, 38) of the top layer (30) have different shapes.



E2

Fig.2

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Description

Technical field

[0001] The present invention relates to a manufacturing method of a security document.

[0002] It relates more specifically to a surface reshaping method to elaborate a security element in a document.

[0003] It also relates to a security document obtained by such method.

Background of the invention

[0004] An identity document shall comply with requirements of being easy to check and difficult to counterfeit.

[0005] Different ways to secure an ID document exist, like using security printing, holographic feature and so on.

[0006] For example, one way to secure a document is to implement the security feature at the latest stage of the production process of the document which is a personalization step of said document.

[0007] Some features have been developed using this methodology but they are only based on laser engraving through a lens pattern like CLI/MLI.

[0008] As a result, two types of information are obtained and which can be observed at a certain angle upon tilting the document.

[0009] A major weakness of this technology is that combinations of images, which can be seen through the lens, are very limited.

Summary of the invention

[0010] Accordingly, the invention provides a manufacturing method of a security document, the method comprising a personalization step characterised in that the personalization step comprises a reshaping step in which a surface of the security document is reshaped.

[0011] Thus, the invention deals with modifying the shape of the surface of the security document, which is considered as the external surface.

[0012] As the external surface's shape is modified, the incidence of a light ray is changed too.

[0013] According to one example embodiment, the security document comprises a lens layer which comprises several lenses (also called microlenses). A surface of the lens layer then forms at least part of the surface of the security document.

[0014] For example, at least one lens of the lens layer is reshaped during the reshaping step.

[0015] According to one example embodiment, the reshaping step comprises a formation step of at least one lens on the surface of the security document.

[0016] Thus, such lens is another lens. Such a lens can be added on a flat surface of the security document, or onto the lens pattern of a lens layer for example, for example between two adjacent lenses of the lens layer.

[0017] According to one example embodiment, a laser is used for reshaping the surface of the security document in the reshaping step.

[0018] The laser modifies the profile of the surface, or even of the lenses the case being such that at least one lens, or even each lens, has different slopes than another.

[0019] Thus, the surface of the document after the personalization step have different optical properties than the same surface before the personalization step.

[0020] The lenses may have different radius, so the path of one incident light ray is modified, in comparison with the original surface shape.

[0021] In case of addition of another lens, the laser modifies the surface so that it creates a bulge which forms a lens.

[0022] If the document comprises a lens layer, adding at least another lens also modifies the lens pattern of the lens layer, i.e. the lens layer surface.

[0023] For example, such lens is added between two lenses of the lens layer.

[0024] The reshaped surface, by adding a lens and/or modifying at least one lens of the lens layer, allows to obtain a designed color shift feature, or a designed metallic shift feature, or a secondary portrait, or a combination thereof, for examples.

[0025] For example, the lens layer may initially comprise semi-cylindrical lenses, or triangle lenses, pyramidal lens etc...

[0026] According to one example embodiment, corresponding flanks of at least two lenses of the lens layer are reshaped in the reshaping step.

[0027] According to one example embodiment, two flanks of one lens of the lens layer are reshaped in the reshaping step.

[0028] For example, the lens profile is reshaped such that one lens has different slopes at each flank.

[0029] According to one example embodiment, the laser is a CO_2 laser, which is implemented for reshaping the surface of the document, for example the surface of the lens layer if the document comprises one.

[0030] For example, the CO_2 laser is configured to emit a laser beam at a wavelength comprised between 9 000 nm and 11 000 nm, preferably equal to 10 600 nm.

[0031] For example, the external surface belongs to a top layer which is integrated in the card body during a lamination step, and then, this top layer is reshaped during the personalization step.

[0032] According to such example embodiment, the method thus comprises a formation step of a card body comprising an assembly step of at least one substrate and a top layer, and a lamination step of at least the substrate and the top layer.

[0033] For example, the top layer comprises the lens layer, which is so integrated in the card body during a lamination step, and then, the obtained lens pattern is reshaped during the personalization step.

[0034] Thus, the method comprises a formation step of a card body comprising an assembly step of at least

the substrate and the lens layer, and a lamination step of the card body including at least the substrate and the lens layer.

[0035] According to one example embodiment, the formation step of the card body comprises an assembly step of a coating layer positioned under the top layer, for example between the substrate and the top layer.

[0036] Then, the top layer is preferably reshaped in such a way that a coating layer is located within the focal plane of the lenses, added or modified, under a certain observation angle.

[0037] The focal plane is set in a vertical distance from the coating layer.

[0038] The vertical distance can be determined by radius of curvature and height at the vertex of the lens, added or modified.

[0039] According to one example embodiment, the coating layer comprises a pigmented coating.

[0040] According to one example embodiment, the method comprises an engraving step in which the coating layer is engraved through the top layer.

[0041] For example, personal information is engraved. Such personal information can comprise, name, numbers, logos, etc...

[0042] According to one example embodiment, a YAG laser is implemented for engraving the coating layer through the top layer.

[0043] For example, the YAG laser is configured to emit a laser beam at a wavelength equal to 1064 nm.

[0044] According to a preferred embodiment, the steps are sequenced as follows: assembly step, then lamination step, then reshaping step.

[0045] According to the invention, it is thus possible to provide a security document which is personalized and very difficult to reproduce.

[0046] It is therefore very difficult to infringe.

[0047] The invention also provides a security document comprising a top layer comprising at least two lenses for providing a viewing angle dependent image and/or color changing effect, characterized in that corresponding flanks of the at least two lenses of the top layer have different shapes.

[0048] In such a document, the profile of the top layer has been modified, by either adding one lens or modifying one lens of a lens layer forming the top layer, such that at least two lenses among the lenses, or even each lens, have different slopes, or even different radius.

[0049] Such a document is thus personalized.

[0050] Here, the shape of a lens deals with the slope and/or the radius of a flank of a lens, which may be either a height (thickness) or a width; the height and the width may be identical in case of a rounded shaped, or different, for example if the lens is flatter.

[0051] The slope can be defined by an angle relative to a substrate for example.

[0052] Accordingly, a path of an incident light ray is modified.

[0053] For example, such document is obtained by a method as described above.

[0054] Thus, at least two different flanks focus the incident light at different depth levels within the document.

[0055] According to one preferred embodiment, the top layer comprises a lens layer.

[0056] For example, two lenses of the lens layer have parallel geometrical axis.

[0057] For example, the lenses of the lens layer are linear lenticules, having same orientations, i.e. with their geometrical axis parallel to each other.

[0058] For example, the lens layer comprises an array of lenticules.

[0059] For example, one lens of the document has two flanks with different shapes.

[0060] In other word, it is not symmetrical.

[0061] Further, one flank may have different curvature radii; therefore, it modulates the incident light at different focal distances.

[0062] In such case, a multifocal lens enables to focus incident light to several focal points along the optical axis.

[0063] For example, two flanks of one lens have different shapes from the corresponding flanks of another lens of the document.

[0064] According to one example embodiment, the document comprises a card body comprising a substrate, laminated with the top layer.

[0065] For example, the substrate is made of plastic material, such as polycarbonate, or of any material which can be fused, for example during a lamination step.

[0066] For example, the top layer and the substrate have a thickness of at least 500 μm (micrometers), and preferably at most 680 μm.

[0067] According to one example embodiment, the card body comprises a coating layer.

[0068] For example, the coating layer is positioned under the top layer, for example between the substrate and the top layer.

[0069] The coating layer may optionally comprise a printed area.

[0070] For example, the coating layer comprises at least two patterns, each of the two patterns being visible through the top layer according to one respective viewing angle.

[0071] For example, the at least two patterns comprise interlaced images so that they can be see through a lens layer.

[0072] For example, at least one pattern of the coating layer comprises personal information.

[0073] According to one example embodiment, the lenses of the top layer overlie and focus the incident light on personal information laser engraved in the coating layer.

[0074] For example, the coating layer is a laser sensitive layer.

[0075] Thus, the laser sensitive layer is arranged such that personal information can be viewed through the lenses.

[0076] For example, the coating layer comprises at

least one metal pigment ink, and/or Optical Variable Material (OVM), and/or other coatings containing interference pigments.

[0077] The observed color(s) of metal ink depend on pigments type, to mention copper (Cu), silver (Ag), or gold (Au) etc.

[0078] An OVM coating acts on the duality of the observation of a color that shifts depending on the clarity or darkness of the background.

[0079] Besides, OVM inks show a very strong fluorescence under UV light.

[0080] Depending on observation angle, one can observe either laser engraved personal information at one depth or a pigmented coating at a different depth level for example.

[0081] According to one example embodiment, the top layer, or even more particularly the lens layer, is made of a transparent material, for example of a plastic material too.

[0082] Thus, the coating layer can be viewed through the top layer.

[0083] For example, each lens focuses or expands impinging light in only one direction at its focal distance; each lens brings light to a line focus.

[0084] For example, the line focus is formed at 90° to the lens power meridian that forms it.

[0085] According to one example embodiment, the flanks of one lens have a focal length of at least 10 μm, preferably at least 100 μm, more preferably at least 250 μm.

[0086] In one embodiment, the lenses of the lens layer have a pitch in the range of between 10 μm and 300 μm.

[0087] The pitch is defined here as centre-to-centre distance between adjacent lenses, for example for parallel cylindrical lenses.

[0088] A space between two adjacent lenses of the lens layer is preferably comprised between 0 μm (which means those two lenses are appended) and 300 μm.

[0089] If another lens is added between two adjacent lenses of the lens layer, the space is preferably comprised between 10 μm and 300 μm, and is preferably about 150 μm.

[0090] If at least one lens of the lens layer is reshaped, without addition of another lens aside it, the space between this lens and an adjacent lens is preferably comprised between 0 μm and 10 μm.

[0091] In one embodiment, one lens of the lens layer has a thickness in the range of between 100 μm and 300 μm.

[0092] An added lens has, for example, a thickness in the range of between 1 μm and 30 μm.

[0093] Such a security document comprises a multilayered body structure.

[0094] For example, each of the layers in the card body is comprised of plastic material, such as polycarbonate.

[0095] Different plastics can be used given that they can be fused together, for example during a lamination step.

[0096] For example, the security document has a width and a length dimensions typically in accordance with those of so called ID-1, ID-2 or ID-3 cards, as defined in the ISO/IEC 7810 specification of 2003.

[0097] For example, the security document can be a passport, an ID card, a passport hinge, a datapage (for example in a passport), etc...

Brief description of the drawings

[0098] Additional features and advantages of the present invention are described in, and will be apparent from, the description of the presently preferred embodiments which are set out below with reference to the drawings in which:

Figure 1 diagrammatically shows a side cut of a security document according to one embodiment of the invention, before a personalization step;

Figure 2 diagrammatically shows a side cut of the security document of figure 1 which has been personalized;

Figure 3 diagrammatically shows a side cut of a security document according to an example embodiment of the invention;

Figure 4 diagrammatically shows a side cut of the security document of figure 3 in which another lens has been added; and

Figure 5 diagrammatically shows a top view of a security document according to one embodiment of the invention.

Detailed description of the invention

[0099] Figure 1 show a side cut of a security document 1 according to one example embodiment, which is not personalized yet according to the invention.

[0100] The security document 1 comprises here a multilayered structure.

[0101] It comprises a substrate 10, a coating layer 20 and a lens layer 30 as a top layer.

[0102] The lens layer 30 comprises several lenses 31.

[0103] The lens layer 30 is bonded by an external surface 32 which defines the lenses 31.

[0104] Such lens layer 30 provides a viewing angle dependent image and color changing effect.

[0105] Such lens layer is generally made of a transparent material.

[0106] A transparent material here refers to a material which transmit some light either in the visible or in the non-visible spectrum.

[0107] In the illustrated example embodiment, the lenses 31 are linear lenticules which axis are all parallel one another, i.e. which extend along one same direction, which have same orientation.

[0108] Besides, all the lenses 31 are here semi-cylindrical and have same dimensions, in eight (thickness) and width, so the pitch are regular.

[0109] The lens 31 here have, by definition, two flanks 33, 34 which each correspond to a quarter circle in the illustrated embodiment.

[0110] Then, both flanks 33, 34 of one lens 31 are here identical to both flanks 33', 34' of another lens 31.

[0111] And by definition, one flank 33 of one lens 31 corresponds to flank 33' of another lens 31. Same applies to corresponding flanks 34 and 34'.

[0112] The lens layer 30 is here laminated on a coating layer 20 usually by means of a lamination plate comprising an imprint of the lenses.

[0113] The coating layer 20 is advantageously a laser sensitive layer.

[0114] As a consequence, it is possible to engrave information, such as personal information, in the coating layer, and such information can be viewed through the lens layer.

[0115] For example, the coating layer comprises at least one metal pigment ink, and/or Optical Variable Material (OVM), and/or other coatings containing interference pigments.

[0116] The observed color(s) of metal ink depend on pigments type, to mention copper (Cu), silver (Ag), or gold (Au) etc.

[0117] An OVM coating acts on the duality of the observation of a color that shifts depending on the clarity or darkness of the background.

[0118] Besides, OVM inks show a very strong fluorescence under UV light.

[0119] Furthermore, the coating layer 20 is here laminated on a substrate 10.

[0120] Accordingly, the coating layer 20 is between the substrate 10 and the lens layer 30.

[0121] The substrate is advantageously made of polycarbonate.

[0122] For example, within a manufacturing method of a security document, a security document as described above is realized by lamination of the substrate 10, the coating layer 20 and the lens layer 30.

[0123] This is illustrated as step E1 in figure 1.

[0124] At this stage, the document is not personalized yet, in the meaning of the invention.

[0125] Then, the method, according to the invention, provides a personalization step E2, illustrated in figure 2.

[0126] The personalization step E2 comprises a reshaping step in which at least one lens 31 is reshaped.

[0127] If only one lens 31 is reshaped, which means that at least one flank 33, 34 of one lens 31 is reshaped, then the lens layer 30 comprises at least two lenses 31 with corresponding flanks which are different, for example flanks 36 and 36', resulting from flanks 33 and 33', or flanks 37 and 37', resulting from flanks 34 and 34'.

[0128] Thus, at least corresponding flanks 36 and 36', or corresponding flanks 37 and 37', here have different slopes, and so the corresponding lenses also have different radius.

[0129] Thus, in step E2, the external surface 32 is reshaped to modified surface 35.

[0130] In figure 2, by way of an example, both flanks 36, 37 of each lens 31 are reshaped, compared to initial flanks 33, 34.

[0131] However, at least one of the flank of the lenses may remain unchanged.

[0132] To perform this reshaping, a laser 100 can be used.

[0133] The laser 100 is configured to emit a laser beam 101 at a wavelength configured to modify surface 32, for example to sublimate the material of the lens layer 30.

[0134] Preferably, the laser 100 is a CO_2 laser.

[0135] In another step E3, not shown here, the coating layer can then be engraved, for example by means of the YAG laser, through the lens layer 30, preferably once it has been modified.

[0136] Figures 3 and 4 illustrate another embodiment of the method, according to the invention.

[0137] In figure 3, the document comprises a top layer comprising a lens layer 30 too, but as another embodiment not illustrated, the top layer may also be a flat layer.

[0138] In figure 4, another lenses 38 have been added between two adjacent lenses 31 of the lens layer 30.

[0139] Therefore, here, the personalization step E2 comprises a reshaping step in which at least one lens 38 is added.

[0140] Accordingly, the original external surface 32 of figure 3 becomes the modified surface 35 in figure 4.

[0141] However, at least one lens 31 can also be modified according to the invention, before, during, or after addition of another lens 38.

[0142] Figure 5 finally illustrates a top view of a part of the external surface of a security document according to the invention.

[0143] It shows that in a document comprising lenses 31 of a lens layer, at least some of which being possibly modified during a personalization step according to the invention or not, the document may also comprise one or more additional lenses 38, added between two adjacent lenses 31.

[0144] This also shows that two adjacent lenses 31 are separated from each other by a space e; such space e is for example comprised between 10 μm and 300 μm, and is preferably about 150 μm or more, in particular if more than one additional lens might be formed here between.

[0145] Besides, the various lenses 38 which have been added can have complete different shapes, as illustrated, which further personalize the document.

[0146] Then, according to the illustrated embodiment, one added lens 38 is preferably formed in contact with one of the two adjacent lenses 31, and optionally (as illustrated) at a distance from the other of the two adjacent lenses 31.

[0147] Owing to the invention, it is thus possible to provide a security document which is very difficult to reproduce, therefore very difficult to infringe.

Claims

1. A manufacturing method of a security document (1), the method comprising a personalization step (E2) **characterised in that** the personalization step (E2) comprises a reshaping step in which a surface (32) of the security document is (1) reshaped.

2. The manufacturing method according to claim 1, in which the security document (1) comprises a lens layer (30) which comprises several lenses (31), a surface (32) of the lens layer forming at least part of the surface of the security document (1), and at least one lens (31) of the lens layer (30) is reshaped during the reshaping step.

3. The manufacturing method according to any of claims 1 or 2, in which the reshaping step comprises a formation step of at least one lens (38) on the surface of the security document (1).

4. The manufacturing method according to claim 2, in which corresponding flanks (33,33', 34,34') of at least two lenses (31) of the lens layer (30) are reshaped in the reshaping step.

5. The manufacturing method according to anyone of claims 2 or 4, in which two flanks (33, 34) of one lens (31) of the lens layer (30) are reshaped in the reshaping step.

6. The manufacturing method according to anyone of claims 1 to 5, in which a laser (100) is used for reshaping the surface (32) of the security document (1) in the reshaping step.

7. The manufacturing method according to claim 6, in which the laser (100) is a CO_2 laser, and the CO_2 laser is configured to emit a laser beam (101) at a wavelength comprised between 9 000 nm and 11 000 nm, preferably equal to 10 600 nm.

8. The manufacturing method according to anyone of claims 1 to 7, comprising a formation step of a card body comprising an assembly step of at least one substrate (10) and a top layer (30), and a lamination step (E1) of at least the substrate (10) and the top layer (30).

9. The manufacturing method according to claim 8, in which the formation step of the card body comprises an assembly step of a coating layer (20) positioned between the substrate (10) and the top layer (30).

10. The manufacturing method according to claim 9, comprising an engraving step (E3) in which the coating layer (20) is engraved through the top layer (30).

11. A security document comprising a top layer (30) comprising at least two lenses (31, 38) for providing a viewing angle dependent image and/or color changing effect, **characterized in that** corresponding flanks (36,36', 37,37') of the at least two lenses (31, 38) of the top layer (30) have different shapes.

12. The security document according to claim 11, in which two flanks (36,37) of one lens (31) have different shapes from the corresponding flanks (36',37') of another lens of the document.

13. The security document according to anyone of claims 11 or 12, comprising a card body comprising a substrate (10), and a coating layer (20) positioned between the substrate (10) and the top layer (30), the coating layer (20) comprising at least two patterns, each of the two patterns being visible through the top layer (30) according to one respective viewing angle.

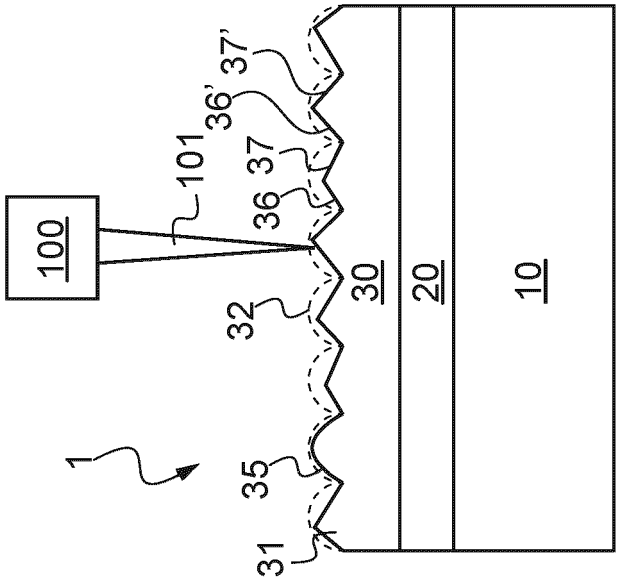
100
101
36'
37'
37
36
32
30
20
10
1
35
31
E2

Fig.2

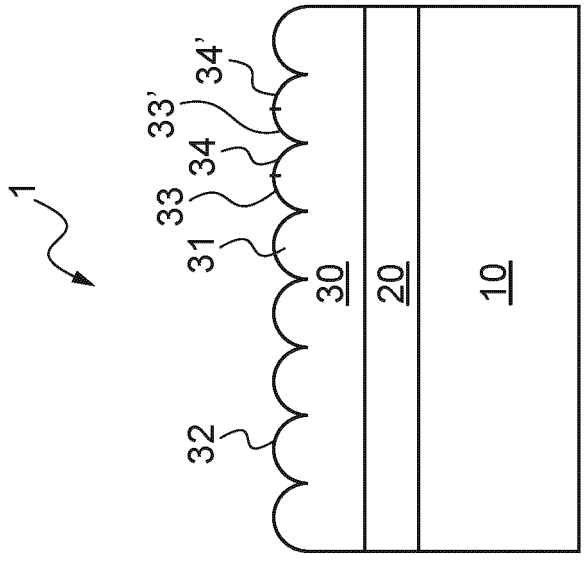
1
33'
34'
34
33
31
32
30
20
10
E1

Fig.1

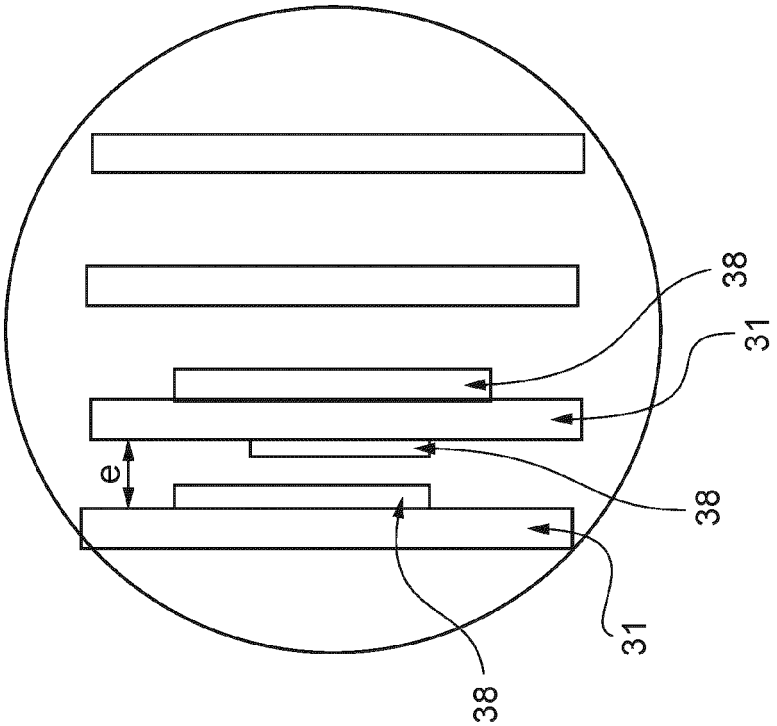

Fig.5

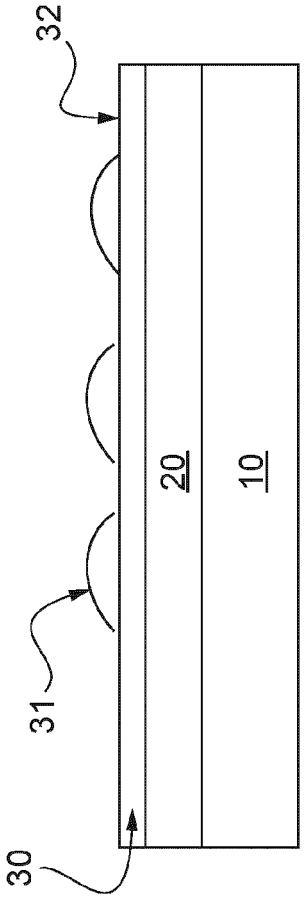

Fig.3

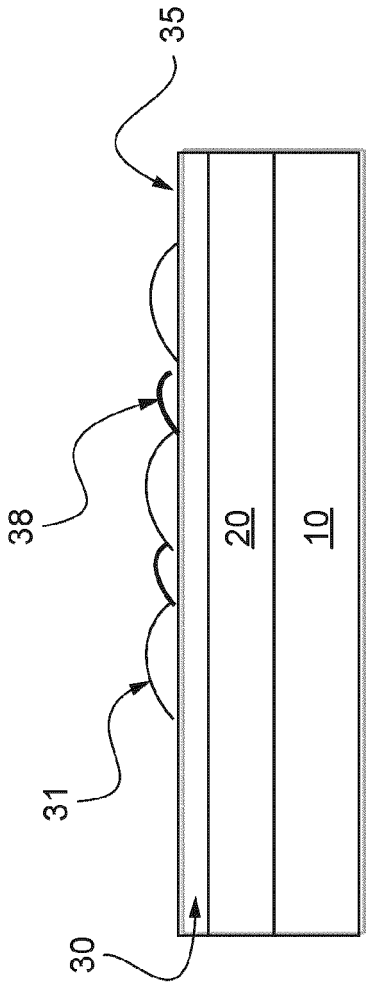

Fig.4

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EUROPEAN SEARCH REPORT

Application Number
EP 19 30 6769

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2018/142127 A1 (DE LA RUE INT LTD [GB]) 9 August 2018 (2018-08-09) * page 2, line 8 - line 16 * * page 4, line 4 * * page 7, line 21 - page 8, line 13 * * page 10, line 32 - page 12, line 12 *	1,6-8,10	INV. B42D25/425 B42D25/324 B42D25/351 B42D25/41 B42D25/45
X	WO 2013/030782 A1 (ARJOWIGGINS SECURITY [FR]; DOUBLET PIERRE [FR]; CAMUS MICHEL [FR]) 7 March 2013 (2013-03-07) * page 7, line 13 - page 8, line 19; figures 1-4 *	1-10	
X	EP 2 875 963 A1 (BUNDESDRUCKEREI GMBH [DE]) 27 May 2015 (2015-05-27) * paragraphs [0013], [0014]; figures 1-2 *	1-5	
X	EP 2 927 881 A1 (GEMALTO SA [FR]) 7 October 2015 (2015-10-07) * paragraphs [0025], [0026]; figure 10 *	11,12	
			TECHNICAL FIELDS SEARCHED (IPC) B42D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	11 May 2020	Achermann, Didier

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 30 6769

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82