

(19)



(11)

EP 3 717 271 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
28.05.2025 Bulletin 2025/22

(21) Application number: **18836936.7**

(22) Date of filing: **30.11.2018**

(51) International Patent Classification (IPC):
B42D 25/324^(2014.01) B42D 25/342^(2014.01)

(52) Cooperative Patent Classification (CPC):
B42D 25/324; B42D 25/342

(86) International application number:
PCT/PL2018/050061

(87) International publication number:
WO 2019/108077 (06.06.2019 Gazette 2019/23)

(54) **A SECURITY ELEMENT WITH A HIDDEN PICTURE AND A VISIBLE PICTURE, AND A METHOD FOR PRODUCING A SECURITY ELEMENT**

SICHERHEITSELEMENT MIT VERSTECKTEM BILD UND SICHTBAREM BILD, UND VERFAHREN ZUR HERSTELLUNG EINES SICHERHEITSELEMENTS

ÉLÉMENT DE SÉCURITÉ À IMAGE CACHÉE ET IMAGE VISIBLE, ET PROCÉDÉ DE FABRICATION D'UN ÉLÉMENT DE SÉCURITÉ

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **30.11.2017 PL 42366217**

(43) Date of publication of application:
07.10.2020 Bulletin 2020/41

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WO-A1-2009/139396

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Description

Field of the Invention

[0001] The invention relates to a security element with hidden picture, security document consisting of such a security element, and a method for producing such security element, the security element consists of a background layer in a form of sequences of parallel first lines, and of an embossed structure having such parameters that one obtains various colour effects for individual parts of the picture constituting the security element.

State of the art

[0002] In the field of valuable and/or security documents, especially banknotes, securities, it is known to insert, thereon, one or more security elements of different types in order to protect these documents against forging, copying, or counterfeiting.

[0003] Security elements in a form of embossed optically variable structures give unique effects. A valuable and/or security document consists of an element in a form of embossed optically variable structure is easily identified, both visually as well as tactilely but difficult to produce and counterfeit.

[0004] Security elements with an angular effect are produced by printing lines located at an appropriate angle relative to each other. Embossed lines consisting of the security pattern are perpendicular to the substrate background. The singular effect becomes visible, since the ink applied onto the substrate is of significant thickness, and at an appropriate angle, the pattern is dark or bright.

[0005] One group of security elements consist of printed security elements applied by a printing technique, that contain a pattern of thin lines. The thin lines are used with such a frequency of lines per unit area, that an observer looking at the valuable and/or security document can see, at the first moment, not single lines but rather a surface of some texture or some colour. The brightness and/or intensity a given colour is perceived, depends, for example, on the number of lines per unit area.

[0006] Moreover, known security elements are produced from many embossed lines divided into partial areas, in which lines run horizontally or vertically, creating a raster structure. These lines adjoin each other directly, and have, usually, a triangular cross-section profile. In this case, depending on the observation angle, one can see either the security element of practically uniform colour or only a part of this element. Also, it is possible to arrange raised lines having a triangular profile in the security element such that grooves are created that come from joining two lines. Each of the lines located in a partial area is a raised line in terms of width and spacing between the lines, having such dimensions that the sequence of lines in the partial area encodes a picture or pictures. A graphical element is printed onto the sub-

strate of a valuable and/or security document.

[0007] Also, it is known to design the raster profile such that a colourful effect is obtained such that when turning the observation axis by 180° colours are mixed and CMY colours (Cyan-Magenta-Yellow) of the imprint are visible as RGB colours RGB (R - red, G - green, and B - blue).

[0008] A technique of concealing a security element in an imprint on a document is a technique of latent image performed by gravure printing. The background is embossed with or without ink, according to the first raster of lines and with a given slope, whereas a hidden security element is placed such that to create a gap in the raster, according to another angle, for example perpendicular to the first slope such that the latent image is difficult to detect at a typical observation direction relative to the substrate plane but it is detectable when observing sideways.

[0009] Also, solutions are known from the state of the art for security elements having complex graphical design manufactured using different printing techniques. These security elements are produced from unicoloured or multicoloured parallel lines or a grid of parallel lines that are oriented differently relative raised lines. Moreover, depending on the observation angle, some colourful effects are produced due to the moiré effect. This effect is an interference visual phenomenon resulting from superimposing (crossing) at least two regular raster grids of irregular lines.

[0010] The main drawback of the solutions employed currently in the market is that, in order to produce a multicoloured hidden picture, one needs to create rasters of different colours on a substrate, and to make an appropriate embossing in an appropriate direction, or to divide the security element into many portions of different engrave profiles, in order to obtain high enough contrast between the areas and reveal, in this manner, the concealed picture. The manufacture process of such protection elements demands high specialised knowledge, as well as machines, but also it is labour consuming and expensive in realisation.

[0011] The document EP 2 562 726 A1 describes security feature with moiré effect, that has been achieved due to the dynamic effect. The document EP 0 581 414 A1 describes anti-counterfeit latent image formation object. However, this solutions are different than said invention.

Summary

[0012] The goal of the present invention is to overcome these drawbacks by providing a security element according to claim 1 and a method according to claim 13.

[0013] Preferably, the security element has an embossed structure of any arbitrary shape creating a multicoloured hidden picture and visible picture with a clear colour division of individual parts of the picture, and is very simple and cheap to produce but also difficult to counterfeit as well as easy to verify.

[0014] The term "security and/or valuable document", according to the invention, means all documents, such as banknotes, personal documents, driving licence, cheques, securities, tickets, passports, as well as other valuable and secured documents, and data storage media for safe storing data. The terms "security document" or "valuable document" are used interchangeably.

[0015] A substrate may be, for example, a paper substrate, a paperlike substrate and/or a substrate made from paperlike materials like teslin, a polymer substrate, including polypropylene (PP) and/or polyamide (PA), as well as hybrid background based on a paper/polymer combination.

[0016] An illuminant is a radiation source having a power distribution within the wavelength range capable of inducing photo-impressions, $380\text{ nm} < \lambda < 780\text{ nm}$. Different illuminant light sources exist. Illuminants include different tones of daylight, various colours of artificial lighting, colours of spectral lines, and colours of phosphors. Also, secondary light sources exist that shine with reflected or transmitted light, as, for example, stained glass, the colour of which depends on the original light source it is illuminated with. Thus, saying that a security element has a given colour, one must indicate the illumination type the colour is detected.

[0017] Objects, generally, are observed due to the light transmitted by the objects (like, e.g., fluids, stained glass) or reflected from the objects (walls, paintings, etc). An eye receives a stream of light originating from an illuminant and transmitted through or reflected from an observed object. The colour of an object reflecting or transmitting the light depends on the light it is observed at. A coloured object will have different colours when observing it under glow lamp light, daylight, and yet another colour will be perceived when illuminating the object with a bulb. An illuminant having tristimulus coordinates of $x=0.31006$, $y=0.31616$ corresponds to, approximately, a colour of diffused daylight or the northern hemisphere. The illuminant has a colour temperature of 6774K and gives an impression of cool white light (CW). Also, other illuminants exist that correspond to diffused light under different geographical conditions. For the purposes of the present invention, it has been assumed that a security and/or valuable document is observed in the diffused light.

[0018] A security and/or valuable document consists of a security element in a form of a hidden picture. Preferably, the picture may be of any, complex shape, and it may be unicoloured or multicoloured. The security element defines a sequence of parallel first lines superimposed onto the substrate, the sequence consists of at least two parallel, colour lines of the same widths. One of these lines within the sequence may have a substrate colour. According to the invention, the background layer defines a sequence of parallel first lines having L different colours, the sequence being repeated any arbitrary number of times. One sequence may be created by two, three, or four lines of different colours, or even 16 colours, how-

ever, even then the substrate colour may be an additional line colour in the sequence of the first lines. The present invention is not restricted to any specific number of colours in a single sequence of the first lines. According to the invention, a sequence of the first lines is created, individually or collectively, by colours, most preferably, from the CMY palette: C- Cyan, M- Magenta, Y- Yellow, but also colours from the PANTONE palette are used. Cyan is a tone of blue, but slightly brighter and more faded, it may be referred to as grey/sky-blue or livid/blue. Most similar colours are sky-blue, sapphire, and turquoise. Magenta is, in the additive synthesis, a colour derived by combining red and blue. The most similar colours are fuchsia, incarnadine, and amaranthine, whereas Yellow is similar to yellow, but slightly brighter from typical hued yellow. It is a colour that, in additive synthesis, is obtained by combining red and green. According to the invention, the sequence of the first lines may also be created, individually or collectively, by colours from palette RGB: R - Red, G - Green, and B - Blue. This is a model originating from perception properties of human eye, in which an impression of any colour may be produced by combining, in given proportions, three light beams, i.e., red, green, and blue. The RGB colour space involves the additive synthesis, in which the lowest values define the colour black, whereas the highest ones - white.

[0019] During restoring colours, not always selected primary colours are being combined. More frequently, colours are produced by illuminating coloured objects with the white light. An example is insertion a colour filter (stained glass) in the path of the light to the eye, or many filters in a cascade. Filters absorb some colours (some portion of the spectrum), and an observer receives the light of the complementary colour relative to the absorbed colour. When the filter absorbs colour red, the observer receives Cyan (C), when green, the observer can see Magenta (M), when the blue is absorbed, then the observer can see Yellow (Y). In more complex cases, the observer can see an effect of mixing colours C,M,Y. The primary colours of the CMY system are the complementary colours to the RGB palette.

[0020] The geometric shapes, according to the invention, are equidistant, when lines going through the centres of these geometric shapes, drawn perpendicularly to the shift direction, are at the same distance within a single part of the hidden or visible picture.

[0021] Preferably, the shift of the first geometric shapes of the embossed structure and/or second geometric shapes of the inked embossed structure relative to the sequences of the first lines of the background layer, is a parallel shift.

[0022] A value of the shift p is calculated from the formula $p = Ln$, where L denotes the number of different colours in a sequence of the first lines, and n denotes the width of a single line in a sequence of the first lines or, alternatively, from the formula: $p = Ln + w$ or $p = Ln - w$, where the coefficient w is calculated from the following formula:

$$w = Ln/i_s$$

where:

L denotes the number of different colours in a sequence of the first lines,
 n denotes the width of a single line in a sequence of the first lines,
 i_s denotes the number of sequences of the first lines in the area of the embossed structure.

[0023] The coefficient w is responsible for a single transition between the used colours. In order to obtain z colour transitions, the coefficient w is multiplied by a value of $z-1$.

[0024] Alternatively, the first geometric shapes of the embossed structure and/or second geometric shapes of the inked embossed structure, as described above, may be shifted clockwise or anticlockwise relative to the sequences of the first lines by a predetermined angle. The predetermined angle is from 1° to 12° , preferably it is equal to 6° .

[0025] The second geometric shapes may have a form of a grid of different elements, the shape of which depends on a designed hidden and/or visible picture of the security element.

[0026] A first element and/or part of the hidden picture in at least one colour of the background layer is obtained by embossing the first geometric shapes of the embossed structure with a shift relative to the sequences of the first lines of the background layer. In turn, the first element and/or part of the hidden picture in one colour of the background layer is obtained by embossing the first geometric shapes of the embossed structure with a shift relative to the sequences of the first lines of the background layer by an integer multiple of the line width, wherein width of a single first geometric shape may not be bigger than n , and a single first shape of the embossed structure is located within a single line of the background layer. The second element and/or part of the hidden picture in at least one another colour of the background layer is obtained by embossing the first geometric shapes of the embossed structure of the second element and/or part with a shift by an additional distance relative to the first geometric shapes of the embossed structure of the first element and/or part of the hidden picture. Preferably, the second element and/or part of the hidden picture in one another colour of the background layer, wherein the width of a single first geometric shape may not be bigger than n is obtained by embossing the first geometric shapes of the embossed structure of the second element and/or part of the hidden picture with a shift by an additional distance equal to an integer multiple of the width of the first lines of the background layer relative to the first geometric shapes of the embossed structure of the first element and/or part of the hidden picture, wherein the width of a single first geometric shape may not be bigger than n . Preferably, the inked embossed structure is inked

with at least one intaglio ink.

[0027] The single geometric shape of the first geometric shapes of the embossed structure has a width in the range from $n-50\%n$ to $n+50\%n$, and the single geometric shape from the second geometric shapes of the inked embossed structure has a width in the range from n to $Ln-1$, where:

L denotes the number of different colours in a sequence of the first lines,
 n denotes the width of a single line in the sequence of the first lines.

[0028] The background layer, according to the invention, defines a multiple of sequences of the first lines of different colours, that are repeating in the same order. Preferably, one sequence of the first lines is defined by three different colours.

[0029] Preferably, the angle at a profile base to obtain a single geometric shape of the first geometric shapes of the embossed structure and/or the angle at a profile base to obtain a single geometric shape from the second geometric shapes of the inked embossed structure is from 75° to 90° .

[0030] Preferably, one shifts the first geometric shapes of the embossed structure and/or the second geometric shapes of the inked embossed structure in parallel relative to the sequences of the first lines of the background layer.

[0031] A value of the shift p is calculated from the formula $p = Ln$, where L denotes the number of different colours in the sequence of the first lines, and n denotes the width of a single line in the sequence of the first lines of the background layer, or from the formula $p = Ln + w$ or $p = Ln - w$, where coefficient w is calculated from the following formula:

$$w = Ln/i_s$$

where:

L denotes the number of different colours in the sequence of the first lines,
 n denotes the width of a single line in the sequence of the first lines,
 i_s denotes the number of sequences of the first lines in the area of the embossed structure.

[0032] Preferably, the first geometric shapes of the embossed structure and/or the second geometric shapes of the inked embossed structure may be turned clockwise or anticlockwise relative to the sequences of the first lines by a predetermined angle. The predetermined angle is from 1° to 12° , preferably it is equal to 6° .

[0033] The second geometric shapes may have a form of a grid of different elements, the shape of which depends on the designed hidden and/or visible picture of the security element.

[0034] One shifts the first geometric shapes of the embossed structure, according to the invention, relative to the sequences of the first lines of the background layer by a value of the shift p , and, by this shift, one obtains the first element and/or part of the hidden picture in at least one colour. If one shifts the first geometric shapes of the embossed structure relative to the sequences of the first lines of the background layer by an integer multiple of the line width, then one obtains the first element and/or part of the hidden picture in a single colour of the background layer, and the width of a single first geometric shape of the embossed structure may not be bigger than n , and the single first shape of the embossed structure is located within a single line of the background layer. In turn, the second element and/or part of the hidden picture in at least one another colour of the background layer is obtained by shifting the first geometric shapes of the embossed structure of the second element and/or part by an additional distance relative to the first geometric shapes of the embossed structure of the first element and/or part of the hidden picture. Preferably, in order to obtain the second element and/or part of the hidden picture in one another colour of the background layer, one shifts the first geometric shapes of the embossed structure of the second element and/or part by an additional distance equal to an integer multiple of the width of first lines of the background layer relative to the first geometric shapes of the embossed structure of the first element and/or part of the hidden picture, the width of a single first geometric shape being not bigger than n .

[0035] Preferably, the sequences of the parallel first lines of the background layer are produced by offset printing, letterset printing, or flexographic printing. The embossed structure is produced by blind embossing, whereas the inked embossed structure is produced by wet embossing using at least one intaglio ink.

[0036] Preferably, the inked embossed structure is embossed in the same run as the first geometric shapes of the blind embossed structure.

[0037] Preferably, a single shape of the first geometric shapes of the blind embossed structure has a width in the range from $n-50\%n$ to $n+50\%n$, and a single shape of the second geometric shapes of the inked embossed structure has a width in the range from n to $Ln - 1$, where:

L denotes the number of different colours in the sequence of the first lines,
 n denotes the width of a single line in the sequence of the first lines.

[0038] Disclosed is a security and/or valuable document comprising a security element as defined above.

[0039] The security and/or valuable document is produced from one: paper, polymer, a combination thereof, and/or bound paper materials, paperlike, and/or polymer materials.

[0040] The present invention will be understood and appreciated more fully basing on the following detailed

description when read along with attached drawing, in which:

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|----|---------|---|
| 5 | Fig. 1 | shows a simplified plan view of a security and/or valuable document comprising a security element; |
| 10 | Fig. 2 | shows a background layer of the security element consisting of sequences of first lines of the background layer; |
| 15 | Fig. 3 | shows a shift of first geometric shapes of an embossed structure according to the invention; |
| 20 | Fig. 4 | shows a cross-sectional view of a part of a intaglio machine with different slope angles of the embossing elements sides; |
| 25 | Fig. 5 | shows a diagram of creating a hidden picture of the security element according to the invention - the first embodiment of the invention; |
| 30 | Fig. 6 | shows a diagram of creating the security element according to a second embodiment of the invention; |
| 35 | Fig. 7 | shows a cross-sectional view of the security element and of the background layer according to a second embodiment of the invention; |
| 40 | Fig. 8 | shows a cross-sectional view of the security element and its observation points according to a second embodiment of the invention; |
| 45 | Fig. 9 | shows a diagram of creating the security element according to a second embodiment of the invention in another variant; |
| 50 | Fig. 10 | shows a cross-sectional view of the security element and its observation points according to a second embodiment of the invention in another variant; |
| 55 | Fig. 11 | shows a cross-sectional view of the security element and of the background layer according to a third embodiment of the invention; |
| | Fig. 12 | shows a diagram of creating the security element according to a third embodiment of the invention; |
| | Fig. 13 | shows a diagram of creating the security element according to a fourth embodiment of the invention; |
| | Fig. 14 | shows a partial cross-sectional perspective |

view of the security element according to a fourth embodiment of the invention;

Fig. 15 shows a diagram of creating the security element according to a fifth embodiment of the invention.

[0041] Below in the present description embodiments are shown of a security element, a security document, and a method for producing the security element, the security element consists of background layer in a form of sequences of parallel first lines and of an embossed structure having such parameters that one obtains various colour effects of individual parts of a picture consisting of the security element. However, it must be emphasised that the below described embodiments are not intended to limit the protection scope, but merely to illustrate one of many possible purposes of the present invention. The present invention may be used in any field where one needs to produce a multicolour hidden picture with a clear colour division of individual parts of the picture, as well as to produce a multicolour hidden picture joined in a visual manner with a visible picture.

Detailed description

[0042] A security and/or valuable document, 100, has a form and format of a banknote, cheque, ticket, or another valuable document.

[0043] The security and/or valuable document, 100, shown in Fig. 1, comprises a substrate, 107, made, for example, from paper, polymer, like polypropylene (PP) and/or polyamide (PA), a combination of paper and polymer materials, and/or bound paper materials, paperlike materials, like teslin, or hybrid materials based on a combination of paper and polymer. The invention is not limited to any specific material. Also, the material of the substrate, 107, may have a multilayered structure comprising several mutually bonded layers.

[0044] The security element, 106, in a form of a hidden picture located on the security and/or valuable document, 100, is consisting of a layer consisting of the background, 108, shown in Fig. 2, superimposed onto the substrate, 107, and of a second layer, manufactured by the blind intaglio technique, shown in Fig. 3. The term "applying" onto the substrate, 107, means offset printing, letterset printing, and the term "blind technique" means to perform the embossing without any ink on the substrate, 107.

[0045] The background or the background layer, 108, according to the invention, is an underprint made from a sequence of parallel first lines of a constant width n , and any number of colours L . The sequence of the first lines results from the formula Ln . Depending on the colourful angular effect that is to be obtained, the background layer, 108, may consist of a sequence of the first lines comprising a single coloured line of a width n , as well as it may be produced from a sequence of the first lines comprising two, three, or any number of mutually parallel lines of

different colours L of the same width n . In the case of applying a single horizontal line onto the substrate, 107, the colour of the substrate, 107, becomes a second colour of the sequence of the first lines of a width n , i.e., of the same width that the first line, superimposed onto the substrate, 107, has. Also in other cases, i.e., with many different colours L in a sequence of the first lines, the colour of the substrate, 107, may be utilised as another colour in a sequence of the first lines. If the sequence of the first lines will be composed of a first, 101, a second, 102, and a third colour, 103, then such sequence of the first lines is denoted by the symbol $3n$. If the sequence of the first lines is composed of two colours, then it will be denoted as $2n$. Such notation will be used, correspondingly, to any number of colours constituting one sequence of the first lines. According to the invention, the background layer, 108, may be constituted by at least one sequence of the first lines, as well as any arbitrary number of sequences of the first lines, and, preferably, the order of the colours in every sequence of the first lines is the same. It means that if the sequence of the first lines is defined by the first, 101, second, 102, and third, 103, colour, then any subsequent sequence of the first lines is created by the same colours arranged, one by one, in the same order, i.e., again the first, 101, second, 102, third colour, 103. In this way, a parallel line of the third colour, 103, of the preceding sequence of the first lines adjoins with its edges with a parallel line of the first colour, 101, of a subsequent sequence of the first lines. Preferably, according to the invention, the first colour, 101, is Cyan, the second colour, 102, is Yellow, and the third colour, 103, is Magenta. The terms, as used herein, a line, first line, line in a sequence of the first lines of the background layer, line of the background layer, are used interchangeably.

[0046] According to the invention, the width n of a line in a sequence of the first lines may be different, however, it affects the readability of the hidden picture. The width n is in the range from 100 to 400 micrometers, preferably from 120 to 250 micrometers, and most preferably 150 - 200 micrometers. However, the readability of the hidden picture is more affected by the number of used colours L in a sequence of the first lines than by the width n of these lines. The higher the number of sequences of the first lines per unit area of the background, 108, the background is composed of, thereby the higher the number of parallel lines of the same colour, the narrower the individual sequences of the first lines become, and the parallel lines of the same colour in neighbouring sequences of the first lines become located more and more close to each other.

[0047] A sequence of the first lines may be imprinted with a colour ink, such as an ink for offset printing, letterset printing, or flexographic printing.

[0048] According to the invention, then an embossing process is performed of an embossed structure onto the homogeneous, striped background layer, 108, as described above. The embossed structure is the second

layer of the security element, 106, consisting of a designed hidden picture. The layer is embossed using an intaglio machine and it is raised. It may present any complex picture showing a plant, an animal, or any other object or abstract graphics. The embossed structure may be constituted by a grid of equidistant, relative to each other, first geometric shapes. The first geometric shapes, within a single part of the hidden picture, are equidistant, when the lines going through the centres of these geometric shapes, drawn perpendicularly to the shift direction, are at the same distance within a single part of the hidden picture. In some embodiments, the peripheral geometric shapes of the hidden picture have a smaller width than the remaining geometric shapes of this hidden picture, and for such peripheral geometric shape the distance from the line going through the centre of this geometric shape to the line going through the centre of neighbouring geometric shape will be smaller than for non-peripheral geometric shapes within a single part of the hidden picture. Under the first geometric shape it is meant, for example, rectangular, square, triangle, trapezium, circle, ellipse, diamond, as well as other shapes of complex structures (fractal structures), or lines. A specific example of equal distances is parallelism.

[0049] In the case, the grid of the embossed structure is defined by equidistant, relative to each other, first geometric shapes, it is beneficial to produce them using semicircular engraving profile. Moreover, the engraving profile is symmetrical. The solution is not limited to such profile but it may be used also with V-shaped or W-shaped profiles. According to the invention, the first geometric shapes of the embossed structure do not adjoin each other directly, since are separated from each other by a value of the *shift p* (Fig. 3), that, depending on the embossed picture and an effect, that is to be achieved, is from 50 to 400 micrometers.

[0050] According to the invention, in the case of an embossed structure obtained by blind embossing, the only colour that is visible, is the colour located on the sides and edges of the embossing. Thus, if a combination of two colours, 101 and 102, will be placed on a side or close to an edge, then a mixed colour will be perceived by an observer's eyes. Using a semicircular profile, colours are mixed smoothly. By the edges of the embossing it is meant a part from the half of a side of the embossed element to the half of the apex of the embossing.

[0051] The security element, 106, in a form of a multi-colour hidden picture is obtained through embossing the first geometric shapes of the embossed structure of different elements and/or parts defining the hidden picture with a shift by an appropriate value of the shift *p* relative to the sequences of the first lines of the background layer, 108. Thus, a value of the shift *p* may be defined by an integer or non-integer width of the first lines or their multiple, and, substantially, the width of a single first geometric shape should be in the range from 50%*n* to 150%*n*, where *n* is the width of a single line in a sequence of the first lines. Whenever, in this document, a hidden

picture is obtained by a shift of the first geometric shapes of an embossed structure relative to the sequences of the first lines, it means that the first geometric shapes of the embossed structure are embossed with a shift relative to the sequences of the first lines of the background layer. These terms are used interchangeably. Similarly, the terms geometric shape and shape are used interchangeably to indicate a single first geometric shape of an embossed structure.

[0052] Other colours of other individual elements and/or parts of a hidden picture are obtained by embossing the first geometric shapes of the embossed structure of these other elements and/or parts, with a shift by an additional distance upwards or downwards relative to the first geometric shapes of an embossed structure of a previous element and/or part of the hidden picture, 105. This additional distance is the width or a multiple of the width of a single first line in a sequence of the background layer, 108. Preferably, the first geometric shapes of an embossed structure are being shifted in parallel relative to the sequences of the first lines, however, also, it is possible to shift with a rotation by a predetermined angle.

[0053] According to the invention, the shift, by a value of the shift *p*, of an embossed structure relative to the sequences of the first lines by a distance even as small as of the order of 1/100 millimetre, causes a change of a tone of the later of hidden picture effect of the security element, 106. Moreover, depending on the preparation of the intaglio matrix, one can obtain various colour effects for individual parts of the hidden picture consisting of the security element, 106.

[0054] The engraving depth for embossing the first geometric shapes is from 30 to 80 micrometers, preferably from 40 to 60 micrometers.

[0055] The width of the first geometric shapes of the embossed structure may be arbitrarily wider $n+50\%n$ or narrower $n-50\%n$. The width of a single shape of the first geometric shapes of the embossed structure depends on the number of colours *L* in a sequence of the first lines, and the width *n* of these lines, and on the colour effect that one assumes to obtain for the hidden picture of 106. The more different colours in a sequence of the first lines, the bigger the width of a single geometric shape of the first geometric shapes of the embossed structure may be. And reversely, the less different colours in a sequence of the first lines, the smaller the width of single geometric shape of the first geometric shapes of the embossed structure may be. The width of a single geometric shape of the first geometric shapes of an embossed structure is from 50 to 600 micrometers, preferably from 150 to 250 micrometers.

[0056] It turned out that in order to obtain a multicoloured hidden picture with a clear colour division of individual parts of the hidden picture, of importance is the slope angle α of the sides of the embossing elements (printing elements) at the base of the engraving shown in Fig. 4. Preferably, this angle is from 75° to 90°. The first geometric shapes of the embossed structure have the

same angle.

[0057] Thus, looking at the security element, 106, from above in diffused light or in parallel to the sequences of the first lines, an observer only can see a uniformly striped background, 108. The hidden picture within the security element, 106, is not visible. In turn, when an observer looks almost transversely to the direction of the printed lines, and the security and/or valuable document, 100, is tilted still more and more in parallel to the sight line, then the picture becomes visible. The picture is visible in almost all lightning conditions, however, it is preferable that the light, when looking at 106, illuminates the security and/or valuable document, 100, from behind of the observer. Then, the light perfectly illuminates the front surfaces of the embossed security element, whereby the colours become more visible.

[0058] According to the invention, if the background layer, 108, will be illuminated with side light, then a hidden picture will appear that will be visible even when observing it transversely, sidewise, or at any other position.

[0059] According to first embodiment shown in Fig. 5, a security element, 106, in a form of a hidden picture, consists of a background layer, 108, superimposed onto a substrate, 107, of a security and/or valuable document, 100. The background layer, 108, is defined by at least one sequence of parallel first lines consisting of at least two lines of different colours, and, moreover, the colour of the substrate, 107, may consist of one of the colours of the sequence of the first lines, and the lines in the sequence of the first lines have the same width. Also, the security element consists of at least one embossed structure, 104, on the background layer, 108, the embossed structure, 104, being defined by equidistant, relative to each other, first geometric shapes, and a hidden picture, 105, is obtained by embossing the first geometric shapes of the embossed structure, 104, with a shift relative to the sequences of the first lines of the background layer, 108.

[0060] According to a second embodiment of the present invention, one obtains a division of a security element, 106, in a form of a hidden picture, 105, into many colouristically separate but, at the same time, clear parts 105a, 105b. To this end, onto the substrate, 107, the background layer, 108, of the security element, 106, is imprinted, the layer comprising a lot of sequences of parallel first lines consisting of at least two lines of different colours, the background layer, 108, being consisted of of any arbitrary number of multiples of the sequences of the first lines. The lines in a sequence are of the same width n .

[0061] The background layer, 108, shown in Fig. 6, is composed of sequences of the first lines $Ln = 3n$, so it is a sequence of the first lines of three colours: a first one, 101, a second one, 102, and a third one, 103. Then, onto the background layer, 108, an embossed structure, 104, is blind-embossed, consisting of raised equidistant, relative to each other, first geometric shapes that are created by a permanent deformation of the substrate, 107, whereby parts of the sequences of the first lines become

accentuated. The length of the first geometric shapes of the embossed structure, 104, depends on the desired effect. A picture, 105, consisting of, for example, the first element, 105b, in a single colour, is obtained by embossing the first geometric shapes of the embossed structure, 104b, with a shift by a value of the shift $p = Ln$ (here $p = 3n$), relative to the sequences of the first lines of the background layer, 108. If only a single element of the picture, 105b, of the second colour, 102, is to be visible, then, the first geometric shapes of the embossed structure, 104b, are embossed with a shift by the value of the shift $p = 3n$ relative to the sequences of the first lines, counting from the lines of the second colour, 102, this causing that the embossing of the embossed structure, 104b, only is performed on the first lines of the second colour, 102. This is shown in Fig. 7 that shows z cross-sectional view of the picture element, 105b, and of the background layer, 108, along the axis $\beta - \beta$. According to the invention, it is also possible that all the picture elements of a single colour and/or of the same shape, are obtained by embossing the first geometric shapes of the embossed structure, 104b, with a shift by the value of the shift $p = Ln$, i.e., $p = 3n$.

[0062] In turn, another colour of a part in the hidden picture, 105, is obtained through embossing, with a shift by an additional distance, the first geometric shapes of the embossed structure, 104a, of the second element, 105a, relative to the first geometric shapes of the embossed structure, 104b, of the first element, 105b. According to this embodiment, another colour is obtained, when the width of the first geometric shapes of the embossed structure is not bigger than n at a shift of the first geometric shapes of the embossed structure, 104a, of the second element, 105a, by the value of the shift $p = n$ relative to the first geometric shapes of the embossed structure, 104b, of the first element, 105b. The first geometric shapes of the embossed structure 104a, 104b, according to the present embodiment, preferably are located within a single line of the background layer, 108.

[0063] If the picture, 105, consists of, for example, two separate elements, this also being shown in Fig. 6, then the first geometric shapes of the embossed structure of both elements, 105a, 105b, are embossed with a shift by the value of the shift $3n$ relative to the sequences of the first lines, 108, but, additionally, the second graphical element, 105a, is shifted relative to the first graphical element, 105b, by additional line width n , such that both graphical elements obtain another colour. Also, depending on the desired colourful effect, a shift by the line width n is performed upwards and/or downwards relative to the first graphical element, 105b. In the shown embodiment consisting of two graphical elements, 105a, 105b, embossed on the background layer, 108, consisting of a plurality of sequences of three parallel lines $3n$, a picture, 105, is obtained that, when observing at an acute angle in diffused light accentuates embossed elements in the first colour, 101, for the second graphical element, 105a, and

in the second colour, 102, for the first graphical element, 105b.

[0064] Thus, looking at the security element, 106, in a form of a hidden picture, 105, from above in diffused light (direction C) or in parallel to the sequences of the first lines, as shown in Fig. 8, an observer only can see a uniformly striped background, 108. But when the security element, 106, is looked at an acute angle (direction A or B) or under side light (D), then the picture is visible of the first graphical element, 105b, in the second colour, 102. Similarly, this being not shown in Fig. 8, the picture of the second graphical element, 105a, is visible in the first colour, 101.

[0065] Also, this principle is valid for a picture, 105, consisting of many elements, each of which being in another colour, as well as for pictures consisting of many colourful parts. By embossing the first geometric shapes of the embossed structure, 104, with a shift by an integer multiple of the width of a single line in the sequence of the first lines, relative to the first part or graphical element, as well as subsequent parts or elements consisting of a portion of the hidden picture, multicolour pictures are produced with a clear colour division of individual parts of the picture, 105. However, the width of a single first geometric shape may not be bigger than the width of a single line in a sequence of the first lines, and the geometric shapes are located within single lines of the background layer.

[0066] Alternatively, a possibility exists that parts of the graphical picture, 105, will be located at a junction between colours, as shown in Fig. 9. It happens, when the shift p is an integer multiple, for example $p=2n$, $3n$. For better understanding the present variant of the invention, Fig. 10 shows a cross-sectional view of the graphical elements of Fig. 9, i.e., of the first graphical element, 105b, and the background layer, 108, the background layer, 108, consisting of the sequences of the first lines 101, 102, and 103, along the axis B - B, and a cross-section of the second graphical element, 105a, and the background layer, 108, along the axis γ - γ . Thus, for example, when the second graphical element, 105a, is located at the junction between the first colour, 101, and the third colour, 103, the first graphical element, 105b, falls onto the junction between the second colour, 102, and the first colour, 101, then, when observing at an acute angle from the direction A, the picture, 105, will be visible, such that the second graphical element, 105a, will be visible in the first colour, 101, whereas the first graphical element, 105b, will be visible in the second colour, 102, and from the direction B the second graphical element, 105a, will be visible in the third colour, 103, whereas the first graphical element, 105b will be visible in the first colour, 101. If a side light (D) will be placed at a level of the substrate, 107, the light being perpendicular to the first geometric shapes of the embossed structure, 104, then the whole colourful effect of both graphical elements, 105a, 105b, is visible from the directions A, B, C, and from any other direction, and a colour will be visible from a

given observation direction.

[0067] According to the present embodiment, the invention may consist of a plurality of graphical elements in many colours consisting of a hidden picture of the security element, 106, accordant with the present embodiment.

[0068] The purpose of the third embodiment is to obtain multicoloured smooth colour transitions in a picture, 205, of the security element, 106, creating a rainbow impression. Under the term of rainbow, according to the invention, it is meant a uniform transition, over some surface, from one colour to second colour, or from one fade of the same colour to its another fade. The rainbow impression, within its classical meaning, is possible to obtain, if the background layer, 108, is created by sequences of first lines at least in colour Magenta, Yellow, and Cyan. In turn, when using Pantone colours, for example red, velvet, brown, no rainbow will be obtained in the classical sense, but a uniform transition from one colours with its tones to another colour with its tones. According to this embodiment, the background layer, 108, of the security element, 106, consists of at least three sequences of parallel first lines of at least two colours, wherein the colour of one of the first lines in a sequence may be the colour of the substrate, 107. The background layer, 108, consists of any number of sequences of the first lines of the same width n . Next, blind embossing of background layer, 108, with the embossed structure, 204, in a form of equidistant, relative to each other, first geometric shapes. The width of the first geometric shapes of the embossed structure, 204, depends on the effect, that is to be obtained, and it is in the range from $n-50\%n$ to $n+50\%n$. The embossed multicoloured picture, 205, being a combination of the coloured background layer, 108, and the embossed structure, 204, is obtained by embossing the first geometric shapes of the embossed structure, 204, with a shift, relative to the sequences of the first lines, by a value of the shift $p = Ln+w$ or $p=Ln-w$, where the coefficient w is calculated from the following formula:

$$w = Ln/i_s$$

where:

L denotes the number of different colours in a sequence of the first lines,
 n denotes the width of a single line in a sequence of the first lines,
 i_s denotes the number of sequences of the first lines in the area of the embossed structure, 204.

[0069] Preferably, the first geometric shapes of the embossed structure, 204, are embossed with a parallel shift relative to the background layer, 108, however, it is also possible to make the embossing with a parallel shift with a turn by a predetermined angle.

[0070] According to the invention, for obtaining the rainbow effect, it is not important if a value of the shift p

is calculated by adding the coefficient w to the Ln value, or by subtracting it. In the case, the coefficient w is subtracted from the Ln value, an effect of colour transition is obtained, the transition being inverted by 180° .

[0071] The rate of the colour transitions depends on the number of sequences, the graphical element of the picture, 205, is located, this being illustrated by the following two calculation examples a and b. The higher the number of sequences of first lines in the background layer, 108, in the area of the graphical element, 205, is, the smaller the coefficient w is, and the transition from the first colour, 101, with its tones, via the second colour, 102, with its tones, up to the third colour, 103, with its tones, is slower. The higher the coefficient w , the "faster" the transition is.

Example a

[0072] If the graphical element of the picture, 205, is contained within 17 sequences of the first lines of three colours, and the width of a single line n is 150 micrometers, then a value of the shift p calculated from the formula $p = Ln + w$ (where $w = Ln/i_s$) is

$$w = 3 \times 150 \text{ micrometers} / 17$$

$$w = \sim 26 \text{ micrometers}$$

$$p = 3 \times 150 \text{ micrometers} + w$$

$$p = 450 \text{ micrometers} + 26 \text{ micrometers}$$

$$p = 476 \text{ micrometers}$$

Example b

[0073] If the graphical element of the picture, 205, is contained within 24 sequences of the first lines of three colours, and the width of a single line n is 150 micrometers, then a value of the shift p calculated from the formula $p = Ln + w$ (where $w = Ln/i_s$) is

$$w = 3 \times 150 \text{ micrometers} / 24$$

$$w = \sim 18,8 \text{ micrometers}$$

$$p = 3 \times 150 \text{ micrometers} + w$$

$$p = 450 \text{ micrometers} + 18,8 \text{ micrometers}$$

$$p = 468,8 \text{ micrometers}$$

[0074] Although the elements of the graphical picture, 205, described in the above Examples are of different heights, this being evidenced by the number of the sequences of the first lines of the same width, within which this element is contained, a single colour transition only takes place within both of these graphical elements of the

same colours and in the same order, with such a notice, however, that for the graphical element of the picture, 205, contained within 24 sequences of the first lines, the transition is longer.

[0075] The embossed structure, 204, is adjusted such that to obtain desired colours of the security element, 106. The tone of the colour obtained in the embossing depends on the overlapping extent of two neighbouring colours onto this embossing. The overlapping extent, according to the invention, denotes mixing two neighbouring colours, in different ratios, on the side profiles of an embossed structure, 204. This is shown in Fig. 11. For example, on one embossing there is 100 % of the first colour, 101, or 10 % of the first colour, 101, and 90 % of the second colour, 102, or 50 % of the first colour, 101, and 50 % of the second colour, 102, then 100 % of the second colour, 102, or 10 % of the second colour, 102, and 90 % of the third colour, 103, or 50 % of the second colour, 102, and 50 % of the third colour, 103, then 100 % of the third colour, 103, or 10 % of the third colour, 103, and 90 % of the first colour, 101, or 50 % of the third colour, 103, and 50 % of the first colour, 101, the mixing ratios of colours on the profiles of the embossed structure, 204, are arbitrary. The more the sequences of the first lines included in the area of the embossed structure, 204, the slower the colour mixing is, creating the whole palette of tones within a single colour transition between the colours of the sequences of the first lines that constitute the picture 205.

[0076] Alternatively, the colour transition between the colours of the sequences of the first lines may be repeated many times in the area of the graphical element of the picture, 205. In order to obtain any number of colour transitions, the coefficient w , that is responsible for a single colour transition, is multiplied by a value of $z-1$. The coefficient w is responsible for a single transition between the used colours. For example, when placing five colour transitions in the picture, 205, the coefficient w is multiplied by $z-1$, i.e., 4. Using the data of Example b, where $p = 450 \text{ micrometers} + 18,8 \text{ micrometers}$ and multiplying the coefficient w by 4, one would obtain the value of the shift $p = 450 \text{ micrometers} + 18,8 \text{ micrometers} \times 4 = 525 \text{ micrometers}$. In consequence, in order to obtain five colour transitions in one picture, 205, the first geometric shapes of the embossed structure, 204, should be shifted by the value of the shift of $p = 525 \text{ micrometers}$, relative to the three-coloured background layer, 108, consisting of 24 sequences of the first lines.

[0077] Fig. 12 shows a preferable embodiment, in which the background layer, 108, of the security element, 106, in a form of a hidden picture, 205, consists of 6 sequences of parallel lines of three colours of the same width n , wherein a colour of a single line in a sequence of the first lines may be the colour of the substrate, 107. Then, an embossed structure, 204 was blind-embossed on the background layer, 108. A multicoloured picture, 205, is obtained by shifting the first geometric shapes of the embossed structure, 204, by a value of the shift p , where

$$p = 3n - w$$

where the coefficient w is calculated from the following formula:

$$w = Ln / i_s$$

where:

Ln denotes the number of colour lines in a sequence of the first lines,
 i_s denotes the number of sequences of the first lines in the area of the embossed structure, 204.

[0078] In this example, Ln is $3n$, and i_s is 6, hence:

$$w = 3n/6 = "n$$

$$p = 3n - "n$$

$$p = 2,5 n$$

[0079] In consequence, in order to obtain a multicoloured picture, 205, in all the tones of the colours 101, 102, and 103, one must emboss the first geometric shapes of the embossed structure, 204, with a shift by the value of the shift $p = 2,5n$ relative to the three-colour background layer, 108. The embossed structure, 204, consists of parallel, relative to each other, first geometric shapes creating an oval pattern, "scattered" by the value of the shift $p = 2,5n$.

[0080] If the first geometric shape of the first geometric shapes of the embossed structure, 204, at the value of the shift $p = 2,5n$, will start from the first colour (counting from above of the picture), 101, then the subsequent shape of the first geometric shapes will accentuate two colours - the third colour, 103, and the first colour, 101, a next geometric shape of the first geometric shapes will only accentuate the third colour, 103, a next geometric shape again two colours, these being now the second colour, 102, and the third colour, 103, then only the second colour, 102, next one two colours - the first colour, 101, and the second colour, 102, and, finally, single first colour, 101. If the first colour, 101, is colour Cyan, the second colour 102, is Yellow, and the third colour, 103, is Magenta, then by making the first geometric shapes of the embossed structure, 204, with the value of the shift $p = 2,5n$, one obtains a transition: Cyan - velvet - Magenta - orange - Yellow- green - Cyan.

[0081] Alternatively, according to the invention, it is also possible to use colours of the PANTONE system.

[0082] Alternatively, the size of the embossed structure, 204, may be bigger than the structure of the first lines, and it may be embossed beyond the area of the background layer, 108. Then, the security element, 106, has a hidden picture over the whole surface of the imprinted background, 108, and the embossing outside the structure of the first lines is not visible, i.e., it gives no

hidden picture. In this way, a risk is reduced of misalignment of the embossed structure, 204, with the background layer, 108.

[0083] According to other embodiments, each of the Examples 1 to 5 may be supplemented by embossing outside the structure of the first lines, as described above.

[0084] According to a fourth embodiment of the present invention, a multicoloured security element, 106, in a form of a hidden picture, 305, shows the moiré effect. This results from a different, relative to the previous embodiments, arrangement of the first geometric shapes of the embossed structure, 304. To this end, the background layer, 108, as described above, is blind-embossed with an embossed structure, 304, consisting of raised first geometric shapes, parallel relative to each other, wherein they are turned from the sequences of the first lines, 108, by a predetermined angle. The width of the first geometric shapes of the embossed structure, 304, may be arbitrarily wider $n+50\%n$ or narrower $n-50\%n$. The security element, 106, created by the superimposed first geometric shapes of the embossed structure, 304, on the background layer, 108, consisting of at least two sequences of the first lines of three different colours, observed in diffused light when observing perpendicularly to the surface or when observing in parallel to the lines, has a uniform colour. However, if the security element, 106, is viewed at an acute angle, then one can observe the moiré effect. This effect, according to the invention, arises due to the fact that on every single geometric shape of the embossed structure, 304, a sequence of one-by-one colours 101, 102, 103, is located, sometimes many times, instead of the single colour of the background layer, 108. Thus, turning the embossed structure, 304, by a predetermined angle relative to the sequences of the first lines of the background layer, 108, causes a transition of the picture, 305, in the security element, 106, of a uniform colour into a multicoloured picture having colours changing from the first colour, 101, into the second colour, 102, and then into the third colour, 103. The colour transition takes place in a diffused/meshing manner from one colour into another, by creating, for example, linear stripes of different colours created by mixing three primary colours of the background layer, 108, and their intermediate tones.

[0085] The first geometric shapes of the embossed structure, 304, according to the invention, may create any arbitrary shape, from simple ones up to very complex patterns presenting leaves, butterflies, drops, or other motifs.

[0086] The predetermined angle is from 1° to 12° , preferably the angle is from 3° to 6° .

[0087] Turning the first geometric shapes of the embossed structure, 304, by a higher angle relative to the background layer, 108, increases the moiré effect.

[0088] Fig. 13 shows a security element, 106, in a form of a hidden picture, 305, produced according to this embodiment. For better understanding the invention, the background layer, 108, is defined by six sequences

of the first lines, every sequence consists of three lines of three different colours, hence $Ln=3n$. The colour of the substrate, 107, may constitute one of the colours in a sequence of the first lines $3n$. The lines are of the same width n . A picture, 305, of the security element, 106, is created by blind embossing, within the background layer, 108, first geometric shapes of an embossed structure, 304, that are shifted, relative to the sequences of the first lines of the background layer, 108, by a value of the shift p , and are turned relative to the sequences of the first lines, by an angle of 6° . The first geometric shapes of the embossed structure, 304, along with the background layer, 108, may define any arbitrary pattern. Depending on the lengths of the first geometric shapes of the embossed structure, 304, a plurality of subsequent colours may be located on a single shape, sometimes many times. Fig. 14 shows an example of the security element, 106, with three repeating lines of different colours within a single geometric shape of the embossed structure, 304.

[0089] Moreover, according to the invention, the moiré effect may be obtained both by turning, by a predetermined angle, the embossed structure, 104, shown in the first embodiment as well as the embossed structure, 204, of the second embodiment. Moreover, the security element, 106, may consist of a plurality of different parts, of which, in every single part, its first geometric shapes of the embossing the embossed structure, are differently, relative to each other, turned and shifted.

[0090] According to another embodiment, the first geometric shapes of embossed structure, 104, 204, 304, are turned by a predetermined angle clockwise or anticlockwise. For example, the hidden picture, 105, of the first embodiment may consist of three parts, of which the upper part of the hidden picture, 105, is turned, for example, by an angle of 6° , the lower part of the picture, 105, is turned by an angle of -6° , and the central part is shifted by the line width n and is turned by 6° .

[0091] The fifth embodiment is the security element, 106, shown in Fig. 15. The security element, 106, in a form of a hidden picture, on a security and/or valuable document, 100, consists of a layer consisting of the background, 108, the layer being superimposed onto the substrate, 107, and of at least one embossed structure, 404, that consists of equidistant, relative to each other, first geometric shapes, a hidden picture, 405, being obtained by embossing the first geometric shapes of the embossed structure with a shift relative to the sequences of the first lines of the background layer, 108. According to this embodiment, the security element, 106, also has at least one inked embossed structure, XXX, consisting of equidistant, relative to each other, second geometric shapes embossed and covered with an ink on the background layer, 108.

[0092] Because of that, the security element, 106, in addition to the hidden picture, 405, also contains a visible picture, XXX', obtained by embossing second geometric shapes of inked embossed structure, XXX, with a shift relative to the sequences of the first lines of the back-

ground layer, 108. The visible picture, XXX', may be any arbitrary picture, however, preferably the visible picture is a complement of the hidden picture, its repetition, or its mirror image.

[0093] The inked embossed structure XXX, may be constituted by a grid of equidistant, relative to each other, second geometric shapes. The second geometric shapes, within a single part of the visible picture, are equidistant, when the lines going through the centres of these geometric shapes, drawn perpendicularly to the shift direction, are at the same distance within a single part of the visible picture. In some embodiments, peripheral geometric shapes of the picture have a smaller width than the remaining geometric shapes of this picture, and for such peripheral geometric shapes the distance from the line going through the centre of this geometric shape to the line going through the centre of a neighbouring geometric shape will be smaller than for non-peripheral geometric shapes within the single part of the picture. Under the term of "second geometric shape" it is meant, for example, a rectangle, square, triangle, trapezium, circle, ellipse, diamond, as well as other shapes of complex structures (fractal structures), or lines. A specific example of equal distances is parallelism.

[0094] For example, the inked embossed structure XXX may be a grid of squares of a side depending on the desired effect. The width of the second geometric shapes of the structure is in the range from n to $Ln-1$. It means that the first geometric shapes of the embossed structure, 404, and the second geometric shapes of the structure may have the same width, but also may have different widths. Thus, if one desires to cover two colours out of a three-coloured background layer, 108, then the square side width is $2n$ and the shift is $3n$. If the goal is to cover one colour out of a four-coloured background layer, 108, then the square side is n and the shift is $4n$. When observing the security and/or valuable document, 100, perpendicularly, and at any other angle too, a colourful effect is visible produced by inked elements, wherein visible are the colours, out of the background layer, 108, that, are not covered by ink, and when observing at an acute angle or using side lightning, a second effect arises in a form of those elements out of the first geometric shapes of the embossed structure, 404, that are not inked, and the complement to this second effect being the visible picture, XXX', and this second effect being the hidden picture, 405.

[0095] By inking the second geometric shapes of the inked embossed structure, XXX, one obtains the same effects that were obtained by blind-embossing of the background layer, 108, - with such a difference that the effect is not hidden but it is visible under any lightning conditions. According to the invention, one may use any ink colour. In the case of using, for example, white, one obtains a pastel effect, whereas using black, one will obtain a more intensive colour of a given part of the background layer, 108, that was not covered by an ink. The advantage of this solution is obtaining colourful parts

of visible pictures using at least one intaglio ink.

[0096] When the background layer, 108, is consisting of 4 colours and, for example, the width of line in a sequence of the first lines is 150 micrometers, and the width of a single geometric shape of the second geometric shapes of the inked embossed structure, XXX, is $2n = 300$ micrometers, then the inked embossed structure, XXX, covers two colours and a colour resulting from the two non-covered colours becomes visible. In turn, when the width of a single geometric shape of the second geometric shapes of the inked embossed structure, XXX, has a width of $3n$, then the fourth non-covered colour is visible, whereas when the width of one geometric shape of the second geometric shapes of the inked embossed structure, XXX, is n , then a colour is visible that consists of a resultant of three non-covered colours. Depending on what a colour is used for inking the inked embossed structure, XXX, the resultant observed colour will have a darker or brighter tone.

[0097] Fig. 15 shows an embodiment in which both a hidden picture, 405, and a visible picture, XXX' co-exist within the security element, 106. According to this embodiment, the background layer, 108, consists of 6 sequences of parallel lines of three colours: a first one, 101, a second one, 102, and a third one, 103, of the same line width n . Then, an embossed structure, 404, was blind-embossed on the background layer, 108, the structure 404 having a form of a grid of squares of a side width n , with a parallel shift by $3n$ relative to the sequences of the first lines of the background layer, 108, and, in the same run, a inked embossed structure, XXX, was wet-embossed, having a form of a grid of squares of a side width $2n$, with a parallel shift by $3n$ relative to the sequences of the first lines of the background layer, 108. In this way, the inked embossed structure, XXX, covers, with the used ink, two colours of the background layer, 108, i.e., the first colour, 101, and the second colour, 102, and only one colour is visible - the colour third, 103, in a darker or brighter tone depending on the colour of the ink used for inking the inked embossed structure, XXX. Thus, in this case, the visible picture, XXX', is a picture of any arbitrary shape resulting from combining the ink covering the first colour, 101, and the second colour, 102, and visible elements of the third colour, 103. The same third colour, 103, is on the blind-embossed structure consisting of the hidden picture, 405.

[0098] According to other variants of the present invention, the first geometric shapes of the embossed structure, 404, as well as the second geometric shapes of the inked embossed structure, XXX, may be arbitrarily shifted according to the second embodiment, as well as may be shifted with a turn by a predetermined angle, this being described in detail in the fourth embodiment.

[0099] According to other embodiments, each of the Examples from 1 to 4 may be completed by a visible picture, XXX', produced in the manner as described in the fifth embodiment. Here, the visible picture is not limited to a grid of squares, but it may be based on any equidistant

geometric shape. Moreover, it should be emphasised that the security element may consist of a plurality of embossed structures and of a plurality of inked embossed structures.

[0100] Also, the invention relates to a method for manufacturing a security element, 106, in a form of a hidden picture, on a security and/or valuable document, 100. Onto the substrate, 107, of the security and/or valuable document, 100, a background layer, 108, is applied, consisting of at least one sequences of parallel first lines comprising at least two lines of different colours. The colour of the substrate, 107, may be one of the colours of the sequences of the first lines of the background layer, 108, and the lines in the sequence of the first lines have the same width n . The sequence of the parallel first lines are produced by offset printing, letterset printing, or flexographic printing. Preferably, the sequence of the first lines consists of three different colours, a first one, 101, a second one, 102, and a third one, 103. Preferably, these are colours from the CMY palette or the PANTONE system. Then, a second layer of the security element, 106, is applied, comprising a designed hidden picture. This layer is embossed using an intaglio machine. Preferably, to this end, a plate for intaglio printing is used. Also, according to the invention, the picture in the intaglio plate may be etched, light-exposed and washed out, engraved, or laser fired. A designed picture creates an embossed structure, 104, 204, 304, 404. In another embodiment, the picture creates an embossed structure 104, 204, 304, 404 and a inked embossed structure XXX. The embossed structure 104, 204, 304, 404, and/or the inked embossed structure XXX may consist of a grid of equidistant, relative to each other, geometric shapes. Under the term of the grid of geometric shapes it is meant a grid of circles, squares, diamonds, ellipses, rectangles, triangles, etc. Also, the shapes may be segments of straight or curved lines. The form of the first geometric shapes of the embossed structure, 104, 204, 304, 404, as well as of the second geometric shapes of the inked embossed structure, XXX, depends on the desired hidden and visible pictures. A single shape of the first geometric shapes of the embossed structure, 104, 204, 304, 404 has a width in the range from $n-50\%n$ to $n+50\%n$. In turn, a single shape of the second geometric shapes of the inked embossed structure, XXX, has a width in the range from n to $Ln-1$. Preferably, the first geometric shapes of the embossed structure, 104, 204, 404, and/or the second geometric shapes of the inked embossed structure, XXX, are embossed with a parallel shift relative to the sequences of the first lines of the background layer, 108, depending on the desired effect. Depending on the desired effect of a colour transition, a value of the shift p is calculated from the formula $p = Ln$ or from the formula $p = Ln+w$ or $p = Ln-w$, where w denotes a coefficient calculated from the formula:

$$w = Ln/i_s$$

L denotes the number of different colours in the sequence of the first lines,
 n denotes the width of a single line in the sequence of the first lines,
 i_s denotes the number of the sequences of the first lines in the area of the embossed structure.

[0101] Thus, a value of the shift p may be an integer or non-integer multiple of the width of the first lines, wherein the width of a single first geometric shape of the embossed structure should be in the range from 50% n to 150% n .

[0102] According to the invention, the embossing of the embossed structure 104, 204, 304, 404, in a form of a designed picture may be performed using an intaglio technique. The embossing of the embossed structure, 104, 204, 304, 404, is performed by blind embossing, whereas the embossing of the inked embossed structure, XXX, is performed in a wet process using at least one intaglio ink.

[0103] If, in a variant of the invention, the security element, 106, consists of a hidden, 405, and visible XXX' pictures, then, according to a method of the invention, in the same run, when blind embossing the embossed structure, 404, with a shift relative to the sequences of the first lines of the background layer, 108, by a predetermined value of the shift p , also inking is performed of the inked embossed structure, XXX. Individual colours are applied onto a mould for wet embossing by means of special patterns for applying intaglio ink (or inks). Every colour has its separate pattern and may comprise another shape, therefore the second geometric shapes of the structure may be inked in different colours by appropriate shapes on different patterns. In the structure of the second geometric shapes of the structure one may define one or, for example, five areas, that will be inked with different colours. The structure is produced by wet embossing on the background layer, 108, i.e., using at least one intaglio ink, the ink being applied onto the coloured lines of the background layer, 108. Preferably, the grid of the elements of the embossed structure with the inked, XXX, and non inked, 404, areas, is shifted in parallel.

[0104] The inked embossed structure, XXX, may have a form of a grid of shapes, the form of the shapes depending on the desired effect. For example, if the grid of the second geometric shapes is a grid of squares, then, if two colours are covered out of a three-colour background layer, 108, then the side width is $2n$ and the shift is $3n$. If one colour is covered out of a four-colour background layer, 108, then the square side is n and the shift is $4n$. Then, when observing perpendicularly, colours of the background layer, 108, are visible that are not covered by the ink, along with the visible picture, XXX'. If, according to the invention, one observes the hidden picture of the security element, 106, then, additionally, when observing at an acute angle or using side light, a second effect appears in a form of those elements of the first geometric

shapes of the embossed structure, 404, that consist of the hidden picture, 405, and the complement of which is the visible picture, XXX'.

[0105] According to a method of the invention, in order to obtain any number z of colour transitions in the hidden picture, a value of the shift p is calculated by adding or subtracting the coefficient w to/from the Ln value. The coefficient w is responsible for a single transition between the used colours. A colour transition between colours of sequences of the first lines may occur repeatedly in an area of the graphical element of the hidden picture. To this end, the coefficient w is multiplied by a value of $z-1$. After calculating the coefficient w considering the number of colour transitions, a value of the shift p is calculated for the first geometric shapes of the embossed structure relative to the first lines of the background layer, 108. The problem of the colour transitions in the hidden picture has been discussed in detail above.

[0106] According to another variant of the invention, if the inked embossed structure, XXX, consists of a grid of squares, rectangles, oval or circular elements, and if one desires to obtain a colour transition of both pictures, the visible one XXX' and the hidden one 405, then a value of the shift p for the inked part is the same as for the blind embossing.

[0107] Moreover, in order to obtain the moiré effect, the first geometric shapes of the embossed structure, 104, 204, 304, are turned by a predetermined angle clockwise or anticlockwise. The predetermined angle is from 1° to 12° , preferably is 6° .

[0108] In order to obtain an element and/or part of the hidden picture, 105, in a single colour, the first geometric shapes of an embossed structure, 104, are embossed with a shift relative to the sequences of the first lines of the background layer, 108, by a value of the shift $p = Ln$, to this end, a single shape of the embossed structure, 104, should be located within a single line of the background layer, 108. In turn, the second element and/or part, 105a, of the hidden picture, 105, of another colour, is obtained by shifting the first geometric shapes of the embossed structure, 104a, of the second element and/or part, 105a, of the hidden picture, 105, by an additional distance upwards and/or downwards relative to the first geometric shapes of the embossed structure, 104b, of the first element and/or part, 105b, of the hidden picture, 105. This additional distance is equal to an integer multiple of the width of the first lines, i.e., for example, it is equal to n , but the width of a single geometric shape of the first geometric shapes may not be bigger than n .

List of reference symbols

[0109]

100	security and/or valuable document
101	line of first colour
102	line of second colour
103	line of third colour

104	embossed structure	
104a	first geometric shapes of embossed structure of second element and/or part	
104b	first geometric shapes of embossed structure of first element and/or part	5
105	hidden picture	
105a	second element and/or part of hidden picture	
105b	first element and/or part of hidden picture	
106	security element	
107	substrate	10
108	background layer, sequence of first lines	
204	embossed structure	
205	hidden picture	
304	embossed structure	
305	hidden picture	15
404	embossed structure	
XXX	inked embossed structure	
405	hidden picture	
XXX'	visible picture	20
p	a value of the shift	
w	coefficient	
L	number of different colours in a sequence of first lines	
n	width of a single line in a sequence of first lines	25
i_s	number of sequences of first lines in an area of an embossed structure	
z	number of colour transitions	

Claims

1. A security element (106), with a hidden picture (405) and a visible picture (XXX'), consisting of:

- a background layer (108) applied onto a substrate (107) of a security and/or valuable document (100), wherein the background layer (108) consists of multiple sequences of parallel, relative to each other, first lines, wherein one sequence of the parallel, relative to each other, first lines, contains at least two lines (101, 102, 103) of different colours, that are repeated in the same order, wherein the colour of the substrate (107) may be one of the colours of the sequence of the first lines, and the lines in the sequence of the first lines are of the same width, and

- at least one embossed structure (104, 204, 304, 404) on the background layer (108), wherein the embossed structure (104, 204, 304, 404) consists of equidistant, relative to each other, first geometric shapes, whereas the hidden picture (105, 205, 305, 405) is obtained by embossing the first geometric shapes of the embossed structure (104, 204, 304, 404) with a shift (P) relative to the sequences of the first lines of the background layer (108), the security element comprising

- at least one inked embossed structure (XXX)

consisting of equidistant, relative to each other, second geometric shapes embossed and covered with ink on the background layer (108), whereas the visible picture (XXX') is obtained by embossing the second geometric shapes of the inked embossed structure (XXX) with a shift relative to the sequences of the first lines of the background layer (108).

2. A security element according to claim 1, wherein the geometric shapes are equidistant, when the lines going through the centres of these geometric shapes, drawn perpendicularly to the shift direction, are at the same distance within a single part of the hidden or visible picture.
3. A security element according to claim 1 or 2, wherein the shift of first geometric shapes of the embossed structure (104, 204, 404) and/or the second geometric shapes of the inked embossed structure (XXX) is a parallel shift relative to the sequences of the first lines of the background layer (108).
4. A security element according to one of the preceding claims, wherein a value of the shift p is calculated from the formula $p = Ln$, where L denotes the number of different colours in the sequence of the first lines, and n denotes the width of one line in the sequence of the first lines.
5. A security element according to one of the claims 1-3, wherein a value of the shift p is calculated from the formula $p = Ln + w$ or $p = Ln - w$, where the coefficient w is calculated from the following formula:

$$w = Ln/i_s$$

where:

L denotes the number of different colours in a sequence of the first lines,
 n denotes the width of a single line in a sequence of the first lines,
 i_s denotes number of sequences of the first lines in an area of the embossed structure.

6. A security element according to claims 1-2 and 3-5, wherein the first geometric shapes of the embossed structure (104, 204, 304, 404) and/or the second geometric shapes of the inked embossed structure (XXX) are shifted relative to the sequences of the first lines by a predetermined angle clockwise or anticlockwise.
7. A security element according to one of the preceding claims, wherein the embossed structure (104, 204, 304, 404) consists of equidistant, relative to each

other, first geometric shapes, and the inked embossed structure (XXX) consists of equidistant, relative to each other, second geometric shapes, that have a form of a grid of different elements, the shape of which depends on the designed hidden picture (105, 205, 305, 405) and/or visible picture (XXX') of the security element (106).

8. A security element according to one of the preceding claims, wherein a first element and/or part (105b) of the hidden picture (105) in at least one colour of the background layer (108) is obtained by embossing the first geometric shapes of the embossed structure (104) with a shift relative to the sequences of the first lines of the background layer (108).

9. A security element according to claim 7, wherein the first element and/or part (105b) of the hidden picture (105) in one colour of the background layer (108) is obtained by embossing the first geometric shapes of the embossed structure (104b) with a shift relative to the sequences of the first lines of the background layer (108) by an integer multiple of the line width, wherein width of a single first geometric shape may not be bigger than n , and a single first shape of the embossed structure (104b) is located within a single line of the background layer (108).

10. A security element according to claims 7 or 9, wherein a second element and/or part (105a) of the hidden picture (105) in at least one another colour of the background layer (108) is obtained by embossing the first geometric shapes of the embossed structure (104a) of the second element and/or part (105a) with a shift by an additional distance relative to the first geometric shapes of the embossed structure (104b) of the first element and/or part (105b) of the hidden picture (105).

11. A security element according to claim 8, wherein a second element and/or part (105a) of the hidden picture (105) in one another colour of the background layer (108), wherein the width of a single first geometric shape may not be bigger than n is obtained by embossing the first geometric shapes of the embossed structure (104a) of the second element and/or part (105a) of the hidden picture (105) with a shift by an additional distance equal to an integer multiple of the width of the first lines of the background layer (108) relative to the first geometric shapes of the embossed structure (104b) of the first element and/or part (105b) of the hidden picture, wherein the width of a single first geometric shape may not be bigger than n .

12. A security element according to one of the preceding claims 1-8, 10, wherein a single geometric shape of the first geometric shapes of the embossed structure

(104, 204, 304, 404) has a width in the range from $n-50\%n$ to $n+50\%n$, and a single geometric shape of the second geometric shapes of the inked embossed structure (XXX) has a width in the range from n to $Ln-1$,

where:

L denotes the number of different colours in the sequence of the first lines,

n denotes the width of a single line in the sequence of the first lines.

13. A method for producing a security element (106), with a hidden picture (405) and a visible picture (XXX'), on a security and/or valuable document (100), comprising steps of:

a) applying a background layer (108) onto a substrate (107), the background layer (108) consists of multiple sequences of parallel, relative to each other, first lines, wherein one sequence of the parallel, relative to each other, first lines, contains at least two lines of different colours that are repeated in the same order, wherein the colour of the substrate (107) may be one of the colours of the sequences of the first lines of the background layer (108), and the lines in the sequence of the first lines are of the same width,

b) embossing at least one embossed structure (104, 204, 304, 404) on the background layer (108), wherein the embossed structure consists of equidistant, relative to each other, first geometric shapes shifted relative to the sequences of the first lines, wherein the hidden picture (105, 205, 305, 405) is obtained by embossing the first geometric shapes of the embossed structure (104, 204, 304, 404) with a shift relative to the sequences of the first lines,

c) embossing at least one inked embossed structure (XXX) on the background layer (108), wherein the inked embossed structure being created by equidistant, relative to each other, second geometric shapes covered with ink and shifted relative to the sequences of the first lines, wherein the visible picture (XXX') is obtained by wet embossing the second geometric shapes of the inked embossed structure (XXX) with a shift relative to the sequences of the first lines of the background layer (108).

14. A method according to claim 13, wherein the embossing of the embossed structure (104, 204, 304, 404) is performed by blind embossing.

15. A method according to claim 13, wherein the inked embossed structure (XXX) is embossed in the same run as the first geometric shapes of the blind em-

bossed structure (104, 204, 304, 404).

Patentansprüche

1. Sicherheitselement (106) mit verstecktem Bild (405) und sichtbarem Bild (XXX'), bestehend aus:

- einer Hintergrundschrift (108), die auf einem Substrat (107) eines Sicherheits- und/oder Wertdokuments (100) aufgebracht ist, wobei die Hintergrundschrift (108) aus mehreren Sequenzen relativ zueinander paralleler erster Linien besteht, wobei eine Sequenz der relativ zueinander parallelen ersten Linien mindestens zwei Linien (101, 102, 103) unterschiedlicher Farbe enthält, die sich in derselben Reihenfolge wiederholen, wobei die Farbe des Substrats (107) eine der Farben der Sequenz der ersten Linien sein kann, und die Linien in der Sequenz der ersten Linien gleich breit sind, und

- mindestens einer Prägestruktur (104, 204, 304, 404) auf der Hintergrundschrift (108), wobei die Prägestruktur (104, 204, 304, 404) aus relativ zueinander äquidistanten ersten geometrischen Formen besteht, während das versteckte Bild (105, 205, 305, 405) durch Prägen der ersten geometrischen Formen der geprägten Struktur (104, 204, 304, 404) mit einer Verschiebung (P) in Bezug auf die Sequenzen der ersten Linien der Hintergrundschrift (108) entsteht, wobei das Sicherheitselement mindestens eine eingefärbte Prägestruktur (XXX) umfasst, die aus geprägten und mit Farbe bedeckten zweiten geometrischen Formen besteht, die relativ zueinander äquidistant auf der Hintergrundschrift (108) angeordnet sind, während das sichtbare Bild (XXX') durch Prägen der zweiten geometrischen Formen der eingefärbten Prägestruktur (XXX) mit einer Verschiebung bezüglich der Sequenzen der ersten Linien der Hintergrundschrift (108) entsteht.

2. Sicherheitselement nach Anspruch 1, wobei die geometrischen Formen äquidistant sind, wenn die Linien, die durch die Mittelpunkte dieser geometrischen Formen verlaufen und senkrecht zur Verschieberichtung gezogen werden, innerhalb eines einzelnen Teils des verborgenen oder sichtbaren Bildes den gleichen Abstand haben.
3. Sicherheitselement nach Anspruch 1 oder 2, wobei die Verschiebung der ersten geometrischen Formen der Prägestruktur (104, 204, 404) und/oder der zweiten geometrischen Formen der eingefärbten Prägestruktur (XXX) parallel zu den Sequenzen der ersten Linien der Hintergrundschrift (108) ist.

4. Sicherheitselement nach einem der vorhergehenden Ansprüche, wobei ein Wert der Verschiebung p nach der Formel $p = Ln$, berechnet wird, wobei L die Anzahl der unterschiedlichen Farben in der Sequenz der ersten Linien und n die Breite einer Linie in der Sequenz der ersten Linien bezeichnet.

5. Sicherheitselement nach einem der Ansprüche 1-3, wobei der Wert der Verschiebung p nach der Formel $p = Ln + w$ oder $p = Ln - w$ berechnet wird, wobei der Koeffizient w nach der folgenden Formel berechnet wird:

$$w = Ln / i_s$$

wobei:

L die Anzahl der unterschiedlichen Farben in einer Sequenz der ersten Linien bezeichnet,
 n die Breite einer einzelnen Linie in einer Sequenz der ersten Linien bezeichnet,
 i_s die Anzahl der Sequenzen der ersten Linien in einem Bereich der Prägestruktur bezeichnet.

6. Sicherheitselement nach den Ansprüchen 1-2 und 3-5, wobei die ersten geometrischen Formen der Prägestruktur (104, 204, 304, 404) und/oder die zweiten geometrischen Formen der eingefärbten Prägestruktur (XXX) in Bezug auf die Sequenzen der ersten Linien um einen vorgegebenen Winkel im oder gegen den Uhrzeigersinn verschoben sind.
7. Sicherheitselement nach einem der vorhergehenden Ansprüche, wobei die Prägestruktur (104, 204, 304, 404) aus relativ zueinander äquidistanten ersten geometrischen Formen und die eingefärbte Prägestruktur (XXX) aus relativ zueinander äquidistanten zweiten geometrischen Formen besteht, die die Form eines Rasters aus unterschiedlichen Elementen aufweisen, dessen Form von dem entworfenen versteckten Bild (105, 205, 305, 405) und/oder sichtbaren Bild (XXX') des Sicherheitselements (106) abhängig ist.
8. Sicherheitselement nach einem der vorhergehenden Ansprüche, wobei ein erstes Element und/oder Teil (105b) des versteckten Bildes (105) in mindestens einer Farbe der Hintergrundschrift (108) durch Prägen der ersten geometrischen Formen der Prägestruktur (104) mit einer Verschiebung bezüglich der Sequenzen der ersten Linien der Hintergrundschrift (108) entsteht.
9. Sicherheitselement nach Anspruch 7, wobei das erste Element und/oder ein Teil (105b) des versteckten Bildes (105) in einer Farbe der Hintergrundschrift (108) durch Prägen der ersten geometrischen

schen Formen der Prägestruktur (104b) mit einer Verschiebung bezüglich der Sequenzen der ersten Linien der Hintergrundschicht (108) um ein ganzzahliges Vielfaches der Linienbreite erhalten wird, wobei eine Breite einer einzelnen ersten geometrischen Form nicht größer als n sein darf, und eine einzelne erste Form der Prägestruktur (104b) sich innerhalb einer einzelnen Linie der Hintergrundschicht (108) befindet.

10. Sicherheitselement nach Anspruch 7 oder 9, wobei ein zweites Element und/oder Teil (105a) des versteckten Bildes (105) in mindestens einer anderen Farbe der Hintergrundschicht (108) entsteht, indem die ersten geometrischen Formen der geprägten Struktur (104a) des zweiten Elements und/oder Teils (105a) mit einer Verschiebung um einen zusätzlichen Abstand relativ zu den ersten geometrischen Formen der geprägten Struktur (104b) des ersten Elements und/oder Teils (105b) des verborgenen Bildes (105) geprägt wird.

11. Sicherheitselement nach Anspruch 8, wobei ein zweites Element und/oder Teil (105a) des versteckten Bildes (105) in einer anderen Farbe der Hintergrundschicht (108) ist, wobei, dass die Breite einer einzelnen ersten geometrischen Form nicht größer als n sein darf, entsteht, indem die ersten geometrischen Formen der geprägten Struktur (104a) des zweiten Elements und/oder Teils (105a) des versteckten Bildes (105) mit einer Verschiebung um einen zusätzlichen Abstand gleich einem ganzzahligen Vielfachen der Breite der ersten Linien der Hintergrundschicht (108) relativ zu den ersten geometrischen Formen der geprägten Struktur (104b) des ersten Elements und/oder Teils (105b) des versteckten Bildes geprägt wird, wobei die Breite einer einzelnen ersten geometrischen Form nicht größer als n sein darf.

12. Sicherheitselement nach einem der vorhergehenden Ansprüche 1-8, 10, wobei eine einzelne geometrische Form der ersten geometrischen Formen der Prägestruktur (104, 204, 304, 404) eine Breite im Bereich von $n-50\%n$ bis $n+50\%n$ aufweist, und eine einzelne geometrische Form der zweiten geometrischen Formen der eingefärbten Prägestruktur (XXX) eine Breite im Bereich von n bis $Ln-1$ aufweist, wobei:

L die Anzahl der unterschiedlichen Farben in der Sequenz der ersten Linien bezeichnet,
 n die Breite einer einzelnen Linie in der Sequenz der ersten Linien bezeichnet.

13. Verfahren zur Herstellung eines Sicherheitselements (106) mit einem versteckten Bild (405) und einem sichtbaren Bild (XXXX') auf einem Sicher-

heits- und/oder Wertdokument (100), umfassend die folgenden Schritte:

- a) Aufbringen einer Hintergrundschicht (108) auf ein Substrat (107), wobei die Hintergrundschicht (108) aus mehreren Sequenzen paralleler erster Linien besteht, wobei eine Sequenz der parallelen ersten Linien mindestens zwei Linien unterschiedlicher Farbe enthält, die sich in derselben Reihenfolge wiederholen, wobei die Farbe des Substrats (107) eine der Farben der Sequenzen der ersten Linien der Hintergrundschicht (108) sein kann, und die Linien in der Sequenz der ersten Linien gleich breit sind,
 b) Prägen mindestens einer Prägestruktur (104, 204, 304, 404) auf die Hintergrundschicht (108), wobei die Prägestruktur aus äquidistanten ersten geometrischen Formen besteht, die in Bezug auf die Sequenzen der ersten Linien verschoben sind, wobei das versteckte Bild (105, 205, 305, 405) durch Prägen der ersten geometrischen Formen der Prägestruktur (104, 204, 304, 404) mit einer Verschiebung bezüglich der Sequenzen der ersten Linien entsteht,
 c) Prägen mindestens einer eingefärbten Prägestruktur (XXX) auf die Hintergrundschicht (108), wobei die eingefärbte Prägestruktur durch äquidistante, relativ zueinander eingefärbte und in Bezug auf die Sequenzen der ersten Linien verschobene zweite geometrische Formen erzeugt wird, wobei das sichtbare Bild (XXX') durch Nassprägen der zweiten geometrischen Formen der eingefärbten Prägestruktur (XXX) mit einer Verschiebung bezüglich der Sequenzen der ersten Linien der Hintergrundschicht (108) entsteht.

14. Verfahren nach Anspruch 13, wobei die Prägung der Prägestruktur (104, 204, 304, 404) durch Blindprägen erfolgt.

15. Verfahren nach Anspruch 13, wobei die eingefärbte Prägestruktur (XXX) in demselben Durchgang wie die ersten geometrischen Formen der Blindprägestruktur (104, 204, 304, 404) geprägt wird.

Revendications

1. Élément de sécurité (106) comportant une image cachée (405) et une image visible (XXX'), comprenant:

- une couche d'arrière-plan (108) appliquée sur un substrat (107) d'un document sécurisé et/ou de valeur (100), dans lequel la couche d'arrière-plan (108) est constituée de multiples séquen-

ces de premières lignes parallèles les unes aux autres, dans laquelle une séquence des premières lignes parallèles les unes aux autres contient au moins deux lignes (101, 102, 103) de couleurs différentes, qui sont répétées dans le même ordre, dans laquelle la couleur du substrat (107) peut être l'une des couleurs de la séquence des premières lignes, et les lignes dans la séquence des premières lignes ont la même largeur, et

- au moins une structure en relief (104, 204, 304, 404) sur la couche de fond (108), dans laquelle la structure en relief (104, 204, 304, 404) est constituée de premières formes géométriques équidistantes les unes des autres, tandis que l'image cachée (105, 205, 305, 405) est obtenue par gaufrage des premières formes géométriques de la structure gaufrée (104, 204, 304, 404) avec un décalage (p) par rapport aux séquences des premières lignes de la couche de fond (108), l'élément de sécurité comprenant - au moins une structure gaufrée encrée (XXX) constituée de secondes formes géométriques équidistantes les unes par rapport aux autres, gaufrées et recouvertes d'encre sur la couche de fond (108), tandis que l'image visible (XXX') est obtenue par gaufrage des secondes formes géométriques de la structure gaufrée encrée (XXX) avec un décalage par rapport aux séquences des premières lignes de la couche de fond (108).

2. Élément de sécurité selon la revendication 1, dans lequel les formes géométriques sont équidistantes lorsque les lignes passant par les centres de ces formes géométriques, tracées perpendiculairement à la direction de décalage, sont à la même distance à l'intérieur d'une seule partie de l'image cachée ou visible.
3. Élément de sécurité selon la revendication 1 ou 2, dans lequel le décalage des premières formes géométriques de la structure gaufrée (104, 204, 404) et/ou des secondes formes géométriques de la structure gaufrée encrée (XXX) est un décalage parallèle par rapport aux séquences des premières lignes de la couche d'arrière-plan (108).
4. Élément de sécurité selon l'une des revendications précédentes, dans lequel une valeur du décalage p est calculée à partir de la formule $p = Ln$, où L désigne le nombre de couleurs différentes dans la séquence des premières lignes, et n désigne la largeur d'une ligne dans la séquence des premières lignes.
5. Élément de sécurité selon l'une des revendications 1 à 3, dans lequel une valeur du décalage p est calculée à partir de la formule $p = Ln + w$ ou $p = Ln - w$, où le

coefficient w est calculé à partir de la formule suivante :

$$w = Ln/i_s$$

où:

L désigne le nombre de couleurs différentes dans une séquence des premières lignes,
n désigne la largeur d'une seule ligne dans une séquence des premières lignes,
 i_s désigne le nombre de séquences des premières lignes dans une zone de la structure en relief.

6. Élément de sécurité selon les revendications 1 à 2 et 3 à 5, dans lequel les premières formes géométriques de la structure en relief (104, 204, 304, 404) et/ou les secondes formes géométriques de la structure en relief encrée (XXX) sont décalées par rapport aux séquences des premières lignes d'un angle prédéterminé dans le sens horaire ou antihoraire.
7. Élément de sécurité selon l'une des revendications précédentes, dans lequel la structure en relief (104, 204, 304, 404) est constituée de premières formes géométriques équidistantes les unes des autres, et la structure gaufrée encrée (XXX) est constituée de deuxièmes formes géométriques équidistantes les unes des autres, qui ont la forme d'une grille d'éléments différents, dont la forme dépend de l'image cachée (105, 205, 305, 405) et/ou de l'image visible (XXX') de l'élément de sécurité (106).
8. Élément de sécurité selon l'une des revendications précédentes, dans lequel un premier élément et/ou une première partie (105b) de l'image cachée (105) dans au moins une couleur de la couche de fond (108) est obtenu(e) par gaufrage des premières formes géométriques de la structure gaufrée (104) avec un décalage par rapport aux séquences des premières lignes de la couche de fond (108).
9. Élément de sécurité selon la revendication 7, dans lequel le premier élément et/ou la première partie (105b) de l'image cachée (105) dans une couleur de la couche d'arrière-plan (108) est obtenu(e) en embossant les premières formes géométriques de la structure embossée (104b) avec un décalage par rapport aux séquences des premières lignes de la couche d'arrière-plan (108) d'un multiple entier de la largeur de ligne, dans lequel la largeur d'une seule première forme géométrique ne peut pas être supérieure à n, et une seule première forme de la structure en relief (104b) est située à l'intérieur d'une seule ligne de la couche d'arrière-plan (108).
10. Élément de sécurité selon les revendications 7 ou 9,

- dans lequel un deuxième élément et/ou une deuxième partie (105a) de l'image cachée (105) dans au moins une autre couleur de la couche d'arrière-plan (108) est obtenu(e) en embossant les premières formes géométriques de la structure embossée (104a) du deuxième élément et/ou de la deuxième partie (105a) avec un décalage d'une distance supplémentaire par rapport aux premières formes géométriques de la structure embossée (104a) du premier élément et/ou de la première partie (105b) de l'image cachée (105). la structure en relief (104b) du premier élément et/ou de la première partie (105b) de l'image cachée (105).
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11. Élément de sécurité selon la revendication 8, dans lequel un deuxième élément et/ou une deuxième partie (105a) de l'image cachée (105) dans une autre couleur de la couche d'arrière-plan (108), dans lequel la largeur d'une seule première forme géométrique ne peut pas être supérieure à n est obtenu en embossant les premières formes géométriques de la structure embossée (104a) du deuxième élément et/ou partie (105a) de l'image cachée (105) avec un décalage d'une distance supplémentaire égale à un multiple entier de la largeur des premières lignes de la couche d'arrière-plan (108) par rapport aux premières formes géométriques de la structure embossée (104b) de la structure en relief (104a) du premier élément et/ou de la partie (105b) de l'image cachée, la largeur d'une seule première forme géométrique ne pouvant être supérieure à n .
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12. Élément de sécurité selon l'une des revendications précédentes 1 à 8, 10, dans lequel une seule forme géométrique parmi les premières formes géométriques de la structure en relief (104, 204, 304, 404) a une largeur comprise entre $n-50\% n$ et $n+50\% n$, et une seule forme géométrique parmi les secondes formes géométriques de la structure gaufrée encrée (XXX) a une largeur comprise entre n et $Ln - 1$, où:
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- 40
- L désigne le nombre de couleurs différentes dans la séquence des premières lignes,
 n désigne la largeur d'une seule ligne dans la séquence des premières lignes.
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13. Procédé de fabrication d'un élément de sécurité (106), avec une image cachée (405) et une image visible (XXX'), sur un document de sécurité et/ou de valeur (100), comprenant les étapes suivantes:
- 50
- a) application d'une couche d'arrière-plan (108) sur un substrat (107), la couche d'arrière-plan (108) étant constituée de plusieurs séquences de premières lignes parallèles les unes aux autres, dans laquelle une séquence des premières lignes parallèles les unes aux autres contient
- 55
- au moins deux lignes de couleurs différentes qui sont répétées dans le même ordre, dans laquelle la couleur du substrat (107) peut être l'une des couleurs des séquences des premières lignes de la couche d'arrière-plan (108), et les lignes dans la séquence des premières lignes ont la même largeur,
- b) embossage d'au moins une structure embossée (104, 204, 304, 404) sur la couche de fond (108), dans lequel la structure embossée est constituée de premières formes géométriques équidistantes les unes par rapport aux autres, décalées par rapport aux séquences des premières lignes, dans lequel l'image cachée (105, 205, 305, 405) est obtenue par gaufrage des premières formes géométriques de la structure gaufrée (104, 204, 304, 404) avec un décalage par rapport aux séquences des premières lignes,
- c) gaufrage d'au moins une structure gaufrée encrée (XXX) sur la couche de fond (108), la structure gaufrée encrée étant créée par des secondes formes géométriques équidistantes les unes des autres, recouvertes d'encre et décalées par rapport aux séquences des premières lignes, dans lequel l'image visible (XXX') est obtenue par gaufrage humide des deuxièmes formes géométriques de la structure gaufrée encrée (XXX) avec un décalage par rapport aux séquences des premières lignes de la couche de fond (108).
14. Procédé selon la revendication 13, dans lequel le gaufrage de la structure gaufrée (104, 204, 304, 404) est réalisé par gaufrage aveugle.
15. Procédé selon la revendication 13, dans lequel la structure gaufrée encrée (XXX) est gaufrée dans le même cycle que les premières formes géométriques de la structure gaufrée à l'aveugle (104, 204, 304, 404).



Fig. 1

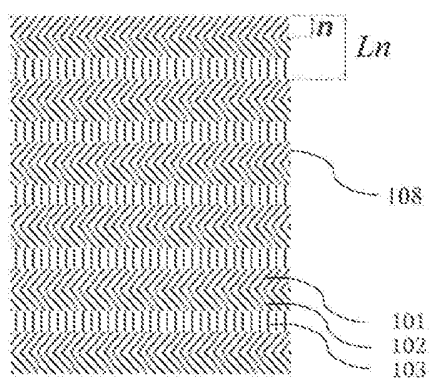


Fig. 2

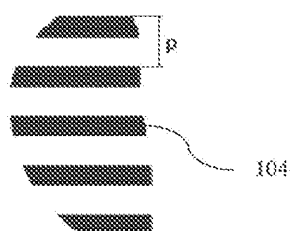


Fig. 3

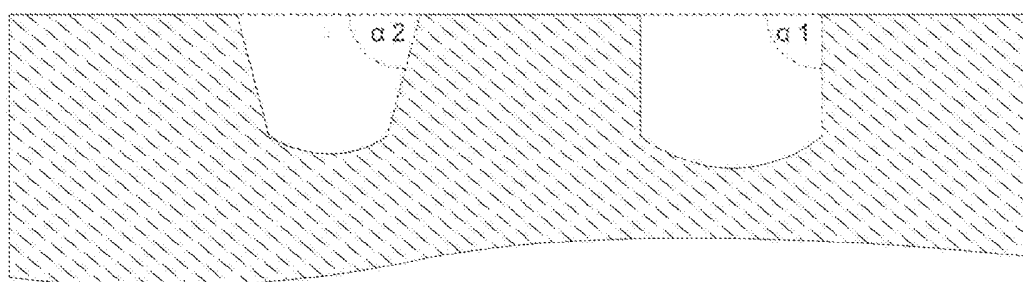


Fig. 4

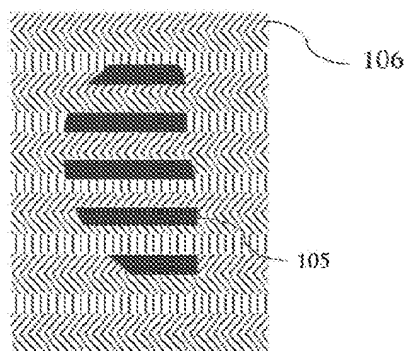


Fig. 5

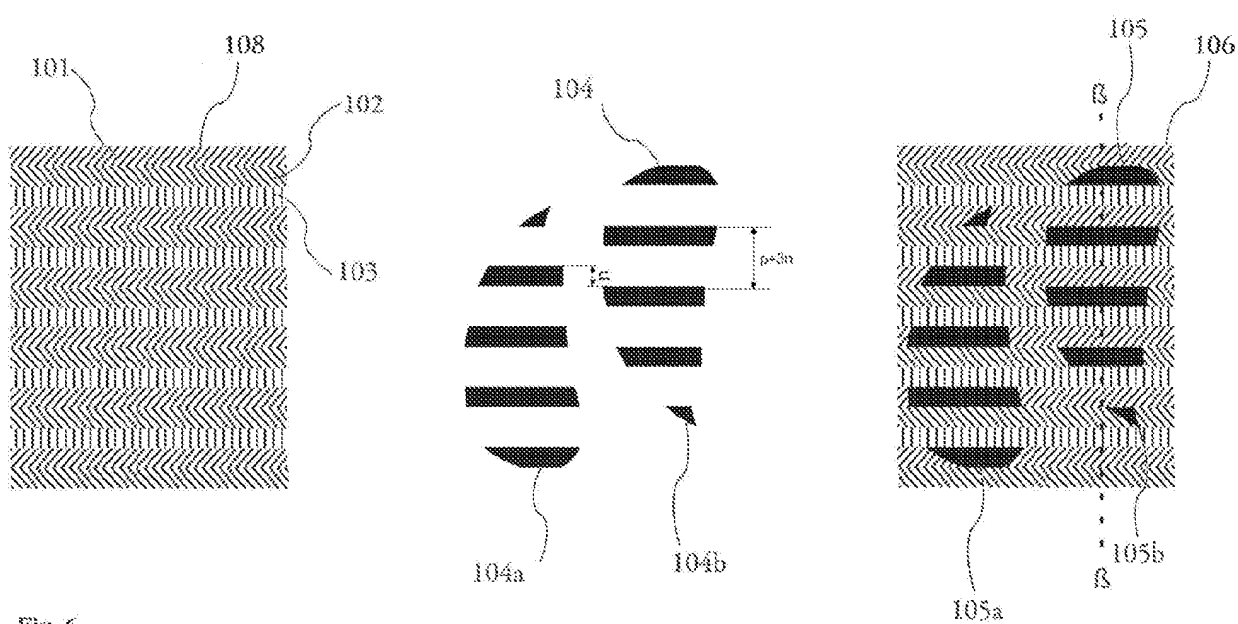


Fig. 6

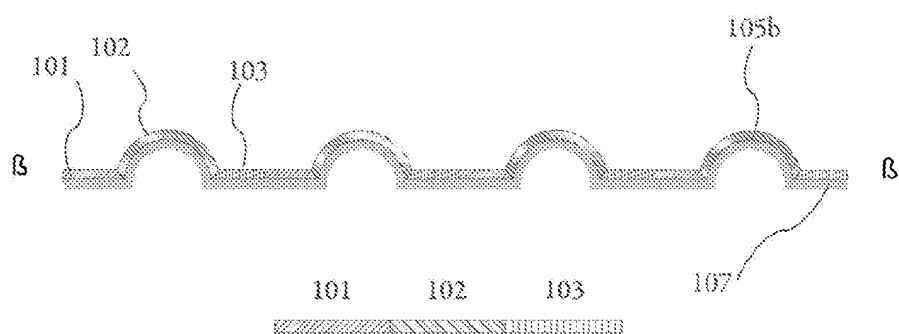


Fig. 7

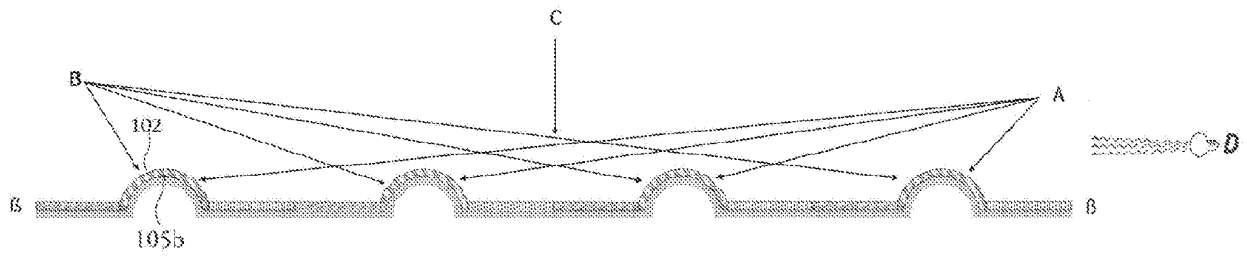


Fig. 8

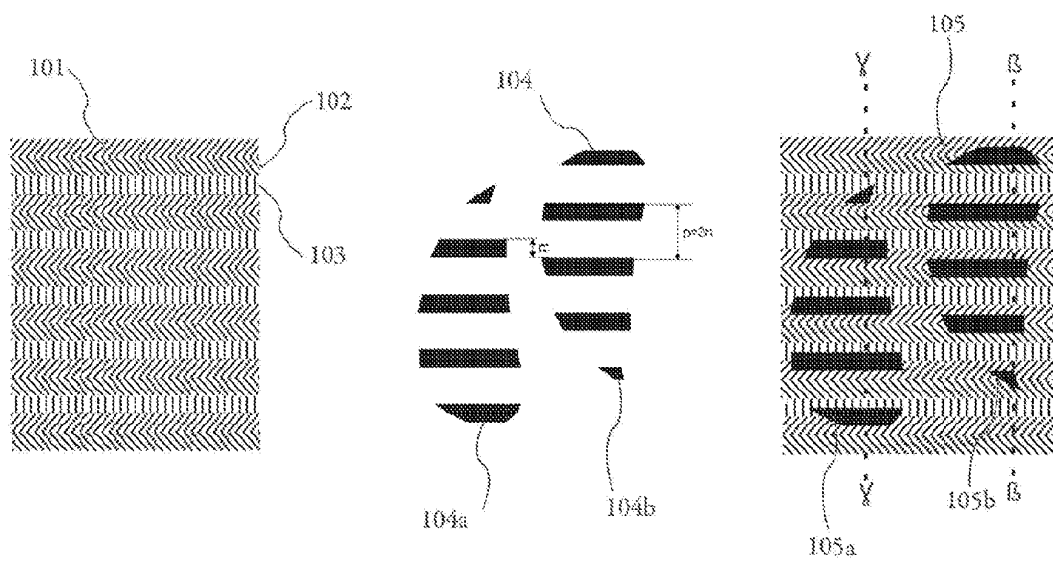


Fig. 9

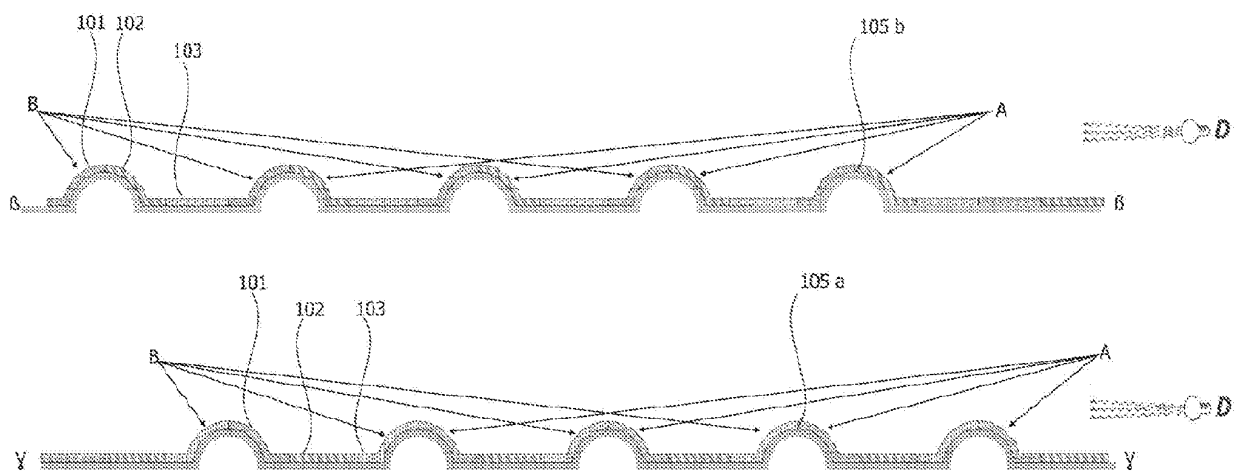


Fig. 10

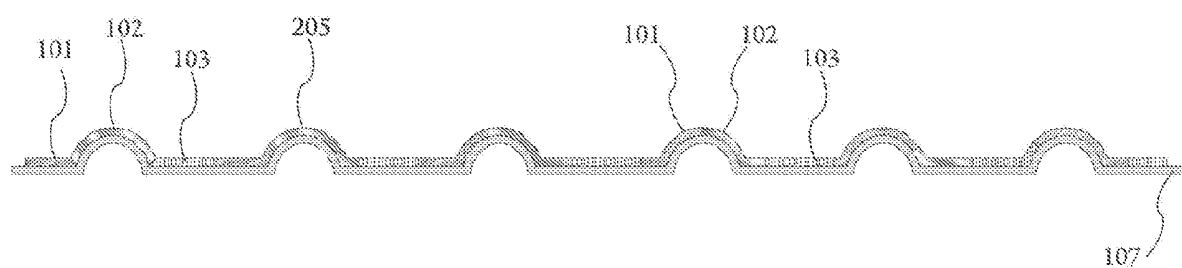


Fig.11

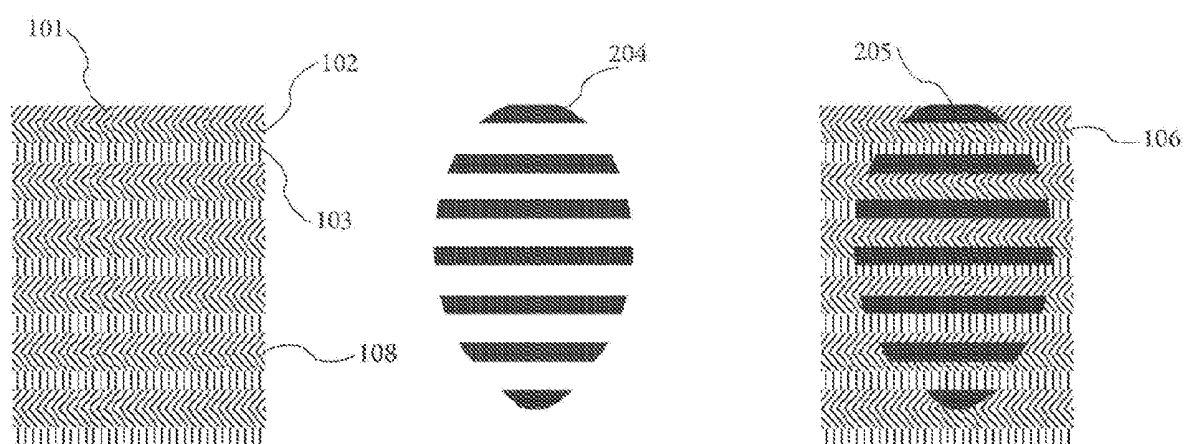


Fig.12

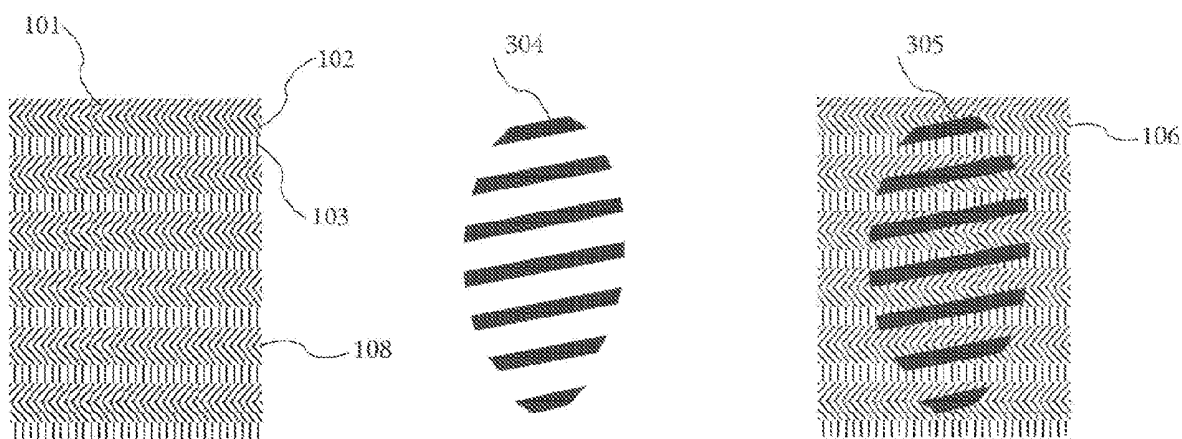


Fig.13

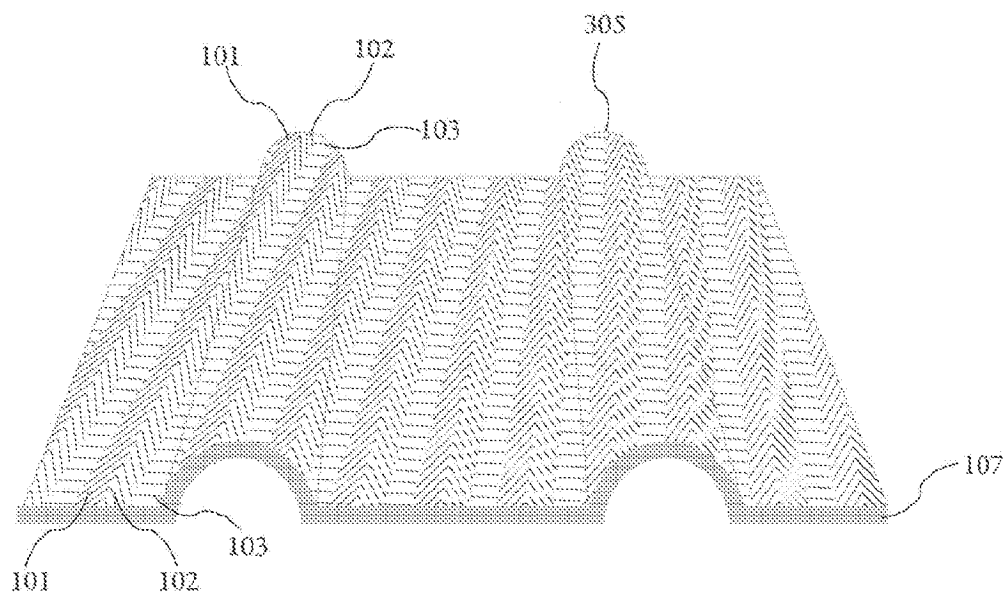


Fig. 14

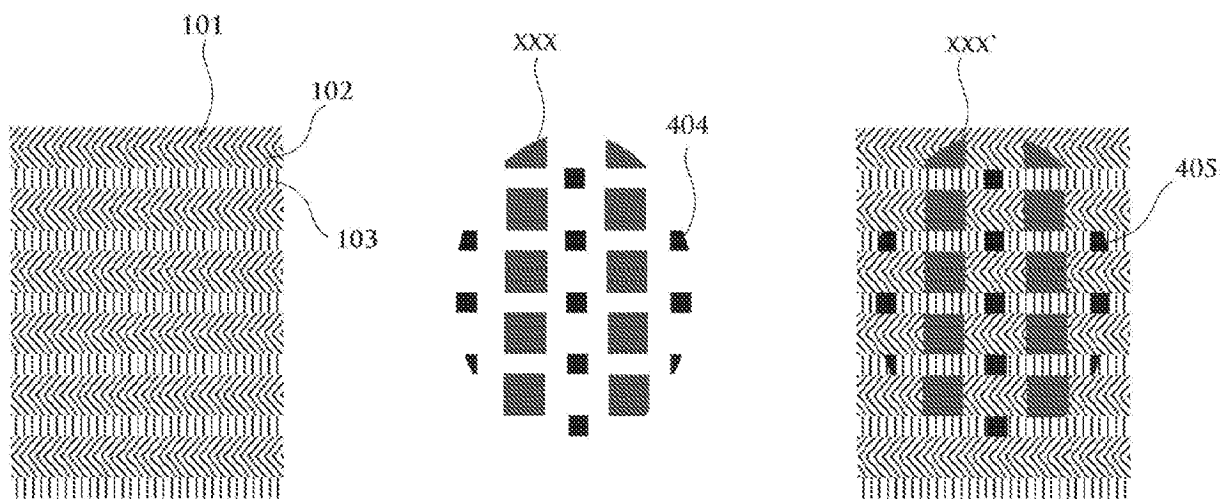


Fig. 15

REFERENCES CITED IN THE DESCRIPTION

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