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DESCRIPTION

The present invention relates to a document of value and/or security document comprising several document layers and patterns formed from image elements in or on the document layers, and a method for producing the same.

Documents of value and/or security documents are used in many different ways. For example, these are identification documents, such as a passport or an identity card, which generally consist at least in part of a multi-layer laminate made of plastic. Such documents are known from DE 10 2008 008 044 A1, for example. Afterwards, card-shaped data carriers, in particular security and/or value documents, can be produced, for example by laminating several individual layers (films) or can also be made in one layer. The individual layers can, for example, consist of polycarbonate (PC), thermoplastic polyurethane-based plastic (TPU), acrylonitrile/butadiene/styrene copolymer (ABS), polyethylene terephthalate (PET), polyethylene, a composite of PC and TPU or paper, cardboard or fabric or a composite of individual materials. For example, the core of the cards can consist of a light-absorbing or diffusing material, such as paper or plastic filled with fillers, while the outer layers consist of a transparent material.

Other documents of value and/or security documents include, for example, the driving licence, a cheque-guarantee card or credit card, a company card, an authorisation card or membership card, which are generally provided in the form of a card in ID-1 format, also laminated and made of plastic. Banknotes, cheques, gift and shopping vouchers can also be made at least in part of plastic. Each of these documents consists of at least one document layer. At least some of the document layers of the ID-1 cards mentioned above are made entirely or at least in part of plastic.

The security features used in the documents of value and/or security documents can only be used to prove the authenticity of the documents regardless of their type or user. Such security elements are, for example, coloured fibres, guilloches, special paper for banknotes and the like. Personalising or other individualising security elements also contain information in coded form or plain text about the type of document, the user of this document or an object to which the document is uniquely assigned. In the latter cases, these are individualised security elements, and in the case of assignment to a person, personalising security elements. Such information can be a photo of the user, his/her personal data, such as name, date of birth, place of birth, signature or a personal identification, such as a member number. Another security element that customises the document can, for example, be a serial number of the document.

For example, a security or value document with an individualising security element is specified in DE 10 2008 012 423 A1. This security or value document is formed as a polymer layer composite which is produced by lamination from several substrate layers and in which at least one piece of individualising information is stored by printing. Within the composite, the information is divided into at least two print extracts, each of which contains partial information on the information. The at least two print extracts are arranged in at least two planes spaced apart from one another, in such a way that the printed print extracts lie precisely above each other in the composite and jointly reproduce the information at a first viewing angle and at least one colour change of the reproduced information occurs at a second viewing angle. In an embodiment specified in this document, it is provided that a printed image embodied by the information is divided into pixels and each pixel is assigned to exactly one of the at least two print extracts, so that after stacking the substrate layers to which the print extracts are applied in each case, a pixel of the information is not arranged in any further substrate layer arranged above it along a layering direction above a pixel applied to a substrate layer. In another embodiment specified in this document, it may also be provided that individual or all print extracts are printed several times, but in perfect register, on different substrate layers at different distances from each other in order to obtain better opacity, for example. For example, the print can reproduce a facial image. To produce the document, the print extracts are printed on the substrate layers. After laminating the printed substrate layers, the printed surfaces lie inside the document.

Such a structure of a document of value and/or security document is very secure, because manipulation, for example an exchange of personalising information for other information, is only possible by delaminating the document. This is very difficult. Therefore, such manipulation is often easily recognisable. However, the production of such documents is also complex. In particular, for logistical reasons, it is advisable not to have the personalisation of the document carried out by a central supplier, but by manufacturers located in the vicinity of a body issuing the document, or by the issuing body itself. For this purpose, document blanks must be transported to these decentralised manufacturers or the issuing point, which requires considerable effort for additional security precautions to prevent the blanks from being stolen.

It is also known that laser engraving in a radiation-sensitive layer produces blackening, for example in the form of a portrait photo of an identity card holder, a signature or the like (EP 0 975 148 A1). In this way, security elements can also be produced by laser means, for example, in an inner layer in a multi-layer laminated carrier material by engraving (DE 199 07 940 A1). However, only blackenings

are formed by laser engraving, so that the produced individualising security element is only created as a black and white representation.

A multi-layer value or ID card with coloured image information is described in EP 0 537 484 A1. The image information is divided into two parts, namely a light/dark part and a colour part. For example, the light/dark part is forgery-proof in a largely transparent film layer. This partial image is then superimposed congruently on the coloured part of the same image information. For example, the light/dark component can be generated by laser inscription. The coloured part is formed according to an example in a colour-absorbing layer after the completion of the map. In another example, the colour portion in an inner layer of the map is generated electrophotographically.

A security and/or value document with personalised overall graphic information is known from DE 10 2008 012 436 A1. For example, the overall information is formed from a combination of different partial colour images, a black-and-white image and one or more different colour (partial) images overlaying these. The graphic partial pieces of information are arranged one above the other in perfect register. The black and white image can be produced by laser engraving or a printing process. The colour (partial) images can be generated using a digital printing process.

Furthermore, a security and/or value document with personalised information is disclosed in DE 10 2007 059 746 A1. In this case, the first personalised information is applied as a coloured printing layer to a polymer layer partial composite using an ink jet printing process. Then a polymer covering layer is laminated onto this printing layer. Finally, a second personalised piece of information is laser-engraved into the resulting polymer layer composite. Both pieces of information result in an overall piece of image information.

WO 2005/058608 A1 specifies a security item with a multicoloured image. The object is made of transparent polymer in several layers, each of the several layers bearing overlapping parts of the picture in different colours.

However, there is a constant need for new types of security features, in particular individualising, for example personalising, security features which are secure against forgery or falsification and which are easily identifiable by a person in order to assign the encoded information to the user and/or the object. For this purpose, the security feature should be disposed in an inner document layer protected against forgery or falsification and appear in a coloured, possibly colourful, display, which thus has an improved optical impression and which additionally has a greater information content.

This object is achieved by the document of value and/or security document according to claim 1 and the process for producing the same according to claim 12. Preferred embodiments of the invention are indicated in the dependent claims.

Where the term "image element" is used in the description of the invention and in the claims, it is to be understood as a component of the pattern in and/or on a document layer which serves as the smallest structural element for forming the pattern, with all image elements forming the pattern, so that the pattern is perceptible to the eye via a contrast with the surroundings of the image element. The material forming an image element can be either transparent, translucent or opaque. Furthermore, it can have a certain brightness (absorption, remission), i.e. it can have for example a blackening, grey hue or white hue, and/or it can have a (spectral) colouring and within this again a certain brightness. The image elements can be circular (point-shaped), rectangular, square, hexagonal or even other shapes. Furthermore, each image element can again be composed of pixels to form a colour of the pixel created from several base colours of a colour space. For example, an image element can be formed by three pixels arranged close together with the base colours yellow, magenta and cyan (CMYK colour space). The pixels can also have a circular (point-shaped), rectangular, square, hexagonal or another shape. The area proportions of the pixels in an image element are selected in a suitable manner in order to achieve the desired picture impression. Typically, the pixels are contained in the image elements, in the same arrangement.

Where the terms "rastered" or "raster" are used in the description of the invention and in the claims, this is understood to mean the separation of an image into individual image elements which are typically arranged regularly, for example in lines or also in another regular arrangement. For example, the image elements can be arranged in a honeycomb arrangement, particularly if they have a hexagonal shape. The image elements can also merge, for example line by line, if the pattern is created using anti-aliasing.

Where the term "pattern" is used in the description of the invention and in the claims, it is to be understood as a two-dimensional structure which is created, for example, by applying a material to a document layer and/or by introducing the material into the document layer or by changing the document layer, and is visible to the eye. A pattern is composed of image elements that typically cannot be resolved with the naked eye. The pattern can have any abstract shape and, in this case, can consist of lines, surfaces, also in any combination, or alternatively of characters, such as alphanumeric

characters, or images, such as the photograph of the document owner or representations of certain objects.

Where the term "in perfect register" is used in the description of the invention and in the claims, this means that the image elements or pixels disposed in different planes, i.e. in or on the same document layer or on different document layers, corresponding to the raster in which the image elements or pixels are arranged, are arranged directly one above the other, i.e. are arranged one above the other in relation to the planes of the document layers parallel to the surface normal of these planes, or alternatively are arranged laterally offset from one another in planes arranged one above the other, i.e. relative to the planes of the document layers at an angle >0° to the surface normal of these planes above one another, when the planes in which the image elements or pixels are disposed are spaced apart from one another.

Where the term "coloured" is used in the description of the invention and in the claims, it means the property 'monochrome', i.e. not white, not grey and also not black, i.e. reproduced in one of the base colours or a combination of the base colours of a colour space, or also 'multi-coloured', i.e. composed of several colours.

The document of value and/or security document according to the invention preferably comprises at least one document layer. For example, in addition to a first document layer, the document can contain a carrier layer and outer layers (overlay films). The document comprises a first pattern which is arranged in one or more first planes and is formed of first image elements, preferably disposed in and/or on at least one first of the at least one document layer, wherein this first pattern can be arranged either completely on each of several first document layers or also separated into first partial patterns, each of which can be arranged on a surface of one or more first document layers. Furthermore, the document comprises a second pattern which is formed in one or more second planes and from second image elements and is arranged in perfect register relative to the first image elements of the first pattern, which is preferably disposed in and/or on the at least one first document layer and/or in and/or on at least one second of the at least one document layer. The second image elements are disposed in front of the first image elements as considered from a viewing side of the document, so that they either cover the underlying first image elements or at least modify their optical impression. The first document layers are the layers in and/or on which first image elements and, if applicable, second image elements are disposed, and the second document layers are the layers in and/or on which, if applicable, second image elements are disposed, but not first image elements.

Information that is preferably individualising, including personalising information, is created according to the invention by the fact that the second image elements are each arranged only over a part of the first image elements, i.e. the at least one second plane in which the second image elements are disposed is located in front of the at least one first plane in which the first image elements are disposed, considered from the viewing side of the document. If there are second image elements above (in front of) first image elements, they are arranged in perfect register above the first image elements. This changes the externally visible impression of the first pattern so that information is obtained by combining the first and second image elements. Overall, the change in the visual impression of the first pattern by the second pattern therefore results in an overall visual impression caused by both patterns, and this overall impression is changed not only by observation in the visible spectral range, but, if applicable, also or only in another spectral range, in particular during observation and/or excitation in the IR or UV spectral range. Generally speaking, the optical features of the document are changed by creating the second pattern. This is done for example by covering some of the first image elements of the first pattern for a viewer with second image elements of the second pattern in perfect register above the former and thus, if applicable, becoming invisible or alternatively simply being changed so that a new pattern is created. The second image elements modify the visibility and/or the appearance of the first image elements. A coloured image impression is preferably created.

The first image elements are formed in a regular arrangement, thus forming a pattern identical for documents of the same type. The second image elements together with the first image elements form a piece of individualising information.

The image impression created by means of the additional second pattern arises in an embodiment of the invention, namely when the second image elements completely cover the first image elements, by reversing the principle of printing. During printing, coloured image elements, such as paper, are applied to the substrate by suitable rastering, which in their entirety create a pictorial impression. According to the invention, a suitable pattern, which is formed by optical structures (e.g. coloured image elements), is placed in at least one first plane on and/or in at least one document layer, which lie below the second image elements in the document. When the second pattern is produced, the first image elements that are not required for generating the information are then switched to black, white or otherwise not visible. The overall picture is therefore created by "deleting" structures and not by applying them as in printing.

To produce the document of value and/or security document according to the invention, the method according to the invention is used, and comprises the following method steps:

(a) producing a document blank by generating a first pattern, which is arranged in one or more first planes and is formed of first image elements, in and/or on at least a first one of the at least one document layer of the document blank, wherein the first image elements are formed in a regular arrangement, and wherein the first pattern is identical for documents of the same type, and

(b) generating a second pattern, which is arranged in one or more second planes and is formed of second image elements and is arranged in perfect register relative to the first image elements of the first pattern, in and/or on the at least one first document layer and/or in and/or on at least a second one of the at least one document layer, wherein the second image elements together with the first image elements form a piece of individualising information,

wherein, in a manner according to the invention, in method step (b), a second image element is generated in each case over only part of the first image elements, or wherein, in method step (b), a second image element already provided is in each case removed above part of the first image elements, such that second image elements remain above a complementary part of the first image elements. Thus, the second pattern can be created either by adding image elements to the document layer or by removing image elements already provided.

The at least one first, and possibly also the at least one second, document layer can be disposed inside a multi-layer document, which for example is formed as a layered composite, preferably as a laminated layered composite. For this purpose, the at least one first document layer is connected, after method step (a) and before method step (b), to further document layers to form a laminate, such that the at least one first document layer is integrated between other document layers. At least one of the other document layers forms the at least one second document layer. This ensures that falsification or forgery of the document is prevented or at least made more difficult, for example by an exchange of information that is, for example, individualising, including personalising, or even manipulation of this information. This would require a delamination of the document in order to reach the document layer containing the information. Falsification or forgery by delamination and re-lamination is practically impossible with the structure according to the invention without the manipulation being subsequently recognisable, because during re-lamination the forger cannot succeed in placing the document layer(s) containing the second image elements precisely on the document layer(s) containing the first image elements and reconnecting them therewith, meaning that the manipulation would always be noticed with the currently conventional rasters of, for example, 300dpi (dots per inch) or even 600dpi.

Since it is possible by means of various techniques, for example laser engraving, to create any pattern in an inner document layer contained in a document without affecting an outer document layer, the second pattern can be formed if there is a document blank which already contains all relevant document layers, in particular also the document layer(s) on or in which the second pattern, in which the information is embodied, is to be formed if this/these document layer(s) is/are embedded in a document.

The first pattern and the second pattern can be matched so that when viewing the document, they together create a visual impression that embodies the desired information. For this purpose, the second pattern in and/or on the at least one first and/or at least one second document layer shall be designed in an appropriate, preferably individualising, manner, in any case as a security element of the document. By contrast, the first pattern disposed in and/or on the at least one first document layer is identical for all documents of the same type. For example, all ID cards can have an identical first pattern, such as a two-dimensional regular arrangement of printed image elements in predetermined colours. Only by introducing a second pattern into the document is an individualising piece of information created which is embodied by the overall visual impression created by the first and the second pattern together. If image elements are formed for the production of the first pattern, which in each case produce a coloured impression, a monochrome second pattern can be produced in and/or on the at least one first and/or at least one second document layer to create a coloured overall impression which embodies the preferably individualising information.

The selected colours of the first image elements or first pixels forming them, their surface distribution and arrangement as well as the optical properties of the selected second image elements or pixels forming them, their surface distribution and arrangement, are decisive for the desired image impression and must therefore be carefully matched to one another.

The second pattern can be designed in a further development of the invention in such a way that it contains no predetermined information (for example individualising information) in isolation. However, this predetermined information is formed by superimposing the second pattern with the first pattern. This can be achieved, for example, by containing a part of the predetermined information in the first pattern and a part of this information in the second pattern and forming the predetermined information from both parts. For example, the first pattern can be formed by character segment aggregates, each of which can be used to form all characters (such as numerals, letters, mathematical symbols) of a character set, while the second pattern is formed by planar elements covering individual

segments of the character segment aggregates. This produces certain characters from the still-visible segments of the first pattern which form the predetermined information (see also the example in Fig. 4).

Alternatively, the predetermined information can already be completely predetermined by the second pattern.

In this way, it is possible to create a document that contains individualising information in the form of a coloured representation in or on document layers disposed inside the document, even after production of the document blank which does not yet contain this individualising information. This makes it possible to produce the document blank and transport the document blank from a first manufacturer to a second document manufacturer in the vicinity of the issuing office of the document or to the issuing office itself without increased security requirements.

In a particularly preferred embodiment of the invention, the first image elements are coloured. In particular, the first image elements can, for example, each be formed in one of the base colours of the CMY or CMYK colour space or alternatively also in a different colour of a certain colour combination, for example red, green, blue. Alternatively, the first image elements can also be black, white or absorb exclusively in a spectral range outside the visible range, for example in the IR and/or UV range. Since the first pattern should preferably be identical for all types of a document, it can, for example, consist of a regular arrangement of image elements from the respective colours, with the base colours also being repeated regularly in the arrangement. For example, the first image elements can be arranged in a row, preferably in the sequence ABABAB... with, for example, rows arranged on a gap (honeycomb-shaped arrangement), the colours being repeated regularly, for example according to CMYKCMYKCMYK.... or GOYSGOYSGOYS.... (G: green, O: orange, Y: yellow, S: black).

In a preferred embodiment of the invention, the first image elements are printed on the at least one first document layer. Suitable printing colours or printing inks are used for this purpose. This makes it very easy to create a suitable initial pattern that does not yet embody the information.

For example, the second pattern above the first pattern is then created so that a combination of the first and second image elements gives a coloured display. This is possible when the image elements are selectively "switched off" by means of the second image elements, for example by blackening or by another change of the material to an opaque state, for example white or another colour, for example the colour of the remaining document surface, above the corresponding first image elements, in each case according to the desired colour distribution in the target pattern embodying the information which

results for a viewer. If the colours of the first image elements are evenly distributed, any hue can be created at any point of the target pattern by hiding the complementary colours in the corresponding area of the target pattern using the second pattern. By selecting the appropriate colour space for the first image elements, a colour cast for the target pattern can also be generated.

In a preferred embodiment of the invention, the second image elements are formed by blackening at least one document layer, in particular the at least one first and/or at least one second document layer. For example, the second image elements can be generated by laser in at least one document layer, preferably the at least one first and/or at least one second document layer. Such methods are known. Such a method makes use of the principle, for example, that materials that absorb the laser radiation pyrolyse so that black residues form at the points hit by the laser beam. For example, a method using such a principle is described in DE 29 07 004 C2, which is included in the present application as disclosure content. Furthermore, a document layer that does not absorb the laser radiation well can be made laser-sensitive by the addition of additional materials. By irradiating laser light, the document layer(s) can then be blackened to a greater or lesser extent in the desired areas, so that the material becomes grey or black. For this purpose, a laser beam is guided over the document blank in a suitable manner and its intensity is changed so that the optical properties of exactly the points above the first image elements in the document which are not required for the construction of the (for example individualising) information are changed, for example blackened. Suitable positioning of the laser beam can be achieved, for example, by a high accuracy of the printing process and by means of a suitable imaging system that actively positions the laser beam. Furthermore, it is known from DE 103 16 034 A1 that in order to generate information that is light-resistant and moisture-resistant over the long term in a document layer, reaction conditions are set in localised sub-areas that cause starting materials contained in the document layer to synthesise. Coloured patterns can thus also be created, such as blue, green, yellow, red and even coloured fluorescent patterns. This method is also included in the disclosure content of this application. Furthermore, dyes contained in a document layer, in particular organic dyes, can also be bleached by exposure to electromagnetic radiation, for example laser radiation in the visible or UV range. While the first two variants assume that the second pattern is formed by adding second image elements to the document layer, the third variant assumes that the second pattern is formed by removing material from the document layer.

Alternatively, a photosensitive film material can be used for the document layer. Such materials are used in photolithography and, depending on the structure of the materials, form patterns of different brightness and, if applicable, different colours with appropriate exposure, for example with a laser device operating in the visible and/or UV range.

In principle, the second pattern can only be black/grey/white with different brightness or coloured. The document material can be transparent or translucent (translucent, but light-scattering) in the area of the second image elements. Alternatively, the document can be opaque or semitransparent in the area of the second image elements. An opaque state of the document for forming a second image element can be achieved by reducing the light transmission and/or increasing the scattering of the material. For example, the opaque state can be caused by blackening, whitening, colouring with an absorbent colourant or pigment, by a colour change in a material that is already coloured per se, or by any other method.

The document materials forming the second image elements therefore have different shades and/or colours. Their colour and/or light transmission can vary according to the requirements. Through suitable arrangement and design of the second image elements, different image impressions of the underlying first image elements and thus of the target pattern are generated. That is because in the case of a second image element formed with a transparent material, a first image element below the correspondingly formed second image element can still be recognised, so that in this case the first image element also influences the image impression. This is different in the case of second image elements formed by an opaque material. Of course, the overall image impression is therefore significantly influenced by the brightness, colouration and light transmission of the material areas that form the second image elements. For example, opaque red second image elements will lead to a red overall appearance of the target pattern. The same applies if the second red image elements are transparent, translucent or semitransparent.

Thus, the material forming the respective second image elements is to be characterised with respect to different optical properties, namely by absorption and/or remission, which may each have a spectral dependence, especially in the visible spectral range.

Furthermore, the material forming the second image elements may also exhibit luminescence in the IR, visible and/or UV spectral range, and the luminescence may, if applicable, have a spectral dependence. Furthermore, there may be at least two groups of different second image elements, each of which differs in terms of optical properties. For example, a first group of second image elements can only be formed in black/grey/white, in particular black, or colour-absorbing, and a second group of second image elements can be white or colour luminescent, if these second image elements are excited by visible or UV radiation. These other second image elements can embody additional information, such as a non-individualising security feature, such as a coat of arms or guilloche, or an individualising feature,

such as the value of a banknote or the signature or name of the document holder. However, in addition to absorption and remission in the visible spectral range, the materials forming the second image elements may also exhibit luminescence.

Similarly, the material forming the first image elements may also be characterised by different optical properties, namely by its absorption and/or remission, which may each have a spectral dependence, particularly in the visible spectral range.

Furthermore, the material forming the first image elements can also be luminescent in the IR, visible and/or UV spectral range, and the luminescence may also have a spectral dependence. In addition to absorption and remission in the visible spectral range, the material forming the first image elements may also exhibit luminescence in the visible spectral range. This allows a generally brighter image to be generated, in particular if the first image elements in the visible spectral range are white or at least broadband luminescent. The material forming the first image elements may contain one or more suitable pigments. Such a brightening is particularly advantageous if the second image elements are created by blackening, which causes a loss of brightness.

There may also be at least two groups of first image elements, each with different optical properties. For example, a first group of first image elements may be formed in one of the colours required for the construction of the individualising information, and a second group of first image elements that are white or coloured luminescent when these first image elements are excited by UV radiation. These further first image elements can in turn embody further information, such as a non-individualising security feature, such as a coat of arms or guilloche, or an individualising feature, such as the value of a banknote or the signature or name of the document holder. For example, it may be provided that the first and/or second image elements embody a first information solely by absorption and remission (without luminescence) and that the first and/or second image elements embody a second piece of information with additional luminescence (for example upon additional excitation with UV light), in that the image elements formed by additional luminescence modify/supplement the first information so that the second information is produced.

In a further embodiment according to the invention, the first image elements can be formed with a material that is expandable under the action of heat and/or light, for example with a foamable material. Under the influence of heat or light, the first pattern changes in such a way that certain first image elements grow at the expense of other (neighbouring) first image elements, i.e. the other (neighbouring) first image elements are displaced. This also results in a changed image impression,

which, regardless of whether second image elements are formed above it, is generated due to the radiation. This can be achieved, for example, by using a material that foams up in a suitable manner when exposed to laser radiation and forms the first pixels. Thus, this measure can additionally contribute to the generation of a pattern presenting itself to the viewer, which embodies, for example, individualising information.

In a further development of the above preferred embodiments of the present invention, the first image elements are formed of first pixels and the second image elements are formed of second pixels. Furthermore, in this case, provided a second image element is arranged above a first image element, second pixels of the second image element arranged above the first image element are arranged in perfect register only above some of the first pixels of said first image element. For example, if each first image element is composed of first pixels formed in the base colours of a standard colour space (such as the CYMK colour space), some of these first pixels can be "switched off" by second pixels of second image elements above them, or their appearance can be modified by the respective second pixels, in order to obtain (additional) colour information at the point of the corresponding second image element, so that a coloured target pattern embodying the individualising information is obtained overall. In principle, not all first image elements need to be affected by second image elements above them in the manner mentioned, but only some of them if applicable.

In a further preferred embodiment of the present invention, the first and second image elements can be arranged in one or more planes: For example, the first image elements can be printed on the at least one first document layer and only on one surface of the first document layer or even on both surfaces of the at least one first document layer. In addition, the first image elements can also be generated with suitable methods within the at least one first document layer, for example with a photolithographic method, for example if the first document layer(s) is/are formed from a photopolymer. If several first document layers are present, the first image elements in one embodiment can be directly adjacent to each other in the document, for example if the first image elements are applied to the surfaces of two first document layers and these surfaces are adjacent to each other in the document. In another embodiment, the first image elements in the document may be spaced apart from one another, for example when the first image elements are each applied to the surfaces of two document layers and these surfaces in the document are spaced apart from one another. In yet another embodiment, the first image elements can be formed on one or more first document layers on one or both surfaces and/or within these document layers. For example, a first group of the first image elements can be formed in a first plane, for example on a first surface of the first document layer, a second group of the first image elements in a second plane, for example on a second surface of the first

document layer, and, if applicable, further groups of the first image elements in further planes of the first document layers. The respective groups can differ in terms of an optical property, for example through their colour. For example, all first image elements formed with the colour Y (yellow) can be disposed in a first plane, all first image elements formed with the colour C (cyan) can be disposed in a second plane, all first image elements formed with the colour M (magenta) can be disposed in a third plane, and all first image elements formed with colour K (black) can be disposed in a fourth plane. If the respective planes are spaced apart from one another, tilting the document relative to the viewing direction can give a varying overall visual impression of the security feature, because the second image elements, which partially modify the view of the first image elements, may then only cover part of the respective first image elements, but still leave another one protruding laterally in a recognisable manner.

In the same way, the second image elements can also be generated in several planes in the document, for example on a surface of the first document layer, within the first document layer and/or on one or both surfaces of one or more second document layers and/or also within one or more second document layers. In order to generate second image elements not only within the document layer but also on its surface(s), for example by blackening using laser engraving, one or more layers can additionally be applied to the first and/or second document layer, which are active, for example, in a laser-sensitive or photosensitive manner. In this case, too, different groups of second image elements can be disposed on different planes in the document.

A printing method is used to form the first pattern in a particularly preferred embodiment according to the invention. To form the second pattern, a method is used in a particularly preferred embodiment according to the invention, in which the second image elements are generated by laser irradiation, preferably by laser engraving. This requires highly accurate positioning and modulation of the laser beam over the document. For this purpose, on the one hand, reference points with predefined information in the document blank can be used to precisely position the laser required to form the second image elements. On the other hand, a high-precision beam guiding component for the laser beam can be provided, which enables very precise guidance of the beam. The laser unit can then be calibrated using the positions of the reference points. For this purpose, the laser beam is guided over the reference points and the scattered or transmitted radiation is measured so that the exact position of the reference points and thus of the document can be determined. The position of the reference points is transmitted to a control unit which controls the beam guiding component.

The reference points can – in contrast to an otherwise even distribution of the colours of the first image elements/pixels – consist for example of an accumulation of rastered first image elements/pixels of a single colour which are determined during calibration. The beam guiding component is arranged downstream of the laser source. It comprises a beam splitter component and a deflection unit downstream thereof, for example one or more mirrors, for the laser beam. The partial beam coupled out of the beam splitter component comes from the laser beam reflected from the document blank. This partial beam is directed at a detector component with which the intensity of the partial beam is detected.

The document of value and/or security document according to the invention may have further document layers in addition to the at least one first and, if applicable, at least one second document layer. For example, from a viewing side of the document, a transparent or translucent document layer can be additionally arranged in front of the at least one first and, if applicable, at least one second document layer.

Furthermore, the document of value and/or security document according to the invention may have a carrier layer which, viewed from one viewing side of the document, is arranged behind the at least one first and, if applicable, at least one second document layer.

Furthermore, first and second document layers, in and/or on which first and second patterns are disposed in a manner according to the invention, can also be arranged on both sides of a carrier layer in the document, and additionally, a transparent or translucent document layer can be disposed on each side on the outside.

The document layers are typically combined into a stack and then connected together by lamination.

The figures described below serve to explain the invention in more detail. These are merely intended to provide a better understanding of the invention and are therefore in no way to be understood as limiting the scope of protection of the claimed invention. In detail:

Fig. 1: shows a schematic representation of a laser engraving device for generating the second pattern;

Fig. 2: shows a view of a document and its associated structure in a schematic representation;

Fig. 3: shows a section through a document with first and second image elements in a first embodiment according to the invention in a section;

Fig. 4: shows a section view of an individualising zone of a document with first and second image elements in a second embodiment according to the invention before and after the formation of the second image elements;

Fig. 5: shows a section as in Fig. 3, but with an additional document layer between the first document layer and the second document layer, in a third embodiment;

Fig. 6: shows a section through a document with first and second image elements in a section in a fourth embodiment according to the invention;

Fig. 7: shows a view of a section of a personalising zone of a document before and after the formation of second image elements;

Fig. 8: shows sections of views from a personalising zone of a document.

Identical reference signs denote elements with identical function in the figures.

The laser engraving device shown schematically in Fig. 1 is suitable for generating a second pattern from second image elements in a document blank 1, which already contains a first (for example printed) pattern. For this purpose, the device comprises a laser 2, a beam splitter 3, a mirror 4, a detector 5 and a control unit 6, with which the mirror is controlled, i.e. calibrated. The laser beam emitted by the laser passes through the beam splitter, hits the mirror and is deflected by the mirror onto the document blank. The laser beam returning from the document blank is deflected onto the detector after deflection by the mirror in the beam splitter and generates a signal there. When controlling the reference points on the document blank, their determined actual positions can be compared with the positions stored in the control unit, so that the exact position of the document blank can be determined with the control unit. With this data, the device can be controlled to generate the second image elements in the document blank in order to complete the document.

Fig. 2 shows a view of a document of value and/or security document 10, for example a personal identification document, in the upper part. The document has a zone 11 for coloured personalising. The lower part shows the layers within the coloured personalising zone in a schematic representation. The arrow indicates the viewing axis S. An outer transparent layer (overlay film) 12 is arranged on the viewing side of the document. This layer is insensitive to laser radiation. Below this layer there is a second document layer 13, which can be blackened by laser radiation and in which blackenings are generated to form second image elements. Below the second document layer there is a first document layer 14, which is provided with a suitable first pattern, for example a printed image embodying first

image elements. These three layers are carried by a carrier layer 15. These four layers are combined in a stack and connected by lamination. Before the second image elements in the second document layer 13 are formed by means of the laser radiation, a document blank is present. This document blank already contains the first document layer 14 provided with the first pattern. The personalised document is created by generating the second pattern in the first document layer. The security feature thus produced is, for example, a facial image of the person to whom the personal identification document is assigned.

Fig. 3 shows a first embodiment of a document of value and/or security document 10 provided with first and second image elements in a manner according to the invention in a sectional representation.

Considered from the viewing side (arrow S), the laminate of the document 10 contains a transparent overlay layer 12 which is insensitive to laser radiation, including a second document layer 13 in which white opaque areas corresponding to second image elements 13.1 are formed by laser radiation, including a first document layer 14 on which there is a printed image of print pixels printed in different colours, which displays first image elements 14.1, 14.2, 14.3, 14.4, 14.1', 14.2', 14.3', 14.4', and below them a carrier layer 15. The print pixels are printed with printing inks on the first document layer with the base colours of the CYMK colour space (C image elements 14.1, 14.1', Y image elements 14.2, 14.2', M image elements 14.3, 14.3' and K image elements 14.4, 14.4'). In the present case, the white second image elements 13.1 cover the Y image elements 14.2, 14.2', the M image elements 14.3, 14.3' and the K image elements 14.4, 14.4', so that only the C image elements 14.1, 14.1' are visible when considered from the viewing side. Thus, apart from the white colour of the second image elements 13.1, only the cyan-coloured image elements 14.1, 14.1' are visible. The corresponding lot in the personalising zone is therefore cyan-coloured. Together with correspondingly formed other areas of the document, individualising information is formed from the uncovered first image elements, and image elements other than the first C-image elements 14.1, 14.1' are also visible in the other areas.

Fig. 4 shows a view of an individualising zone of a document of value and/or security document in a section before the formation of the second image elements in the document blank (top) and after the formation of the second image elements (bottom).

The first image elements 14.5 are printed on the first document layer with a colour that is white fluorescent, in UV light, on a black base. This first print pattern is regularly in the form of bars arranged in a matrix. To form second image elements 13.5 in the second document layer above, which is laser-

sensitive, opaque blackenings are formed at individual points disposed above the individual first image elements. By covering individual first image elements with the second image elements, a white fluorescent sequence of digits is created when considered in UV light, here “8 1 5”, which can be used as an individualising feature for the document, for example as the serial number of a banknote.

Fig. 5 shows, like Fig. 3, a section through the personalising zone of the document of value and/or security document 10. In this case, there is a further transparent document layer 16 between the first document layer 14 and the second document layer 13, which generates a larger distance between the print pixels forming the first image elements 14.1, 14.2, 14.3, 14.4 on the first document layer and the whitenings 13.1 in the second document layer. The larger distance between the first and second document layers results, when viewing the document, in different visual effects when the document is tilted: when viewing along the viewing axis S, only the C image elements 14.1 are visible, whereas only the K image elements 14.4 are visible when viewing along the viewing axis S', i.e. the colour impression is changed.

Fig. 6 shows a further embodiment. In contrast to the embodiments of Figs. 3 and 5, the second image elements 13.1 in this case are formed in the first document layer 14. The print pixels that form the first image elements 14.1, 14.2, 14.3, 14.4 are printed on the underside of the first document layer. They are thus located under the second image elements. This means that no further document layers are required to generate the second image elements. Both types of image elements are formed only by means of the first document layer 14. In this case, the second image elements cover the C, M and K print pixels (14.1, 14.3, 14.4) of the first image elements, creating a yellowish image impression, since only the C image elements 14.2 are visible.

Fig. 7 shows a section of a personalising zone of a document of value and/or security document 10 before and after the formation of second image elements. On the left, the document 10 is reproduced with the personalising zone 11 and a section 11' thereof. The section is enlarged to the right (middle illustration). The print forming the first image elements 14.1, 14.2, 14.3 comprises green (14.1), red (14.2) and blue (14.3) print pixels. By forming second image elements 13.5, here in the form of a modification of the second document layer that merges into a translucent state (right illustration), some of the first image elements are brightened when viewed because the incident light is partially scattered from the outside and not absorbed by the print. This results in a changed brighter image impression within the area formed by the second image elements, whereas the first image elements outside this area are not changed.

Fig. 8 shows two further examples of a modification of the overall visual image by the second image elements 14.1, 14.2, 14.3 of Fig. 7. In this case, too, only the section 11' shown in Fig. 7 is enlarged and reproduced below in the actual view without enlargement.

In the left illustration in Fig. 8, all first image elements 14.1, 14.2, 14.3 are covered by second image elements 13.1 formed by blackening the second document layer, so that only the white spaces between the first image elements remain visible. The visual impression is grey.

In the right view, the green (14.1) and blue (14.3) first image elements are covered by black second image elements 13.1, whereas the red first image elements 14.2 remain uncovered. This results in an overall red colouring of the section area.

Patentkrav

1. Værdi- og/eller sikkerhedsdokument (10), omfattende et første mønster, som er tilvejebragt i et eller flere første planer og dannet af første billedelementer (14.1, 14.2, 14.3, 14.4, 14.5), og et andet mønster, der er dannet i et eller flere andet planer og af anden billedelementer (13.1, 13.5) samt anbragt nøjagtigt passende med første billedelementer (14.1, 14.2, 14.3, 14.4, 14.5) i det første mønster, hvorved anden billedelementer (13.1, 13.5), set fra dokumentets (10) iagttagelsesside, befinder sig foran første billedelementer (14.1, 14.2, 14.3, 14.4, 14.5), idet der kun over en del af hvert af første billedelementer (14.1, 14.2, 14.3, 14.4, 14.5) er tilvejebragt et andet billedelement (13.1, 13.5), **kendetegnet ved, at** første billedelementer (14.1, 14.2, 14.3, 14.4, 14.5) er dannet i et regelmæssigt arrangement under dannelse af et mønster, som for respektive dokumenter (10) af samme type er identisk, og hvorved anden billedelementer (13.1, 13.5) sammen med første billedelementer (14.1, 14.2, 14.3, 14.4, 14.5) tilvejebringer en individualiserende information.

2. Værdi- og/eller sikkerhedsdokument (10) ifølge krav 1, **kendetegnet ved, at** første mønster befinder sig i og/eller på et første dokumentlag (14) i dokumentet, og at andet mønster befinder sig i og/eller på det mindst ene første dokumentlag (14) og/eller i og/eller på mindst et andet dokumentlag (13).

3. Værdi- og/eller sikkerhedsdokument (10) ifølge et af de foregående krav, **kendetegnet ved, at** første billedelementer (14.1, 14.2, 14.3, 14.4, 14.5) er farvede.

4. Værdi- og/eller sikkerhedsdokument (10) ifølge et af de foregående krav, **kendetegnet ved, at** en kombination af første billedelementer (14.1, 14.2, 14.3, 14.4, 14.5) og anden billedelementer (13.1, 13.5) resulterer i en farvet visning.

5. Værdi- og/eller sikkerhedsdokument (10) ifølge et af de foregående krav, **kendetegnet ved, at** anden billedelementer (13.1, 13.5) er dannet ved sværtning af mindst et første og/eller andet dokumentlag (13, 14).

6. Værdi- og/eller sikkerhedsdokument (10) ifølge et af de foregående krav, **kendetegnet ved, at** anden billedelementer (13.1, 13.5) er frembragt ved laserpåvirkning i mindst et dokumentlag (13, 14).

7. Værdi- og/eller sikkerhedsdokument (10) ifølge et af de foregående krav, **kendetegnet ved, at** dokumentet (10) i området ved anden billedelementer (13.1, 13.5) er ikke-gennemskinneligt.

8. Værdi- og/eller sikkerhedsdokument (10) ifølge et af kravene 2 til 7, **kendetegnet ved, at** første billedelementer (14.1, 14.2, 14.3, 14.4, 14.5) er trykt på det mindst ene første dokumentlag (13).

9. Værdi- og/eller sikkerhedsdokument (10) ifølge et af de foregående krav, **kendetegnet ved, at** første billedelementer (14.1, 14.2, 14.3, 14.4, 14.5) efter excitering i UV-spektralområdet er luminescerende i det synlige spektralområde.

10. Værdi- og/eller sikkerhedsdokument (10) ifølge et af de foregående krav, **kendetegnet ved, at** første billedelementer (14.1, 14.2, 14.3, 14.4, 14.5) er dannet med et materiale, som kan ekspandere ved påvirkning med varme og/eller lys.

11. Værdi- og/eller sikkerhedsdokument (10) ifølge et af de foregående krav, **kendetegnet ved, at** første billedelementer (14.1, 14.2, 14.3, 14.4, 14.5) er dannet af første billedpunkter, og anden billedelementer (13.1, 13.5) er dannet af anden billedpunkter, **og at,** hvis et andet billedelement er anbragt over et første billedelement (14.1, 14.2, 14.3, 14.4, 14.5), der kun over en del af respektive første billedpunkter i første billedelementer (14.1, 14.2, 14.3, 14.4, 14.5) perfekt passende er anbragt anden billedpunkter i det derover placerede andet billedelement (13.1, 13.5).

12. Fremgangsmåde til fremstilling af et værdi- og/eller sikkerhedsdokument (10) med mindst et dokumentlag, omfattende følgende fremgangsmådetrin:

(a) fremstilling af et dokument-råemne ved frembringelse af et første mønster, som er arrangeret i et eller flere første planer og er dannet af første billedelementer, i og/eller på mindst et første af det mindst ene

dokumentlag i dokument-råemnet, hvorved første billedelementer er dannet i et regelmæssigt arrangement, og hvorved første mønster for respektive dokumenter af samme type er identiske, og

(b) frembringelse af et andet mønster, der er arrangeret i et eller flere anden planer og er dannet af anden billedelementer og er anbragt perfekt passende med første billedelementer i første mønster, i og/eller på det mindst ene første dokumentlag og/eller i og/eller på mindst et andet af det mindst ene dokumentlag, hvorved anden billedelementer sammen med første billedelementer tilvejebringer en individualiserende information, hvorved der kun over en del af respektive første billedelementer (14.1, 14.2, 14.3, 14.4, 14.5) i fremgangsmådetrin (b) frembringes et andet billedelement (13.1, 13.5), eller hvorved i fremgangsmådetrin (b) der kun over en del af respektive første billedelementer (14.1, 14.2, 14.3, 14.4, 14.5) fjernes et allerede foreliggende andet billedelement (13.1, 13.5), således at der over en komplementær del af første billedelementer (14.1, 14.2, 14.3, 14.4, 14.5) forbliver anden billedelementer (13.1, 13.5).

13. Fremgangsmåde ifølge krav 12, **kendetegnet ved, at** de mindst ene første dokumentlag (14) efter fremgangsmådetrin (a) og før fremgangsmådetrin (b) forbindes med yderligere dokumentlag (12, 13, 15) til et laminat, således at det mindst ene første dokumentlag (14) er integreret mellem de andre dokumentlag (12, 13, 15).

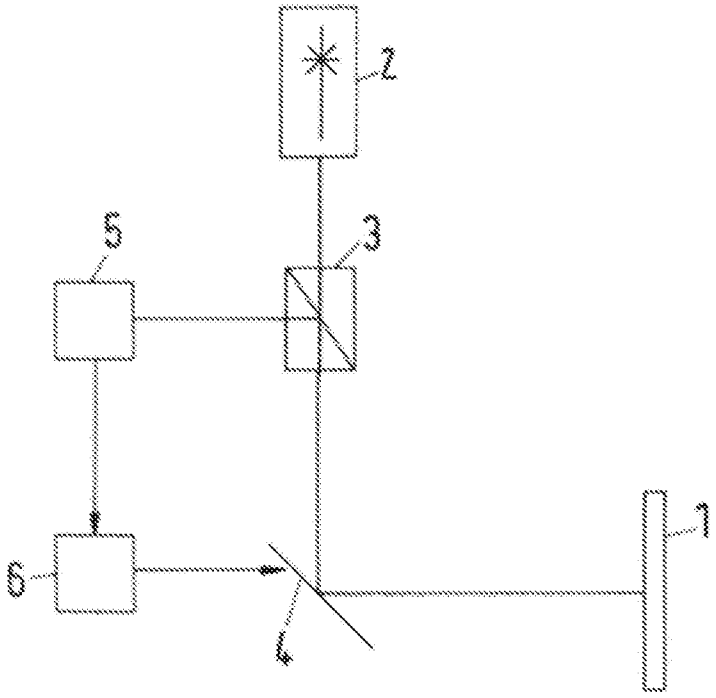

Fig.1

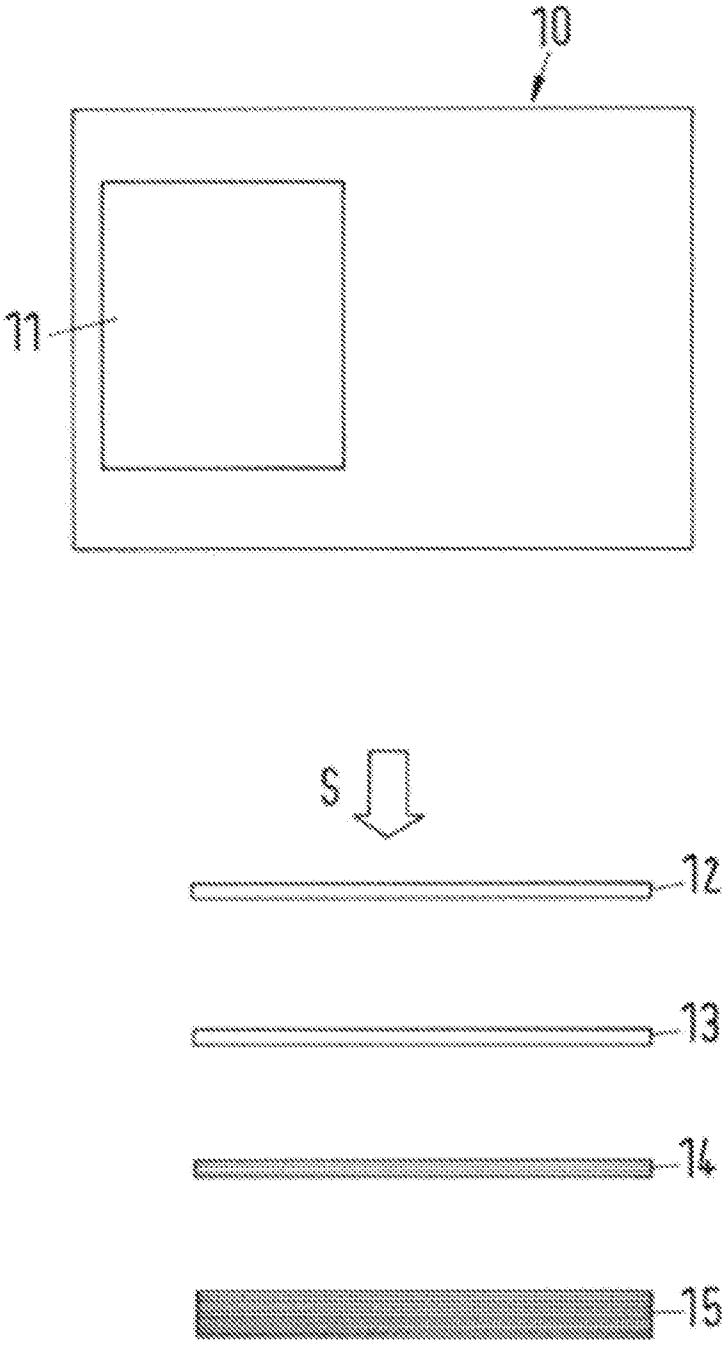

Fig. 2

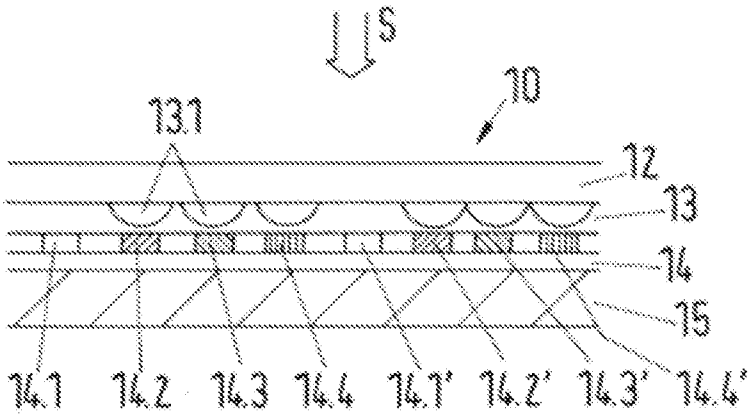

Fig.3

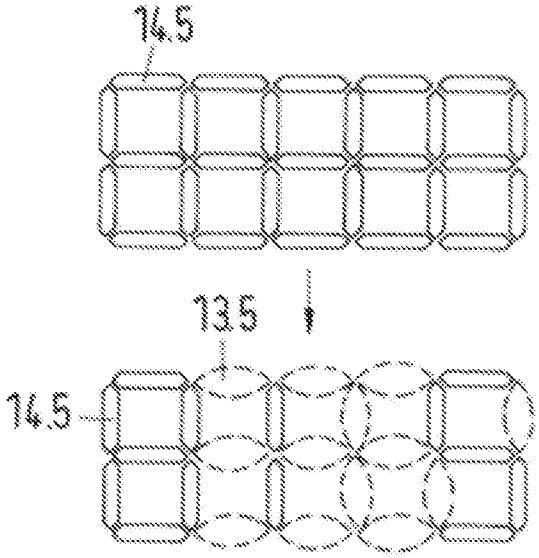

Fig.4

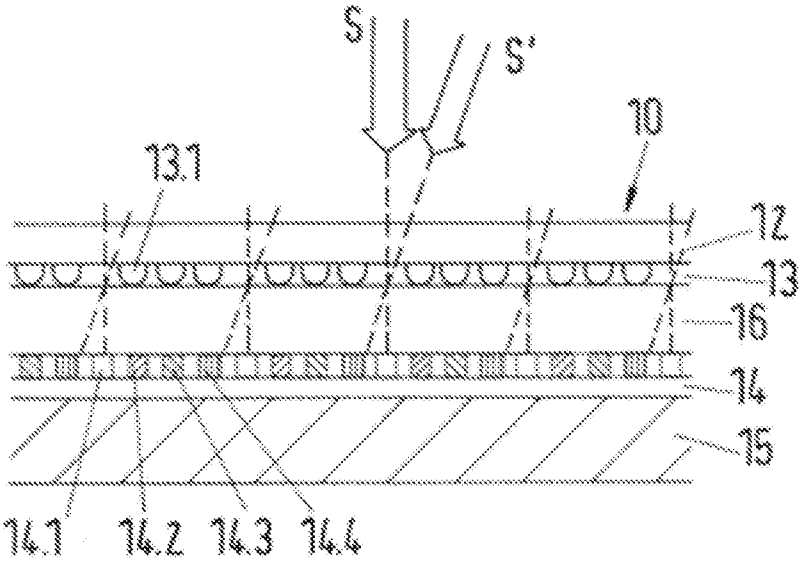
S
S'
10
13.1
12
13
16
14
15
14.1
14.2
14.3
14.4

Fig.5

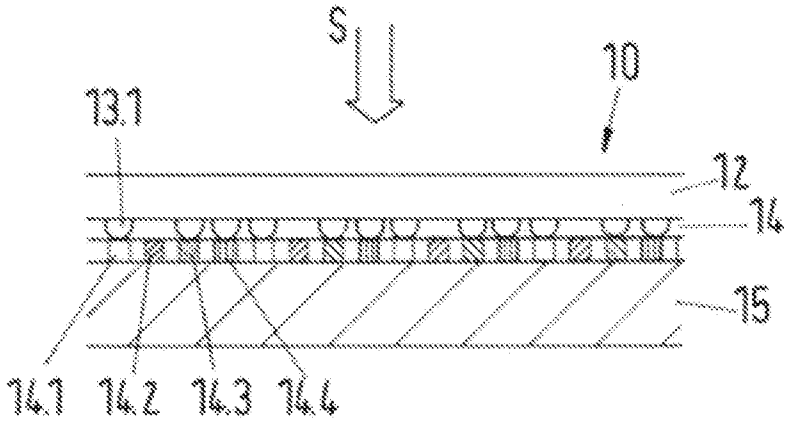
S
10
13.1
12
14
15
14.1
14.2
14.3
14.4

Fig.6

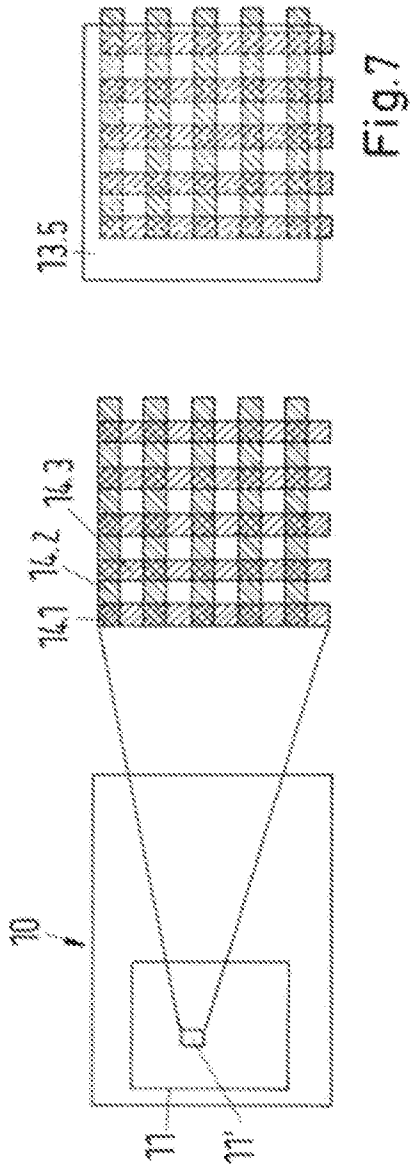

Fig.7

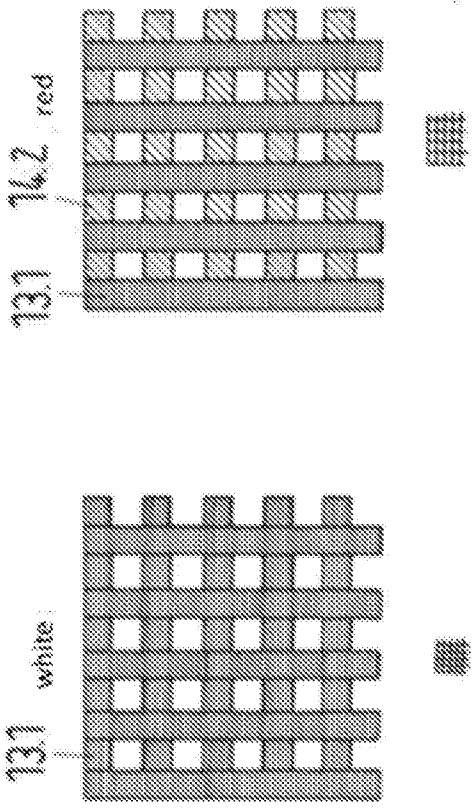

Fig.8