

IDENTIFICATION DOCUMENT COMPRISING A GUILLOCHE AND AN ARRANGEMENT OF PIXELS

Background of the invention

5 The present invention lies in the field of security documents, and it relates more particularly to securing identity documents by means of a pattern printed on the document, e.g. a guilloche.

10 In this document, the term "identity document" is used to designate any document including information serving to identify the bearer of the document in more or less secure manner. This identity information may appear physically on the body of the document (photograph, text, etc.) so as to be verifiable visually by a person or by
15 an inspection machine. Identification information may also be stored in digital form in an electronic component with which the identity document is provided.

 The term "identity documents" covers in particular: identity documents, passports, or microcircuit cards.

20 In the present state of the art, it is known during a stage of producing an identity document to print a pattern on the document, e.g. a guilloche, and then to personalize the document during a subsequent stage by printing (e.g. by laser) personalization data on the
25 document such as the name of the bearer of the document, date of birth, nationality, photograph, ...

 Figure 1 shows an example guilloche IM1 made on the body 2 of a card. A guilloche is typically made up of a plurality of lines of arrangement and dimensional
30 specifications that are selected so as to make the document as secure as possible.

 Printing a guilloche provides good security since it is excessively difficult to reproduce such a pattern without having access to the equipment, to the software,
35 and the parameters that were used to create the pattern on the document.

Nevertheless, conventional printing of a security pattern, e.g. such as a guilloche, on the body of an identity document can present certain drawbacks. As shown in Figure 2, a guilloche 2 may be provided on various zones of the identity document, some of which zones may include other elements, patterns, or information obtained in superposition on the lines of the guilloche.

In the example of Figure 2, an image 6 (e.g. showing the face of the bearer) is provided on the body of a card 4. In this example, a guilloche 2 is also formed on the body of the card so as to cross the image 6, at least in part.

Printing the pattern 2 in the zone of the image 6 presents the drawback of degrading the quality and the general appearance of the image 6. The brightness and the sharpness of the image 6 can be reduced to a greater or lesser extent, depending on the shape, the density, or indeed the general arrangement of the guilloche lines in the zone of the image 6.

Furthermore, improvements are still desirable in securing identity documents that include specifically a security pattern such as a guilloche, for example.

25 Object and summary of the invention

To this end, the present invention provides an identity document comprising:

- a transparent layer;
- a pixel arrangement in register with the transparent layer, each pixel comprising at least two sub-pixels of different colors, the sub-pixels being arranged in such a manner as to form at least two lines of sub-pixels in the pixel arrangement; and
- a guilloche in a zone adjacent to the pixel arrangement, the guilloche comprising at least one guilloche line;

wherein the transparent layer is suitable for being made opaque locally so as to block the passage of light at least in part through at least one region of the transparent layer; and

5 wherein at least one guilloche line, referred to as a "first" line, extends a line of sub-pixels, referred to as a "second" line, forming part of the pixel arrangement, so that together they form a single, common line.

10 The above defined arrangement of lines of the guilloche advantageously makes it possible to improve the quality of an image developed in the arrangement of pixels with the help of the regions that have been made opaque. By means of the invention, the guilloche lines
15 no longer cross the lines of pixels on the identity document in conventional manner, but rather extend at least some of those lines.

 The lines of sub-pixels can also act as guilloche lines in addition to their primary function, namely
20 forming an image on the body of the identity document. The present invention thus presents the advantage of making it possible to improve the security of identity documents. Specifically, as explained in greater detail below, in the event of a malicious person attempting to
25 falsify such an identity document by replacing the image formed by the pixel matrix with some other image, it would be excessively difficult for that person to cause the ends of the guilloche lines present on the remainder of the document to coincide with the pixel lines in the
30 new image (assuming that the new image contains such lines of sub-pixels). If the new image does not contain such lines of sub-pixels, then detecting a fake is made even more simple.

 In a particular embodiment, each first line extends
35 a respective second line of sub-pixels, in continuous or discontinuous manner.

In a particular embodiment, each first line is a line that is rectilinear or curvilinear.

In a particular embodiment, each second line is a line that is rectilinear or curvilinear.

5 In a particular embodiment, each said extension is made in pairs between a first line of the guilloche and a dedicated second line of said pixel arrangement.

In a particular embodiment, each first line is arranged in register with the respective second line so
10 that neither of these two lines crosses the other.

In a particular embodiment, each first line is arranged in register with the respective second line in one of the following configurations:

a) a first end of the first line and a second end of
15 the second line are contiguous with each other;

b) a first end portion of the first line and a second end portion of the second line are spaced apart and in register with each other in such a manner that said first and second end portions share a common
20 tangent.

In a particular embodiment, in the configuration a), a first end portion of the first line leading to the first end and a second end portion of the second line leading to a the second end:

25 · extend in the same direction so as to form a rectilinear or curvilinear junction between said first and second lines; or

· extend in different directions so as to form an angle at the junction between said first and second
30 lines.

In a particular embodiment, each first line and each second line is rectilinear, and they join together in pairs.

In a particular embodiment, the pixel arrangement is
35 printed on said transparent layer.

In a particular embodiment, the pixel arrangement and the guilloche are printed on the same face of said transparent layer.

In a particular embodiment, each pixel of said
5 arrangement includes at least one first sub-pixel in a first color and at least one second sub-pixel in a second color different from the first color, wherein the sub-pixels are arranged so as to form at least one line of first sub-pixels in the first color and at least one line
10 of the second sub-pixels in the second color.

In a particular embodiment, at least one said second line is formed by a line of first sub-pixels in the first color, the second line corresponding to the guilloche being formed in said first color.

15 In a particular embodiment, the transparent layer is a layer of polycarbonate, suitable for being made locally opaque in at least one region of the polycarbonate layer under the action of a laser beam.

In a particular embodiment, each first line is
20 formed by a continuous or discontinuous arrangement of sub-pixels.

In a particular embodiment, each second line is made continuously or by a discontinuous arrangement of at least two segments along said second line.

25 Correspondingly, the present invention also provides a method of fabricating an identity document, the method comprising:

- providing a transparent layer;
- forming a pixel arrangement in register with the
30 transparent layer, each pixel comprising at least two sub-pixels of different colors, the sub-pixels being arranged in such a manner as to form at least two lines of sub-pixels in said pixel arrangement;
- forming a guilloche in a zone adjacent to the
35 pixel arrangement, said guilloche comprising at least one guilloche line; and

· making opaque at least one region of the transparent layer so as to block the passage of light, at least in part, in said at least one region;

5 wherein at least one guilloche line, referred to as a "first" line, is formed so as to extend a line of sub-pixels, referred to as a "second" line, forming part of the pixel arrangement so that together they form a single, common line.

10 The particular embodiments and variants defined above with reference to the identity document apply in analogous manner to the fabrication method of the invention. Certain particular implementations of the fabrication method are defined below.

15 In a particular implementation, each first line is arranged in register with the respective second line in one of the following configurations:

a) a first end of the first line and a second end of the second line are contiguous with each other;

20 b) a first end portion of the first line and a second end portion of the second line are spaced apart and in register with each other in such a manner that said first and second end portions share a common tangent.

25 In a particular implementation, the pixel arrangement and the guilloche are formed during the same printing step.

In a particular implementation, the pixel arrangement and the guilloche are formed on the same face of the transparent layer.

30 In a particular implementation, each first line of the guilloche is traced as a function of the positioning of the corresponding second line.

35 In a particular implementation, the transparent layer is made of polycarbonate, at least one region of the transparent layer being made opaque locally by the action of a laser beam.

Brief description of the drawings

Other characteristics and advantages of the present invention appear from the following description made with reference to the accompanying drawings, which show
5 embodiments having no limiting character. In the figures:

- Figure 1, described above, shows a card including a guilloche;

- Figure 2, described above, shows an identity
10 document on which a guilloche crosses an image;

- Figures 3A and 3B show an identity document including a matrix of pixels and a guilloche in accordance with a known arrangement;

- Figure 4 shows an identity document in a
15 particular embodiment of the invention;

- Figure 5 shows an arrangement of pixels in accordance with a particular embodiment of the invention;

- Figure 6 is an enlargement of a pixel contained in the arrangement of pixels shown in Figure 5;

- Figure 7 shows a matrix laid out as lines of sub-pixels in accordance with a particular embodiment of the
20 invention;

- Figure 8 shows a plan view of an identity document in accordance with a particular embodiment of the
25 invention;

- Figure 9 is an enlargement of a region of the identity document shown in Figure 8;

- Figures 10A to 10D show variant embodiments of the invention;

- Figures 11A and 11B show how the present invention
30 secures identity documents in particular embodiments;

- Figure 12 shows a particular colorimetric configuration in a particular embodiment of the invention;

- Figure 13 shows, in the form of a flowchart, the
35 steps of a particular fabrication method of the invention;

- Figure 14 shows the fabrication of an identity document in accordance with the method shown in Figure 13;

- Figure 15 shows the portion of a line of a guilloche that includes a barcode; and

- Figure 16 is a photograph of an identity document including guilloche lines in accordance with a particular embodiment of the invention.

10 Detailed description of several embodiments

As mentioned above, the present invention lies in the field of security documents, and it relates more particularly to securing identity documents by means of a pattern printed on the document, e.g. a guilloche.

15 Unless specified to the contrary, elements that are common or analogous in more than one of the figures carry the same reference numbers and present characteristics that are identical or analogous, such that these common elements are generally not described again for reasons of
20 simplicity.

A known technique for developing images by using a matrix of pixels and at least one transparent layer is briefly described below with reference to Figure 3A. Implementations of this technique for forming images are
25 described in patent documents FR 2 958 777 and FR 2 984 217, for example.

Figure 3A shows a section view of an identity document 10 comprising a substrate 12 having assembled thereon in succession both a transparent layer 14 and
30 also a transparent layer 16. The faces 14a and 14b of the transparent layer 14 in this example are assembled respectively with the transparent layer 16 and with the substrate 12. A matrix 18 of pixels is also printed on the surface 14a of the transparent layer 14 prior to
35 assembly with the transparent layer 16.

The transparent layer 14 is made of material that is said to be "laserizable", i.e. a transparent layer that

has the ability to become opaque under the effect of a laser beam.

The pixel matrix 18 is made up of sub-pixels of at least three different colors, embedded under the transparent layer 16. As shown in Figure 3B, gray levels are created in register with the sub-pixels by using a laser beam 24. Under the effect of the laser beam 24, regions 22 of the transparent layer 14 in register with the matrix of pixels 18 become locally opaque so as to block the passage of light in these regions to a greater or lesser extent. Applying the laser beam 24 leads to non-reflecting surfaces being formed under some of the sub-pixels the matrix 18, thereby making it possible to produce the gray levels of a personalized image. Likewise, application of the laser beam 24 can lead to opaque surfaces being formed above some of the sub-pixels of the matrix 18 (e.g. in the layer 16 when it is laserizable) and can contribute to producing the gray levels of the personalized image.

This treatment makes it possible to modify the brightness of certain sub-pixels of the matrix 18 and thus to develop an image from the matrix 18 and the transparent layers 14 and 16 that have been made locally opaque.

The processing shown in Figures 3A and 3B makes it possible to obtain high-quality personalization of color images and is particularly suitable for security personalization of identity documents.

The image as personalized in this way is observed by reflection through the transparent layers 16 and 14.

In the example shown in Figure 3A, a pattern IM3 such as a guilloche is also printed on a face of the substrate prior to assembling that face with the laserizable transparent layer 14. A portion of the pattern IM3 is thus visible to an observer in a superposition on the pixel matrix 18, and thus on the image that results therefrom.

This configuration significantly degrades the quality and the general appearance of images made using the image-developing technique shown in Figures 3A and 3B. The brightness and the sharpness of the image can be
5 reduced to a greater or lesser extent, depending on the shape, the density, or indeed the general arrangement of the guilloche lines in the zone of the image.

It is also desirable to improve the security of identity documents including a security pattern such as a
10 guilloche, for example, and more particularly to improve the security of such identity documents also including an image made using the above-described image-developing technique (or equivalent techniques).

The present invention specifically proposes
15 mitigating the above-described problems and drawbacks.

A particular embodiment of the invention is described below with reference to Figures 4 to 9. More precisely, the identity documents 30 shown in section view in Figure 4 comprises a substrate 12 having
20 assembled thereon both a transparent layer 14 and also a transparent layer 16. The faces 14a and 14b of the transparent layer 14 are assembled respectively with the transparent layer 16 and with the substrate 12.

A pixel matrix 19 is also printed on the top face
25 14a of the transparent layer 14 (more particularly in a zone Z1), or else on the bottom face 16b of the transparent layer 16, prior to assembling together the layers 14 and 16. Also, a pattern GL, a guilloche in this example, is made on the top face 14a of the layer
30 14, or else on the bottom face 16b of the layer 16, prior to assembling the layers 14 and 16 together. Under all circumstances, the pattern GL is made in a zone Z2 adjacent to the zone Z1 containing the pixel matrix 19 (Figure 8). It can be understood that the pixel matrix
35 19 and the pattern GL are made on the same face of a transparent layer, namely on the top face 14a of the

transparent layer 14, or else on the bottom face 16b of the transparent layer 16.

As shown in Figure 5, the pixel matrix 19 in this particular embodiment comprises a plurality of pixels 20
5 ordered in rows and columns.

As shown in Figure 6, each pixel 20 comprises, by way of example, four sub-pixels 21 of respective colors CR1, CR2, CR3, and CR4 that may in particular be primary colors (e.g. red/green/blue together with white), or,
10 more generally, at least two different colors. The number of sub-pixels, their arrangement in each pixel, and the colors of the sub-pixels in particular may be adapted to requirements by the person skilled in the art, e.g. using optionally repetitive patterns, in an
15 extremely wide range of possible arrangements.

As shown in Figures 5 and 6, the sub-pixels 21 are arranged so as to form lines of the sub-pixels in the matrix 19. In the present example, each row and each column of sub-pixels in the matrix 19 constitutes a line
20 of sub-pixels.

Although this example forms a "matrix" of pixels 20, it should be understood that it is possible more generally to form any arrangement of pixels in register with the transparent layer 14, each pixel comprising at
25 least two sub-pixels of different colors, the sub-pixels being arranged so as to form at least two lines of sub-pixels in said arrangement of pixels. By way of example, these lines may be rectilinear or curvilinear.

In this example, consideration is given below to the specific configuration, as shown in Figure 7, in which:

- the sub-pixels PX1 of the same color CR1 together form monochromatic lines LN1 in the matrix 19;
- the sub-pixels PX2 of the same color CR2 together form monochromatic lines LN2 in the matrix 19;
- 35 · the sub-pixels PX3 of the same color CR3 together form monochromatic lines LN3 in the matrix 19; and

· the sub-pixels PX4 of the same color CR4 together form monochromatic lines LN4 in the matrix 19.

By way of example, the colors CR1, CR2, CR3, and CR4 correspond to yellow, magenta, cyan, and white

5 respectively, with it naturally being possible to envisage other embodiments. In a particular embodiment, the arrangement of pixels 19 is made up of sub-pixels 21 of at least two different colors.

The transparent layer 14 on which the pixel matrix
10 19 is printed in this example is a laserizable layer, as described above with reference to Figures 3A and 3B, i.e. a layer made of a transparent material suitable for being made locally opaque under the effect of a laser beam.

Nevertheless, it can be understood that, more
15 generally, the layer 14 may be any transparent layer suitable for being made locally opaque (and preferably with various gray levels) so as to block, at least in part, the passage of light through at least one region of the transparent layer in register with the pixel matrix
20 19.

Likewise, still in this example, the transparent layer 16 is also a laserizable layer, and more generally a transparent layer suitable for being made locally opaque, preferably with various gray levels) so as to
25 block, at least in part, the passage of light through at least one region of the transparent layer in register with the pixel matrix 19.

As nonlimiting examples, laserizable materials include polycarbonates doped with titanium oxide, certain
30 treated polyvinyl chlorides, treated acrylonitrile butadiene styrenes, or treated polyethylene terephthalates. The laserizable material is partially carbonized by the laser so as to form the gray levels of a personalized image. The degree of blackening (or of
35 opaqueness) is controlled as a function of the energy transmitted by the laser.

In this example, at least one of the transparent layers 14 and 16 is treated by laser in order to form more or less opaque layers facing the pixel matrix 19, thereby developing an image 32 (Figure 8) from the pixel matrix 19. Consideration is given below to an example in which both of the transparent layers 14 and 16 are laserizable and they are subjected to local laser treatment in order to form more or less opaque regions facing the pixel matrix 19.

Nevertheless, it can be understood that it is not essential for both of the layers 14 and 16 to be laserizable. More generally, the identity document 30 has at least one transparent layer capable of being made opaque facing (above and/or below) the pixel matrix 19 so as to block the passage of light, at least in part. As indicated below, the pixel matrix 19 may be printed on the transparent layer (on one of its faces) or on another layer (e.g. an opaque layer), it being understood that the pixel matrix 19 is situated facing said transparent layer that can be made opaque.

In the presently described example, making the transparent layers 14 and 16 partially opaque serves to develop the image 32, e.g. representative of the face of the proprietor of the identity document 30, in the zone Z1 in which the pixel matrix 19 is to be found. The matrix 19 has multiple lines LN of sub-pixels, namely a plurality of lines LN1, LN2, LN3, and LN4 in this example, as described above with reference to Figure 7. In this example, these lines LN extend horizontally (along the X axis) to the boundary 32a defining the junction between the zones Z1 and Z2 in the identity document 30.

In accordance with the invention, the guilloche GL made in the zone Z2 adjacent to the zone Z1 includes at least one guilloche line extending in line with a line of sub-pixels LN so that the guilloche line and the line of sub-pixels together form a single common line.

In a particular embodiment, each of the guilloche lines and each of the lines of the sub-pixels situated in line with said guilloche lines present a line width lying in the range 10 micrometers (μm) to 120 μm , preferably
5 lying in the range 40 μm to 90 μm , and still more preferably having a width of substantially 80 μm .

Figure 8 shows diagrammatically an example where two lines GL1 and GL2 of the guilloche GL extend in line with respective lines LN of sub-pixels of the matrix 19.

10 More precisely, in the particular example of Figure 8, the guilloche line GL1 extends in line with the line LN2 of sub-pixels PX2. As shown in Figure 9, the guilloche line GL1 in this example extends the line LN2 of sub-pixels of the matrix 19 in a manner that is
15 continuous. In other words, in this particular example, the end LN2a of the line LN2 of sub-pixels and the end GL1a of the guilloche line GL1 extended so as to meet at their respective ends GL1a and LN2a; as a result, the two ends of GL1a and LN2a are contiguous with each other.

20 As explained in detail below, a variety of variant embodiments can be envisaged in the ambit of the present invention. More generally, at least one guilloche line is made so as to be positioned in line with a respective line of sub-pixels of the matrix of sub-pixels.

25 This line extension may be continuous or discontinuous (i.e. with or without a gap between the ends GL1a and LN2a, for example).

It is possible to envisage that a plurality of guilloche lines are positioned so as to extend a single
30 common line of sub-pixels. Nevertheless, in the example presently under consideration, one guilloche line GL and one dedicated line LN of the matrix 19 of sub-pixels extend each other in pairs.

In a particular example, each guilloche line is
35 arranged in register with the corresponding line of sub-pixels so that neither of these two lines crosses the

other. In a particular example, none of the guilloche lines cross a line of sub-pixels.

Various configurations of guilloche lines in register with lines of the pixel matrix are described below with reference to Figures 10A to 10D, in accordance with particular embodiments of the invention.

In general manner, there are numerous advantages in positioning a guilloche line so as to extend a line of sub-pixels.

10 Firstly, the arrangement of guilloche lines of the invention advantageously makes it possible to improve significantly the quality of the image 32 develop in the matrix 19 by using regions that have been made opaque in the transparent layers 14 and 16. By means of the
15 invention, the guilloche lines no longer cross the lines of pixels on the identity document in conventional manner, but rather extend at least some of those lines. Unlike the conventional configuration shown by way of example in Figure 2, the guilloche lines in the invention
20 do not clash with observing the zone of the image made on the identity document.

The lines of sub-pixels can also act as guilloche lines in addition to their primary function, namely forming an image on the body of the identity document.

25 The present invention presents the advantage in that it makes it possible to improve the security of identity documents. Specifically, as explained in greater detail below with reference to Figures 11A and 11B, in the event of a malicious person attempting to falsify such an
30 identity document by replacing the image formed by the pixel matrix with some other image, it would be excessively difficult for that person to cause the ends of the guilloche lines present on the remainder of the document to coincide with the pixel lines in the new
35 image (assuming that the new image contains such lines of sub-pixels). If the new image does not contain such

lines of sub-pixels, then detecting a fake is made even more simple.

As mentioned above, the present invention makes provision for positioning at least one guilloche line to
5 extend a line of sub-pixels of the matrix 19 in such a manner that the guilloche line co-operates with said line of sub-pixels to form a single line. Nevertheless, it should be understood that this line extension may take place in various different ways, as explained in
10 particular below with reference to Figures 10A to 10D.

In a first example shown in Figure 10A, the line of sub-pixels LN2 and the guilloche line GL1 lead to respective end portions LN2b and GL1b. These two end portions are rectilinear and together they share the same
15 tangent TG. In this example, these end portions LN2b and GL1b are contiguous with each other (or in other words join each other) so as to form a line extension that is continuous, even though that is not essential.

As shown in Figure 10D, it is also possible to
20 envisage positioning the rectilinear end portions LN2b and GL1b so they are spaced apart from each other. Under such circumstances, the end portions GL1b and LN2b still share the same tangent (their respective tangents TG1 and TG2 coincide) but a space SP is left between the ends
25 GL1a and LN2a of the end portions GL1b and LN2b. This produces visual continuity as a result of the end portions of the guilloche lines and of the corresponding lines of sub-pixels being in alignment. In this example, the extension between the guilloche line and the
30 corresponding line of sub-pixels is discontinuous since there is a space separating the ends of the two lines.

In another alternative is shown in Figure 10B, the rectilinear end portions GL1b and LN2b join so as to provide continuous extension between the respective lines
35 GL1 and LN2. Nevertheless, in this example, the tangent TG1 of the end portion GL1b and the tangent TG2 of the

end portion LN2b do not coincide, since between them they form an angle α other than 0° and 180° .

As mentioned above, it is possible to envisage examples in which at least one of the guilloche line GL1 and the line of sub-pixels LN2 is not rectilinear. In a particular embodiment, at least one of these lines is curvilinear.

As shown in Figure 10C, the end portion GL1b of the guilloche line GL1 may for example be curvilinear and join the end portion LN2b of the line of sub-pixels LN2. In this example, the line extension is provided by continuity in the junction between the two line end portions.

As explained above, the present invention makes it possible in particular to make identity documents more secure. Figures 11A and 11B show examples in which the authentic image 32 has been deleted by a counterfeiter and replaced by a counterfeit image. It is very difficult for a counterfeiter to form the counterfeit image in such a manner that the lines of sub-pixels making it up are extensions of the guilloche lines present on an adjacent portion of the document.

In Figure 11A as in Figure 11B, the ends LN2a and GL1a of the lines LN2 and GL1 respectively do not join one another (or are not contiguous). Furthermore, the end portions of these lines do not share a common tangent. On the basis of the space situated between the ends of these lines and also of the misalignment between the respective end portions, it can thus be deduced that the identity document is not authentic.

Furthermore, as shown in Figure 12, the guilloche line GL1 and the line of sub-pixels LN2 may be of the same color (CR2 in this example). In a particular embodiment, each guilloche line extending a line of sub-pixels is in the same color as the corresponding line of sub-pixels.

Advantageously, it is thus also possible to ensure color continuity between the lines of sub-pixels of the matrix and the corresponding guilloche lines. For example, it is possible to verify that the color of each
5 guilloche line coincides with the color of the corresponding line of sub-pixels. If this is not true, then the identity document is not authentic. In a particular embodiment, the document is considered as being non-authentic if the color difference between at
10 least one guilloche line and the corresponding line of sub-pixels exceeds a predetermined threshold.

Furthermore, at least one guilloche line GL, and in particular the guilloche lines extending in line with the lines of sub-pixels LN in the arrangement 19 of sub-
15 pixels, may be personalized in order to contain information, e.g. about the bearer of the identity document and/or about the identity document itself (the identifier of the document, of a batch, etc.). In a particular embodiment, a barcode 65 is included in at
20 least one guilloche line so as to personalize that line and further increase the overall level of security (as shown diagrammatically in Figure 15). By way of example, the barcode 65 may be formed by using a laser beam.

In a particular embodiment, each vertical bar of the
25 barcode 65 is constituted by at least one laser spot in a region of the guilloche line. By adapting the number and the positions of the laser spots together making up the vertical bar, it is possible to form a barcode and thus personalize the guilloche line. By way of example, a
30 narrow vertical bar may be made up of two laser spots that are adjacent to each other so that these two spots extend along the axis of the vertical bar.

It is also possible to envisage alternatives in which both the guilloche line and the corresponding line
35 of sub-pixels present respective pluralities of colors, e.g. so that the same color code is adopted in both of the lines in question. For example, the color code

adopted in a line of sub-pixels may be an alternation of two distinct colors that is repeated in the successive sub-pixels of a given line of sub-pixels (e.g. CR1 - CR2 - CR1 - CR2 etc.). Under such circumstances, the identity document may be considered as being non-authentic if, for example, a mismatch is detected between the color code of a line of sub-pixels and the color code of the corresponding guilloche line.

It should also be observed that each line of sub-pixels, and in particular lines extended by corresponding guilloche lines, may be made up of a continuous or discontinuous arrangement of sub-pixels.

Furthermore, each guilloche line, in particular guilloche lines extending respective lines of sub-pixels, may be formed in a manner that is continuous or by means of a discontinuous arrangement of at least two segments going along said guilloche line.

Figure 16 is a photograph of an identity document having a guilloche and a matrix of sub-pixels, with some of the lines of the guilloche being arranged in accordance with a particular embodiment of the invention.

A method of fabricating an identity document in accordance with a particular embodiment of the invention is described below with reference in particular to Figures 13 and 14.

The identity document 50 resulting from this method comprises in particular the assembly 30 described above with reference to Figure 8.

A production stage S1 is performed initially during steps S2 to S6.

The pixel matrix 19 and the guilloche GL as described above are printed on the same face 14a of the transparent layer 14 and/or on the bottom face 16b of the layer 16, with this printing taking place during a single printing step S2. As explained above, the matrix 19 may, more generally, be any arrangement of pixels in which each pixel of the arrangement has at least two sub-pixels

of different colors, the sub-pixels being arranged in such a manner as to form at least two lines of sub-pixels in said arrangement.

5 The matrix 19 and the guilloche GL may be printed simultaneously or sequentially during a single printing step.

10 In a particular embodiment, the pixel matrix 19 is printed on an opaque layer (a nontransparent layer) other than the transparent layer (14 or 16), e.g. on a substrate (e.g. a layer of plastics material, of polyethylene terephthalate (PET) or some other type). Nevertheless, the pixel matrix 19 is always arranged in such a manner as to be in register with the transparent layer 14 and/or 16 that is capable of being made opaque, 15 as described above. In this particular embodiment, the guilloche GL may thus be printed on the face of said opaque layer that includes the pixel arrangement 19.

20 In a particular embodiment, the pixel matrix 19 and the guilloche GL are both printed on the same face of a layer (which may be transparent or not as the case may be), such that the pixel arrangement is situated in register with a transparent layer that can be made locally opaque (as described above). It is advantageous to print the matrix 19 and the guilloche GL on the same 25 face of a layer (e.g. on the transparent layer 14 or 16) during a single printing step since that makes it easier to cause the ends of the guilloche lines to coincide with the lines of the sub-pixels, as described above, so that they extend one another in the desired manner.

30 In a particular embodiment, the guilloche lines are made in the zone Z2 from at least one reference point in the matrix 19 (reference points RF1 and RF2 in the example of Figure 8). Conversely, it is possible to make the pixel matrix 19 from at least one reference point in 35 the guilloche. This makes it possible to optimize the positioning of the lines of the guilloche in register with the lines of sub-pixels of the matrix 19.

In a step S4, an image or a pattern 52 (e.g. an "artwork") may be made on a face 12a of the substrate 12 in order to provide a combined artistic and security background that identifies the issuer of the document as well as said document.

Thereafter, the face 14b of the transparent layer 14 is assembled (S6) on the face 12a of the substrate 12 by laminating the layer 14 together with the substrate 12. Assembly is performed in such a manner that the matrix 19 is placed in register with the transparent layer 14. In this example, this step S6 includes potentially assembling a transparent layer 16 on the face 14a of the transparent layer 14. Where appropriate, this transparent layer 16 is suitable for being made locally opaque in the same manner as the transparent layer 14. When the transparent layer 16 is not applied, it is possible to assemble a transparent layer 54 on the layer 14. In contrast, when the transparent layer 16 is applied, there is no need to add the layer 54.

Still in step S6, a second substrate 56 carrying an image or a pattern 58 is assembled on the face 12b of the first substrate 12. Thereafter, a transparent protective layer 60 is arranged so as to cover the second substrate 56 while enabling the pattern 58 on the back of the identity document 50 to be observed from the outside.

Thereafter, a personalization stage S8 made up of steps S10 and S12 is then performed. In step S10, at least one region of the transparent layers 14 and 16 is made opaque so as to impede the passage of light, locally. In this example, the transparent layers 14 and 16 are made of a laserizable material as explained above, and each of the regions concerned is made opaque by the action of the laser beam on the transparent materials, e.g. as a result of additive fillers.

More generally, at least one of the transparent layers 14 and 16 is made opaque S10 so as to block, at least in part, the passage of light through at least a

region facing the pixel matrix 19. In a particular embodiment, regions are made opaque in the transparent layer 16 that is suitable for being made locally opaque, as mentioned above, whereas the transparent layer 14 is not suitable for being made locally opaque.

It is also possible to personalize (S12) the guilloche GL, e.g. by using the laser. In a particular embodiment, a barcode 65 is made in at least one of the lines of the guilloche GL, as explained above with reference to Figure 15.

In a variant implementation, the guilloche GL and the pixel matrix 19 are not made during the same printing step. In a particular implementation, the guilloche GL and the matrix 19 are printed on different layers of the identity document 50. Under such circumstances, the guilloche GL is preferably made as a function of at least one reference point in the pixel matrix 19 (or vice versa). In a particular implementation, the guilloche GL is not printed on the face 14a of the transparent layer 14, but on the face 12a of the substrate 12.

In a particular implementation, the guilloche GL is not printed on the face 14a of the transparent layer 14, but on the bottom face 16b of the substrate 16. A person skilled in the art understands that the above-described implementations and variants are no more than nonlimiting examples of how the invention may be performed. In particular, the person skilled in the art can envisage any combination of the above-described variants an implementation is in order to satisfy any particular need.

CLAIMS

1. An identity document (30) comprising:

- a transparent layer (14, 16);
- a pixel arrangement (19) in register with the
5 transparent layer (14, 16), each pixel (20) comprising at
least two sub-pixels (21) of different colors, the sub-
pixels being arranged in such a manner as to form at
least two lines (LN) of sub-pixels in said pixel
arrangement (19); and
- 10 · a guilloche (GL) in a zone (Z2) adjacent to the
pixel arrangement (19), said guilloche comprising at
least one guilloche line (GL1, GL2);

wherein the transparent layer (14, 16) is suitable
for being made opaque locally so as to block the passage
15 of light at least in part through at least one region of
the transparent layer; and

wherein at least one guilloche line (GL1), referred
to as a "first" line, extends a line of sub-pixels (LN2),
referred to as a "second" line, forming part of the pixel
20 arrangement (19), so that together they form a single,
common line.

2. A document according to claim 1, wherein each first
line extends a respective line of sub-pixels continuously
25 or discontinuously, wherein each first line and each
second line is a line that is rectilinear or curvilinear.

3. A document according to claim 1 or claim 2, wherein
each said extension is made in pairs between a first line
30 (GL1) of the guilloche and a dedicated second line (LN2)
of said pixel arrangement.

4. A document according to any one of claims 1 to 3,
wherein each first line is arranged in register with the
35 respective second line so that neither of these two lines
crosses the other.

5. A document according to any one of claims 1 to 4, wherein each first line (GL1) is arranged in register with the respective second line in one of the following configurations:

5 a) a first end (GL1a) of the first line (GL1) and a second end (LN2a) of the second line (LN2) are contiguous with each other;

 b) a first end portion (GL1b) of the first line (GL1) and a second end portion (LN2b) of the second line
10 (LN2) are spaced apart and in register with each other in such a manner that said first and second end portions share a common tangent (TG).

6. A document according to claim 5, wherein in the
15 configuration a), a first end (GL1b) of the first line (GL1) leading to said first end portion (GL1a) and a second end portion (LN2b) of said second line (LN2) leading to a said second end (LN2a):

 · extend in the same direction so as to form a
20 rectilinear or curvilinear junction between said first and second lines; or

 · extend in different directions so as to form an angle (α) at the junction between said first and second lines.

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7. A document according to any one of claims 1 to 6, wherein each first line (GL1, GL2) and each second line (LN) is rectilinear, and they join together in pairs.

30 8. A document according to any one of claims 1 to 7, wherein the pixel arrangement (19) is printed on said transparent layer (14, 16).

9. A document according to claim 8, wherein the pixel
35 arrangement and the guilloche are printed on the same face of said transparent layer (14, 16).

10. A document according to any one of claims 1 to 9,
wherein each pixel (20) of said arrangement (19) includes
at least one first sub-pixel (PX1) in a first color (CR1)
and at least one second sub-pixel (PX2) in a second color
5 (CR2) different from the first color, wherein the sub-
pixels are arranged so as to form at least one line (LN1)
of first sub-pixels in the first color (CR1) and at least
one line (LN2) of the second sub-pixels in the second
color (CR2).

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11. A document according to claim 10, wherein at least
one said second line is formed by a line of first sub-
pixels in the first color, the first line corresponding
to the guilloche being formed in said first color.

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12. A document according to any one of claims 1 to 11,
wherein the transparent layer (14, 16) is a layer of
polycarbonate, suitable for being made locally opaque in
at least one region of the polycarbonate layer under the
20 action of a laser beam.

13. A document according to any one of claims 1 to 12,
wherein each second line (LN2) is formed by a continuous
or discontinuous arrangement of sub-pixels.

25

14. A document according to any one of claims 1 to 13,
wherein each first line (GL1, GL2) is made continuously or
by a discontinuous arrangement of at least two segments
along said first line.

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15. A document according to any one of claims 1 to 14,
wherein said first line is personalized.

16. A method of fabricating an identity document, the
35 method comprising:

- providing a transparent layer (14, 16);

· forming a pixel arrangement (19) in register with the transparent layer (20, 14), each pixel (16) comprising at least two sub-pixels (21) of different colors, the sub-pixels being arranged in such a manner as to form at least two lines (LN) of sub-pixels in said pixel arrangement (19);

· forming a guilloche (GL) in a zone (Z2) adjacent to the pixel arrangement (19), said guilloche comprising at least one guilloche line (GL1, GL2); and

10 · making opaque at least one region of the transparent layer (14, 16) so as to block the passage of light, at least in part, in said at least one region;

 wherein at least one guilloche line (GL1), referred to as a "first" line, is formed so as to extend a line of sub-pixels (LN2), referred to as a "second" line, forming part of the pixel arrangement (19) so that together they form a single, common line.

17. A method according to claim 16, wherein each first line (GL1) is arranged in register with the respective second line (LN2) in one of the following configurations:

a) a first end (GL1a) of the first line (GL1) and a second end (LN2a) of the second line (LN2) are contiguous with each other;

25 b) a first end portion (GL1b) of the first line (GL1) and a second end portion (LN2b) of the second line (LN2) are spaced apart and in register with each other in such a manner that said first and second end portions (GL1b, LN2b) share a common tangent (TG).

30

18. A method according to claim 16 or claim 17, wherein the pixel arrangement (19) and the guilloche (GL) are formed during the same printing step (S2).

35 19. A method according to claim 18, wherein the pixel arrangement (19) and the guilloche (GL) are formed on the same face of the transparent layer (14, 16).

20. A method according to any one of claims 16 to 19,
wherein each first line (GL1) of the guilloche (GL) is
traced as a function of the positioning of the
5 corresponding second line (LN2).

21. A method according to any one of claims 16 to 20,
wherein the transparent layer (14, 16) is made of
polycarbonate, at least one region of the transparent
10 layer being made opaque locally by the action of a laser
beam.