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METHOD OF GENERATING A LASER MARK IN A SECURITY DOCUMENT, AND SECURITY DOCUMENT OF THIS KIND

Description

[0001] The invention relates to a method for the generation of a laser marking in a security document by means of at least one laser beam, wherein the security document has at least one laser-markable layer as well as at least one reflective layer which at least partially overlaps with the at least one laser-markable layer and has opaque regions.

[0002] The introduction of laser markings into such security documents as copy protection is known from DE 44 10 431 A1. An identity card or a similar data carrier is formed therein in this order with a laser-markable layer, a reflective metallic layer and a transparent card cover layer. With the aid of a laser beam, congruent markings are introduced into the reflective metallic layer as well as the laser-markable layer through the card cover layer. The laser-markable layer can thus be applied as a lacquer layer to a card core layer, wherein the reflective metallic layer does not completely cover the laser-markable layer and thus markings can additionally be introduced into the laser-markable layer alongside the reflective metallic layer.

[0003] Furthermore, a method for the production of a data carrier is known from WO 01/62509 A1, which has a laser-markable layer as well as a light-permeable optically variable layer which overlaps with this at least in regions. Optically variable layers show different visual impressions at different observation angles, such as, for example, different colours. The light-permeable optically variable layer is arranged on the side of the laser-markable layer facing towards the observer and is extensively transparent for the laser beam used. Visually perceptible markings, in particular black markings, are written into the laser-markable layer with a laser beam through the optically variable layer, wherein the optically variable effect is easily visible, in particular in the regions of the optically variable layer which lie over the generated laser marking. In the remaining regions of the laser-markable layer which are covered by the optically variable layer, however, the optically variable effect is less easily visible.

[0004] Security elements having opaque, reflective regions according to DE 44 10 431A1 are, however, visually easily recognisable independently of the background due to the high reflectivity of the opaque metallic regions. The reflective metallic layer is penetrated here congruently during the laser marking of a laser-markable layer which is arranged thereunder, such that material of the laser-markable layer which is changedexclusively by the laser radiation in the openings which have been generated in the reflective metallic layer is visible. Information content of the laser marking which is independent of the formation of the openings in the reflective metallic layer is not able to be generated in the laser-markable layer.

[0005] It is the object of the invention to provide a method for the generation of a laser marking in a security document as well as a security document produced according to this which enables more expressive optical impressions than before.

[0006] The object is solved for the method for the generation of a laser marking in a security document by means of at least one laser beam, wherein the security document has at least one laser-markable layer as well as at least one reflective layer which overlaps the at least one laser-markable layer at least partially and has opaque regions, in that the at least one reflective layer is formed at least in an overlap region in which the at least one reflective layer and the laser-markable layer overlap, as seen perpendicularly to the plane of the reflective layer, having at least one transparent region surrounded by an opaque region of the at least one reflective layer on at least two sides, in that the at least one reflective layer is arranged between at least one laser beam source for the at least one laser beam and the at least one laser-markable layer and in that the laser marking is generated to be visually recognisable in the at least one laser-markable layer through the at least one transparent region, wherein the at least one reflective layer remains largely unchanged, at least visually.

[0007] The method according to the invention enables a laser marking to be introduced into a laser-markable layer without thereby changing or only partially changing a reflective layer having opaque or semi-transparent regions and transparent regions which is located in the laser beam path over the laser-markable layer during the laser marking in terms of visual impression. This means that the reflective layer can indeed possibly be slightly changed, but that this is not recognisable visually for the observer, so without additional aids such as magnifying glasses, microscopes or similar. A slight change of the visual impression, for example in the reflective behaviour, can even be desired as an additional specific security effect. Expressive optical effects are achieved by the opaque regions of the at least one reflective layer which are able to be recognised excellently independently of the background. The laser marking of the laser-markable layer which lies thereunder which has been introduced through the transparent regions is visible in the semi-transparent or transparent regions of the at least one reflective layer, which are formed to be at least largely permeable for the laser beam used. Thus, for the observer,the laser marking preferably extends optically over several semi-transparent or transparent regions which are separated from one another by opaque regions.

[0008] The object is solved for a security document which is in particular able to be obtained according to the method according to the invention and which has at least one laser-markable layer as well as at least one reflective layer which overlaps with the at least one laser-markable layer at least partially and has opaque regions, wherein the at least one reflective layer is formed at least in an overlap region in which the at least one reflective layer and the laser-markable layer overlap, seen perpendicularly to the plane of the reflective layer, having at least one transparent region surrounded by an opaque region of the at least one reflective layer on at least two sides, in that a coherent laser marking which spans the at least two transparent regions in the laser-markable layer is visually recognisable for an observer in at least two adjacent transparent regions, wherein the laser marking is formed independently of the design of the transparent regions in the reflective layer, and that the laser marking in the laser-markable layer is disrupted in a manner that is not visually recognisable for the observer below the opaque regions.

[0009] Thus the impression is visually created that the laser marking was already present in the laser-markable layer before the application of the at least one reflective layer onto the laser-markable layer.

[0010] Generally, alphanumericcharacters and character chains, symbols, logos, images, photos, signatures, lines, biometric data such as fingerprints or similar are permanently written into the laser-markable layer as a mark or marking using the at least one laser beam.

[0011] In particular, identity cards, passports, identification cards, bank cards, tickets, documents of value such as banknotes, etc. are understood as security documents. The laser beam serves for the individualisation or personalisation of a security document or document of value in that person-specific data such as name, date of birth, address, signature, CV, etc., or other data such as serial numbers, barcodes, etc., are generated on the document. Thus, black and white markings, grey-scale images, colour images or coloured markings can generally be formed.

[0012] Preferably, a metallic layer is used as a reflective layer, yetcoloured semiconductor layers, such as, for example, layers made from silicon, germanium or lead sulphide are also suitable.

[0013] It has proved to be expedient if the opaque regions of the at least one reflective layer, seen perpendicularly to the plane of the reflective layer, are formed from parallel and/or curved lines in the form of a pattern and/or a grid and/or a field. Furthermore, the opaque regions can form a dot matrix which can have the same or different grid distances and/or the same or different grid dot sizes.

[0014] Preferably, the at least one transparent region is surrounded on all sides by opaque regions.

[0015] An at least extensive visual impairment of the at least one reflective layer in the opaque regions is effectively prevented during the laser marking on the one side by the at least one reflective layer being formed with a thickness in the range from 0.2 to 150µm in the opaque regions and by the at least one laser beam for the generation of the laser marking being guided away over the opaque regions of the at least one reflective layer and the at least one transparent region.

[0016] Due to the fairly high thickness of the at least one reflective layer in the opaque regions in comparison to usual reflective layers used on security elements, the reflective layer material there is only partially or not at all vaporised or damaged during the laser radiation if the at least one laser beam crosses the opaque regions. If the heat conduction of the thick reflective layer is sufficiently high, then the reflective layer is not vaporised in the opaque regions. A sufficiently thick reflective layer remains in the opaque regions after crossing an opaque region in any case in order to be visually equivalent or almost equivalent to opaque regions which are not crossed with the laser beam.

[0017] In this instance, it has proved to be expedient if the material for the formation of the at least one reflective layer absorbs the laser beam as little as possible. Preferably, the at least one reflective layer is formed as a metallic layer, in particular from silver, gold, aluminium, nickel, chromium, copper, etc..

[0018] The reflective layer can also be a multilayer structure made from at least two layers which are arranged congruently one over the other and are made from different materials. Thus, for example, a thin, optically attractive reflective layer which is visible for the observer, can be combined with a thick, optically less attractive reflective layer, which is not visible and above all serves for heat conduction.

[0019] Furthermore, a diffractive relief structure can be arranged in opaque regions of the reflective layer which in particular causes a reduction in the absorption of the laser beam.

[0020] A visual impairment of the at least one reflective layer in the opaque regions is furthermore effectively prevented during the laser marking by a position recognition of at least parts of the opaque regions of the at least one reflective layer beingcarried out,by the at least one laser beam being controlled to generate the laser marking based on data determined from the position recognition in such a way that the at least one laser beam for the generation of the laser marking appears at nopoint on the opaque regions of the at least one reflective layer. During the control of the laser beam path, the opaque regions are therefore completely omitted and not impinged by the laser beam.

[0021] Alternatively, a lowering of the performance of the laser beam occurs in the opaque regions of the reflective layer.

[0022] The position recognition is preferably implemented optically here. The position of the opaque regions is thereby detected optically by means of a sensor unit at least in regions and the determined data is transmitted to a calculation unit. The calculation unit controls the laser by means of the data.

[0023] Thus, on the one hand, the possibility exists that a position recognition occurs only at selected points and a reference image of the opaque regions is deposited in the calculation unit. A synchronisation of the determined data with the deposited reference image of the opaque regions then occurs, wherein potential distortions of the opaque regions with respect to the reference image can be detected and can be considereddduring the control of the laser beam. The actual position calculated by means of the synchronisation of all opaque regions is the basis of the control of the laser beam, wherein opaque regions are omitted from the laser treatment or are impinged with a laser beam with a lower performance.

[0024] On the other hand, a direct optical detection of the position of all opaque regions can occur, in particular with a camera, in particular however the opaque regions which lie in the laser path of the laser beam for the formation of the laser marking. The detected image of all opaque regions of the at least one reflective layer supplies the required data in order to control the laser accordingly and to omit opaque regions from the laser treatment or to impinge them with a laser beam with a lower performance. This is then particularly advantageous if the opaque regions vary, for example due to the production tolerances, the formation of individual or personal data or a Kinegram®.

[0025] If only the opaque regions which lie in the laser path of the laser beam for the formation of the laser marking are detected, then the laser path to be completed must be deposited in the calculation unit already as a data set, for example in the form of a signature stroke or a serial number. Based on the data set, an optical scanning of the laser-markable layer occurs at all points which the laser beam for the generation of the at least one laser marking covers. At the points at which the presence of opaque regions is determined in the scanning, data is generated and this is used to control the laser beam, such that no laser treatment or a laser treatment that is reduced in performance occurs in the region of the opaque regions. Distortions of the opaque regions of the reflective layer which are potentially present are thereby compensated for directly.

[0026] It has proved to be expedient if the at least one reflective layer is formed with at least one optically detectable position marking and a position of the position marking is determined or if at least one optically detectable position marking is formed independently of the reflective layer on the security document and a position of the position marking is determined. Diffractive markings, printed markings, markings generated by means of a laser, machine-readable markings, such as markings which are detectable by infra-red radiation, magnetic marks, etc. are suitable as position markings. The reflective layer itself can be formed for the formation of the position markings with opaque regions in the form of arrows, stripes, dots, etc.

[0027] The at least one reflective layer or the security document is preferably formedwith at least three optically detectable position markings and the position of the at least three position markings is determined in order to detect a distortion of the at least one reflective layer which has possibly resulted during the application of the at least one reflective layer onto the at least one laser-markable layer and to be able to compensate for this.

[0028] A visual impairment of the at least one reflective layer in the opaque regions is also effectively prevented during the laser marking by at least one detection laser beam being coupled into the at least one laser beam for generation of the laser marking or being guided in parallel to the at least one laser beam, and by a lowering of the performance of the at least one laser beam for the generation of the laser marking or the deactivation thereof taking place if the at least one detection laser beam detects a presence of opaque regions of the at least one reflective layer. In the reversed case, an increase in the performance of the at least one laser beam for the generation of the laser marking or the deactivation thereof takes place.

[0029] In the use of laser radiation of different wavelengths for the detection laser beam and the laser beam for the generation of the laser marking, it should be noted that the beam is diverted differently depending on the wavelength, such that a “spatial” correction must occur between the position of the opaque regions detected with the detection laser beam and the position that is actually to be omitted from the radiation by the laser beam for the generation of the laser marking. The detection laser beam can be arranged coaxially with the laser beam for the generation of the laser marking. Alternatively, the detection laser beam, however, can also be aligned to be bent with respect to the laser beam for the generation of the laser marking, wherein both the detection laser beam and the laser beam for the generation of the laser marking are directed to a mutual point of the reflective layer.

[0030] However, a single laser which is operated in different modes assumes the function of a detection laser beam and a laser beam for the generation of the laser marking. If the laser beam moves to a new position of the reflective layer, then the performance of the laser is adjusted to a value below a performance limit value, from which an ablation occurs, and the direct or diffuse reflection of the performance-reduced laser beam is measured at this position. If a transparent region is set with lower or without reflection, the performance of the laser is increased and the laser marking is generated in the laser-markable layer at the selected position. In another case, the laser is moved further without a change inperformance and the measurement is repeated at the next point.

[0031] Alternatively to a control of the performance of the laser beam, a control of the movement speed of the laser beam can also take place in order to achieve as short as possible an exposure time of the laser beam on the opaque regions. This is currently useful above all for relatively wide opaque regions which are crossed in an accelerated manner by the laser beam.

[0032] A further possibility for the protection of opaque regions of the reflective layer consists in using a mask which is arranged in the beam path between the laser and the reflective layer. Here, the mask is implemented in such a way that this has regions which are impenetrable for the laser beam congruently to the opaque regions of the reflective layer, which protect the opaque regions of the reflective layer which lie thereunder from the laser beam. Furthermore, a lens arrangement or a lens array can be used as a mask over the reflective layer, wherein the laser beam is focused by means of the lens on determined points of the reflective layer and influences the path of the laser beam on the reflective layer.

[0033] An optical scanning of the opaque regions of the reflective layer serves for the as accurate as possible positioning of the impenetrable regions of the mask or regions of the mask which deflect the laser beam via the opaque regions of the reflective layer.

[0034] For such methods which protect the opaque regions of the reflective layer, both low and highly absorbent materials can be used to form the at least one reflective layer. It has thus proved to be expedient to form the at least one reflective layer as a metallic layer, in particular from silver, gold, aluminium, nickel, copper, chromium, etc..

[0035] It is particularly preferred if the opaque regions of the at least one reflective layer, seen perpendicularly to the plane of the at least one reflective layer, are formed as filigree lines having a width in the range from 0.5

to 1000μm. Such thin, opaque lines are particularly difficult to imitate and particularly easy to damage by laser radiation such that a high level of protection from counterfeiting or amending is achieved for the security document.

[0036] Here, it is particularly preferred if the filigree, opaque lines are arranged on the at least one transparent region to be adjacent. In the transparent region, one laser marking ispreferably visible here, in particular next to unmarked, coloured and therefore different regions of the laser-markable layer.

[0037] It has proved to be expedient if the at least one reflective layer is arranged on or in a transparent film body and the film body including the at least one reflective layer is arranged overlapping the at least one laser-markable layer. Thus the formation of the at least one reflective layer does not occur directly on the laser-markable layer and can furthermore contain method steps which could impair the laser-markable layer.

[0038] In this instance, the film body can be applied as a transfer layer of a transfer film or as a lamination film, overlapping the at least one laser-markable layer. A transfer layer can also be applied to a transparent protection layer which is permeable for laser beams and can be laminated onto the at least one laser-markable layer together with this. This has the advantage that the at least one reflective layer can be arranged beneath the protective layer to be protected from mechanical and/or chemical attack. For example, the transfer layer of the transfer film can be embossed onto a banknote by means of hot embossing.

[0039] It has proved to be expedient if the film body is glued or laminated onto the at least one laser-markable layer. The film body can contain further security elements, such as, for example, luminescent material, photochromic material, interference or liquid crystal pigments, among other things.

[0040] For the formation of the at least one transparent region, the at least one reflective layer is provided with an opening at these points to be formed preferably with a lower thickness than in the opaque regions or the at least one reflective layer. Thus, either the at least one reflective layer is present in a transparent regionwith such a low thickness that this is transparent and is not or is hardly visible for an observer. Here, methods for the production of such a reflective layer are particularly suitable, in which first regions having a diffractive relief structure are embossed into a transparent layer and subsequently the flat second regions and the first regions of the transparent layer provided with the relief structure are sputtered with material for the formation of the reflective layer with a constant surface density with regard to the plane of the transparent layer. The material for the formation of the reflective layer is sputtered on in a thickness that forms an at least largely transparent reflective layer on the surface of the transparent layer due to the relief structure in the first regions, while an opaque reflective layer is formed in the flat second regions.

[0041] Alternatively to this, the at least one reflective layer can be interrupted completely in a transparent region such that no material of the reflective layer is present there. This is usually achieved by partial formation of the reflective layer via masks or a partial removal of the reflective layer, for example by etching of the reflective layer.

[0042] Furthermore, it has proved to be advantageous if opaque regions of the reflective layer are formed with at least two different layer thicknesses. The result during the laser treatment can additionally be varied thereby.

[0043] It has proved to be expedient if the at least one transparent region is filled with the laser marking only partially, such that unmarked regions of the laser-markable layer remain visible within the at least one transparent region.

[0044] It is advantageous if the at least one laser beam for the generation of the laser marking occurs perpendicularly to the plane of the security document.

[0045] It can, however, also be advantageous if the at least one laser beam for the generation of the laser marking at the edge of the at least one transparent region is aligned at an angle to the plane of the security document and the laser marking is continued underneath the opaque regions, at least over a short region. For this purpose it is required to provide a transparent spacer layer which is permeable for the laser beam between the laser-markable layer and the reflective layer.

[0046] Preferably, a colour change, a blackening or a bleaching takes place in the at least one laser-markable layer in the region of the laser marking. Thus, coloured markings, colour images, black and white markings, greyscale images or combinations thereof are generated. Here, the laser marking is, in particular, generated permanently or irreversibly in the laser-markable layer and is not able to be removed again by a subsequent UV radiation or another method.

[0047] For the generation of coloured images, it has proved to be expedient if at least three laser-markable layers arranged one over the other are provided, in particular in the colours cyan, magenta and yellow. Alternatively, the different dyes can also be added to a single laser-markable layer which is present before the laser treatment in the mixed colours made from all laser-sensitive dyes.

[0048] Here, coloured layers containing bleachable pigments are preferably used as laser-markable layers. Thus, yellow pigments are preferably bleached by means of blue laser light, cyan-coloured pigments preferably with red laser light and magenta-coloured pigments preferably with green laser light. Black laser-markable layers preferably contain carbon while laser-markable layers which are able to be blackened in particular contain carbon compounds which are able to be broken down by means of laser radiation. Alternatively or additionally, laser-markable materials which, for example, show a significant, irreversible colour change during laser radiation are contained in the laser-markable layer. During the use of several laser-markable layers one over the other or a laser-markable layer containing a mixture of different dyes, full colour images having a natural colour course are generated, for example a photo of the holder of the security document to be marked, by means of gradual laser radiation of the individual laser-markable layers or individual points of the laser-markable layer containing a mixture of different dyes by subtractive or additive colour mixing.

[0049] The at least one laser-markable layer can be arranged on a carrier substrate made from paper, PE, PC, PET, PVC or Teslin®. The at least one laser-markable layer can also, similarly to the reflective layer, be laminated onto the carrier substrate as a laminating film or transfer layer of a transfer film or glued with the aid of an adhesive layer.

[0050] Furthermore, the security document can comprise additional layers such as protective layers, printed layers, etc., which are arranged on the back side of the carrier substrate between the carrier substrate and the laser-markable layer, between the laser-markable layer and the reflective layer as well as on the reflective layer.

[0051] It has proved to be expedient if a background layer is arranged at least in regions between the at least one laser-markable layer and the carrier substrate, said background layer absorbing the at least one laser beam to generate the laser making. This is, in particular, advantageous for delicate carrier substrates made from paper.

[0052] Preferably, the at least one laser-markable layer is arranged in a pattern on the carrier substrate. This can take place due to a direct application of the layer material by means, for example, of printing or by a transfer method in which the laser-markable layer is formed on a carrier, for example a transfer film, and is transferred in the solid state onto the carrier substrate while the carrier is removed again. This enables an optically particularly attractive design of the security document.

[0053] Furthermore, the at least one laser-markable layer itself can be provided by a laser markable carrier substrate made from paper, PVC, PC, Teslin ® or a carrier substrate which has laser-markable substances.

[0054] It has proved to be expedient if at least two reflective layers having opaque regions of different colours are arranged on the at least one laser-markable layer. In particular, the combination of silver and gold-coloured opaque metallic regions generates a particularly high-value appearance.

[0055] It has proved to be advantageous if the transparent film body or the security document has, as well as the at least one reflective layer, a transparent or semi-transparent coloured layer and/or a transparent or semi-transparent dielectric layer and/or a transparent or semi-transparent optically variable layer. This can potentially also be laser-markable, wherein a laser markingcan take place with the same laser beam which is also used to mark the laser-markable layer. A simultaneous laser marking with the laser-markable layer is thus preferred. The transparent coloured layer and/or the transparent HRI layer and/or the transparent optically variable layer is preferably arranged on the side of the reflective layer which lies opposite the laser-markable layer.

[0056] An optically variable layer preferably comprises a diffractive structure and/or a holographic structure, in particular a hologram or a Kinegram®, and/or a liquid crystal material and/or a thin-film multilayer system having a viewing angle-dependent interference effect, which can also comprise transparent metallic thin-films, and/or a photochromic substance and/or a luminescent substance. The permeability of the transparent regions of the reflective layer for the at least one laser beam is preferably not or is only insubstantially impaired by the additional transparent or semi-transparent layers contained in the transparent film body or security document.

[0057] It has proved to be expedient if at least opaque regions of the at least one reflective layer, seen by an observer, are arranged at least partially beneath the optically variable layer, in particular beneath a hologram or a Kinegram® or a thin-film multilayer system. In particular, it is advantageous if the optically variable layer extends over opaque regions and/or over the at least one transparent region. Here, the optically variable effect of the optically variable layer can be shown only above and in register with opaque regions or only above and in register with the at least one transparent region. Here, a diffractive or holographic structure can preferably be arranged precisely in terms of register with respect to the respective opaque or transparent regions. The optically variable effect of the optically variable layer is reinforced in the region of the diffractive or holographic structure either by the reflective layer itself or, provided this has an opening, for example by an additional transparent dielectric HRI layer (High Refractive Index).

[0058] Generally, an at least substantially transparent dielectric HRI layer can be provided underneath and/or on top of the reflective layer which does not or hardly disturbs a laser marking or laser-markable layer and which is not or is substantially not impaired by the laser beam. Such a HRI layer can be arranged in register with the opaque regions and/or the transparent regions of the reflective layer and thus can provide additional, attractive optical effects. Known materials for HRI-layers are, for example, ZnS or TiO_2.

[0059] The transparent coloured layer and/or the transparent HRI layer and/or the transparent optically variable layer can be arranged on the side of the reflective layer which lies opposite the laser-markable layer.

[0060] The coloured layer, the HRI layer or the optically variable layer can be applied directly to the reflective layer or can be applied to a transparent film which possibly shows at least diffractive relief structures in regions or as a pattern, wherein the film is subsequently arranged on top of or underneath the reflective layer, for example by gluing, laminating, hot embossing, etc.

[0061] Furthermore, a microlens array can be present in combination with the reflective layer, wherein the laser beam is focused by means of a microlens and the result of the laser radiation as well as the result which is visible thereafter is additionally influenced.

[0062] It has proved to be expedient if the at least one laser beam for the generation of the laser marking is generated by a NeodymYAG laser beam source. However, other laser beam sources can also be used. Pulsed, frequency-converted solid-state lasers, optical parametric oscillators (OPOs) and pulsed UV lasers (such as excimer lasers) are suitable. For the laser treatment, energy densities of between 0.05 and 0.5J/cm^2 for a pulse duration of 5 to 20ns are preferably applied. The result is determined furthermore by the pulse count.

[0063] It is noted that the invention does not exclude opaque regions of the reflective layer or regions of a HRI layer or optically variable layer from alsobeing changed in combination in a completely targeted manner at least in regions with the laser beam in order, for example, to carry out an additional personalisation. Thus, as a result, as well as opaque regions of the reflective layer which were not or were hardly changed according to the invention by the laser radiation of the laser-markable layer arranged thereunder, opaque regions which are visibly changed by means of the laser beam, for example by blackening, clouding or ablation, are also present, such as is already sufficiently known from DE 44 10 431 A1. In a thin-film multilayer system, targeted layers of the thin-film stack can be changed by means of the laser radiation in order to change the viewing angle-dependent interference effect or to remove it. Thus a plurality of possibilities result to design a security document in a manner that is secure against counterfeiting and is nevertheless optically attractive by means of the laser radiation.

[0064] In this context,it has proved to be expedient to implement the thickness of the reflective layer in the opaque regions not to be equal, but rather with different layer thicknesses in order to achieve a differentability for influencing the opaque regions of the reflective layer by the laser beam.

[0065] Figures 1 to 3 are to explain the invention by way of example. Here are shown:

Figure 1	a security document in the form of an identity card,
Figure 2a	a simplified cross-sectional depiction in the region A-A' through a security document according to Figure 1,
Figure 2b	a real cross-sectional depiction in the region A-A' through a security document according to Figure 1,
Figure 2c	a further simplified cross-sectional depiction in the region A-A' through a security document according to Figure 1 containing an optically variable layer having a diffractive structure,
Figure 3	a transparent film body having a reflective metallic layer comprising filigree metallic lines as opaque regions, and
Figures 4a to 4c	the personalisation of an identity card by means of a laser.

[0066] Figure 1 shows a security document 1 in the form of an identity card in a top view. The security document 1 comprises a laser-markable layer 2 which is printed on in regions in the form of a signature field as well as a circular film body 5.

[0067] For the formation of the laser-markable layer 2, a coloured lacquer having the following composition was used:

Methylethylketone	34.0 parts
Toluene	26.0 parts
Ethylacetate	13.0 parts
Nitrocellulose (low viscosity, 65% in alcohol)	20.0 parts
Linear polyurethane (Fp. > 200°C)	3.5 parts
High molecular dispersing additive (40%, amine count 20)	2.0 parts
Blue pigment 15:4	0.5 parts
Red pigment 57:1	0.5 parts
Yellow pigment 155	0.5 parts

[0068] The film body 5 comprises a metallic layer as a reflective layer, the opaque regions 3 of which are formed to be linear,each having a width of 50µm, and show two concentric circles containing three concentric stars. Transparent regions 3a which are permeable for laser beams are situated between the opaque metal lines 3 in which the metallic layer has openings which release the view of regions of the laser-markable layer 2, of a photo 6 of the card holder as well as a carrier substrate 7 (see Figures 2a to 2c), which lie thereunder. A laser marking 4 in the form of signature of the card holder is introduced into the laser-markable layer 2 with the laser beam. The laser marking 4 acts for the observer as if it were already present in the laser-markable layer 2 before the application of the film element 5.

[0069] Figure 2a shows a simplified cross-sectional depiction in the region A – A' through the security element 1 according to Figure 1. In the simplified depiction of Figure 2a, it is accepted that the intersection exactly follows the course of the laser marking 4 and thus cuts the opaque metallic lines 3 of the concentric circles and stars as well as the transparent regions 3a exactly in the region of the laser marking 4. The laser-markable layer 2 which covers the film body 5 containing the metallic layer is recognisable on a carrier substrate 7. The film body 5 comprises the filigree, linear opaque metallic regions 3. The upper side of the security element 1 which is depicted here in sections is laminated over with a transparent protective film 8 which is permeable for laser beams, such that the film element 5 is embedded in a protected manner between the protective film 8 and the carrier substrate 7. The laser beam for the generation of the laser marking 4 (see Figure 1) was aligned perpendicularly on the plane of the security element 1 and generates the laser marking 4 in the laser-markable layer 2.

[0070] For the protection of the carrier substrate 7, a background layer which is not shown here can be arranged between the laser-markable layer 2 and the carrier substrate 7, which can be formed from a coloured lacquer having the following composition:

Methyl ethyl ketone	40.0 parts
Toluene	22.0 parts
Ethylene vinyl acetate terpolymer (Fp. = 60°C)	2.5 parts
Polyvinyl chloride (Tg : 89°C)	5.5 parts

Polyvinyl chloride (Tg : 40°C)	3.0 parts
Dispersing additive (50%, acid count 51)	1.0 parts
Titanium dioxide (d = 3.8 – 4.2 g/cm^3)	26.0 parts

[0071] If the laser beam is guided away over the opaque metallic regions with unchanged performance, then the opaque metallic regions 3 of the metallic layer are formed from silver and formed at a thickness of 10µm.

[0072] If, alternatively, a position recognition of the opaque metallic regions 3 is carried out by means of, for example, a camera which detects the position of a single or all opaque metallic regions 3 and generates corresponding data, a control of the laser beam occurs by means of the generated data in such a way that the opaque metallic regions 3 are either omitted from the laser treatment or are impinged with a lower laser performance or the laser beam is guided more quickly over the opaque metallic regions 3 than over the regions of the laser-markable layer 2 that are to be marked. Thus the opaque metallic regions 3 of the metallic layer are formed at a thickness of 30nm and gold is used as the material for the metallic layer.

[0073] The laser-markable layer 2 is present in the regions 2b underneath the opaque metallic regions 3 in each case in an unchanged form, as the laser beam for the generation of the laser marking 4 (see Figure 1) is not active underneath the opaque metallic regions 3. The at least one laser beam reaches the laser-markable layer 2 next to the opaque metallic regions 3 which is thus changed in colour in the regions 2a and shows a laser marking 4 which is formed as a signature stroke to the observer, seen perpendicularly to the plane of the metallic layer.

[0074] The laser marking 4 (or the laser-marked regions 2a) is shown in Figure 1 as being, to the observer, a continuous signature stroke in the laser-markable layer 2 which is otherwise unchanged in colour and independently in front of the form of the opaque metallic regions 3 of the metallic layer. In fact, the signature stroke, however, is interrupted in the region underneath one of each opaque metallic line.

[0075] Usually, from an economic point of view, only small regions in terms of surface of a laser-markable layer are laser treated. Regions with a large surface area could also be laser marked, however. Thus in Figure 1, the background region which deposits the signature stroke could be formed as a laser marking and the signature stroke is therefore present in the colour of the non-laser-marked, laser-markable layer which is therefore not changed in colour. In this case, seen perpendicularly to the plane of the metallic layer, a disruption of the laser marking would be present underneath the metallic regions in the background regions – visually not perceivable for an observer – while the signature stroke would also be present in a continuous manner underneath the opaque metallic regions.

[0076] Figure 2b shows, as opposed to Figure 2a, the real cross-sectional depiction in the region A-A' through the security element 1 according to Figure 1.

[0077] Figure 2c shows a further simplified cross-sectional depiction in the region A-A' through a security element 1 according to Figure 1, which here, however, comprises an optically variable layer 9 having a diffractive relief structure 9'. In the simplified depiction of Figure 2b, it is in turn assumed that the intersection precisely follows the course of the laser marking 4 and thus cuts the opaque metallic lines 3 of the concentric circles and stars as well as the transparent regions 3a exactly in the region of the laser marking 4. The laser-markable layer 2 is recognisable on a carrier substrate 7 which covers the film body 5 containing the metallic layer. The film body 5 comprises the filigree, linear opaque metallic regions 3. The upper side of the security element 1 depicted here in sections is laminated over with a transparent protective film 8 which is permeable for laser beams, such that the film element 5 is embedded in a protected manner between the protective film 8 and the carrier substrate 7. The diffractive relief structure 9' is arranged in register with the transparent regions in the metallic layer, wherein a transparent HRI layer made from ZnS which is not depicted separately here is arranged on the side of the optically variable layer 9 which has the diffractive relief structure 9'.

[0078] Figure 3 shows an approximately 400% enlargement of an example of a film element 5' containing filigree, opaque metallic regions 3 arranged in gridlines as well as further opaque metallic regions (among other things in the shape of a cross), wherein the film element 5' shows a Kinegram® and can be arranged over one or more laser-sensitive layers.

[0079] Figure 4a shows a blank identity card 10' in a top view before laser personalisation, so before the introduction of personal, individual data of an identity card holder. The blank identity card 10' offers space for an image of the identity card holder as well as for the surname, first name, date of birth, as well as for the validity period of the identity card. A laser-markable layer into which the data is able to be written is located at least in these regions of the blank identity card 10'.

[0080] According to Figure 4b, a film element 50 is transferred onto the blank identity card 10' by means of a hot embossing film, wherein the laser-markable regions into which the personal data is to be written are partially covered. The film element 50 has a metallic layer as a reflective layer, the opaque regions 30 of which are formed to be linear, each having a width of 55µm. All opaque regions 30 together result in a flower-like structure which is composed of newly individual ellipses. The opaque regions 30 are located in a region of the film element 50 having a relief structure which shows a kinematic effect. A so-called Kinegram® is visible. Transparent regions 30a are located next to the opaque regions 30 of the film element 50, through which the laser-markable regions of the blank identity card 10' lying thereunder are able to be seen. The identity card 10'' coated by means of the film element 50 still contains no personal data, but rather only the film element 50.

[0081] According to Figure 4c, the personal data of an identity card holder is now introduced into the coated identity card 10'' by means of a laser beam. Thereby, an image 60 of the identity card holder is generated by means of a laser beam which intersects with the film element 50. Furthermore, data 40a, 40b is written in, wherein the data 40b likewise intersects with the film element 50. The laser personalisation in the region of the film element 50 or the opaque regions 30 takes place according to the method according to the invention by the opaque regions 30 of the metallic layer being omitted from the laser radiation or being protected during the laser treatment. Optically, the impression for the completed identity card 10'' arises as if the laser marking in the form of the data 40b or the image 60 had already been generated before the application of the film element 50 into the blank identity card 10'. The opaque regions 30 of the metallic layer adjacent to the regions having the laser marking do not differ at least optically from the opaque regions 30 which have no adjacent laser marking. An application of the film element 50 only after the introduction of the laser marking can thus be omitted.

ELJÁRÁS LÉZERES JELÖLÉS BIZTONSÁGI DOKUMENTUMBAN TÖRTÉNŐ LÉTREHOZÁSÁRA ÉS ILYEN BIZTONSÁGI DOKUMENTUM

Szabadalmi igénypontok

1. Eljárás lézeres jelölés (4) biztonsági dokumentumban (1) legalább egy lézersugárral történő létrehozására, ahol a biztonsági dokumentum (1) legalább egy lézerrel jelölhető réteget (2), valamint legalább egy, a legalább egy lézerrel jelölhető réteggel (2) legalább részben átlapoló és átlátszatlan tartományokkal rendelkező reflexiós réteget tartalmaz, **azzal jellemezve**, hogy
a legalább egy reflexiós réteget legalább egy olyan átfedési tartományban, melyben a legalább egy reflexiós réteg és a lézerrel jelölhető réteg (2) átfedésben vannak – a reflexiós réteg síkjára merőlegesen tekintve – legalább egy, a legalább egy reflexiós réteg átlátszatlan tartományával (3) legalább két oldalról körülvett átlátszó tartománnyal (3a) képezzük ki, továbbá a legalább egy reflexiós réteget a legalább egy lézersugár legalább egy lézersugárforrása és a legalább egy lézerrel jelölhető réteg (2) között rendezzük el, továbbá
a lézeres jelölést (4) a legalább egy lézerrel jelölhető rétegben (2) a legalább egy átlátszó tartományon (3a) keresztül vizuálisan felismerhetőn hozzuk létre, miközben a legalább egy reflexiós réteget legalább vizuálisan nagyrészt változatlanul maradón tartjuk meg.

2. Az 1. igénypont szerinti eljárás, **azzal jellemezve**, hogy
a legalább egy reflexiós réteget fémréteggel és/vagy színes félvezető réteggel alakítjuk ki.

3. Az 1. vagy a 2. igénypont szerinti eljárás, **azzal jellemezve**, hogy
a legalább egy reflexiós réteg átlátszatlan tartományait (3) a reflexiós réteg síkjára merőlegesen tekintve mintázatot és/vagy rácsot és/vagy mezőt képező párhuzamos és/vagy ívelt vonalak és/vagy pontmátrix formájában alakítjuk ki.

4. Az 1-3. igénypontok bármelyike szerinti eljárás, **azzal jellemezve**, hogy
az átlátszatlan tartományokban (3) a legalább egy reflexiós réteg vastagsága a 0,2-150 μm tartományban van, továbbá a lézeres jelölés (4) létrehozására szolgáló legalább egy lézersugarat a legalább egy reflexiós réteg átlátszatlan tartományai (3) és a legalább egy átlátszó tartomány (3a) fölött vezetjük el.

5. Az 1-4. igénypontok bármelyike szerinti eljárás, **azzal jellemezve**, hogy
a legalább egy reflexiós réteg átlátszatlan tartományai (3) vagy a maszk áthatolhatatlan tartományai legalább egy része pozícióját detektáljuk, továbbá a lézeres jelölés (4) létrehozására szolgáló legalább egy lézersugarat a pozíciódetektálás keretében meghatározott adatok alapján olyan módon vezéreljük, hogy a lézeres jelölés (4) létrehozására szolgáló legalább egy lézersugár a legalább egy reflexiós réteg átlátszatlan tartományainak (3) vagy a maszk áthatolhatatlan tartományainak egyetlen pontjába sem csapódik be, vagy a lézeres jelölés (4) létrehozására szolgáló lézersugár teljesítményét a legalább egy reflexiós réteg átlátszatlan tartományain (3) vagy a maszk áthatolhatatlan tartományain lecsökkentjük.

6. Az 1-3. igénypontok bármelyike szerinti eljárás, **azzal jellemezve**, hogy
legalább egy detektáló lézersugarat a lézeres jelölés (4) létrehozására szolgáló legalább egy lézersugárhoz csatolunk vagy a legalább egy lézersugárral párhuzamosan vezetünk, továbbá a legalább egy reflexiós réteg

átlátszatlan tartományainak (3) a legalább egy detektáló lézersugárral történő észlelésekor a lézeres jelölés (4) létrehozására szolgáló lézersugár teljesítményét csökkentjük vagy azt kikapcsoljuk.

7. Az 1-6. igénypontok bármelyike szerinti eljárás, **azzal jellemezve**, hogy
a legalább egy reflexiós réteg átlátszatlan tartományait (3) a legalább egy reflexiós réteg síkjára merőlegesen tekintve 0,5-1000 μm tartományba eső szélességű apró vonalakkal alakítjuk ki.

8. Az 1-7. igénypontok bármelyike szerinti eljárás, **azzal jellemezve**, hogy
a legalább egy lézerrel jelölhető rétegben (2) a lézeres jelölés (4) tartományában színváltozás, elfeketedés vagy kifehéredés következik be.

9. Biztonsági dokumentum (1), amely az 1-8. igénypontok bármelyike szerint nyerhető, és amelynek legalább egy lézerrel jelölhető rétege (2), valamint legalább egy, a legalább egy lézerrel jelölhető réteggel (2) legalább részben átlapoló és átlátszatlan tartományokkal rendelkező legalább egy reflexiós rétege van, ahol a legalább egy reflexiós réteg legalább egy olyan átfedési tartományban, melyben a legalább egy reflexiós réteg és a lézerrel jelölhető réteg (2) átfedésben vannak, – a reflexiós réteg síkjára merőlegesen tekintve – legalább egy, a legalább egy reflexiós réteg átlátszatlan tartományával (3) legalább két oldalról körülvett átlátszó tartománnyal (3a) rendelkezik, **azzal jellemezve**, hogy
a lézerrel jelölhető rétegben (2) legalább két szomszédos átlátszó tartományban (3a) egy, a legalább két átlátszó tartományon (3a) átívelő és azokat összekötő lézeres jelölés (4) ismerhető fel vizuálisan megfigyelő számára, ahol a lézeres jelölés (4) az átlátszó tartományok (3a) kialakításától függetlenül a reflexiós rétegben van kiképezve, továbbá a lézerrel jelölhető rétegben (2) a lézeres jelölés (4) az átlátszatlan tartományok (3) alatt a megfigyelő számára vizuálisan nem felismerhető módon van megszakítva.

10. A 9. igénypont szerinti biztonsági dokumentum, **azzal jellemezve**, hogy
a legalább egy reflexiós réteget fémréteg és/vagy félvezető réteg képezi.

11. A 9. vagy a 10. igénypontok bármelyike szerinti biztonsági dokumentum, **azzal jellemezve**, hogy
a legalább egy reflexiós réteg átlátszatlan tartományait (3) a reflexiós réteg síkjára merőlegesen tekintve mintázatot és/vagy rácsot és/vagy mezőt képező párhuzamos és/vagy ívelt vonalak és/vagy pontmátrix képezi.

12. A 9-11. igénypontok bármelyike szerinti biztonsági dokumentum, **azzal jellemezve**, hogy
a legalább egy reflexiós réteg átlátszatlan tartományait (3) a legalább egy reflexiós réteg síkjára merőlegesen tekintve 0,5-1000 μm tartományba eső szélességű apró vonalak alkotják.

13. A 9-12. igénypontok bármelyike szerinti biztonsági dokumentum, **azzal jellemezve**, hogy
legalább három lézerrel jelölhető réteg, különösen cián, magenta és sárga színű van egymáson elrendezve.

14. A 9-13. igénypontok bármelyike szerinti biztonsági dokumentum, **azzal jellemezve**, hogy
a legalább egy reflexiós réteg átlátszó fóliaanyagon (5) vagy átlátszó fóliaanyagban van elrendezve, továbbá a legalább egy reflexiós réteget tartalmazó fóliaanyag (5) a legalább egy lézerrel jelölhető réteggel (2) átlapolón helyezkedik el, továbbá az átlátszó fóliaanyagnak (5) adott esetben lézerrel jelölt átlátszó színes rétege és/vagy átlátszó HRI rétege és/vagy optikailag változó átlátszó rétege (9) van.

15. A 14. igénypont szerinti biztonsági dokumentum, **azzal jellemezve**, hogy

az optikailag változó réteg (9) diffrakciós szerkezetet (9') és/vagy holografikus szerkezetet és/vagy folyadékkristályos anyagot és/vagy a rátekintés szögétől függő interferenciahatást mutató többrétegű vékonyréteg-rendszert és/vagy fotokróm anyagot és/vagy termokróm anyagot és/vagy lumineszcens anyagot tartalmaz.

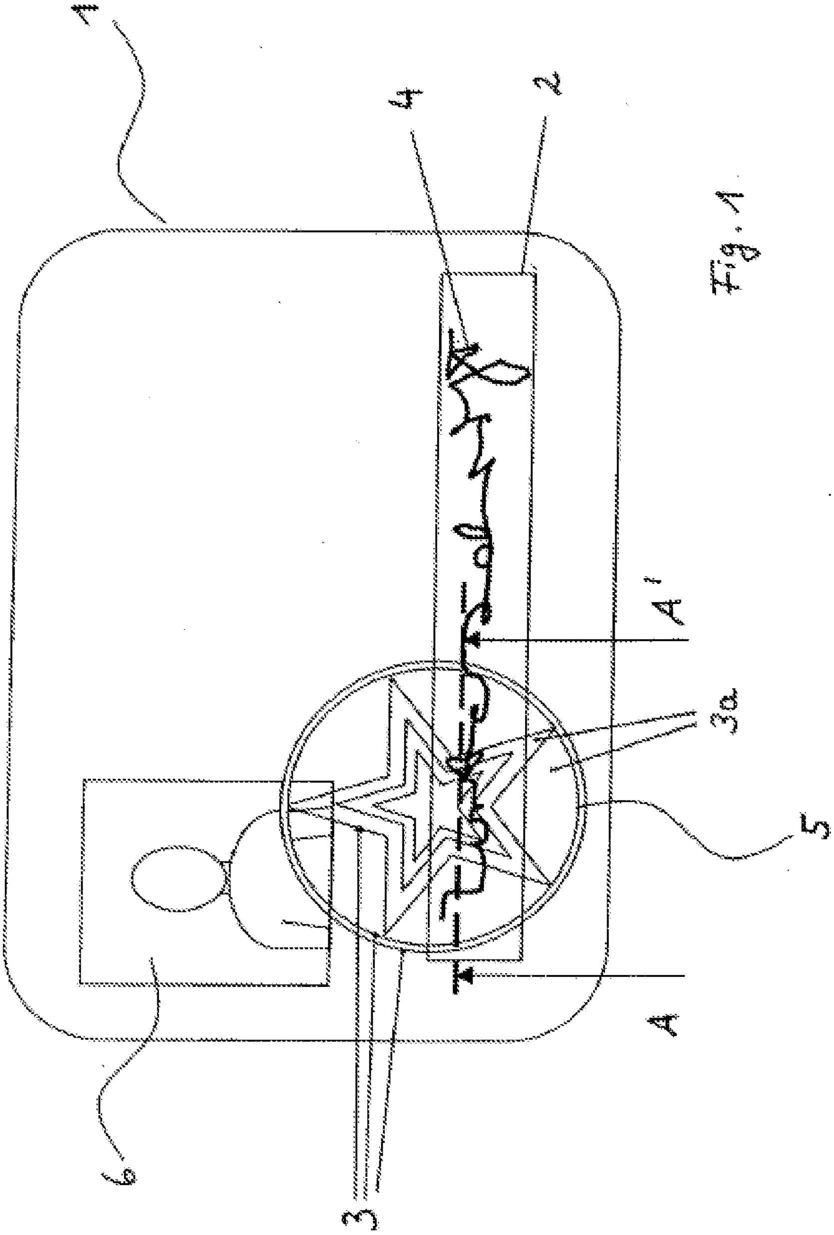

Fig. 1

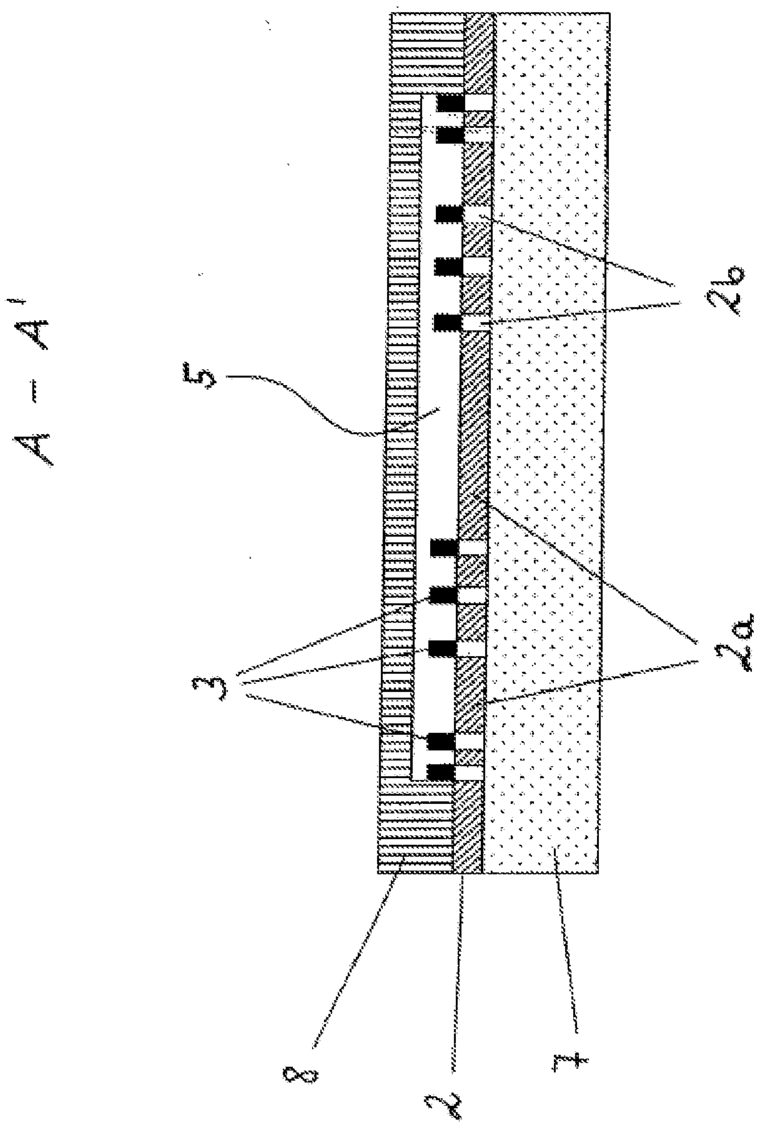

Fig. 2a

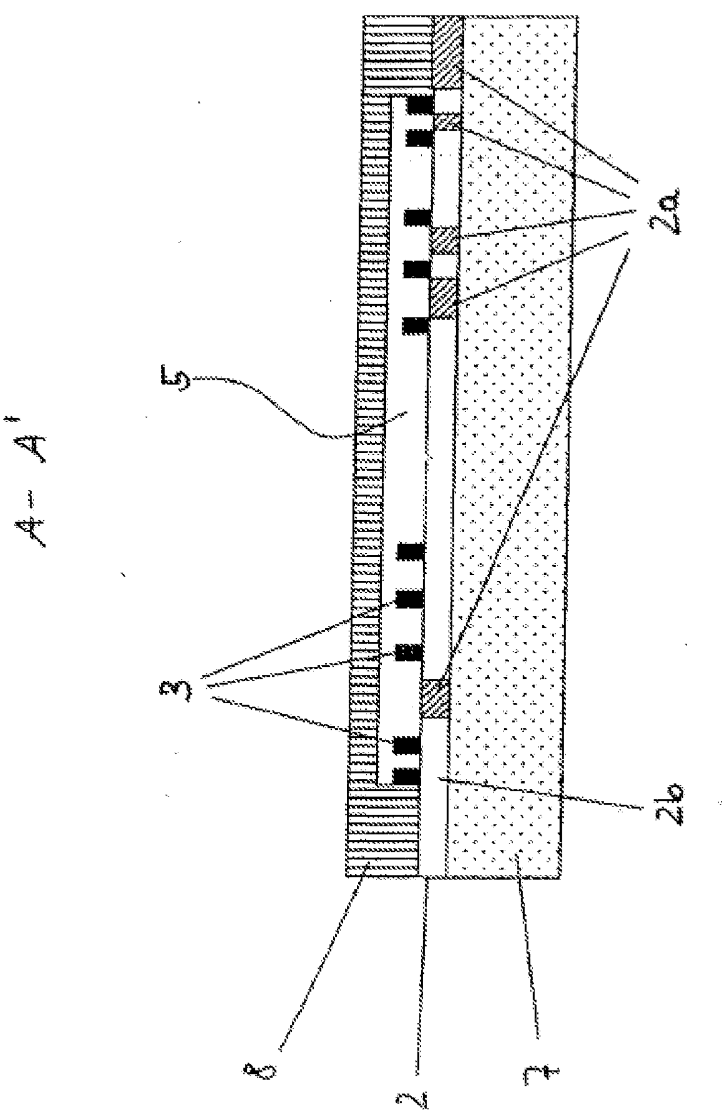

Fig. 2b

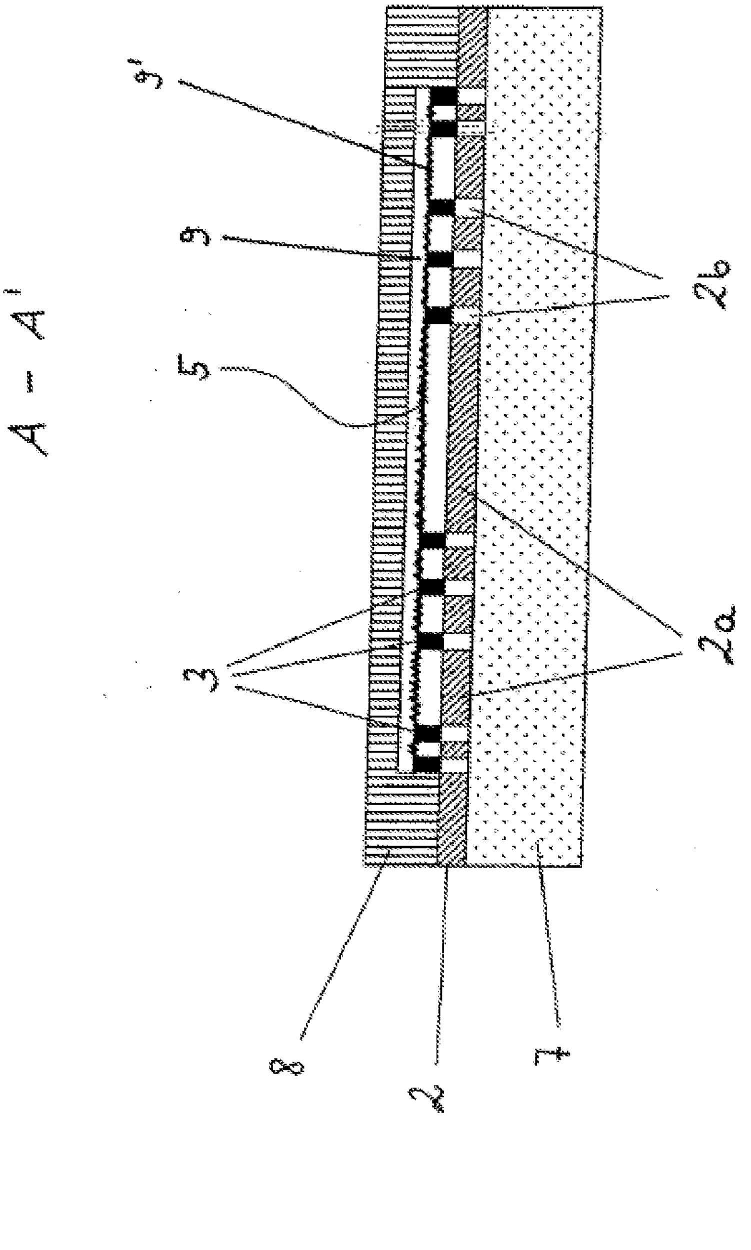

Fig. 2c

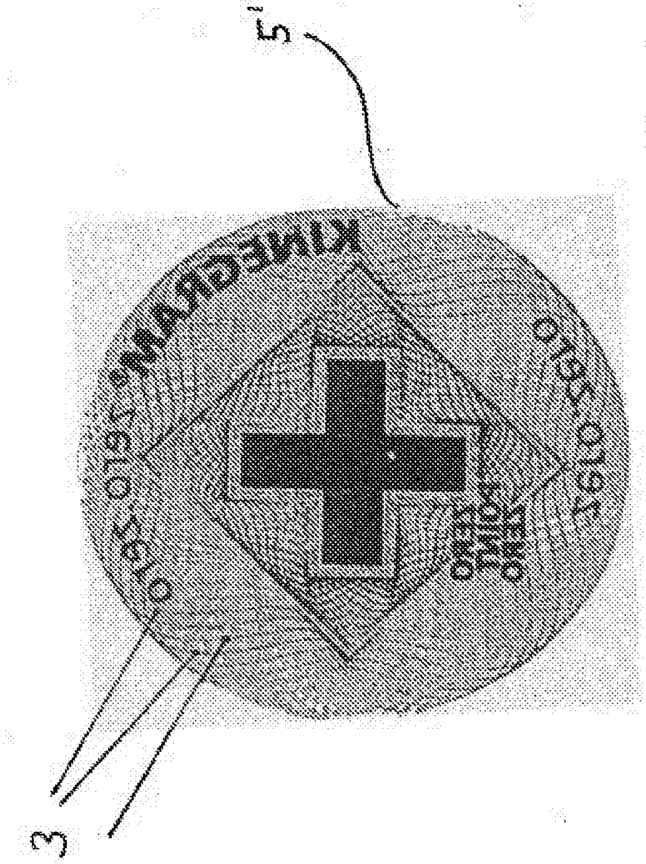

Fig. 3

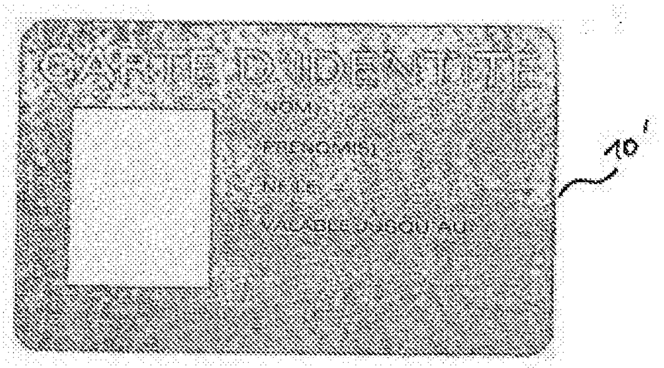

Fig. 4a

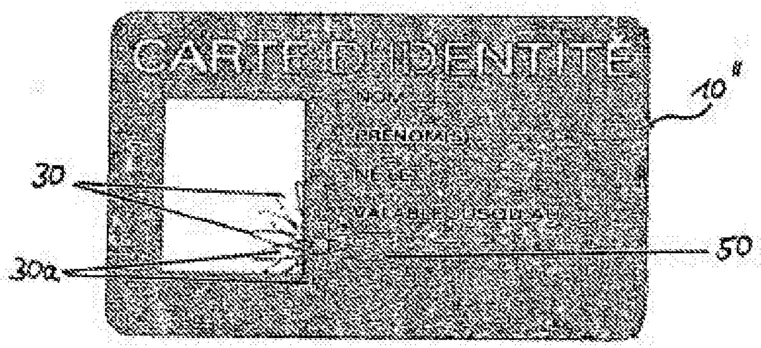

Fig. 4b

Fig. 4c