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(54) **SECURITY ELEMENT FOR A DATA CARRIER, DATA CARRIER AND METHOD OF
PRODUCTION OF THE SECURITY ELEMENT AND USE OF THE SECURITY ELEMENT FOR
PRODUCTION OF A DATA CARRIER**

(57) The present invention relates to a security element for a data carrier comprising at least one layer, completely or partially transparent, with a thickness of at least 0.03 mm, wherein the at least one layer of the security element is at least partially susceptible to being marked by printing or laser marking, characterised in that it comprises:

- a security pattern (301), wherein the security pattern (301) is located in such a way that the area of the security pattern (301) at least partially overlaps with the transparent area of the security element, so that the security pattern (301) is at least partially visible from both sides of the security element, wherein the security pattern (301) comprises at least two security markings (A, B), wherein each security marking (A, B) consists of bands arranged in intervals so that the corresponding edges of the bands being a part of a given security marking are at equal distance (P) from each other, and each band being a part of one security marking (301) is adjacent on each side to a band being a part of a different security marking; and/or
- a revealing element (401), wherein the location of the revealing element (401) at least partially overlaps with the transparent area of the security element, so that the

revealing element is at least partially visible from both sides of the security element, wherein the revealing element (401) comprises a set of parallel opaque lines (411) and transparent lines (412) acting as gaps located between the opaque lines (411), wherein the period (R) of the revealing element (401) is the sum of the width (L) of an opaque line (411) and the width (G) of a transparent line (412); wherein the security pattern (301) and/or the revealing element (401) are applied by means of printing or laser marking, wherein above or below the applied security pattern (301) and/or the revealing element (401), at a distance of at least 0.03 mm, within the same layer or in a different layer of the security element, there is another surface susceptible to being marked by printing or laser marking, wherein the security element, at least in the transparent area, does not comprise reflective material.

The invention also relates to a data carrier comprising the security element according to the invention, a method of manufacturing the security element according to the invention and use of the security element according to the invention to manufacture a data carrier.

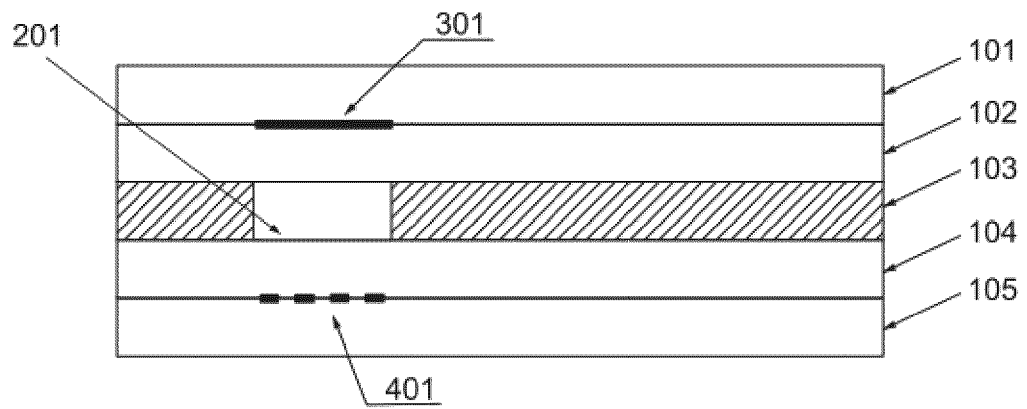


Fig. 1

Description

Field of the Invention

[0001] The present invention relates to a security element for a data carrier comprising at least one completely or partially transparent layer which is at least partially susceptible to marking, for example by means of printing or laser marking. The present invention also relates to a data carrier including such a security element and to a method of manufacturing of such a security element and to a use of the security element to manufacture a data carrier that can be personalised.

Prior Art

[0002] EP1827868 describes a data carrier with two layers having metallic coatings that overlap at least partially, wherein both metallic coatings comprise perforated markings, with the perforations in both layers with metallic coatings being shifted relative to each other, making them visible and contrasting with metallic coatings when viewed at a certain angle.

[0003] EP2766776 describes the markings on the data carrier in the form of two overlapping patterns, with one pattern affecting the visibility of the other when observed at different angles.

[0004] DE102004007379 discloses a security element, comprising a layer with moire band pattern and a layer with a revealing element of a moire band pattern, wherein observing both layers in transmitted light allows the marking to be seen. It is also possible to use two different revealing layers, which allow two different markings to be seen when observing the security element in reflected light.

[0005] EP2384898 reveals a security element, comprising a layer comprising marking and a layer comprising a revealing element, the marking being applied in the form of a grid of lines forming a pattern and lines concealing the pattern. The revealing layer allows to observe the pattern from a certain angle by shading the lines concealing the pattern.

[0006] EP0655032 describes a copy-protected document that comprises a layer with marking and a mask that conceals the marking in the form of opaque lines placed over the bands of breaks in the marking. When observing the document protected in this manner perpendicularly to its plane (or when copying it), the pattern is not visible, but becomes observable when viewed at an angle, through gaps between the opaque lines of the mask.

[0007] EP1089883 describes a document comprising two markings in different layers of the document. The markings are created by partially overlapping bands, which makes the image different depending on the angle of view of the document.

[0008] EP1845496 describes a security element in the form of a moire pattern, the feature including an additional

layer comprising a filter. The marking hidden in the moire pattern can be observed through the filter consisting of opaque and transparent lines, with two different markings becoming visible when the angle of observation changes.

5 Similar solutions are also described in the international application WO2004036507, which discloses a data carrier with marking being made visible by means of a revealing element comprising a series of stripes. One example involves an arrangement of several phase-shifted markings in the form of alternating bands. Observation 10 through the revealing element in the form of pattern of lines at different angles allows for observation of different markings.

[0009] EP2123470 describes a data carrier that uses 15 a revealing layer in the form of a linear filter, which in turn allows two different markings to be observed depending on tilt angle of the carrier relative to the direction of observation. The application refers in particular to a teaching where the revealing layer is underneath the layer comprising the marking.

[0010] EP2684178 describes a data carrier with a layer 20 comprising a sub-pixel structure with basic additive colours (red, green, blue) located between a laser-markable top layer and a transparent body, comprising a personalised, colour laser image. This image is obtained by producing shades of grey above each of the sub-pixels mentioned, obtained using a laser beam. A personalised, colourful image can be observed when appropriately back-lighting the carrier.

[0011] WO2017100838 reveals, among other things, 25 a data carrier comprising a first periodical arrangement of image elements located on a first surface and a first periodical arrangement of revealing elements on a second surface. The two mentioned element arrangements extend in different directions, giving the effect of optical 30 variation when the carrier is tilted or the angle of observation changes. One of the advantages of such arrangements is the possibility of using such element arrangements on a transparent substrate or using a transparent window in the data carrier.

[0012] EP2114690 describes a data carrier with a 35 transparent opening, wherein markings can be applied. Above the markings there is a developer material, e.g. UV-excited fluorescent paint, and under the markings there is a filtering material, e.g. a UV filter. Under certain lighting conditions, the developer material and filtering material change the appearance of these markings depending on the side of the carrier from which it is observed.

[0013] EP2872340 describes a data carrier on a preferably transparent substrate that comprises a revealing 40 pattern of thin strips of metal with a layer of paint and a marking element comprising a number of interlaced images. The revealing pattern allows for the observation of individual images depending on the angle of observation. It is possible to observe the data carrier from both sides.

[0014] The present invention relates to a security element for a data carrier comprising at least one layer, com-

pletely or partially transparent, with a thickness of at least 0.03 mm, wherein at least one layer of the security element is at least partially susceptible to being marked by printing or laser marking, wherein the security element comprises:

- a security pattern, wherein the security pattern is placed on a surface of a layer of the security element, in such a way that the area of the security pattern at least partially overlaps with the transparent area of the security element, so that the security pattern is at least partially visible from both sides of the security element, wherein the security pattern comprises at least two security markings, each security marking constituted of bands arranged in intervals so that the corresponding edges of the bands being a part of a given security marking are at equal distance from each other and each band being a part of one security marking is adjacent on each side to a band being a part of a different security marking; and/or
- a revealing element, wherein the location of the revealing element at least partially overlaps with the transparent area of the security element, so that the revealing element is at least partially visible from both sides of the security element,

wherein the revealing element comprises a set of parallel opaque lines and transparent lines acting as gaps located between the opaque lines, the period of the revealing element being the sum of the width of an opaque line and the width of a transparent line

wherein the security pattern and/or the revealing element are applied by means of printing or laser marking, wherein above or below the applied security pattern and/or the revealing element, at a distance of at least 0.03 mm, within the same layer or in a different layer of the security element, there is another surface susceptible to being marked by printing or laser marking, wherein the security element does not contain reflective material, at least within the transparent area.

[0015] The opaque lines in the revealing element should preferably be able to obscure the security pattern as much as possible so that each marking of the pattern is clearly visible from different angles. The revealing element can be printed, e.g. in the form of dark, preferably black, or optionally dark blue lines or, in particular, preferably laser engraved. In practice, the maximum acceptable transmittance for opaque lines of the revealing element is 25% (which means that a maximum of 25% of incident radiation in the visible range is transmitted).

[0016] The term "reflecting material" herein means a material which forms a light reflecting or reflective background or layer, such as e.g. a metallic layer.

[0017] The security element according to the invention hence provides the possibility to personalise the data car-

rier by later application of a security pattern or a revealing element accordingly. Due to the fact that the security pattern and the revealing element can be applied at different stages of the production of a data carrier, e.g. a document, a significant facilitation of the technological process is possible. For example, the security pattern can be printed before the production (lamination) of a blank data carrier, e.g. a document, and the revealing element can be applied later, at the personalisation stage. It is possible to precisely match both the parameters of the revealing element as well as its position in relation to the security pattern at the final stage (personalisation), which is undoubtedly an advantage of this solution, as it allows to avoid matching errors at the stage of data carrier production. Thus, the subject matter of the invention provides an advantage in the form of a decrease in the level of defects and, as a result, a reduction in the number of shortages, which directly results in lower total production costs.

[0018] It should be noted here that the security pattern comprises alternately arranged bands which are part of individual security markings. In one example, the security pattern comprises two security markings, e.g. two characters such as letters, shapes or numbers, etc., wherein during observation of the security element from one angle, one marking will be visible (e.g. the first letter) and during observation from another angle the other marking will be visible (e.g. the second letter). Alternatively, one of the markings may comprise a character (e.g. a letter) and the other one may comprise e.g. a uniform background. In this arrangement, when the security element is observed from one angle, one marking will be visible (e.g. the letter), and when observed from another angle, the other marking will be visible (e.g. uniform background, no visible letter). In alternative embodiments, there may be more than two markings.

[0019] Thus, a ready (e.g. laminated) security element according to this invention can, for example, comprise only a security pattern as defined above. Alternatively, it may, for example, comprise only a revealing element as defined above. The further implementation of a revealing element or security pattern, as appropriate, may take place later, e.g. at the personalisation stage. The term "within the same layer of the security element" means that the elements indicated (i.e., for example, the security pattern and the revealing element, or one of the above and another surface susceptible to being marked by printing or laser marking) are within the same layer of the security element and must be at a distance of at least 0.03 mm thickness of this layer from one another, one above the other, so that in practice, these elements are on two opposite sides of this layer.

[0020] The term "in a different layer of the security element" means that the elements indicated (e.g., the security pattern and the revealing element, or one of the above and another surface susceptible to being marked by printing or laser marking) are located in different layers of the security element. In an embodiment where a se-

curity element is incorporated in a data carrier that has more than one sheet or page (such as e.g. a passport document), these different layers may appear on different pages or sheets of the data carrier. It is important that their arrangement allows for combining all the mentioned parts of the security element, including the transparent areas, so that they can be viewed from both sides of the thus combined security element.

[0021] In an embodiment, the surface susceptible to being marked by printing or laser marking is at a distance of 0.30 - 0.70 mm above or below the applied security pattern and/or the revealing element.

[0022] The surface susceptible to being marked by printing or laser marking may also be at a distance of e.g. 0.03 - 1.00 mm above or below the applied security pattern and/or the revealing element.

[0023] In a preferred embodiment, the present invention relates to a security element for a data carrier comprising at least one inner layer, at least semi-transparent or opaque, and on both sides of the inner layer at least one outer layer, wherein an opening is made in the inner layer, optionally filled with a transparent filling, with the outer layers of the security element being transparent at least in the area of the opening and susceptible to marking, preferably by means of printing or laser marking, wherein none of the outer layers in the area of the opening comprises reflective material, wherein the safety component comprises:

- a security pattern, wherein the security pattern is placed on the surface of at least one layer of the carrier, in such a way that the area of the security pattern at least partially overlaps with the area of the opening present in the inner layer, so that the security pattern is at least partially visible from both sides of the security element,

wherein the security pattern comprises at least two security markings, each security marking constituted of bands arranged in intervals so that the corresponding edges of the bands being a part of a given security marking are at equal distance from each other and each band being a part of one security marking is adjacent on each side to a band being a part of a different security marking; and/or

- a revealing element, wherein the location of the revealing element at least partially overlaps with the area of the opening in the inner layer, so that the revealing element is at least partially visible from both sides of the security element,

wherein the revealing element comprises a set of parallel opaque lines and transparent lines acting as gaps located between the opaque lines, the period of the revealing element being the sum of the width of an opaque line and the width of a transparent line, wherein the security pattern and/or the revealing element

are applied by means of printing or laser marking, wherein above or below the applied security pattern and/or the revealing element, within the area of the opening, at a distance of at least 0.03 mm, within the same layer or in a different layer of the security element, there is another surface susceptible to being marked by printing or laser marking.

In an embodiment, the surface susceptible to being marked by printing or laser marking is 0.30 - 0.70 mm above or below the applied security pattern and/or the revealing element.

[0024] The surface susceptible to being marked by printing or laser marking may also be at a distance of e.g. 0.03 - 1.00 mm above or below the applied security pattern and/or the revealing element.

[0025] In an embodiment, the area of the revealing element and/or of the security pattern overlap entirely with the transparent area (or the opening area, in the embodiment with the opening made in the inner layer). In another embodiment, the transparent area (or the opening, in the alternative embodiment with the opening made in the inner layer) corresponds to the size and position of the area, wherein the revealing element and/or the security pattern is located.

[0026] In the embodiment of the security element, it comprises both the security pattern and the revealing element, wherein the revealing element is located below or above the security pattern, at a distance of at least 0.03 mm, and the area of the revealing element at least partially overlaps with the area of the security pattern, the period of the revealing element, which is the sum of the width of an opaque line and the width of a transparent line, being equal to the distance between the corresponding edges of the bands of each security marking in the security pattern.

[0027] In a preferred embodiment of the security element, the bands of the security markings of the security pattern are substantially parallel with regard to the lines of the revealing element, wherein the tilt of the bands of the security markings of the security pattern with regard to the lines of the revealing element is less than $\pm 5^\circ$.

[0028] In a preferred embodiment of the security element, the security pattern comprises more than two security markings.

[0029] The security element according to the invention can be observed from both sides, due to the transparent area (or, for example, the opening) and it is not necessary to use any reflective material, and the markings can be observed in transmitted light. The optical effect obtained clearly differs from solutions from the state of the art, and at the same time the security element is relatively simple to produce, without the need for using metallic elements, special paint, perforation in markings, etc.

[0030] In an embodiment, both in variants where the security element only comprises the security pattern and in variants where both the security pattern and the revealing element are present, the security pattern can be applied by printing, and the security markings it compris-

es are printed with paint in different colours. In one embodiment, each security marking may be in the form of an image (e.g. a letter or a symbol), and each security marking may have a different colour.

[0031] In an alternative embodiment, each security marking is in the form of uniform bands, with each security marking having a different colour. In such a solution, the security pattern is hence in the form of an arrangement of bands in alternate colours.

[0032] In a further embodiment, both in variants where the security pattern comprises only a revealing element and in variants where both the security pattern and the revealing element are present, the revealing element can be applied by laser engraving. In an embodiment, the revealing element may be in the form of alternating transparent and opaque bands, as in the preceding embodiments, but in addition, there may also be a transparent marking within it. In such a variant, the security pattern, also present in the security element, may take the form of an arrangement of bands in alternate colours (in which each security image consists of bands in a colour different than other security images). As a result of the mutual matching of the security pattern and the revealing element, a smooth change of colour is then observed in the finished security element, depending on the angle of observation, resembling optical phenomena known from holograms and optically variable inks. In the presence of a transparent marking within the revealing element, the different colour bands present in the security element provide a changing background for the marking. In this variant, the revealing element can also be individualised, i.e. it can be different for each security element/data carrier.

[0033] The present invention relates also to a data carrier comprising the security element according to the invention.

[0034] In an embodiment, the data carrier comprises a security element which comprises a security pattern and a revealing element as defined above, with both the security pattern and the revealing element being applied on both sides of the same layer or on different layers that are permanently attached to each other (e.g., by lamination). In an alternative embodiment, the data carrier comprises more than one sheet or page (for example, the data carrier is a multi-page or multi-sheet document, such as a passport), wherein the security element in that data carrier comprises a security pattern applied in a layer being a part of one sheet of the data carrier and the revealing element is applied in an area, which is at least partially transparent in a layer being a part of another sheet of the data carrier (e.g. another page of a document, such as a passport), wherein the security pattern and the revealing element can be folded together so that their areas overlap.

[0035] Alternatively, a data carrier in the form of a multi-page or multi-sheet document (such as a passport) may only comprise a security pattern or only a revealing element applied in a layer being a part of one sheet of the

data carrier, and it can additionally comprise an area comprising a surface susceptible to being marked by printing or laser marking, in an at least partially transparent area of another sheet of the data carrier, so that the data carrier can be further personalised by subsequent application in the latter area comprising the surface susceptible to marking, of a revealing element or a security pattern, accordingly, so that after personalisation the security pattern and the revealing element can be folded together so that their areas overlap.

[0036] The present invention relates further to a method of manufacturing the security element according to the invention, the method including the following steps:

a) providing at least one layer of the security element, the at least one layer being completely or partially transparent, and if more than one layer is present, then each layer being completely or partially transparent, so that the transparent areas of individual layers overlap at least partially;

b) applying a security pattern and/or a revealing element so that it overlaps at least partially with the transparent area,

wherein the security pattern comprises at least two security markings, each security marking constituted of bands arranged in intervals so that the corresponding edges of the bands being a part of a given security marking are at equal distance from each other and each band being a part of one security marking is adjacent on each side to a band being a part of a different security marking;

wherein the revealing element comprises a set of parallel opaque lines and transparent lines acting as gaps located between the opaque lines, the period of the revealing element being the sum of the width of an opaque line and the width of a transparent line; wherein, if both the security pattern and the revealing element are applied, they are applied on different sides of the same layer or on separate layers;

c) providing a completely or partially transparent second layer of the security element, or alternatively, providing an opaque layer with making an opening therein, the opening being optionally filled with a transparent filling;

d) placing the second layer from step c) under or above the layer from step b) or between the layers from step b) and matching the position of the transparent area or opening in the layer from step c) with the position of the security pattern and/or the revealing element in the layer or layers from step b), wherein, above or below the security pattern or the revealing element, within the same layer that comprises the security pattern or the revealing element, or within another layer of the security element, at a distance of at least 0.03 mm, there is another surface which

is susceptible to being marked by printing or laser marking;

e) laminating the layers arranged in step d), optionally with additional layers, in order to obtain a homogeneous block of material;

f) optional cutting material out of the laminated block to obtain the target data carrier format.

[0037] In a preferred embodiment of the method according to the invention, the method involves the application of one of the security pattern or the revealing element in step b) and, in addition, the method comprises, after step e) or f), step g) application of the revealing element if the security pattern was applied in step b), or of the security pattern if the revealing element was applied in step b), accordingly, wherein the application in step g) is done below or above the security pattern or the revealing element applied in step b), accordingly, at a distance of at least 0.03 mm and the area of the revealing element at least partially overlaps with the area of the security pattern and the transparent area or the opening, wherein the period of the revealing element, which is the sum of the width of an opaque line and the width of a transparent line, is equal to the distance between the corresponding edges of the bands of each security marking in the security pattern.

[0038] In a preferred embodiment of the method according to the invention, the application in step g) takes place below or above the security pattern or the revealing element applied in step b), at a distance of 0.03 - 1.00 mm above or below the security pattern and/or the revealing element applied.

[0039] Application in step g) may also take place e.g. at a distance of 0.03 - 1.00 mm above or below the security pattern and/or the revealing element.

[0040] In a preferred embodiment of the method according to the invention, the application in step g) is performed so that the bands of the security markings of the security pattern are substantially parallel to the lines of the revealing element, wherein the tilt of the bands of the security markings of the security pattern from the lines of the revealing element is less than $\pm 5^\circ$.

[0041] In another embodiment, the method according to the invention involves the application of one of the security pattern or the revealing element in step b) and, in addition, the method comprises, after step e) or f), step g) of the application of the revealing element if the security pattern was applied in step b), or of the security pattern if the revealing element was applied in step b), accordingly, wherein the application in step g) is done on another sheet or page of the data carrier than the sheet or page obtained in step e) or f), and the application in step g) is done so that after folding both sheets or pages of the data carrier, the revealing element or the security pattern applied in step g) will be located below or above the security pattern or the revealing element applied in

step b), accordingly, at a distance of at least 0.03 mm and the area of the revealing element will at least partially overlap with the area of the security pattern and the transparent area or the opening, wherein the period of the revealing element, which is the sum of the width of an opaque line and the width of a transparent line, is equal to the distance between the corresponding edges of the bands of each security marking in the security pattern.

[0042] In a preferred embodiment of the method according to the invention, the security pattern and/or the revealing element are applied by printing or laser marking.

[0043] In a preferred embodiment of the method according to the invention, the security pattern comprises more than two security markings.

[0044] The present invention relates further to a use of the security element according to the invention to produce a data carrier that can be personalised.

[0045] Within the meaning of the present invention, a data carrier can be any data carrier known in the art in which security elements are used, e.g. a value document or an identification document such as an identity card, passport, driving licence, any kind of card, bank cards, membership cards and other secured documents which comprise information, for example, in the form of personal data.

[0046] The data carrier according to this invention is made, for example, of plastic, thermoplastic or thermosetting, such as: polycarbonate (PC), polyethylene (PE), polypropylene (PP), poly(vinyl chloride) (PVC), or various types of resins, for example: phenolic, phenol-formaldehyde.

[0047] The security pattern and/or the revealing element may be applied by means of well-known printing techniques, for example screen printing, offset printing, digital printing, thermal printing, laser printing or, e.g. laser marking.

[0048] Within the meaning of the present invention, the terms "transparent" or "translucent" or "clear" or "completely transmitting light" are considered to have the same meaning.

Brief Description of the Figures

[0049]

Fig. 1 is a schematic view of the cross-section of a data carrier comprising an optically variable security element according to an embodiment of the invention.

Fig. 2 is a schematic view of the cross-section of a data carrier at the place of application of the optically variable security element according to an embodiment of the invention.

Fig. 3 is a schematic view of the cross-section of a data carrier at the place of application of the optically

variable security element according to an embodiment of the invention.

Fig. 4 shows examples of security markings and their appearance at different tilt angles of the document.

Fig. 5 presents various other possible variants of the location of the security pattern in relation to the revealing layer for an optically variable security element according to the invention.

Fig. 6 illustrates the structure of the data carrier according to an embodiment, with a cut-out opening (Fig. 6A) or an opening filled with transparent filling (Fig. 6B).

Fig. 7 illustrates the format of laminate and a single data carrier (e.g. a card).

Fig. 8 shows an identification document according to an embodiment, comprising a security element.

Fig. 9 presents an exemplary embodiment of a card comprising a security pattern and a revealing element in accordance with an embodiment of the present invention.

Fig. 10 presents an identification document (such as a passport) comprising a security pattern and a revealing element in accordance with an embodiment of the present invention.

Fig. 11 presents an identification document (such as a passport) comprising a security pattern and a revealing element in accordance with an embodiment of the present invention.

Fig. 12 shows the structure of the security element according to an embodiment.

Fig. 13 presents an exemplary embodiment of a card comprising a security pattern and a revealing element in accordance with an embodiment of the present invention.

Fig. 14 presents an exemplary embodiment of a card comprising a security pattern and a revealing element in accordance with an embodiment of the present invention.

Fig. 15 presents an identification document (such as a passport) comprising a security pattern and a revealing element in accordance with an embodiment of the present invention.

[0050] An embodiment of this invention will be described in the context of an identification document (ID) and a method of its production. However, the invention

is suitable for use in any data carrier which includes, but is not limited to, an identity card, passport, driving licence, any kind of card, bank card, membership card and other secured documents which comprise information in the form of, for example, personal data.

[0051] An exemplary security element comprises at least one inner layer, at least partially transparent, with a thickness of at least 0.03 mm, susceptible to marking, preferably by means of printing or laser marking. For example, the following variants are possible:

- the transparent layer is susceptible to laser marking in its entire volume;
- the transparent layer is susceptible to laser marking in part, e.g. it comprises a markable centre (core) and non-markable external surfaces or vice versa;
- the transparent layer is only susceptible to laser marking on one side.

[0052] To the security element e.g. a security pattern is applied, comprising at least two security markings, each security marking constituted of bands arranged in intervals so that the corresponding edges of the bands being a part of a given security marking are at equal distance from each other and each band being a part of one security marking is adjacent on each side to a band being a part of a different security marking.

[0053] Such a security element with a security pattern may be combined and laminated with other layers which are at least partially transparent so that the transparent area overlaps at least in part with the security pattern so that it can be observed from both sides of the security element. However, it is important that there must be another surface susceptible to marking, at least 0.03 mm above or below the security pattern, at least in part overlapping partially or completely with the security pattern.

[0054] The security element thus obtained is suitable for further personalisation. This is because it allows for a subsequent application of the revealing element. The revealing element comprises a set of parallel opaque lines and transparent lines acting as gaps between the opaque lines, the period of the revealing element being the sum of the width of an opaque line and the width of a transparent line. It may be applied on the other side of the said inner layer if it is susceptible to marking on both sides or in its entirety, and it is also possible to apply the revealing element to another layer of the security element. The period of the revealing element, which is the sum of the width of an opaque line and the width of a transparent line, should be equal to the distance between the corresponding edges of the bands of each security marking in the security pattern.

[0055] Thus, the security element according to the invention allows for the subsequent addition of a revealing element, which will allow for the observation of security markings. Alternatively, a security element of the inven-

tion may, instead of a security pattern, comprise a revealing element, wherein it is important that there must be another surface susceptible to marking, at least 0.03 mm above or below the revealing element, at least in the part overlapping partially or completely with the revealing element. In such a case, further personalisation will involve application of a security pattern, comprising personalised markings for each data carrier, e.g. for a document, e.g. the image of the document holder, an individual document number, an identification number or, e.g. the date of issue or validity of the document.

[0056] The security pattern and the revealing element can be applied e.g. by printing or laser marking.

[0057] Preferably, the position (orientation) of the security pattern relative to the revealing element in the plane of the data carrier may be twisted by an angle of not more than $\pm 5^\circ$.

[0058] Alternatively, the security element may include both the security pattern and the revealing element. The period of the revealing element, which is the sum of the width of an opaque line and the width of a transparent line, should be equal to the distance between the corresponding edges of the bands of each security marking in the security pattern. The revealing element and the security pattern may be in the same layer of the security element (e.g. on both sides of the same layer) or in different layers, wherein the distance between them (material thickness between them) is at least 0.03 mm.

Example 1

[0059] Fig. 1 is a schematic view of a cross-section of a data carrier comprising a preferred embodiment of the security element according to invention. The carrier comprises at least one inner layer 103 (core), at least semi-transparent or opaque (e.g. white), and at least one outer layer 101, 102, 104, 105 on each side of the inner layer 103. The inner layer 103 may also be a multi-layer Duplex-type core and may comprise at least one inner layer, at least semi-transparent or opaque (white) and at least one transparent outer layer. The inner layer 103, preferably at least in the area of the security element, comprises an opening 201, which makes it possible to make a transparent window in the carrier and, as a result, to observe the security element from both sides of the document. The opening is made in the inner layer 103, for example, by means of a cutting plotter equipped with a knife, laser, blanker or any other method known in the art. Transparent filling may be placed in the opening 201. The filler material should be compatible with the material of the other layers of the data carrier (the filler can therefore be made of various materials known to one skilled in the art in the field of materials, for example: polycarbonate (PC), polyethylene (PE), polypropylene (PP), poly(vinyl chloride) (PVC), or various resins, for example: phenolic, phenol-formaldehyde and others).

[0060] The outer layers, 101, 102, 104, 105 are transparent at least in the area of the opening 201. Preferably

at least one outer layer 101, 102, 104, 105, at least in the area of the security element, has properties that enable laser marking, for example laser engraving. A security pattern 301 is located on the surface of at least one layer of the carrier in such a way that the area of the security pattern 301 at least partially overlaps with the opening 201. A revealing element 401 is located on the surface of at least one layer of the carrier, preferably on the side of the opening 201 opposite to the security pattern 301, such that the area of the revealing element 401 at least partially overlaps with the opening 201 and the area of the security pattern 301. The security pattern 301 and the revealing element 401 may be applied on two opposite sides of the same layer or on different layers. However, they must be at least partially one over the other. It is important that the thickness of the material between the security pattern and the revealing element is at least 0.03 mm.

[0061] Both the security pattern 301 and the revealing element 401 may be applied in whole or in part during the manufacture of the security element, or the security pattern 301 or the revealing element 401 may be applied in whole or in part after the security element has been manufactured, for example at a stage of subsequent personalisation of the data carrier.

[0062] Fig. 2 and 3 are a schematic view of a cross-section of the data carrier in the area of application of the security element according to an embodiment of the invention.

[0063] The revealing element 401 may be produced by printing by means of printing techniques well-known in the art, such as screen printing, offset printing, digital printing, thermal printing, laser printing or by laser marking, e.g. laser engraving. The revealing element 401 may, for example, be applied on the lower or upper surface of any of the transparent outer layers 101, 102, 104, 105 present or, alternatively, may be applied by laser marking in any of the transparent outer layers 101, 102, 104, 105 present which is preferably susceptible to laser marking. The revealing element 401 acts like a filter and comprises a set of parallel opaque lines 411 and transparent lines 412 acting as gaps between the lines. The opaque lines have a certain width L and the gaps a certain width G. The period R of the filter is defined by the sum of the width L of the lines and the width G of the gaps.

[0064] The security pattern 301 can be produced using printing technologies commonly used in the field of cards, such as screen printing, offset printing, digital printing, thermal transfer, inkjet printing, laser printing, laser marking, etc. The security pattern 301 is preferably applied during the personalisation of the document. It may therefore comprise personalised data, such as, for example, the name, surname, date of birth, individual number of the document or its holder, etc. The security pattern 301, comprising security markings such as the first security marking A and the second security marking B, arranged in interconnected bands, may be printed on the upper or lower surface of any transparent outer layer 101, 102,

104, 105, above or below the revealing element 401, or may, for example, be applied by means of a laser marking technique to at least one of the outer layers 101, 102, 104, 105, which is preferably susceptible to laser marking.

[0065] Each security marking A, B consists of bands, arranged alternately at intervals so that the corresponding edges of the bands of a given security marking are separated by a distance P (for example, a left edge of one band being a part of the first security marking A is separated by a distance P from the left edge of the next band being a part of the first security marking A, etc.) and each band being a part of the first security marking A is adjacent to two bands being a part of the second security marking B and vice versa. The distance P between each band of each security marking of the security pattern 301 must be substantially the same as the period R of the revealing element 401.

[0066] When tilting the document, only one of the markings A or B is visible in the gaps of the filling of the revealing element 401. In the embodiment shown in Fig. 2, it can be seen that a mark A can be seen when tilting the document by a viewing angle VA, and a mark B can be seen when tilting the document by a viewing angle VB.

[0067] It is important that the bands of security markings A and B of the security pattern 301 should be substantially parallel relative to the lines 411 and 412 of the revealing element 401. Here, substantially parallel means that a tilt of the bands of the security markings A and B of the security pattern 301 relative to the lines 411 and 412 of the revealing element 401 should not be more than $\pm 5^\circ$.

[0068] In this embodiment, which was explained with reference to Fig. 2 and 3, only the effect of a variable image is described, i.e. the security element enables observation of the first security mark A (first image) or the second security mark B (second image), accordingly, depending on the angle of inclination. However, it is possible to observe a security pattern with another visual effect, such as for example animation, three-dimensional effect, magnification, etc. Depending on the desired visual effects, the security pattern may comprise multiple images, the width of the gap in comparison to line width determined by the number of images to be displayed, and the distance between the revealing layer and the security pattern are also adjusted. In order to obtain magnification or another phenomenon, e.g. moiré, it is necessary to adjust both the filter, i.e. the revealing element, and the security pattern.

[0069] Fig. 4 shows an example of different images viewed by an observer at different angles of inclination of the document. In this embodiment, the security marks are represented by the letters A and B. The period R of the revealing element 401 is defined by the sum of the width L of the lines 411 and the width G of the gaps 412 and is essentially the same as the distance P between each band of each security marking. Therefore, under the first predetermined viewing angle VA, the observer

can read the first security mark, which is the letter "A" in the illustrated embodiment and under the second predetermined viewing angle VB, the observer can read the second security mark, which is the letter "B" in the illustrated embodiment. In simple terms, the revealing element 401, comprising a set of interlaced parallel opaque 411 and transparent 412 lines, is schematically represented in the Figure as a square. However, it can take all kinds of graphic forms, such as circles, curves, wavy lines, triangles, etc., provided that the distances R between the opaque parts 411 are always identical.

[0070] In this example, the widths L of the opaque lines 411 of the revealing element 401 and the widths G of the gaps 412 between the opaque lines are equal, so that the security pattern allows two different data / images, "A" or "B", to be shown as they emerge when the document is tilted, so that the individual markings are adequately visible between the lines 411. The width L of the lines and the period R of the revealing element 401 define the required resolution of the markings. With proper selection of these parameters, the observer should not see more than one marking (image / data) from the security pattern between the opaque lines 411. If the width L of the lines and the distance G between the lines are equal, two different images revealed when tilting the document can be obtained, so that the markings visible between the lines are switching.

[0071] If the gap G is half the width L of the lines (i.e. the gap G is one third of the period R, for example gap width $G = 50 \mu\text{m}$, line width $L = 100 \mu\text{m}$ and period $R = 150 \mu\text{m}$), three images can be placed on the markings. If the gap G is one third of the width L of the lines (gap G is one quarter of the period R, for example gap width $G = 50 \mu\text{m}$, line width $L = 150 \mu\text{m}$, and period $R = 200 \mu\text{m}$), four images / data, etc. can be obtained. The gap G generally determines the required resolution for the markings.

[0072] Importantly, unlike the solutions according to the state of the art, the images created by security pattern 301 can be observed from both sides of the carrier, due to the presence of a transparent area, e.g. in this embodiment, the opening 201. In the solution according to this invention, it is therefore not necessary to use a background or reflective layer, and the markings are visible in transmitted light.

[0073] Importantly, since both the security pattern 301 and the revealing element 401 can be manufactured by printing or laser marking, parts of them or each of them in their entirety or both of them in part or in whole can be applied at a later step, e.g. after the manufacturing of the data carrier. It is possible, for example, to apply a part of or a complete security pattern 301 and/or the revealing element 401 at the stage of personalisation of the data carrier, e.g. the application of personal data in an identification document. Different relative positions are possible between the security pattern 301 and the revealing element 401. Fig. 5 shows other possible variants of the location of the security pattern in relation to the revealing

layer for an optically variable security element according to the invention in an identification document. The revealing element 401 may be placed on a cross-section of the data carrier, e.g. an identification document, below or above the security pattern 301, provided that the location of the revealing layer and the security pattern overlap at least partially.

Example 2

[0074] In an embodiment, the security pattern comprises two different security markings, namely component images (e.g. letters "A" and "B"). There may be more than two component images in other variants. Each security marking, as described in Example 1, consists of bands, alternately arranged in intervals so that the corresponding edges of the bands of a given security marking are separated by a distance P (for example, the left edge of one band of the first security marking A is separated by a distance P from the left edge of the next band of the first security marking A, etc.) and each band of the first security marking A is adjacent to two bands of the second security marking B and vice versa. The distance P between each band of each security marking of the pattern 301 must be substantially the same as the period R of the revealing element 401.

[0075] In an embodiment, security markings are applied by means of printing on a transparent film (e.g. polycarbonate), e.g. using offset technique. Each security marking is printed with paint of a different colour.

[0076] Fig. 6 shows an example of a layer layout in a data carrier obtained in such a way. The inner layer 103 is in the centre. In this example, it is non-transparent and an opening 201 is cut out within it, which can optionally be filled with transparent filling 202. On both sides of the inner layer 103 there are outer layers 102, 104, which in this example are made of transparent, non-engrivable film. Print may be applied onto these layers, e.g. the security pattern 301 and/or a document background 402. On the outer layers 102, 104 there are further outer layers 101, 105, in this example made of transparent, engrvable film. A revealing element 401 can be applied on these layers using laser engraving. The layers are arranged so that the distance H between the security pattern 301 and the revealing element 401 is at least 0.03 mm, preferably 0.30 - 0.70 mm.

[0077] In this embodiment, the data carrier is manufactured as follows.

1. Security markings (two, but there may be more in other variants), in the form of alternately arranged bands, are printed on a transparent polycarbonate film 104 using offset technique. Each marking forming part of a security pattern 301 is printed in paint of a colour different than that of the other security markings.

2. A window 201 is made in opaque polycarbonate

film 103. This can be done e.g.:

a) by cutting openings in the white polycarbonate film 103.

For example, in a sheet of white film with a thickness of 0.050 mm to 0.150 mm, 21 openings for a transparent window are cut out using a plotter.

b) by cutting openings in the white polycarbonate film 103 and filling in resulting cavities with filling 202, e.g. non-engrivable transparent film.

[0078] For example, in a sheet of white film with a thickness of 0.150 mm to 0.500 mm, 21 openings are cut out, which are then filled with transparent film of the same thickness ($\pm 10\%$). 3. A fold of polycarbonate films for lamination is prepared.

[0079] The completion involves matching (aligning to the edges) and arranging in the right order the individual sheets of film comprising: a security pattern print (consisting of security images), possible offset print of the document background 402, possible other anti-counterfeiting protection, and a sheet with cut-out openings 201 for the window obtained in step 2. The security pattern can be printed on a separate sheet or on the same background as the entire document. In the examples shown in Fig. 6, security pattern 301 is printed together with the background 402 of the document.

4. Lamination. The standard lamination process involves placing the film fold obtained in step 3 between metal plates and heat-sealing to obtain a uniform block of material (laminate).

5. Cutting out single data carriers (e.g. cards) from the laminate. The aim of cutting out is to obtain individual cards of the required format from a sheet of laminate comprising, in this example, 21 products arranged in 7 rows and 3 columns (see Fig. 7).

6. Engraving a revealing element in the window of the data carrier (e.g. a card).

[0080] The revealing element is applied, in this example, at the stage of data carrier personalisation by laser marking technique, using an Nd:YAG 1064 nm laser. During engraving, the parameters of the revealing element, in the form of opaque bands separated by transparent bands, such as contrast (greyness degree), thickness, density and parallel position of the lines, are matched to the parameters of the security pattern.

[0081] Fig. 8 shows an identification card according to an embodiment, comprising such a security element. The document comprises at least one inner layer 103, at least semi-transparent or opaque and at least one outer transparent layer 102. The inner layer 103 preferably comprises a transparent 201 window at least in the area of the

security element, which allows observation of the security element located in this place from both sides of the card. Advantageously, both the outer layer 102 and the inner layer 103 at least in the area of the security element have markable properties that allow laser marking. Personalization information comprising the owner's personal data and photo are printed or applied using laser marking technique in layer 103. The security pattern 301, which may also comprise personal data, is printed or applied using laser marking technique, for example in the inner layer 103 in the place of the transparent window. The revealing element 401 comprising parallel lines may be printed or applied using laser marking technique in the outer layer 102 or, e.g. in the transparent window of the inner layer 103.

[0082] The revealing element 401 and the security pattern 301 can be made using different methods in different variants. For example, the revealing element may be printed on one of the layers inside the document, while the security pattern is printed on an external surface of the document together with personalisation data; or the revealing element may be laser-marked on one of the layers sensitive to laser radiation, located inside the document or on its surface, while the security pattern is printed on an external surface of the document; or the revealing element may be printed on one of the layers inside the document, while the security pattern is applied by laser marking technique on one of the layers sensitive to laser radiation inside or on the surface of the document; or the revealing element and the security pattern may be applied by laser marking technique. The security element may include all types of markings, such as a photograph, and/or image and/or number and/or text, etc.

[0083] An example of a card comprising a security element with security images in different colours is shown in Fig. 9.

Example 3

[0084] Fig. 10 presents a passport comprising a data carrier 501 in the form of a multi-layer plastic card, for example a polycarbonate (PC) card, which consists of at least one inner layer, at least semi-transparent and at least one outer transparent layer. It is preferred that the data carrier 501 comprises a transparent window 201 and that both the external layer and the internal layer at least in the area of the window have marking properties that enable laser marking. The window comprises a security pattern 301 printed during the card production process or applied using laser marking technique during personalisation. The security pattern 301 may also comprise personal data such as, for example, the image of the document holder, first name, surname or date of birth. The passport booklet on the inside of the cover 601 (fly-leaf) or on the visa page 701 contacting the data carrier at the location of placing the security pattern 301 in the data carrier, comprises a revealing element 401 printed preferably in offset, intaglio, inkjet, thermal transfer, etc.,

or applied using laser marking technique. Revealing of the marks in the security pattern 301 takes place when superimposing the security pattern 301 from the data carrier 501 and the revealing element 401 from the flyleaf 601 or the visa page 701.

Example 4

[0085] Fig. 11 shows an embodiment of the security element according to the invention in a passport, wherein this example includes two security patterns on two different pages of the passport. Each of these patterns, in the example, comprises two security images. These images may be observed through the revealing element located on a personalised page of the passport, placed here between the pages comprising security elements. The observation of individual security patterns through the revealing element allows different security images to be seen depending on the tilt angle.

Example 5

[0086] In an alternative embodiment, the security pattern can be in the form of alternate bands in different colours. In this example, each security image will constitute a coloured background, each security image having a different colour. For example, the security pattern is in the form of a repetitive sequence of lines in three different colours (e.g. C-Cyan, M-Magenta, Y-Yellow). In this example, the laser-engraved revealing element has the form of alternating transparent and opaque bands, as in the previous examples, but additionally, there may also be a transparent marking within it (Fig. 12). As a result of the mutual matching of the two images, in the finished document, depending on the angle of observation, a smooth change of colours is observed, resembling optical phenomena known for holograms and optically variable paints. In the presence of a transparent marking within the revealing element, security markings then provide a changing background for the marking. In this variant, the revealing element may also be individualised, i.e. it may be different for each data carrier.

[0087] Fig. 6 shows an example of a layer layout that may also be present in such a data carrier. The inner layer 103 is in the centre. In this example, it is non-transparent and an opening 201 is cut out within it, which can optionally be filled with transparent filling 202. On both sides of the inner layer 103 there are outer layers 102, 104, which in this example are made of transparent, non-engraversable film. Print may be applied onto these layers, e.g. the security pattern 301 and/or the document background 402. On the outer layers 102, 104 there are further outer layers 101, 105, in this example made of transparent, engraversable film. A revealing element 401 can be applied on these layers using laser engraving. The layers are arranged so that the distance H between the security pattern 301 and the revealing element 401 is at least 0.03 mm, preferably 0.30 - 0.70 mm.

[0088] In this embodiment, the data carrier is manufactured as follows.

1. Security markings in the form of alternately arranged bands are printed on transparent polycarbonate film using offset technique. Each marking is printed in paint of a colour different than that of the other security markings. For example, the security pattern comprises a repeatable line sequence in three different colours (C-Cyan, M-Magenta, Y-Yellow).

2. A window is made in opaque polycarbonate film. This can be done e.g.:

a) by cutting openings in white polycarbonate film

For example, in a sheet of white film with a thickness of 0.050 mm to 0.150 mm, 21 openings for a transparent window are cut out using a plotter.

b) by cutting openings in white polycarbonate film and filling in the resulting cavities with non-engrivable transparent film.

[0089] For example, in a sheet of white film with a thickness of 0.150 mm to 0.500 mm, 21 openings are cut out, which are then filled with transparent film of the same thickness ($\pm 10\%$). 3. A fold of polycarbonate films for lamination is prepared.

[0090] The completion involves matching (aligning to the edges) and arranging in the right order the individual sheets of film comprising: a security pattern print (consisting of security images), possible offset print of the document background, possible other anti-counterfeiting protection, and a sheet with cut-out openings for the window obtained in step 2. The security pattern can be printed on a separate sheet or on the same background as the entire document. For example, the security pattern is printed together with the background of the document (similarly as shown in Fig. 6).

4. Lamination. The standard lamination process involves placing the film fold obtained in step 3 between metal plates and heat-sealing to obtain a uniform block of material (laminate).

5. Cutting out single data carriers (e.g. cards) from laminate. The aim of cutting out is to obtain individual cards of the required format from a sheet of laminate comprising, in this example, 21 products arranged in 7 rows and 3 columns (as shown in Fig. 7).

6. Engraving a revealing element in the window of the data carrier (e.g. a card).

[0091] The revealing element is applied, in this example, at the stage of data carrier personalisation by laser

marking technique, using an Nd:YAG 1064 nm laser. During engraving, the parameters of the revealing element, in the form of opaque bands separated by transparent bands, such as contrast (greyness degree), thickness, density and parallel position of the lines are matched to the parameters of the security pattern. In this embodiment, the revealing element can be individualised, i.e. it can be different for each carrier (e.g. a card).

[0092] Fig. 13 and 14 show embodiments of a card with this variant. Fig. 15 represents a variant in which the security pattern and the revealing element are placed on different pages of a passport.

15 Claims

1. A security element for a data carrier, comprising at least one layer, completely or partially transparent, with a thickness of at least 0.03 mm, wherein at least one layer of the security element is at least partially susceptible to being marked by printing or laser marking, **characterised in that** it comprises:

- a security pattern (301), wherein the security pattern (301) is located in such a way that the area of the security pattern (301) at least partially overlaps with the transparent area of the security element, so that the security pattern (301) is at least partially visible from both sides of the security element,

wherein the security pattern (301) comprises at least two security markings (A, B), wherein each security marking (A, B) consists of bands arranged in intervals so that the corresponding edges of the bands being a part of a given security marking are at equal distance (P) from each other, and each band being a part of one security marking (301) is adjacent on each side to a band being a part of a different security marking;

and/or

- a revealing element (401), wherein the location of the revealing element (401) at least partially overlaps with the transparent area of the security element, so that the revealing element is at least partially visible from both sides of the security element,

wherein the revealing element (401) comprises a set of parallel opaque lines (411) and transparent lines (412) acting as gaps located between the opaque lines (411), wherein the period (R) of the revealing element (401) is the sum of the width (L) of an opaque line (411) and the width (G) of a transparent line (412);

wherein the security pattern (301) and/or the revealing element (401) are applied by means of printing or laser marking, wherein above or below the applied

security pattern (301) and/or the revealing element (401), at a distance of at least 0.03 mm, within the same layer or in a different layer of the security element, there is another surface susceptible to being marked by printing or laser marking, wherein the security element, at least in the transparent area, does not comprise reflective material.

2. The security element for a data carrier according to claim 1, **characterised in that** the surface susceptible to being marked by printing or laser marking is located at a distance of 0.03 - 1.00 mm above or below the applied security pattern (301) and/or revealing element (401).

3. The security element for a data carrier according to claim 1, **characterised in that** it comprises at least one inner layer (103), at least semi-transparent or opaque, and on both sides of the inner layer (103) at least one outer layer (101, 102, 104, 105), wherein an opening (201) is made in the inner layer (103), optionally filled with transparent filling, wherein the outer layers (101, 102, 104, 105) of the security element are transparent at least in the area of the opening (201) and susceptible to marking, preferably by means of printing or laser marking, wherein none of the outer layers in the area of the opening (201) comprises reflective material, the security element comprising:

- a security pattern (301), wherein the security pattern is located on the surface of at least one layer of the carrier, in such a way that the area of the security pattern (301) at least partially overlaps with the area of the opening (201) present in the inner layer (103), so that the security pattern (301) is at least partially visible from both sides of the security element, wherein the security pattern (301) comprises at least two security markings (A, B), wherein each security marking (A, B) consists of bands arranged in intervals so that the corresponding edges of the bands being a part of a given security marking are at equal distance (P) from each other, and each band being a part of one security marking is adjacent on each side to a band being a part of a different security marking; and/or

- a revealing element (401), wherein the location of the revealing element (401) at least partially overlaps with the area of the opening (201), so that the revealing element is at least partially visible from both sides of the security element,

wherein the revealing element (401) comprises a set of parallel opaque lines (411) and transparent lines (412) acting as gaps located between the opaque lines (411), wherein the period (R) of the revealing

element (401) is the sum of the width (L) of an opaque line (411) and the width (G) of a transparent line (412),

wherein the security pattern (301) and/or the revealing element (401) are applied by means of printing or laser marking, wherein above or below the applied security pattern (301) and/or the revealing element (401), at a distance of at least 0.03 mm, within the same layer or in a different layer of the security element, there is another surface susceptible to being marked by printing or laser marking.

4. The security element for a data carrier according to claim 3, **characterised in that** the surface susceptible to being marked by printing or laser marking is located at a distance of 0.03 - 1.00 mm above or below the applied security pattern (301) and/or revealing element (401).

5. The security element for a data carrier according to any one of claims 1-4 **characterised in that** it comprises both the security pattern (301) and the revealing element (401), wherein the revealing element (401) is located below or above the security pattern (301), at a distance of at least 0.03 mm, and the area of the revealing element (401) at least partially overlaps with the area of the security pattern (301), wherein the period (R) of the revealing element (401), which is the sum of the width (L) of an opaque line (411) and the width (G) of a transparent line (412), is equal to the distance (P) between the corresponding edges of the bands of each security marking in the security pattern (301), wherein, preferably, the bands of the security markings (A, B) of the security pattern (301) are substantially parallel relative to the lines (411, 412) of the revealing element (401), wherein, more preferably the tilt of the bands of the security markings of the security pattern (301) relative to the lines of the revealing element (401) is less than $\pm 5^\circ$.

6. The security element for a data carrier according to any one of claims 1-5, **characterised in that** the security pattern (301) comprises more than two security markings.

7. A data carrier comprising the security element as defined in any one of claims 1-6.

8. A method of manufacturing the security element as defined in any one of claims 1-6, **characterised in that** it comprises the following steps:

- a) providing at least one layer of the security element, wherein the at least one layer is completely or partially transparent, and if more than one layer is present, then each layer is completely or partially transparent, so that the trans-

parent areas of individual layers overlap at least partially;

b) applying a security pattern and/or a revealing element so that it overlaps at least partially with the transparent area,

wherein the security pattern comprises at least two security markings, wherein each security marking consists of bands arranged in intervals so that the corresponding edges of the bands being a part of a given security marking are at equal distance from each other, and each band being a part of one security marking is adjacent on each side to a band being a part of a different security marking;

wherein the revealing element comprises a set of parallel opaque lines and transparent lines acting as gaps located between the opaque lines, wherein the period of the revealing element is the sum of the width of an opaque line and the width of a transparent line;

wherein, if both the security pattern and the revealing element are applied, they are applied on different sides of the same layer or on separate layers;

c) providing a completely or partially transparent second layer of the security element, or alternatively, providing an opaque layer and making an opening therein, wherein the opening is optionally filled with a transparent filling;

d) placing the second layer from step c) below or above the layer from step b) or between the layers from step b) and matching the position of the transparent area or opening in the layer from step c) with the position of the security pattern and/or the revealing element in the layer or layers from step b), wherein, above or below the security pattern or the revealing element, within the same layer which comprises the security pattern of the revealing element, accordingly, or in another layer of the security element, at a distance of at least 0.03 mm, there is another surface which is susceptible to being marked by printing or laser marking;

e) laminating the layers arranged in step d), optionally with additional layers, in order to obtain a homogeneous block of material;

f) optional cutting material out of the laminated block to obtain the target data carrier format.

9. The method according to claim 8, **characterised in that** it involves application of one of the security pattern or the revealing element in step b) and, in addition, the method comprises, after step e) or f), step g) of the application of the revealing element if the security pattern was applied in step b), or of the security pattern if the revealing element was applied in step b), accordingly, wherein the application in step g) is done below or above the security pattern or the

revealing element applied in step b), accordingly, at a distance of at least 0.03 mm and the area of the revealing element at least partially overlaps with the area of the security pattern and the transparent area or the opening, wherein the period of the revealing element, which is the sum of the width of an opaque line and the width of a transparent line, is equal to the distance between the corresponding edges of the bands of each security marking in the security pattern.

10. The method according to claim 9, **characterised in that** the application in step g) takes place below or above the security pattern or the revealing element applied in step b), at a distance of 0.03 - 1.00 mm above or below the security pattern and/or the revealing element applied.
11. The method according to claim 9 or 10, **characterised in that** the application in step g) is performed so that the bands of the security markings of the security pattern are substantially parallel relative to the lines of the revealing element, wherein the tilt of the bands of the security markings of the security pattern relative to the lines of the revealing element is less than $\pm 5^\circ$.
12. The method according to claim 8, **characterised in that** it involves application of one of the security pattern or the revealing element in step b) and, in addition, the method comprises, after step e), step g) of the application of the revealing element if the security pattern was applied in step b), or of the security pattern if the revealing element was applied in step b), accordingly, wherein the application in step g) is done on another sheet or page of the data carrier than the sheet or page obtained in step e), and the application in step g) is done so that after folding both sheets or pages of the data carrier, the revealing element or the security pattern applied in step g) will be located below or above the security pattern or the revealing element applied in step b), accordingly, at a distance of at least 0.03 mm and the area of the revealing element will at least partially overlap with the area of the security pattern and the transparent area or the opening, wherein the period of the revealing element, which is the sum of the width of an opaque line and the width of a transparent line, is equal to the distance between the corresponding edges of the bands of each security marking in the security pattern.
13. The method according to any of claims 8-12, **characterised in that** the security pattern and/or the revealing element are applied by printing or laser marking.
14. The method according to any of claims 8-13, **char-**

acterised in that the security pattern comprises more than two security markings.

15. Use of the security element as defined in any one of claims 1-6 to manufacture a data carrier that can be personalised. 5

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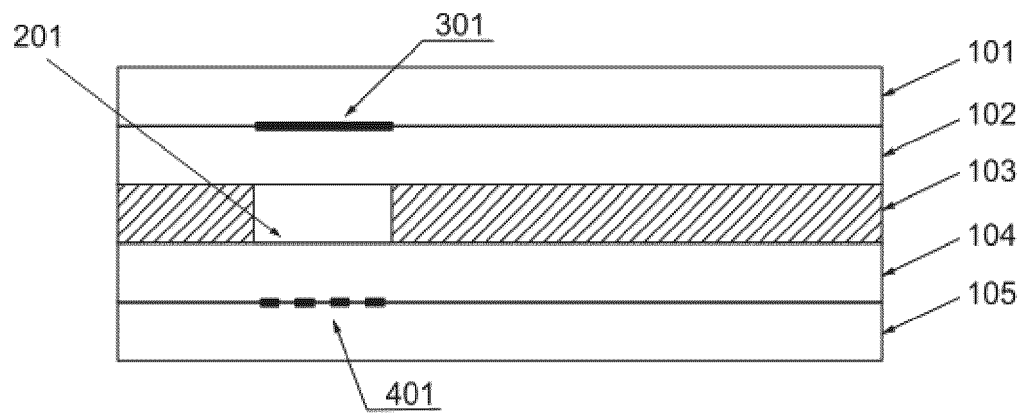


Fig. 1

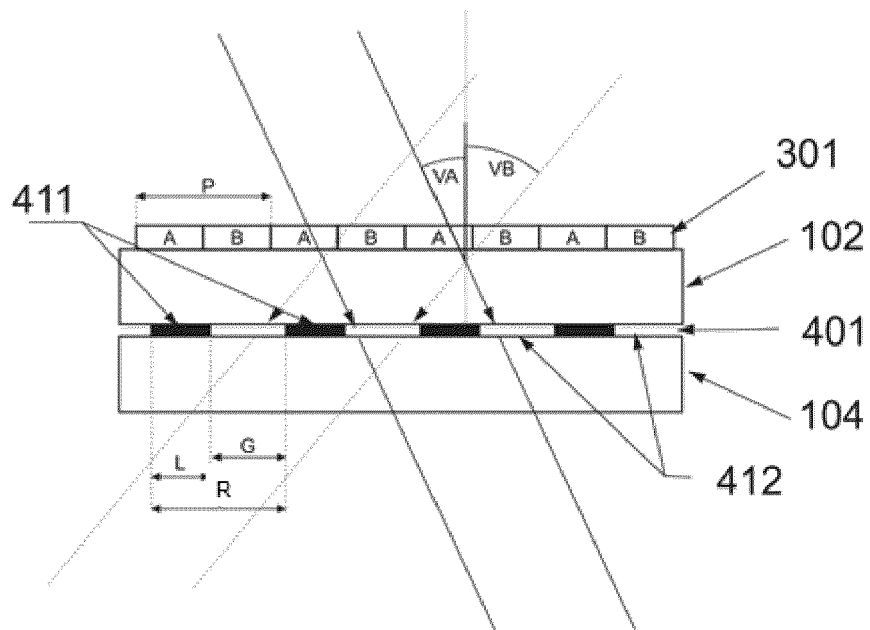


Fig. 2

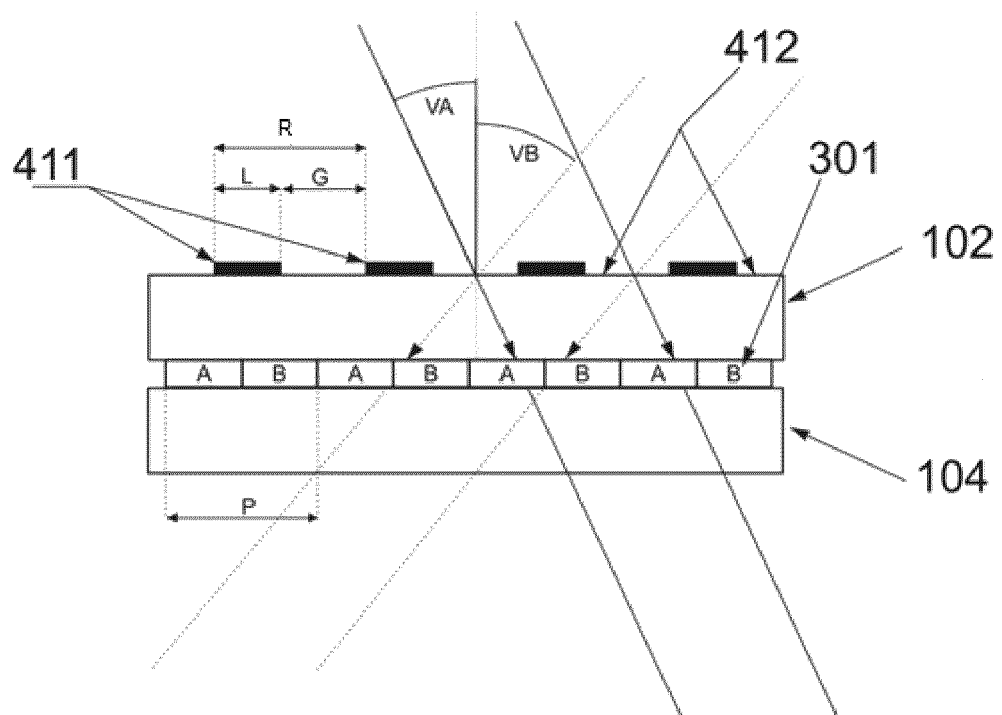


Fig. 3

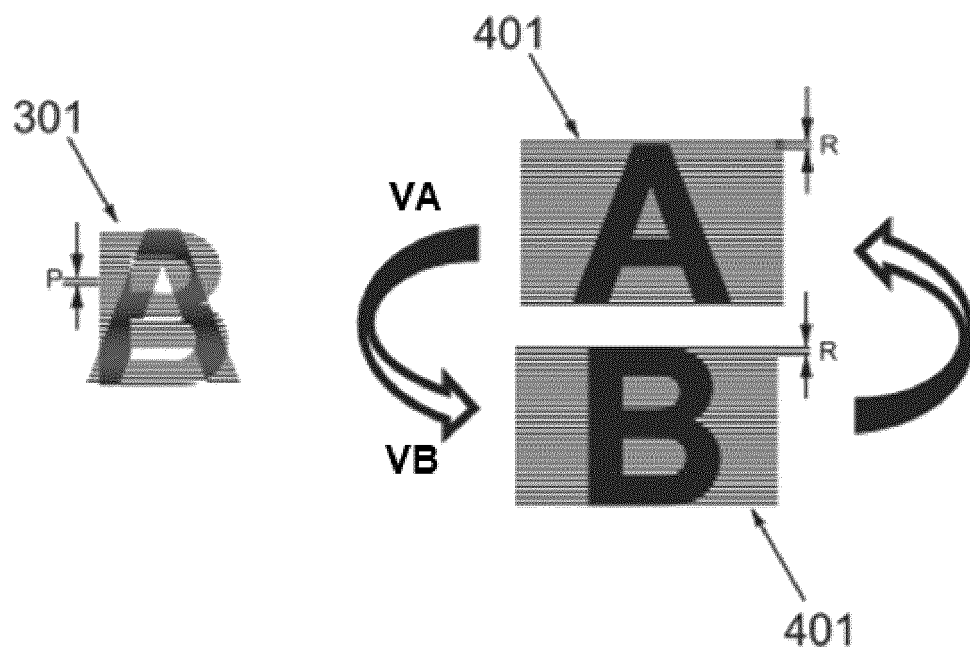


Fig. 4

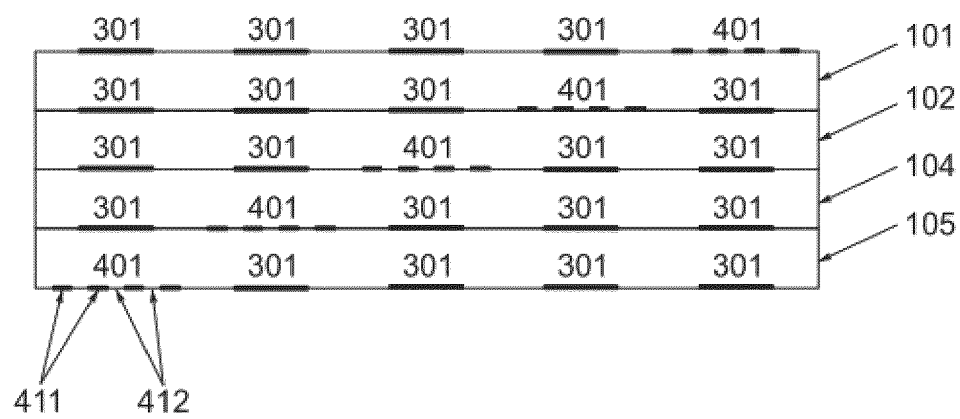
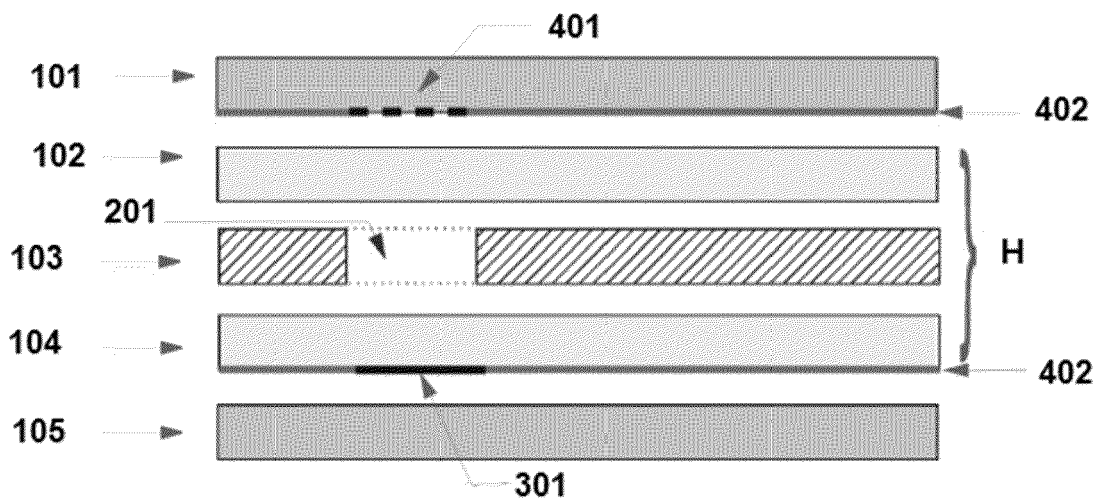


Fig. 5

A)



B)

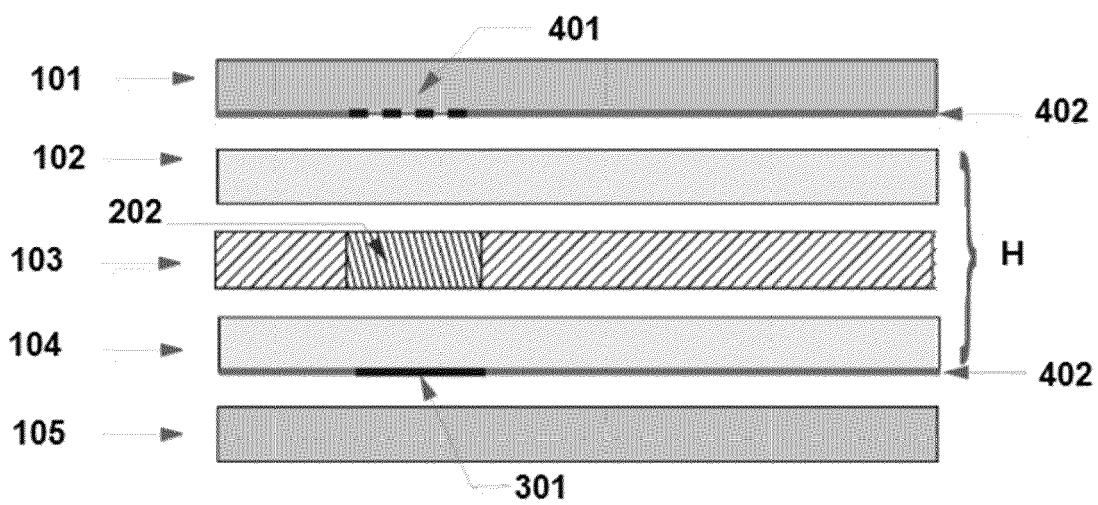


Fig. 6

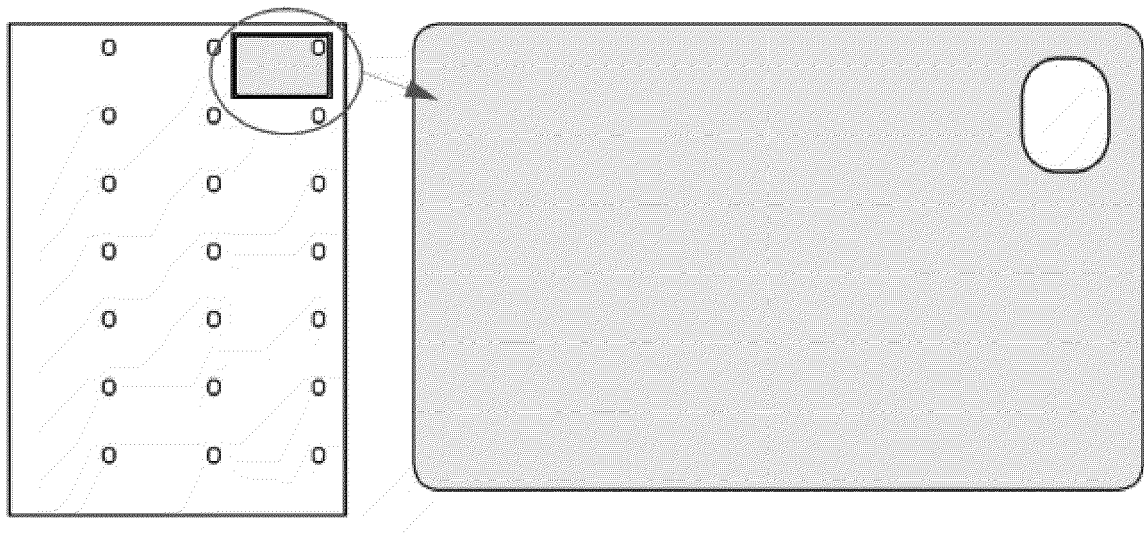


Fig. 7

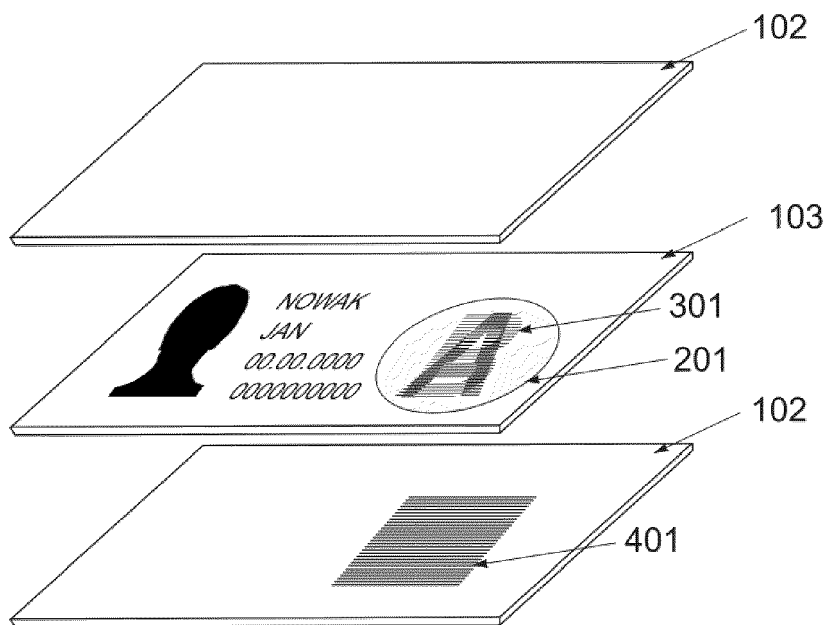


Fig. 8

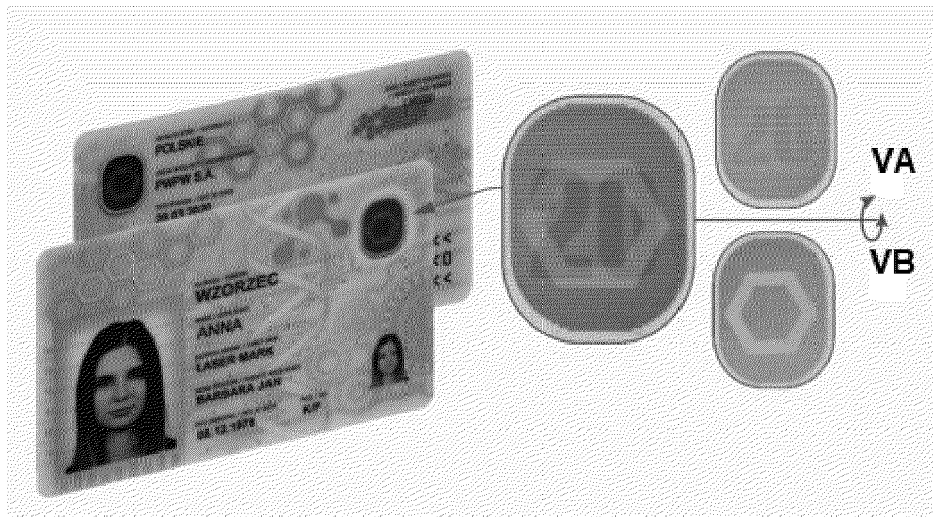


Fig. 9

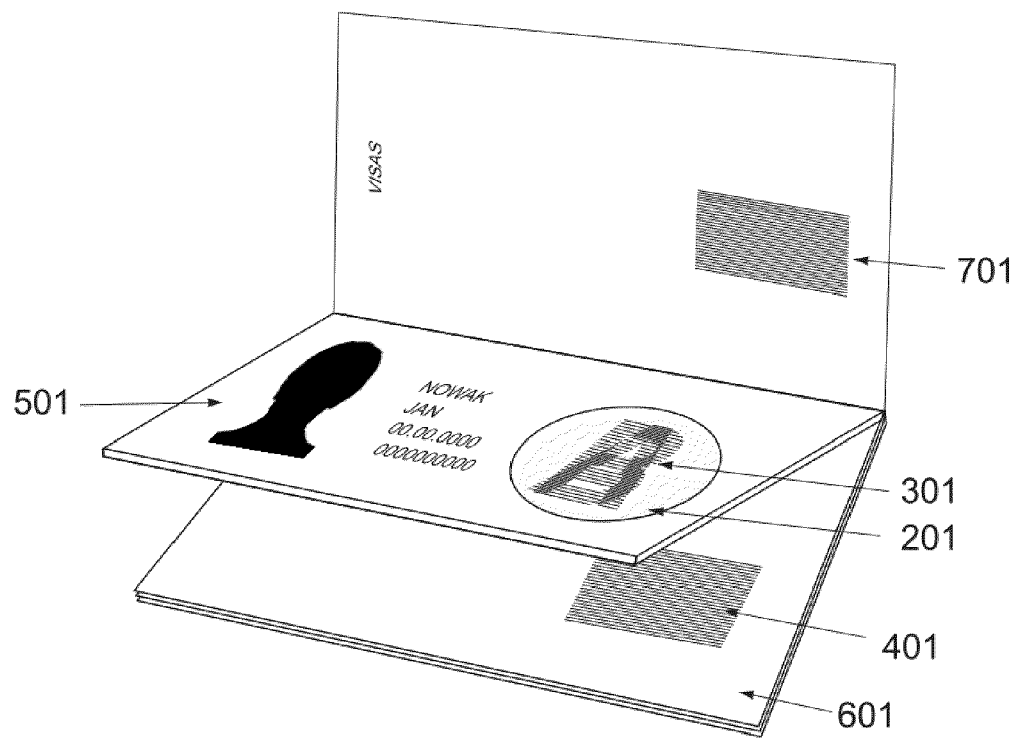


Fig. 10

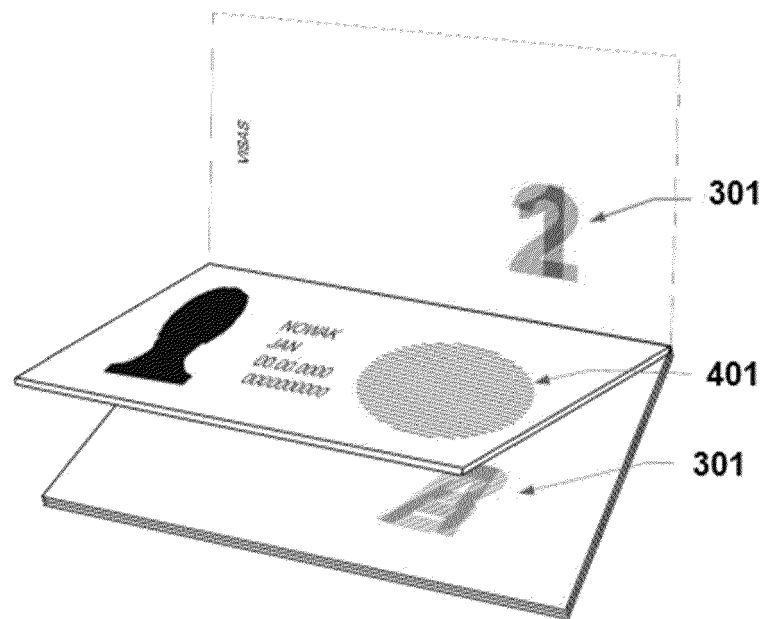


Fig. 11

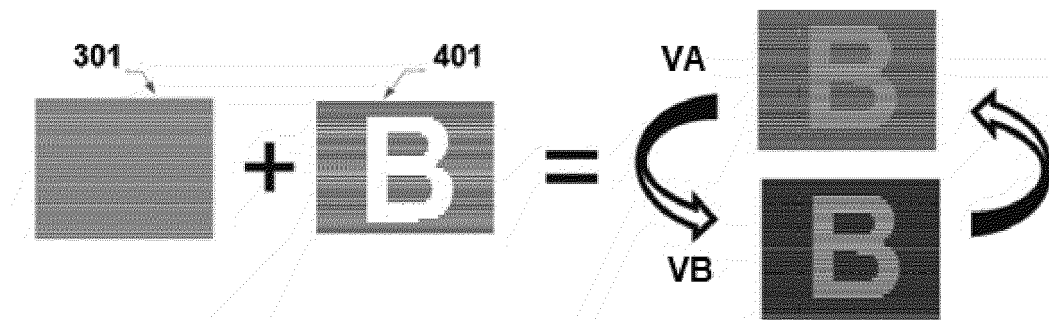


Fig. 12

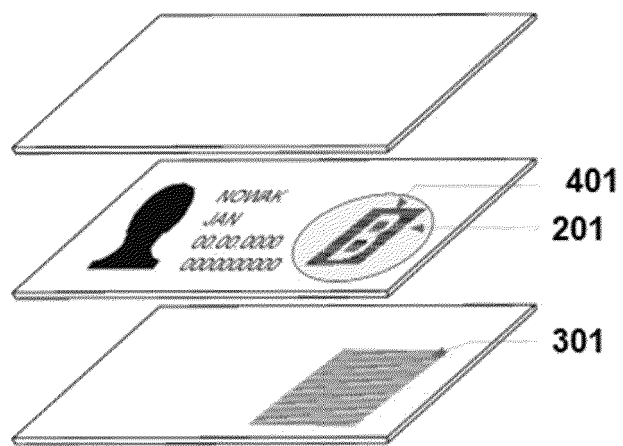


Fig. 13



Fig. 14

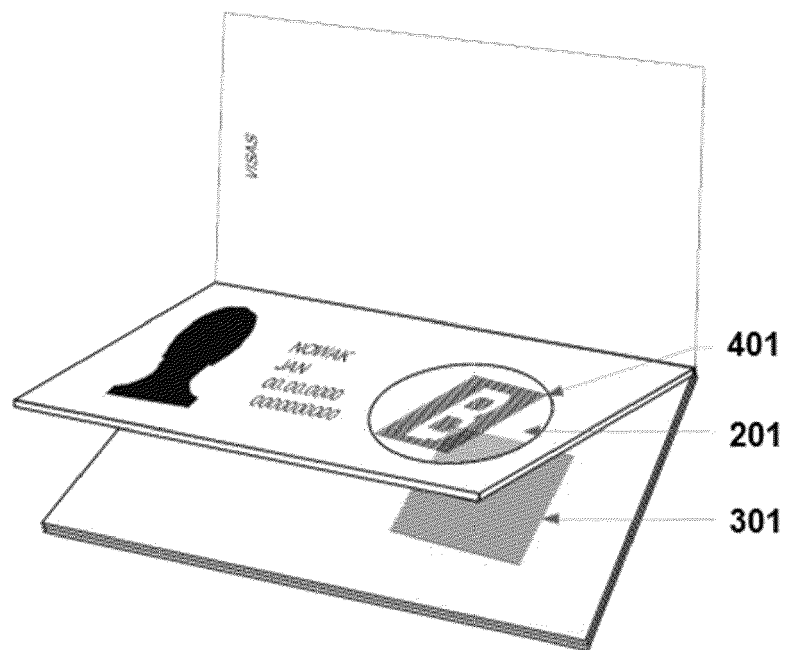


Fig. 15



EUROPEAN SEARCH REPORT

Application Number
EP 20 21 4994

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X	WO 2010/115872 A1 (GEMALTO SA [FR]; LESUR JEAN-LUC [FR]; POHJOLA TEEMU [FR]) 14 October 2010 (2010-10-14) * page 2, line 28 - page 3, line 3 * * page 4, lines 6-20 * * page 6, lines 1-3 * * page 9, lines 1-3 * * page 18, lines 29,30 * * page 22, lines 12-14 * * page 26, line 11 - page 27, line 10; claims 1-4,9,13; figure 20 *	1-15	INV. B42D25/20 B42D25/351 B42D25/41 B42D25/435
X	WO 2011/007344 A1 (ARJOWIGGINS SECURITY [FR]; VINCENT REMI [FR]) 20 January 2011 (2011-01-20) * paragraphs [0004], [0015] - [0018], [0020], [0023] - [0027], [0029], [0031]; figures *	1-5, 7-13,15	
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 12 May 2021	Examiner Cametz, Cécile
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