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(54) METHOD FOR PRODUCING DATA CARRIER AND DATA CARRIER PRODUCED THEREOF

(57) A method of forming a data carrier for a security document, the method comprising: providing a first outer layer and second outer layer, forming a first security feature at the interface between at least two adjacent layers, said first security feature comprising a first deformation of one of the layers, providing at least one revealing layer, forming a stacked structure with said first outer layer, said second outer layer and said revealing layer, said stacked structure being formed by lamination, wherein said first deformation is formed by ultrasonic welding.

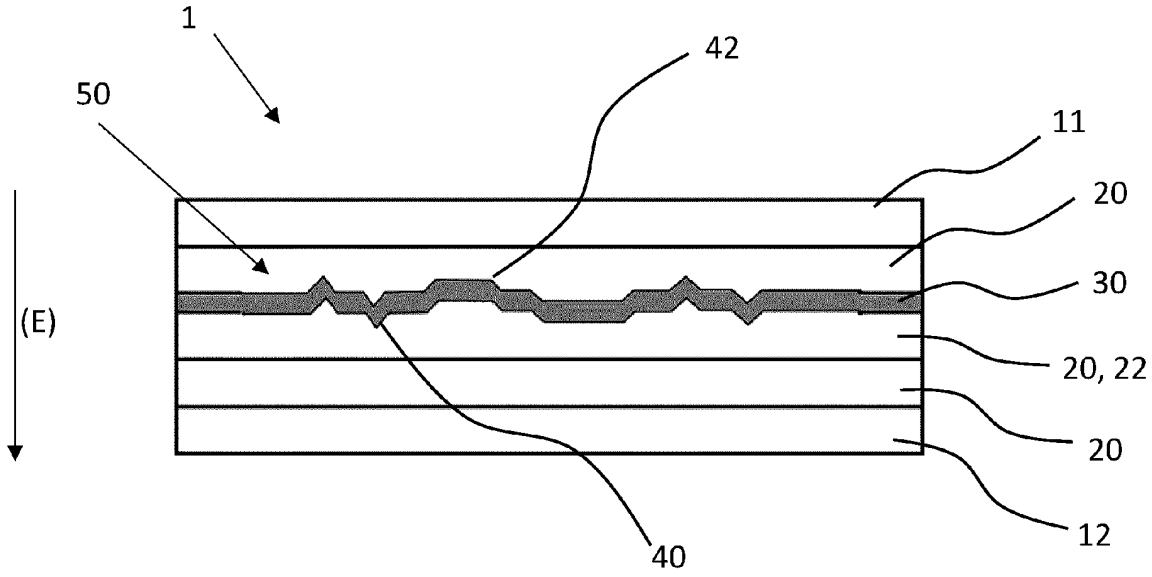

Fig. 3

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Description

TECHNICAL FIELD

[0001] The present invention relates to method of producing a data carrier, to a data carrier produced thereof and to a security document comprising or consisting of such a data carrier.

PRIOR ART

[0002] Data carriers for security documents such as identity cards, passports or the like typically comprise at least one security element. Said security element can be provided on a top surface of the data carrier. Well-known method to protect data is surface embossing made by lamination plates. The weakness of such method is the fact that the security feature can be copied, removed and/or replaced. It is also possible to produce look-alike surface embossing by means of desktop printing, combination of glue & suitable particles, etc. Thus, such security elements are prone to forgery.

SUMMARY OF THE INVENTION

[0003] It is an object of the present invention to provide a method of forming a data carrier especially for a security document of greater security that is less prone to forgery.

[0004] This object is achieved with a method according to claim 1. In particular, a method of forming a data carrier for a security document, the method comprising:

- providing a first outer layer and second outer layer,
- forming a first security feature at the interface between at least two adjacent layers, said first security feature comprising a first deformation of one of the layers,
- providing at least one revealing layer,
- forming a stacked structure with said first outer layer, said second outer layer and said revealing layer, said stacked structure being formed by lamination,

wherein said first deformation is formed by ultrasonic welding.

[0005] This method allows forming a security feature fully inside the data carrier, said security feature surviving in lamination, leaving a pre-made and designed deformation at the interface between some of the layers. This first security feature can also be referred to as an interfacial security feature, as it is located at the interface between some of the layers of the data carrier. As the security feature is inside the data carrier, removal of data becomes more complicated, as grinding of the data carrier would remove simultaneously also the designed deformation. Also, as the first deformation is formed before forming the stack structure of the data carrier by lamination, a modification of said first deformation and the corresponding security feature after the lamination step would be particularly difficult for a forger. Therefore, the security feature is less prone to copy, reproduction or modification by a forger. The data carrier obtained by this method allows subsequent personalization such as laser engraving. In the same way, this method of marking the data carrier does not interfere with embossing or diffractive surface elements in a negative way. It enables various possibilities in terms of design and feature visibility, it can be overt or covert, if required. Finally, this method can leave the outer surface of the data carrier fully smooth and intact.

[0006] The term "deformation" of one of the layers means that there is no added matter or removal of matter on the surface of said layer. This deformation of layer is formed by ultrasonic welding.

[0007] Ultrasonic welding corresponds to a process that uses mechanical vibrations in the ultrasonic range. These vibrations, produced by a sonotrode, as it is generally known, are used to act on at least part of deformed layer, whereby the first deformation is produced. To this end it is preferred that the deformed layer is placed on an anvil as it is known in the art as well, and wherein the sonotrode is pressed onto the layer on a side being opposite the anvil. The ultrasonic welding is preferably performed using an ultrasonic welding device as it is known in the art. The ultrasonic welding device is preferably commercially available.

[0008] Advantageously, the first security element is preferably produced by applying vibrations having a frequency in the range of 1 kHz to 100 kHz, preferably in the range of 20 kHz to 70 kHz. Additionally or alternatively the first security element is preferably produced by applying vibrations having an amplitude in the range of 1 micrometer to 100 micrometer, preferably in the range of 5 micrometer to 50 micrometer. Additionally or alternatively the first security element is preferably produced during a welding time in the range of 0.05 second to 1 second, preferably in the range of 0.1 second to 0.5 second.

[0009] The use of ultrasonic welding step to form the first deformation allows a high degree of freedom in terms of design. Ultrasonic welding enables fine details such as microtext and furthermore enables the generation of various features such as optically variable element, and notably latent images. The marking can be overt and visible for bare eyes. On the other hand, the marking may be covert and require use of a magnification such as a loupe, a microscope and/or different lighting conditions in order to be visible.

[0010] The layers of the data carrier preferably comprise or consists of at least one plastic and/or of one or more polymers such as thermoplastic polymer or thermoset polymer. The layers of the data carrier preferably comprise or consists of polycarbonate (PC) and/or polyvinyl chloride (PVC) and/or polyethylene terephthalate (PET) and/or polyethylene (PE) and/or cross-linked polyethylene and/or polypropylene (PP) and/or copolymers thereof and/or mixtures thereof. The layers of the data carrier are not necessarily of the same material. It is

furthermore preferred that the data carrier is provided by means of one or more layers, i.e. it preferably corresponds to a layered structure. The data carrier particularly preferably corresponds to a card body as it is known in the field of the invention.

[0011] Advantageously, the first deformation is replicated during lamination such that at least one replicated deformation is formed inside the data carrier at the interface between at least some of the layers. The term "replicated deformation" corresponds to the deformation of layers which are adjacent to the layer with the first deformation. Said replicated deformation is induced by the first deformation through lamination process. The first deformation of one of the layers is replicated to at least one adjacent layer. Said first deformation can be replicated to several adjacent layers such that the data carrier formed by the present method comprises several replicated deformations of the first deformation of one of the layers. However, the replicated deformation is not on the outermost surface of the data carrier obtain by the present method. The replicated deformation and the first deformation are in alignment along the extension direction (E). The replicated deformation has a profile sensibly similar to the profile of the first deformation. In other words, if the deformation comprises recesses, bumps and/or dips, the replicated deformation includes similar recesses, bumps and/or dips. However, the height and depth of the recesses, bumps and/or dips of the replicated deformation along the extension direction (E) may be of lower height and depth than those of the original deformation, the amplitude of the recesses, bumps and/or dips of the replicated deformation being therefore reduced compared to said original deformation along the extension direction (E).

[0012] Advantageously, the data carrier comprises at least one inner layer. Said inner layer preferably comprises the first deformation.

[0013] The revealing layer increase and/or improve the visibility of the first deformation and the security feature once the stacked structure of the data carrier is formed. The revealing layer is preferably selected with respect to the internal layer carrying the first deformation. Advantageously, the chemical composition and physical properties of the revealing layer are not identical with those of the layer with the first deformation. The revealing layer is preferably adjacent to the layer with the first deformation. The revealing layer advantageously faces the first deformation of one of the layers such that said revealing layer is in contact with the first deformation of one of the layers. The revealing layer can also face the rear side of the layer with the first deformation on its front side. The revealing layer can also be separated from the first deformation of one of the layers by some inner layers in between.

[0014] The first deformation is replicated on the revealing layer during lamination such that said revealing layer comprises a replicated deformation. The first deformation is not formed directly on the revealing layer. On the contrary, the first deformation is formed on a different layer, such as a first inner layer, and will be replicated to the revealing layer only through lamination. Consequently, the revealing layer can be welded to a second inner layer as a preform. Once the first deformation is formed on a layer such as a first inner layer, said preform is applied onto the first inner layer, with the revealing layer.

[0015] As the deformation is done on another surface rather than directly on a revealing layer or an ink layer, said revealing layer is not damaged by the deformation. Another benefit coming from this approach is that the feature is more attractive and has more dimensions when the deformation and revealing layer are not precisely in the same interface.

[0016] The revealing layer does not necessarily have the same surface as the first deformation. According to one embodiment, the at least one revealing layer covers a surface bigger than the surface covered by the first deformation of one of the layers. The security feature is therefore not formed only in the portion where the revealing layer is present but rather on the portion where the first deformation is present. In this case, the revealing layer does not need to be cut or preformed in order to define the shape or area of the desired security feature. The revealing layer can cover substantially all the surface of the layer with the first deformation. According to another embodiment, the at least one revealing layer covers a surface smaller than the surface covered by the first deformation of one of the layers. In this case, the whole revealing layer shows the desired effect while the deformation outside the revealing layer can disappear during lamination process.

[0017] The first deformation can be formed on any of the layers as it is not on the outermost surface of the data carrier. For example, the first deformation can be formed on an inner surface of one of the outer layers. This first deformation can also be formed on a surface of one of the inner layers. The at least one inner layer preferably comprises a so-called core layer, the first deformation being formed on the surface of said core layer. The core layer is preferably substantially at the center of the stacked structure. Said core layer can also comprises several sub layers. Such a multilayered core can be deformed and then laminated to the revealing layer along with the outer layers.

[0018] The core layer carrying the first deformation can be substantially transparent. Alternatively, said core layer carrying the first deformation can be colored, advantageously white. Depending on the appearance of the core layer, the revealing layer can have different composition and appearance.

[0019] Further to the above mentioned advantages, the method according to the invention is also advantageously compatible with addition of other security features and subsequent personalization. Indeed, as mentioned before, this method of marking the data carrier does not interfere with embossing or diffractive surface

elements in a negative way.

[0020] Advantageously, the method according to the invention comprises a step of forming a second security feature. Said second security feature can be formed by a modification of the surface of the data carrier. In that case, the second security feature can be of many types as a modification of the uppermost surface of the data carrier will not interfere with the first security feature as said first security feature is a so called interfacial feature at the interface between at least some of the layers of the data carrier. In this case, the step of forming the second security feature is subsequent the step of forming the stack structure by lamination. Advantageously, the second security feature is obtained by laser engraving, after the formation of the stack structure by lamination. The laser engraving of the data carrier according to the invention allows forming a second security feature with high level of complexity and reliability while not interfering with the first security feature.

[0021] The second security feature can also be an interfacial feature formed with the method according to the invention. In that case, the step of forming the second security feature comes before the step of forming the stack structure by lamination.

[0022] Preferably, the second security feature is at least partially overlapping the first security feature along the extension direction (E).

[0023] Advantageously, the method comprises a step of forming a personalization element. Said personalization element can be formed by many different techniques well known from the state of the art. Advantageously, the personalization element is formed by laser engraving. Preferably, said personalization element is at least partially overlapping the first security feature along the extension direction (E). This overlapping allows forming particularly complex design which would be very difficult for a forger to reproduce and/or to selectively alter.

[0024] Advantageously, the method comprises a step of forming a see-through portion or a window. The see-through portion can be produced by forming a void in one or more layers of the data carrier, allowing visibility through the data carrier. The void can be formed by punching or cutting away some material from one or more layers of the data carrier. In the context of the invention, the see-through portion allows viewing at least part of the deformation and/or the replicated deformation of the security feature.

[0025] Preferably, said see-through portion is at least partially overlapping the first security feature along the extension direction (E). This overlapping allows forming particularly complex design which would be very difficult for a forger to reproduce and/or to selectively alter.

[0026] According to another aspect, the invention concerns a data carrier obtained by the method previously disclosed. In particular, the data carrier according to the invention extends along an extension direction (E) and comprises:

- a first outer layer forming a first outer surface of the data carrier, and
- a second outer layer forming a second outer surface of the data carrier, and
- at least one revealing layer,

said first outer layer, said second outer layer and said at least one revealing layer forming a stacked structure,

wherein the data carrier comprises a first security feature at the interface between at least two adjacent layers, said first security feature comprising a first deformation of one of the layers, said first deformation being formed by ultrasonic welding.

[0027] All the technical advantages presented above in relation with the method of forming a data carrier applies equally to the data carrier according to the invention.

[0028] Advantageously, the data carrier according to the invention comprises at least one replicated deformation induced by the first deformation. The at least one replicated deformation is at the interface between at least some of the layers of the data carrier. Preferably, the revealing layer comprises a replicated deformation.

[0029] Advantageously, the data carrier comprises at least one inner layer. Said inner layer preferably comprises the first deformation.

[0030] The revealing layer increase and/or improve the visibility of the first deformation and the security feature once the stacked structure of the data carrier is formed. Visibility means that deformation can be observed by one way or the other. Possible means of detection methods of normal light, sidelight, see-through light, UV light is used, or a crosscut is made, or polarization films are used. Usable devices are bare eyes, loupe, microscope, etc.

[0031] The revealing layer is preferably selected with respect to the internal layer with the first deformation. Advantageously, the chemical composition and physical properties of the revealing layer are not identical with those of the inner layer with the first deformation. The revealing layer advantageously faces the first deformation of one of the layers such that said revealing layer is in contact with the first deformation of one of the layers. The revealing layer can also face the rear side of the layer with the first deformation on its front side. The revealing layer can also be separated from the first deformation of one of the layers by some inner layers in between.

[0032] The first deformation is replicated on the revealing layer during lamination such that said revealing layer comprises a replicated deformation.

[0033] Another advantage of the data carrier according to the invention is the nature of the security feature formed by ultrasonic welding and its level of details. Said first security feature of the data carrier can be overt and visible for bare eyes. On the other hand, the marking may be covert and require use of a magnification such as a loupe, a microscope and/or different lighting conditions in order to be visible. The security feature or security ele-

ment preferably has the shape of a pattern. The pattern can be an ordered pattern or a disordered pattern. An ordered pattern preferably comprises pattern elements being arranged in a repetitive manner. A disordered pattern preferably comprises randomly distributed pattern elements. The pattern elements in both cases can correspond to geometric shapes such as lines or circles or the like, a barcode, or any random looking set of elements. A security element being inspectable by the bare human eye is understood as being verifiable without the need of any dedicated equipment. A machine-readable security element is understood as being verifiable by means of dedicated equipment, e.g. by means of a mobile phone that takes a photograph of the security element and being configured to perform a software-based verification of the pattern. A phone operates in visible light regarding the light source as well as the capture. However, the verification could likewise require specific lighting conditions such as ultraviolet lighting or infrared lighting, and the same applied to the capturing device. Furthermore, the verification could require magnification of some level if the security element is provided at very high resolution.

[0034] Advantageously, the security feature comprises a watermark-like element. A so-called watermark-like element consists of slightly thicker and slightly thinner areas of material, and it resembles a real watermark known from security papers, when a see-through light is used. A security feature comprising a watermark-like element can become visible or more prominent under backlight conditions compared to any other lighting configuration.

[0035] Advantageously, the security feature comprises a latent image. A security feature comprising a latent image can become visible when suitably altering the viewing and/or lighting angle.

[0036] Advantageously, the security feature comprises at least one micro text. A micro text can form letters or numerals that are visible with naked eye or with use of a magnification such as a loupe, a microscope.

[0037] Preferably, the at least one revealing layer comprises offset inks and varnishes, silk screen printing inks and varnishes, DOVID (Diffractive Optically Variable Image Device), OVI (Optically Variable Ink), pearlescent inks, metallic inks, metallic foils, and/or a colored plastic film. The nature of the revealing layer is advantageously selected depending on the nature of the layer with the first deformation.

[0038] Advantageously, the data carrier comprises a so-called core layer comprising the first deformation. The core layer is an inner layer of the data carrier. The core layer is preferably substantially at the center of the stacked structure. Said core layer can also comprises several sub layers.

[0039] The first outer layer and/or the second outer layer may be formed by different material adapted for their use in security documents and data carrier such as PVC, PETG, ABS and so on. Advantageously, the first outer layer and/or the second outer layer comprises thermoplastic material. Preferably, the first outer layer and/or the second outer layer comprises polycarbonate.

[0040] In the same way, the at least one core layer may be formed by different material adapted for their use in security documents and data carrier such as PVC, PETG, ABS and so on. Advantageously, the at least one core layer comprises thermoplastic material. Preferably, the at least one core layer comprises polycarbonate and more preferably transparent polycarbonate.

[0041] The outer layers and the core layer do not have to be of same type. For instance, a data carrier with PET core and PVC surface layers could be manufactured according to the method of the invention.

[0042] Advantageously, the data carrier according to the invention comprises a second security feature. Said second security feature can be formed by a modification of the surface of the data carrier. In that case, the second security feature can be of many types as a modification of the uppermost surface of the data carrier will not interfere with the first security feature as said first security feature is a so-called interfacial feature at the interface between at least some of the layers of the data carrier. Advantageously, the second security feature is obtained by laser engraving. The laser engraving of the data carrier according to the invention allows forming a second security feature with high level of complexity and reliability while not interfering with the first security feature.

[0043] The second security feature can also be an interfacial feature formed with the method according to the invention.

[0044] Preferably, the second security feature is at least partially overlapping the first security feature along the extension direction (E).

[0045] Advantageously, the data carrier comprises a see-through portion or a window. In this case, the different layers of the data carrier are preferably at least partially translucent at the region of the see-through portion.

[0046] Preferably, said see-through portion is at least partially overlapping the first security feature along the extension direction (E). This overlapping allows forming particularly complex design which would be very difficult for a forger to reproduce and/or to selectively alter.

[0047] The interaction between the see-through portion and the first security feature involves the strategic placement of the first deformation and/or the replicated deformation in alignment with the see-through portion. This configuration allows enhancing the security of the document by combining different security feature elements in a way that is challenging to replicate or counterfeit. By integrating interfacial security feature with the formation of a see-through portion, the data carrier achieves a multilayered security approach. This makes it even more difficult for counterfeiters to reproduce all the security elements accurately.

[0048] The see-through portion can be produced by forming a void in one or more layers of the data carrier,

allowing visibility through the data carrier. The void can be formed by punching or cutting away some material from one or more layers of the data carrier. In the context of the invention, the see-through portion allows viewing at least part of the deformation and/or the replicated deformation of the security feature.

[0049] In the described embodiment, the see-through portion is part of a multilayered structure involving clear and white polycarbonate layers, with the clear layer potentially having embossed security features. This combination of a see-though portion and embossed elements contributes to the document's security and makes it more resistant to counterfeiting.

[0050] Advantageously, the data carrier comprises a personalization element. Said personalization element can be formed by many different techniques well known from the state of the art, such as laser engraving. The personalization element can notably comprise a photograph of the holder of a security document comprising the data carrier. Advantageously, said personalization element is at least partially overlapping the first security feature along the extension direction (E). This overlapping allows forming particularly complex design which would be very difficult for a forger to reproduce and/or to selectively alter.

[0051] Preferably, the see-through portion and the personalization element are at least partially overlapping the first security feature along the extension direction (E). This overlapping allows forming an even more complex design which would be particularly difficult for a forger to reproduce and/or to selectively alter.

[0052] According to another aspect, the invention concerns a security document comprising or consisting of at least one data carrier as previously disclosed. The security document is preferably a smart card, an identity card, a passport, a credit card, a bank note or the like.

BRIEF DESCRIPTION OF THE DRAWINGS

[0053] Preferred embodiments of the invention are described in the following with reference to the drawings, which are for the purpose of illustrating the present preferred embodiments of the invention and not for the purpose of limiting the same. In the drawings,

- Fig. 1 shows a first step of the method of forming a data carrier according to the invention in a cross section view;
- Fig. 2 shows a second step of the method of forming a data carrier according to the invention in a cross section view;
- Fig. 3 shows a third step of the method of forming a data carrier according to the invention in a cross section view;
- Fig.4 shows another embodiment of a stacked structure formed according to the invention in a cross view;
- Fig. 5a shows a top view of a data carrier 1 according to the invention with normal light,
- Fig. 5b shows the data carrier of figure 5a with reflective light,
- Fig. 5c shows the data carrier of figure 5a and 5b with transmitted light,
- Fig. 6a shows a top view of the data carrier of figure 5a to 5c which has been personalized, said data carrier being shown with normal light,
- Fig. 6b shows the data carrier of figure 6a with reflective light,
- Fig. 6c shows the data carrier of figure 6a and 6b with transmitted light,
- Fig. 7a shows a top view of another data carrier 1 according to the invention with normal light,
- Fig. 7b shows the data carrier of figure 7a with reflective light,
- Fig. 7c shows the data carrier of figure 7a and 7b with transmitted light,
- Fig. 8 shows a top view of another data carrier 1 according to the invention.

DESCRIPTION OF PARTICULAR EMBODIMENTS

[0054] Aspects of the invention shall be further illustrated with reference to the figures.

[0055] Figure 1 depicts a first step of the method of forming a data carrier according to the invention in a cross-section view. In this first step, a first outer layer 11, a second outer layer 12 and several inner layers 20 are provided. The number of inner layers 20 can vary depending on the desired properties of the data carrier 1. One of those inner layers 20 is a so-called core layer 22. This core layer 22 is substantially at the center of the data carrier 1 according to the extension direction (E). Additionally, a revealing layer 30 is provided. The layers represented in these figures are not in scale. The revealing layer 30 is, in most of cases, much thinner than the other layers.

[0056] In the second step as depicted in figure 2, a first deformation 40 of the core layer 22 is formed by ultrasonic welding. This first deformation 40 of the core layer 22 will form a first security feature 50 at the interface between the core layer 22, the revealing layer 30 and an upper inner layer 20 facing the revealing layer 30.

[0057] In the third step as depicted in figure 3, a stacked structure is formed with the first outer layer 11, a first inner layer 20, the revealing layer 30, the core layer 22, a second inner layer 20 and the second outer layer 12. This stacked structure is formed by lamination. The parameters of the lamination process will depend on the nature of the layers of the data carrier, on their thickness and so on. During lamination, heat and pressure in applied on the stack of layers, some material of the layers adjacent to the core layer with the first deformation flow and follows the shape of the first deformation. Therefore, during said lamination, the first deformation 40 of the surface of the core layer 22 is replicated such that at least one replicated deformation 42 is formed inside the data

carrier 1 at the interface between at least some of the layers. In the embodiment shown in figure 3, a replicated deformation 42 is located at the interface between the core layer 22 and the revealing layer 30 and another replicated deformation 42 is located at the interface between the revealing layer 30 and the above inner layer 20 facing the revealing layer 30. Depending on the intensity of the deformation 40, the height and depth of the resulting recesses and the thickness of the layers, bumps and/or dips, the replicated deformation 42 could be replicated to more adjacent layers. For example, for a stronger deformation with higher intensity, some replicated deformation could be also located at the interface between the upper inner layer 20 and the first outer layer 11.

[0058] Figure 4 is another embodiment of a stacked structure formed according to the method described above. This structure further comprises a see-through portion 70. The first outer layer 11 and second outer layer 12 are opaque layers. This opacity is represented in figure 4 by a hatched pattern. On the contrary, the core layer 22 and the inner layers 20 are translucent or sensibly transparent. This illustration is for explanatory purposes only, it is obviously not excluded that the layers shown without a hatched pattern in the other figures could also be opaque layers. The opaque layers of the stacked structure comprise an opening, advantageously formed before the lamination step. The opaque layers of the stacked structure comprise translucent or sensibly transparent material, such as clear polycarbonate for example, at the area corresponding to the see-through portion. This clear portion of the opaque layers can be formed by removing a part of the opaque material before the lamination step. During lamination, the clear material of adjacent layers flows and fill the void in the opaque layer. In the embodiment shown in figure 4, the clear polycarbonate of inner layers 20 flows during lamination and fill the void in the first outer layer 11 and second outer layer 12. The see through portion is represented by the area 70. At least part of the first security feature 50 overlaps the see through portion 70. In other words, the first security feature 50 is at least partially in alignment with the see-through portion 70.

[0059] Figures 5a to 5c depicts a top view of a data carrier 1 according to the invention comprising a first security feature 50. In this data carrier, the first deformation 40 is formed by ultrasonic welding of a core layer made of polycarbonate. The first deformation and the corresponding first security feature is a microtext forming the letter "R". The revealing layer 30 used in this data carrier 1 is a white polycarbonate layer. Figure 5a shows the data carrier with normal light. Figure 5b shows the data carrier with reflective light. Figure 5c shows the data carrier with transmitted light. The first security feature, i.e. the letter "R", is not visible in normal light, barely visible in reflective light and well visible in transmitted light. Therefore, first security feature 50 is a covert security feature or level 2 security feature as it is not visible to the naked eye in normal lighting condition but rather needs specific lighting conditions.

[0060] Figures 6a to 6c depicts a top view of the data carrier 1 of figure 5a to 5c which has been personalized. The first deformation 40 is formed by ultrasonic welding of a core layer made of polycarbonate. The first deformation 40 and the corresponding first security feature 50 is a microtext forming the letter "R". The size of the marking can vary and can indeed be much smaller that the letter "R" represented in this figure which has an illustrative purpose only. The revealing layer 30 used in this data carrier 1 is a polycarbonate layer. The personalization element 60 is a photograph of the holder of the data carrier 1 or the security document 100 comprising said data carrier 1. Figure 6a shows the data carrier 1 with normal light. Figure 6b shows the data carrier 1 with reflective light. Figure 6c shows the data carrier 1 with transmitted light. The first security feature 50, i.e. the letter "R", is almost not visible in normal light, visible in reflective light and well visible in transmitted light. Therefore, first security feature 50 is a covert security feature or level 2 security feature as it is almost not visible to the naked eye in normal lighting condition but rather needs specific lighting conditions.

[0061] Figures 7a to 7c depicts a top view of another data carrier 1 according to the invention comprising a first security feature 50. In this data carrier, the first deformation 40 is formed by ultrasonic welding of a core layer made of polycarbonate. The first deformation and the corresponding first security feature 50 is a pattern of lines forming a latent image. The revealing layer 30 is a printed layer forming the dark rectangular shape, the latent image being located at the upper right corner of it. Figure 7a shows the data carrier 1 with normal or direct light. With this lighting condition, the latent image 50 shows lines forming a grid. Figure 7b shows the data carrier 1 with reflective light. With this lighting condition, the latent image 50 shows lines forming a checkboard pattern. Figure 7c shows the data carrier 1 with transmitted light. With this lighting condition, the latent image 50 shows lines forming a grid, said grid being way more visible than the rest of the data carrier.

[0062] Figure 8 depicts a top view of another data carrier 1 according to the invention comprising a first security feature 50. In this data carrier, the first deformation 40 is formed by ultrasonic welding of an inner layer made of polycarbonate. The first deformation and the corresponding first security feature 50 is forming the numerals "00000". The revealing layer 30 used in this data carrier 1 is a DOVID layer.

Claims

1. A method of forming a data carrier (1) for a security document (100), the method comprising:

   - providing a first outer layer (11) and second

outer layer (12),
- forming a first security feature (50) at the interface between at least two adjacent layers, said first security feature (50) comprising a first deformation (40) of one of the layers,
- providing at least one revealing layer (30),
- forming a stacked structure with said first outer layer (11), said second outer layer (12) and said revealing layer (30), said stacked structure being formed by lamination, wherein said first deformation (40) is formed by ultrasonic welding.

2. The method of claim 1, wherein the first deformation (40) is replicated during lamination such that at least one replicated deformation (42) is formed inside the data carrier (1) at the interface between at least some of the layers.

3. A method according to any of the preceding claims, wherein the data carrier comprises at least one inner layer (20), said at least one inner layer (20) comprising the first deformation (40).

4. A method according to any of the preceding claims, wherein it comprises a step of forming a see-through portion (70), said see through portion (70) at least partially overlapping the first security feature (50) along an extension direction (E).

5. The method according to any of the previous claims, wherein it comprises a step of forming a personalization element (60), said personalization element (60) preferably at least partially overlapping the first security feature (50) along the extension direction.

6. Data carrier (1) for a security document (100), said data carrier (1) extending along an extension direction (E) and comprising:

- a first outer layer (11) forming a first outer surface of the data carrier (1), and
- a second outer layer (12) forming a second outer surface of the data carrier (1), and
- at least one revealing layer (30),
said first outer layer (11), said second outer layer (12) and said at least one revealing layer (30) forming a stacked structure,
wherein the data carrier (1) comprises a first security feature (50) at the interface between at least two adjacent layers, said first security feature (50) comprising a first deformation (40) of one of the layers, said first deformation being formed by ultrasonic welding.

7. Data carrier (1) according to claim 6, wherein it comprises at least one replicated deformation (42) induced by the first deformation (40), said at least one replicated deformation (42) being at the interface between at least some of the layers of the data carrier (1).

8. Data carrier (1) according to claim 7, wherein the revealing layer (30) comprises a replicated deformation (42).

9. Data carrier according to claims 6 to 8, wherein it comprises at least one inner layer (20), said at least one inner layer (20) comprising the first deformation (40).

10. Data carrier (1) according to claims 6 to 9, wherein the first security feature (50) comprises a watermark-like element, at least one latent image, and/or at least one micro text.

11. Data carrier (1) according to claim 6 to 10, wherein the at least one revealing layer (30) comprises offset inks and varnishes, silk screen printing inks and varnishes, DOVID, OVI, pearlescent inks, metallic inks, metallic foils, and/or a colored plastic film.

12. Data carrier (1) according to claims 6 to 11, wherein it comprises a personalization element (60), said personalization element (60) preferably at least partially overlapping the first security feature (50) along the extension direction (E).

13. Data carrier (1) according to any of claims 6 to 12, wherein it comprises a see-through portion (70), said see through portion (70) at least partially overlapping the first security feature (50) along an extension direction (E).

14. Data carrier (1) according to claims 12 and 13, wherein the see-through portion (70) and the personalization element (60) are at least partially overlapping the first security feature (50) along the extension direction (E)

15. A security document (100) comprising or consisting of at least one data carrier (1) according to claims 6 to 14, the security document (100) preferably being a smart card, an identity card, a passport, a credit card, a bank note or the like.

Fig. 1

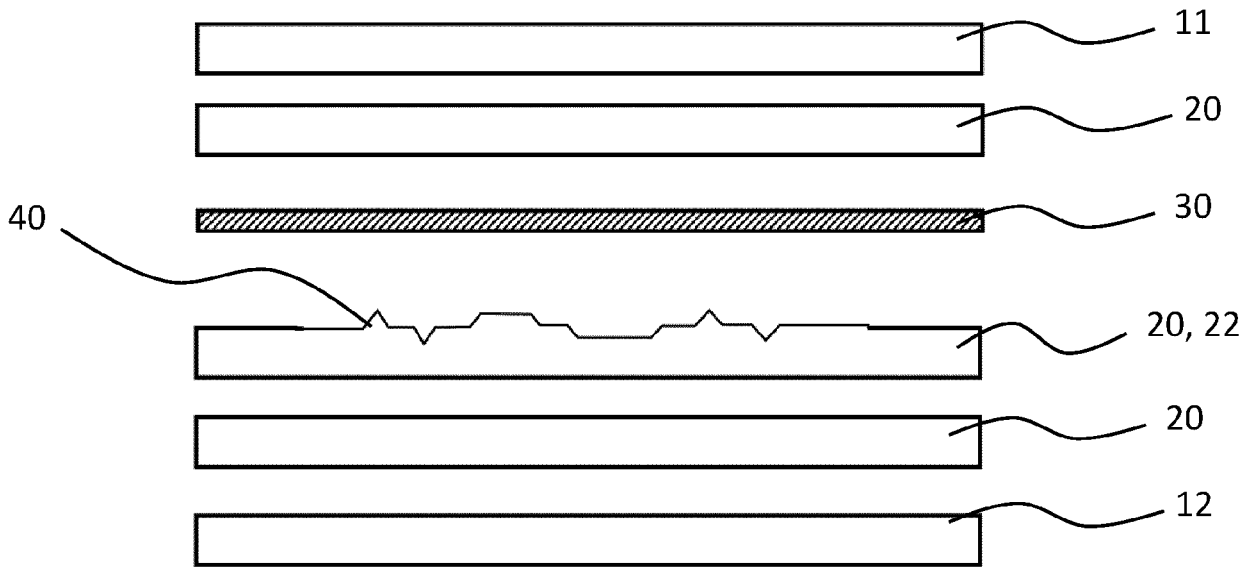

Fig. 2

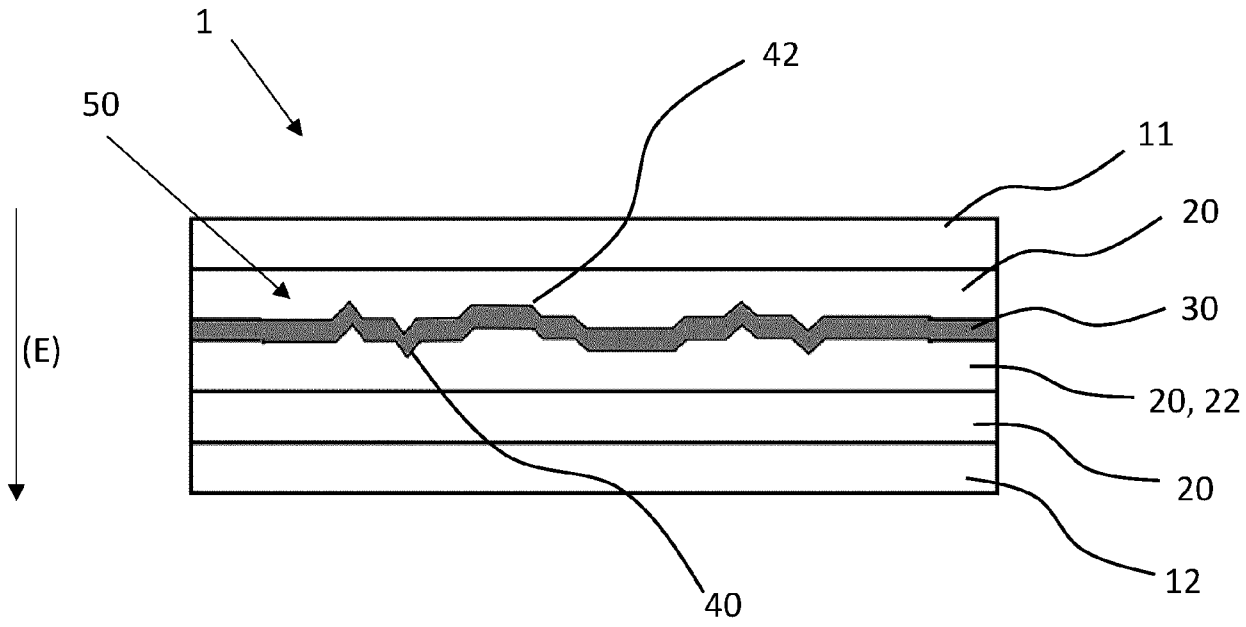

Fig. 3

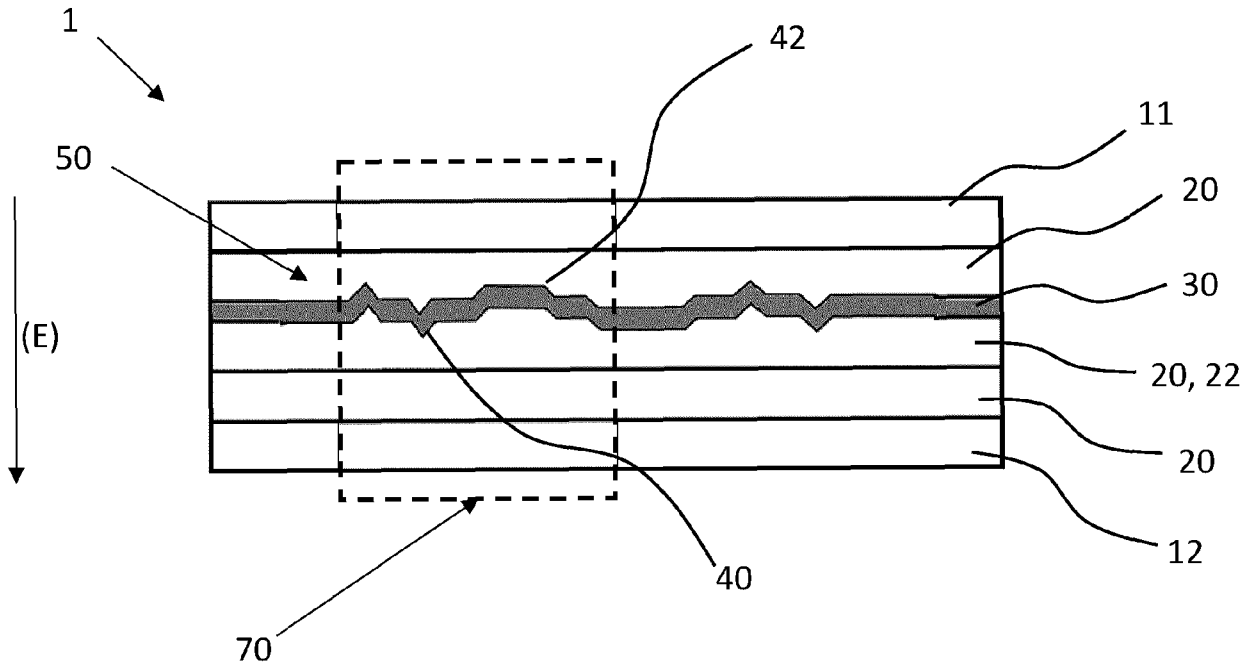

Fig. 4

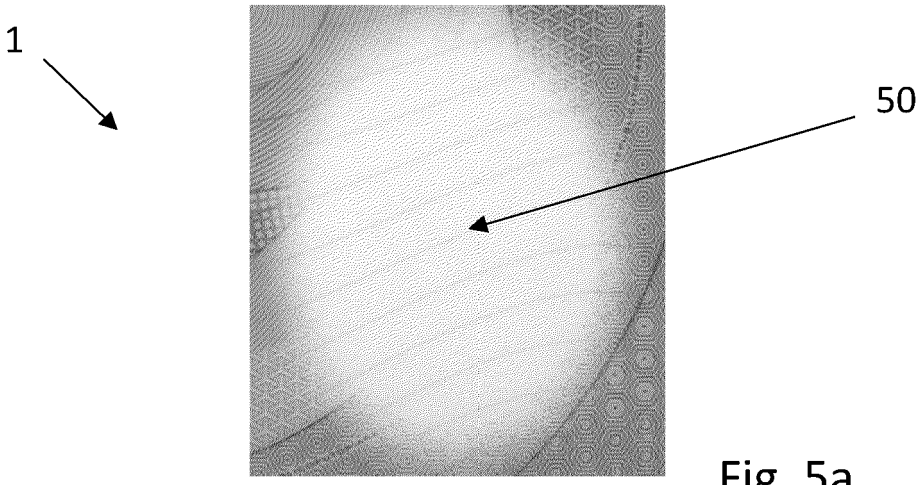

Fig. 5a

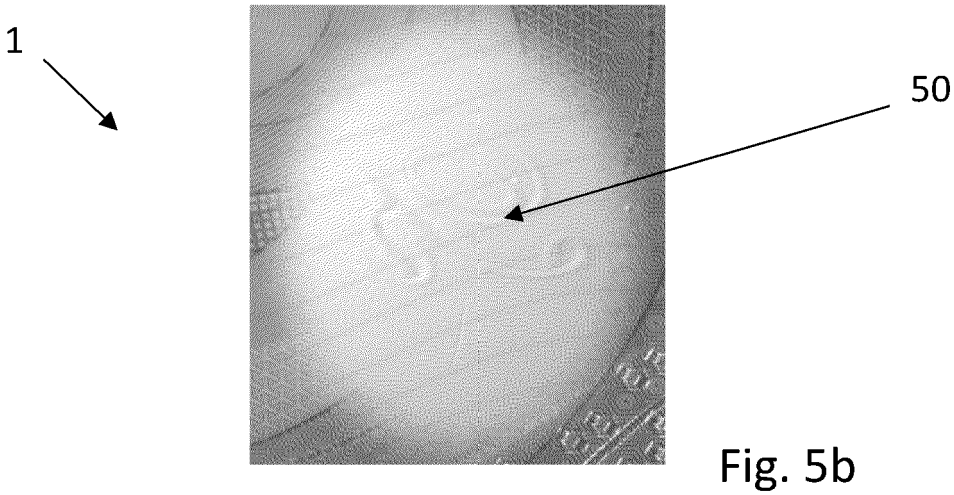

Fig. 5b

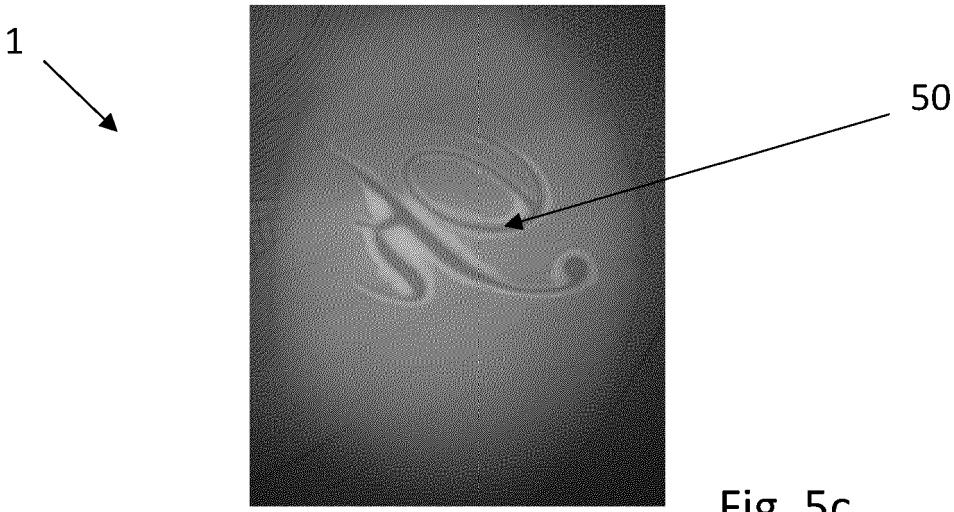

Fig. 5c

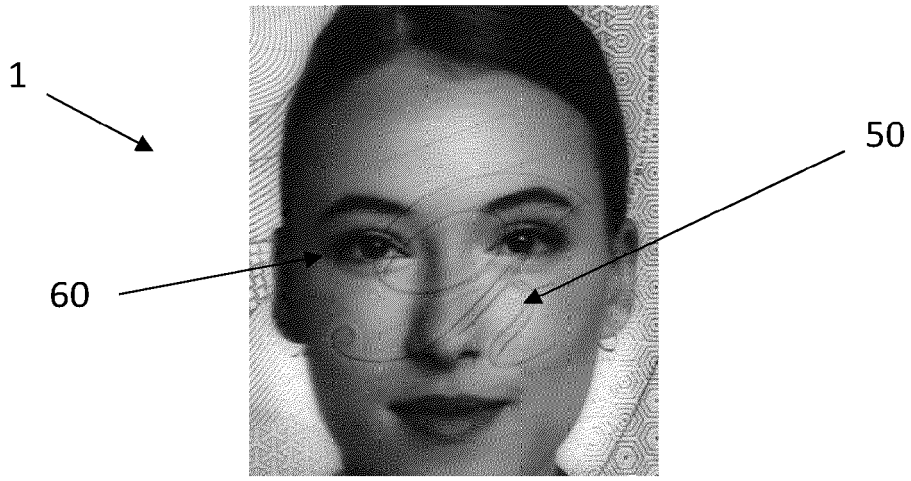

Fig. 6a

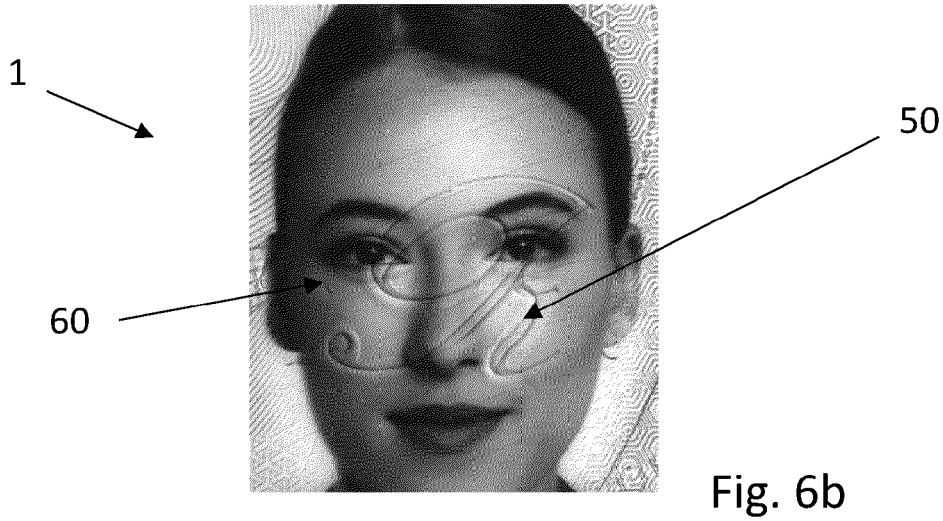

Fig. 6b

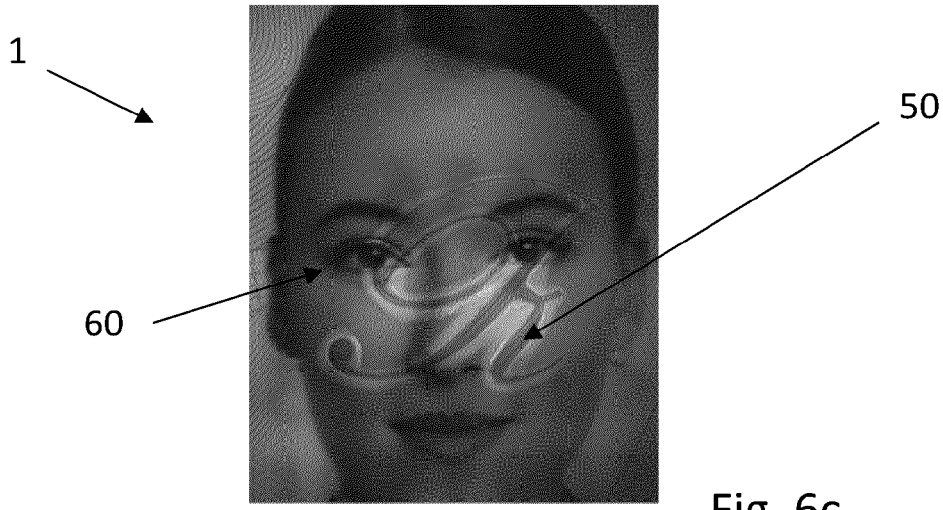

Fig. 6c

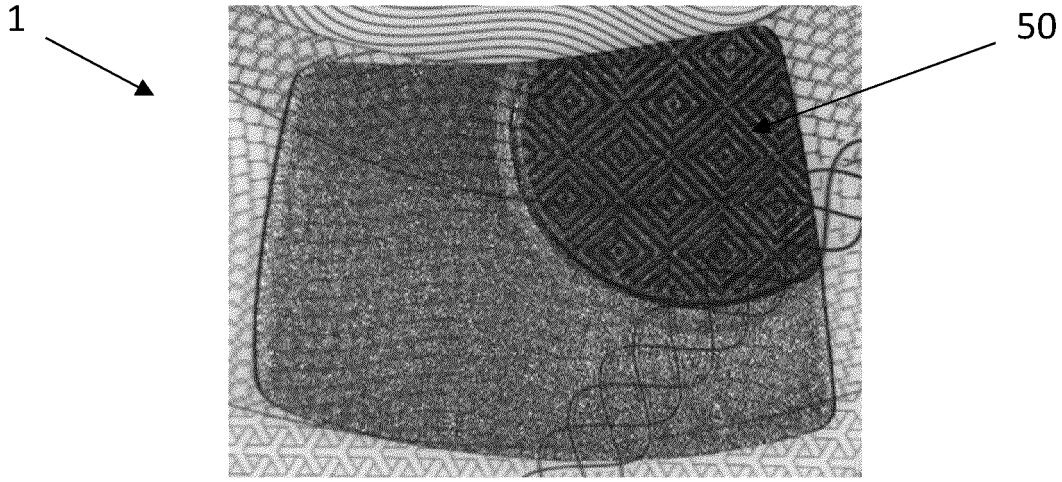

Fig. 7a

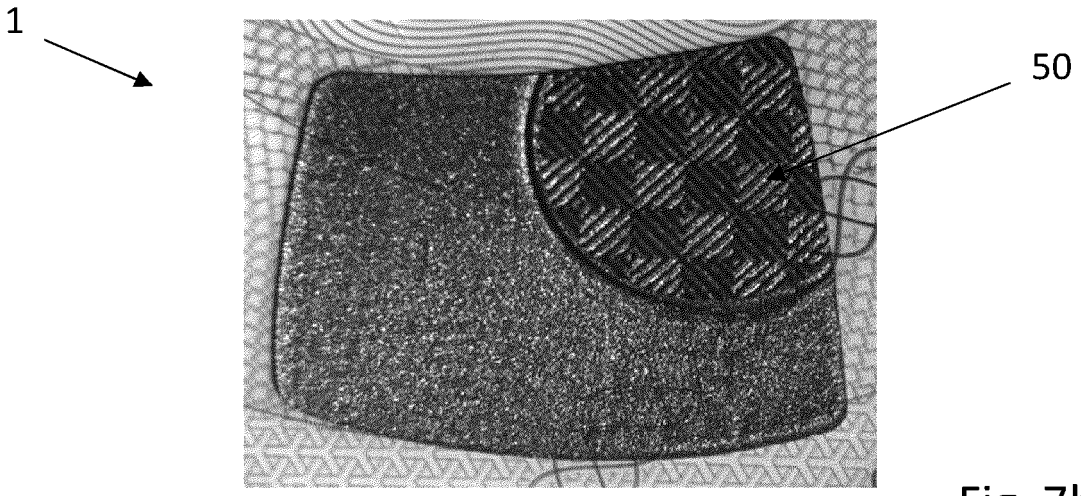

Fig. 7b

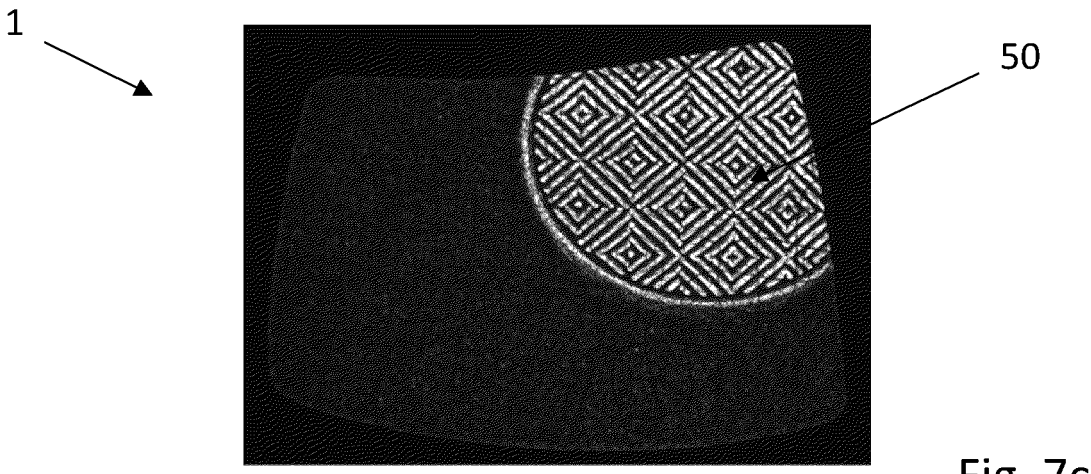

Fig. 7c

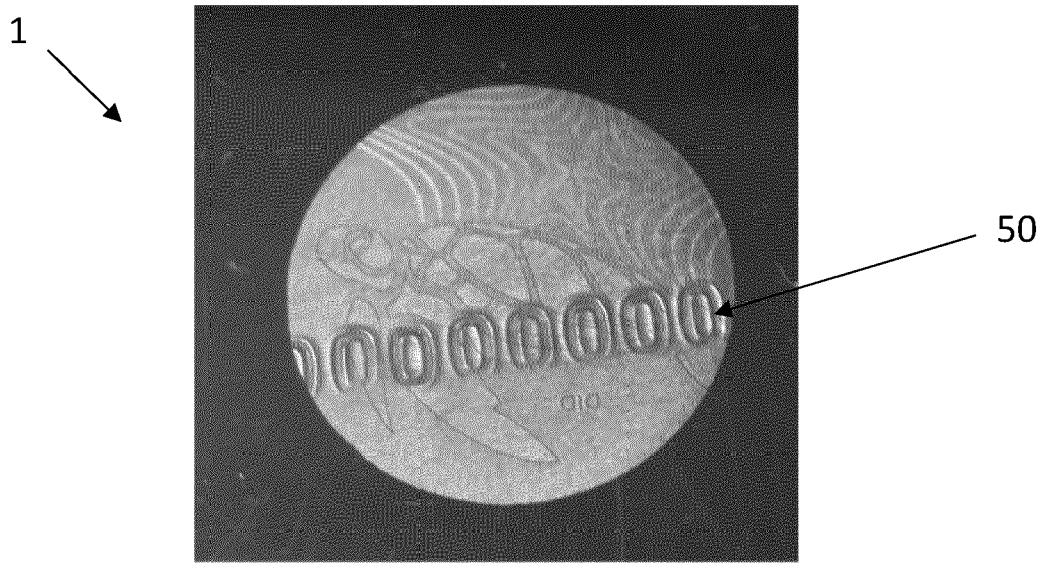

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 23 30 7406

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	DE 10 2008 031656 B4 (BUNDESDRUCKEREI GMBH [DE]) 28 July 2016 (2016-07-28) * paragraphs [0036] - [0044]; claims 1,12; figures *	1,2,4, 6-8,10, 11,13,15 3,5,9, 12,14	INV. B42D25/24 B42D25/324 B42D25/351 B42D25/425
X Y	EP 4 257 367 A1 (THALES DIS FRANCE SAS [FR]) 11 October 2023 (2023-10-11) * paragraphs [0001], [0011] - [0015], [0024] - [0028], [0030] - [0032], [0040] - [0044]; claims; figures *	1,2,4, 6-8,10, 11,13,15 3,5,9, 12,14	
X Y	WO 2010/089155 A1 (BUNDESDRUCKEREI GMBH [DE]; SEIJO BOLLIN HANS-PETER [DE] ET AL.) 12 August 2010 (2010-08-12) * page 12, line 7 - page 14, line 7; claims; figures *	1,2,4, 6-8,10, 11,13,15 3,5,9, 12,14	
X Y	EP 4 257 366 A1 (THALES DIS FRANCE SAS [FR]) 11 October 2023 (2023-10-11) * paragraphs [0065] - [0074]; claims; figures *	1,6,15 3,5,9, 12,14	TECHNICAL FIELDS SEARCHED (IPC) B42D
X Y	GB 2 472 247 A (INNOVIA FILMS SARL [CH]) 2 February 2011 (2011-02-02) * claims *	1,6,15 3,5,9, 12,14	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 May 2024	Zacchini, Daniela

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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13-05-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102008031656 B4	28-07-2016	DE 102008031656 A1	07-01-2010
		WO 2010000499 A2	07-01-2010
EP 4257367 A1	11-10-2023	EP 4257367 A1	11-10-2023
		WO 2023194281 A1	12-10-2023
WO 2010089155 A1	12-08-2010	CN 102271929 A	07-12-2011
		DE 102009007779 B3	07-10-2010
		EP 2393668 A1	14-12-2011
		WO 2010089155 A1	12-08-2010
EP 4257366 A1	11-10-2023	EP 4257366 A1	11-10-2023
		WO 2023194605 A1	12-10-2023
GB 2472247 A	02-02-2011	AU 2010277381 A1	23-02-2012
		AU 2016201996 A1	21-04-2016
		CA 2769549 A1	03-02-2011
		EP 2459386 A2	06-06-2012
		GB 2472247 A	02-02-2011
		NZ 597834 A	28-03-2013
		US 2012187673 A1	26-07-2012
		WO 2011012893 A2	03-02-2011

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82