



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
30.06.2021 Bulletin 2021/26

(21) Application number: **19306768.3**

(22) Date of filing: **24.12.2019**

(51) Int Cl.:
B42D 25/387 ^(2014.01) **B42D 25/382** ^(2014.01)
B42D 25/346 ^(2014.01) **B42D 25/351** ^(2014.01)
B42D 25/309 ^(2014.01) **B42D 25/23** ^(2014.01)
B42D 25/24 ^(2014.01) **B42D 25/41** ^(2014.01)
B42D 25/435 ^(2014.01) **B42D 25/45** ^(2014.01)
B42D 13/00 ^(2006.01)

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

(71) Applicant: **THALES DIS FRANCE SA**
92190 Meudon (FR)

(72) Inventor: **LARINA, Nina**
92190 MEUDON (FR)

(74) Representative: **Lotaut, Yacine Diaw**
Thales Dis France SA
Intellectual Property Department
6, rue de la Verrerie
92190 Meudon (FR)

(54) **PERSONALIZABLE LUMINESCENT SECURITY ELEMENT**

(57) A data carrier (1) comprises at least one blocking element (2), at least one radiating element (3), at least one unblocking region (4) being provided in the blocking element (2), and at least one security element (7). At least one region (5) of the radiating element (3) is uncovered by the at least one unblocking region (4), whereby the at least one security element (7) is formed. The blocking element (2) is configured to block impinging electromagnetic radiation constituting a blocking element spectrum (RB). The radiating element (3) is configured to emit electromagnetic radiation constituting a radiating element emission spectrum (REM) upon irradiation of electromagnetic radiation constituting a radiating element excitation spectrum (REX), the radiating element excitation spectrum (REX) differing from the radiating element emission spectrum (REM). The blocking element (2) and the radiating element (3) are further configured such, i) that the blocking element spectrum (RB) essentially corresponds to the radiating element excitation spectrum (REX), or ii) that the blocking element spectrum (RB) essentially corresponds to the radiating element emission spectrum (REM).

ment emission spectrum (REM) upon irradiation of electromagnetic radiation constituting a radiating element excitation spectrum (REX), the radiating element excitation spectrum (REX) differing from the radiating element emission spectrum (REM). The blocking element (2) and the radiating element (3) are further configured such, i) that the blocking element spectrum (RB) essentially corresponds to the radiating element excitation spectrum (REX), or ii) that the blocking element spectrum (RB) essentially corresponds to the radiating element emission spectrum (REM).

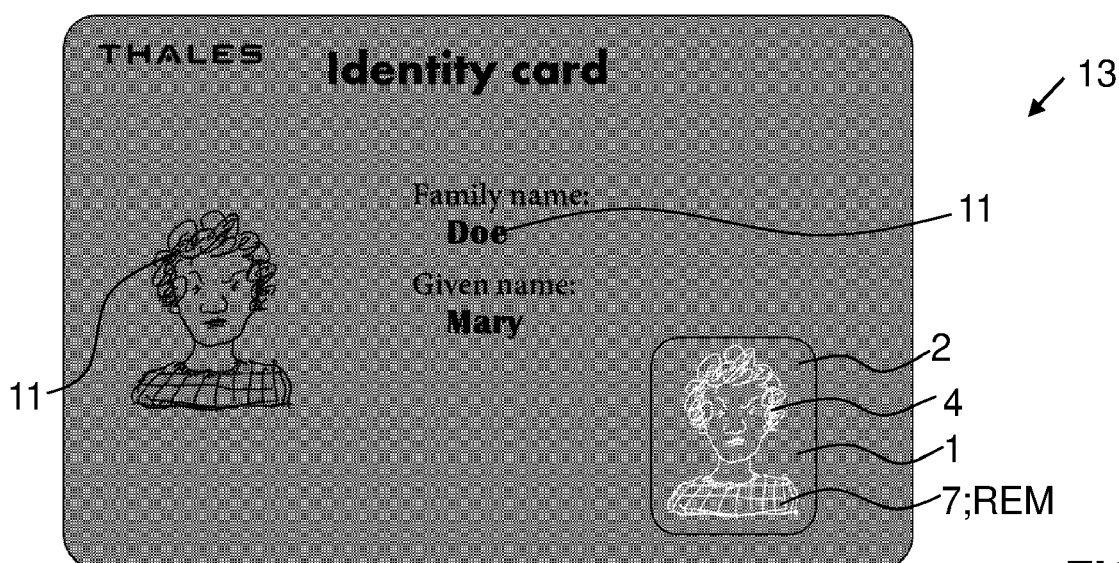


FIG. 9c

Description

TECHNICAL FIELD

5 **[0001]** The present invention relates to a data carrier comprising at least one security element according to claim 1, a security document comprising such a data carrier according to claim 14, and a method of producing at least one security element in a data carrier according to claim 15, respectively.

PRIOR ART

10 **[0002]** Security elements in data carriers used as or in security documents such as identity cards, credit cards, banknotes or the like are usual features in the field of counterfeit protection. To this end, various solutions are known. Some of the known solutions involve security elements with specific optical properties, including those based on the phenomenon of luminescence.

15 **[0003]** Generation of security elements with personalized information via a process using electromagnetic radiation, such as by laser or LED or other light sources, is often preferred over alternative personalization solutions such as conventional printing. One of the significant advantages is generating personalization marks in the volume of the document material rather than on the surface only, thus enhancing the document anti-fraud protection. For example, the document US2005/0098636 A1 discloses a method and device for personalizing the luminescent authenticity features on data carrier, in particular plastic cards. The luminescent authenticity feature is applied to or incorporated in a composite card, and the authenticity feature is personalized with a high-energy beam in that the intensity and/or wavelength of the beam is chosen such that local bleaching of the structure of the authenticity feature takes place, and the destruction of a chromophoric substance of the luminescent security feature cannot be detected in visible light.

20 **[0004]** From EP 2 424 735 B1, for example, a process for securing an identification document and secure identification document are known; the document comprising a layer of UV sensitive ink(s) applied on top of a layer of a transparent ablation varnish. A personalized graphical pattern is then generated, wherein during the personalization process parts of the UV sensitive ink are removed by means of a laser beam, and wherein the said pattern can only be revealed under UV radiation.

25 **[0005]** It is a common desire to enhance the security provided by security elements in data carriers used as or in security documents such as identity cards, credit cards, banknotes or the like.

SUMMARY OF THE INVENTION

30 **[0006]** It is an object of the present invention to provide a data carrier comprising at least one preferably personalizable security element of increased safety.

35 **[0007]** This object is achieved with a data carrier according to claim 1. In particular, a data carrier is provided which comprises at least one blocking element, at least one radiating element, at least one unblocking region being provided in the blocking element, and at least one security element. The radiating element is arranged after the blocking element with respect to an extension direction extending from the blocking element towards the radiating element. At least one region of the radiating element is uncovered by the at least one unblocking region of the blocking element when seen along the extension direction, whereby the at least one security element is formed. The blocking element is configured to block impinging electromagnetic radiation constituting a blocking element spectrum. The radiating element is configured to emit electromagnetic radiation constituting a radiating element emission spectrum upon irradiation by electromagnetic radiation constituting a radiating element excitation spectrum, the radiating element excitation spectrum differing from the radiating element emission spectrum. The blocking element and the radiating element are further configured such, i) that the blocking element spectrum essentially corresponds to the radiating element excitation spectrum, or ii) that the blocking element spectrum essentially corresponds to the radiating element emission spectrum.

40 **[0008]** That is to say, the blocking element is either configured to block electromagnetic radiation that can excite the radiating element or to block electromagnetic radiation that is emitted by the excited radiating element during the relaxation of the excited radiating element. Blocking the impinging electromagnetic radiation by the blocking element refers to blocking the electromagnetic radiation impinging on the blocking element essentially along the extension direction, i.e. the radiation coming from an outside of the data carrier, as well as the radiation impinging on the blocking element along a direction extending essentially opposite to the extension direction, i.e. radiation coming from an inside of the data carrier. In the former case, the blocking element prevents excitation of the radiating element. In the latter case, the blocking element prevents emission of the emission radiation emitted by the relaxing radiating element towards an outside of the data carrier. However, this blocking effect is cancelled or at least strongly reduced at the position of the unblocking region. Namely, in the former case the unblocking region allows excitation radiation, i.e. electromagnetic radiation constituting the radiating element excitation spectrum, to be transmitted through the blocking element at the

position of the unblocking region and to impinge on the radiating element being arranged below the unblocking region, whereby the radiating element is excited at the location of impingement of the radiation. In the latter case the unblocking region allows the emission radiation of the relaxing radiating element, i.e. the radiating element emission spectrum, to be transmitted through the blocking element and to reach an outside of the data carrier at the position of the unblocking region.

[0009] In summary it can thus be said that the blocking element acts like a filter for the radiating element, and wherein the radiating element is only revealed at positions where the blocking element comprises unblocking regions. To this end, the blocking element in the sense of a filter element is preferably a selective filter element, wherein it selectively blocks one or more particular wavelengths and at the same time has as low impact as possible on electromagnetic radiation of other wavelengths. In this way, it can allow a combination of the security element according to the present invention with other security elements known in the art, wherein said other security elements are based on these other wavelength regions. The expressions "uncovered" or "revealed" are used herein to indicate that excitation radiation can reach and excite the radiating element and that emission radiation being emitted from the excited radiating element is made detectable at an outside of the data carrier, respectively.

[0010] By selectively generating one or more unblocking regions in the blocking element, a particular security element being detectable upon illumination by particular electromagnetic radiation is formed. Said one or more unblocking regions preferably constitute an alphanumeric character and/or an image and/or a machine-readable optical element such as a bar code or a QR code, whereby a security element in the form of an alphanumeric character and/or an image and/or a machine-readable optical element such as a bar code or a QR code is generated.

[0011] The expressions "blocking element spectrum", "radiating element excitation spectrum" and "radiating element emission spectrum" in each case refer to a spectrum being composed of one or more wavelengths. Moreover, the expression "essentially correspond" is used to indicate that the one or more wavelengths constituting the blocking element spectrum, the radiating element excitation spectrum, and the radiating element emission spectrum, respectively, are essentially the same. Essentially the same in turn means that the intensity of electromagnetic radiation that impinges on the blocking element is reduced by the blocking element by about 70 % or more, preferably by about 80 % or more. That is, if electromagnetic radiation constituting the radiating element excitation spectrum impinges on the blocking element, its intensity is reduced by about 70 % or more, preferably by about 80 % or more. In this case the blocking element essentially prevents excitation of the radiating element by the electromagnetic radiation constituting said radiating element excitation spectrum because the intensity is too low. Likewise, if the electromagnetic radiation constituting the radiating element emission spectrum impinges on the blocking element, its intensity is reduced by about 70 % or more, preferably by about 80 % or more. In this case, the blocking element essentially prevents transmission and therefore detection of the emission radiation emitted by the radiating element towards an outside.

[0012] The radiating element is preferably luminescent, preferably a luminescent ink or additive, particularly preferably a fluorescent ink or a phosphorescent ink. To this end it is preferred to use one or more luminescent inks or additives such as luminescent pigments that are commercially available. For instance, suitable luminescent pigments can be selected from the Lumilux™ product range of Honeywell. Ready luminescent inks can be acquired for example from security ink ranges of Sicpa (Switzerland) or Luminescence Sun Chemical Security (UK). Said inks or additives are preferably applied by conventional printing methods.

[0013] The radiating element can be configured to absorb electromagnetic radiation constituting the radiating element excitation spectrum being in the ultraviolet region, preferably in the near-ultraviolet region, and/or in the visible region and/or in the infrared region, preferably in the near-infrared region, of the electromagnetic spectrum and to emit electromagnetic radiation constituting the radiating element emission spectrum being in the ultraviolet region, preferably in the near-ultraviolet region, and/or in the visible region and/or in the infrared region, preferably in the near-infrared region, of the electromagnetic spectrum.

[0014] In other words, the radiating element excitation spectrum can correspond to electromagnetic radiation in the ultraviolet region, preferably in the near-ultraviolet region, in the visible region, and/or in the infrared region, preferably in the near-infrared region, of the electromagnetic spectrum. Likewise, the radiating element emission spectrum can correspond to electromagnetic radiation in the ultraviolet region, preferably in the near-ultraviolet region, in the visible region, and/or in the infrared region, preferably in the near-infrared region, of the electromagnetic spectrum. Hence, the at least one region of the radiating element being uncovered by the unblocking region of the blocking element constitutes the security element when seen or detected under ultraviolet radiation and/or visible radiation and/or infrared radiation. It is preferred to use security inks or additives with so-called "Stokes behaviour" or so-called "anti-Stokes behaviour" as the radiating element. Such inks are commercially available, wherein the former type exhibits emission upon excitation that is in a longer wavelength region than the excitation, and wherein the latter type exhibits emission upon excitation that is in a shorter wavelength region than the excitation. For example, the radiating element can be provided by means of a UV-fluorescent ink which absorbs electromagnetic radiation in the ultraviolet region, whereby it is excited. Upon relaxation into its ground state, the fluorescent species within the ink emits electromagnetic radiation in the visible region of the electromagnetic spectrum, for example. Similarly, if an IR-fluorescent ink is used, it is excited into its excited state

upon excitation with electromagnetic radiation in the infrared region of the electromagnetic spectrum, for example. Upon relaxation into its ground state, the fluorescent species within the ink emits electromagnetic radiation in the infrared region of the electromagnetic spectrum, although at longer wavelengths as compared to the excitation radiation, for example. Said emission radiation can be detected by common infrared detectors known in the art, such as forensic NIR viewers or a photo camera with an IR filter. From a physical point of view it should be noted that for the majority of known substances the absorption is most often nearly continuous below the longest-wavelength absorption band, and most often it is the longest-wavelength / lowest-energy electronic transition which is in charge of emitting fluorescence radiation. An absorption band as well as an emission band can be very narrow or very broad and covering e.g. near-UV plus half of the visible. Hence, a UV-fluorescent species, for example, may also absorb in the visible and have a visible colour. The same applies to radiating elements that absorb and/or emit in other wavelength regions than those indicated above.

[0015] The blocking element is preferably configured to absorb and/or reflect and/ or scatter the impinging electromagnetic radiation constituting the blocking element spectrum.

[0016] Said blocking element spectrum preferably likewise corresponds to electromagnetic radiation in the ultraviolet region, preferably in the near-ultraviolet region, and/or in the visible region and/or in the infrared region, preferably in the near-infrared region, of the electromagnetic spectrum. In other words, the blocking element preferably comprises species which absorb and/or scatter and/or reflect wavelength ranges that are comprised in or constitute the radiating element emission spectrum or the radiating element excitation spectrum. To this end the blocking element can correspond to an ink or an additive which absorbs electromagnetic radiation in the ultraviolet region and being based on a 2-hydroxyphenyl-s-triazine derivative such as the commercially available Tinuvin® 1600 from BASF. Examples of inks which absorb in the infrared region are the commercially available spectraCARD IRB from Printcolor or MSD4800 or MSC3600 from H. W. Sands.

[0017] The radiating element and/or the blocking element preferably extends entirely or partially along a width of the data carrier with respect to a transverse direction running perpendicularly to the extension direction.

[0018] To this end it is particularly preferred that the radiating element and the blocking element are arranged essentially congruently with respect to the extension direction. In other words, it is preferred that the radiating element and the blocking element are located at the same place with respect to the extension direction and have the same geometric extension along the transverse direction. In this case, it is ensured that the blocking element can block, except at the location(s) of the unblocking region(s), irradiation of the radiating element or emission of radiation emitted by the radiating element, respectively.

[0019] The blocking element and/or the radiating element are preferably provided in the form of layers, which layer(s) extend partially or entirely along the transverse direction. For example, the blocking element could be provided as a layer of ink, which ink comprises at least one of absorbing, reflecting and scattering species. Likewise, the radiating element could be provided as a layer of ink, which ink comprises luminescent species.

[0020] However, it is also conceivable that the blocking element and/or the radiating element are provided in a patterned manner. That is, the radiating element and/or the blocking element can have the form of a pixelated pattern. Additionally or alternatively, two or more unblocking regions can be provided in the blocking element in the form of a pixelated pattern. Particularly preferred in this context is a radiating element in the form of a pixelated pattern, wherein different pixels have different properties such as different excitation or emission properties, see also further below. For example, two or more pixels having different excitation properties could be two or more pixels that are excited by electromagnetic radiation of different wavelengths. Analogously, two or more pixels having different emission properties could be two or more pixels that emit electromagnetic radiation of different wavelengths. A pixel in the sense of the present invention should be understood as a unitary element of confined geometrical extensions which is uniform in terms of its excitation properties and radiation properties, if it serves the purpose of a radiating element, or in terms of its blocking properties or sensitivity to impinging electromagnetic radiation, if it serves the purpose of a blocking element, respectively. Conceivable geometrical extensions are in the range of about 20 micrometres to 1000 micrometres in a first horizontal direction and a second horizontal direction running perpendicularly to the first horizontal direction, and wherein the first horizontal direction and the second horizontal direction run perpendicularly to the extension direction. For example, a radiating element being provided in the form of a pixelated pattern could be constituted by dots of luminescent ink that are arranged in one or more arrays, wherein the dots have a size of about 20 micrometres to 500 micrometres. Said two or more unblocking regions being provided in the blocking element in the form of a pixelated pattern allow to selectively uncover or reveal particular pixels of the radiating element. Depending on the absorption and emission properties of the pixelated radiating element, a security element of multiple colours being visible/detectable upon illumination with e.g. infrared or ultraviolet light but being invisible under daylight could be provided. Furthermore, the pixelated patterns could be configured such, that the additive colour mixing scheme applies. For example, the radiating element could be constituted by dots, arrays of dots, arrays constituted by sub-arrays of dots or otherwise shaped elements, wherein the individual dots emit electromagnetic radiation of a wavelength that constitutes the colour red, green or blue. A printed line of one color can be considered as an array or a sub-array of pixels or dots in terms of addressing individual dots in the process of generating the security element according to the present invention. If dots that emit as red, green and

blue are uncovered, then an overall colour of white is created. If dots that emit as red and green are uncovered, then an overall colour of yellow is created. If dots that emit as green and blue are uncovered, then an overall colour of cyan is created, etc. It could be also conceivable that the initial pixelated pattern constituting either the radiating element or the blocking element or the both is configured differently than application of additive mixing of visual emitted colors.

[0021] The blocking element is preferably configured to interact with electromagnetic radiation, preferably with laser radiation or LED light or radiation from other sources, such that the unblocking region is generated upon interaction with said electromagnetic radiation. Hence, the blocking element could be configured so as to enable a laser personalization, wherein laser radiation is irradiated onto the blocking element so as to generate unblocking regions and therefore a security element that constitutes an image and/or an alphanumeric character such as a name, a date, a photograph, a state emblem, and/or a machine-readable optical element such as a bar code or a QR code etc. Such personalization can likewise be achieved by irradiating electromagnetic radiation of other sources such as for example LED light sources or other sources.

[0022] The unblocking region preferably corresponds to a recess or a transparent or a translucent region within the blocking element. Transparent or translucent regions in the context of the present invention means that the one or more wavelengths constituting the radiating element excitation spectrum or the radiating element emission spectrum, respectively, are transmitted through said regions.

[0023] For example, the recess can be generated in the blocking element by laser ablating the blocking element. It is however likewise conceivable to provide the blocking element as a material capable of being bleached, discoloured or otherwise physically and/or chemically and/or optically altered upon interaction with electromagnetic radiation. Said bleached, discoloured or altered region then corresponds to the transparent or translucent region mentioned above.

[0024] The data carrier can further comprise at least one preferably transparent intermediate layer, wherein the radiating element and/or the blocking element is arranged on and/or within the intermediate layer. A transparent layer in the sense of the present invention refers to a layer that is as transmissive as possible for electromagnetic radiation being in the entire ultraviolet, the visible and the infrared region of the electromagnetic spectrum, i.e. not only for electromagnetic radiation constituting the radiating element emission spectrum and the radiating element excitation spectrum. Being as transmissive as possible includes sufficient transmissivity for electromagnetic radiation so that the presence of the said intermediate layer has no or very low influence on the generation or the functionality of the security element according to the present invention. The transmissivity of the transparent layer(s) to the electromagnetic radiation within the ultraviolet, the visible and the infrared spectral regions can be limited by the inherent physical and chemical properties of the material of the transparent layer(s) and by eventual presence of additives, preferably non-scattering additives, if they do not interfere with the generation or the functionality of the security element according to the present invention.

[0025] The intermediate layer is preferably made of plastics, particularly preferably made from a polycarbonate, from a polyester such as polyethylene terephthalate, or from a polyolefin such as polyethylene or polypropylene. However, other types of plastics that are known in the art are conceivable as well. The radiating element and/or the blocking element can be printed on the intermediate layer, which is particularly preferred if the radiating element and the blocking element are applied in the form of printable inks. However, it is also conceivable to provide the radiating element and/or the blocking element within the intermediate layer, e.g. by embedding these elements into the intermediate layer during the manufacturing of the intermediate layer. This procedure is particularly preferred if the radiating element and the blocking element are provided by means of additives. In this case, the additives can be dispersed into a polymer matrix by using standard extrusion equipment.

[0026] It is conceivable to provide only one intermediate layer, wherein the blocking element is arranged on or within a top side of the intermediate layer and the radiating element is arranged on or within the opposite bottom side of the intermediate layer. However, it is likewise conceivable to provide at least two intermediate layers, wherein the blocking element is arranged on or within a first intermediate layer and the radiating element is arranged on or within a second intermediate layer. Said two or more intermediate layers are preferably arranged successively with respect to the extension direction.

[0027] The data carrier can comprise at least one further radiating element, wherein the further radiating element is configured to emit electromagnetic radiation constituting a further radiating element emission spectrum upon irradiation by electromagnetic radiation constituting a further radiating element excitation spectrum, the further radiating element excitation spectrum differing from the further radiating element emission spectrum. To this end the radiating element excitation spectrum and the further radiating element excitation spectrum can differ from one another, and/or the radiating element emission spectrum and the further radiating element emission spectrum can differ from one another.

[0028] That is to say, it is conceivable to provide at least one further radiating element whose excitation spectrum differs from its emission spectrum. Moreover, the excitation spectrum of this further radiating element can be the same or different from the excitation spectrum of the radiating element. In addition or alternatively, the emission spectrum of this further radiating element can be the same or different from the emission spectrum of the radiating element. In other words, and as has already been mentioned previously with regard to the pixelated patterns, it is conceivable to provide at least a further radiating element, wherein said further radiating element exhibits different absorption characteristics

and/or different emission characteristics than the radiating element. For example, it is conceivable to use two radiating elements, wherein one of which is configured to absorb electromagnetic radiation in the visible range of the electromagnetic spectrum and the other is configured to absorb electromagnetic radiation in the infrared region of the electromagnetic spectrum. Upon irradiation by visible and infrared radiation, different radiating element emission spectra are generated. In the context of the radiating element in the form of the pixelated pattern it has already been disclosed previously that the pixelated pattern is preferably provided by means of dots of a certain geometrical dimension. It should be noted, however, that the radiating element and the further radiating element do not necessarily have to correspond to a pixelated pattern. To the contrary, it is likewise conceivable that the radiating element and the further radiating element correspond to two layers comprising different luminescent species, for example.

[0029] The radiating element and the further radiating element can be arranged on a same height with respect to the extension direction. Alternatively, the radiating element and the further radiating element can be arranged spaced apart from one another with respect to the extension direction.

[0030] That is to say, the radiating element and the further radiating element can be arranged next to one another, preferably on the same intermediate layer. To this end the radiating element and the further radiating element can be arranged immediately adjacent to one another or spaced apart from one another with respect to the transverse direction. However, it is also conceivable that the radiating element and the further radiating element at least partially overlap. For example, it is conceivable that a first luminescent ink or additive constituting the radiating element and a second luminescent ink or additive constituting the further radiating element are at least partially arranged at the same location. It is of course also conceivable that the radiating element and the further radiating element overlap spatially entirely, e.g. by applying a mixture of a first luminescent ink and a second luminescent ink. Alternatively, it is also conceivable that the radiating element and the further radiating element are spaced apart from one another, e.g. by arranging the radiating element on the top side of the intermediate layer and the further radiating element on the bottom side of the intermediate layer or on a further intermediate layer. In the case of radiating elements being spaced apart from one another with respect to the extension direction it is conceivable that these elements are arranged at least partially overlapping or offset with respect to one another when viewed along the extension direction.

[0031] The data carrier can comprise at least one further blocking element, wherein the at least one further blocking element comprises at least one further unblocking region that uncovers at least one further region of the radiating element and/or of the further radiating element, wherein the further blocking element is configured to block impinging electromagnetic radiation constituting a further blocking element spectrum. To this end the blocking element spectrum and the further blocking element spectrum can differ from one another. The further blocking element and the radiating element and/or the further radiating element are preferably configured such, that the further blocking element spectrum essentially corresponds to the radiating element excitation spectrum and/or to the further radiating element excitation spectrum. Alternatively, the further blocking element spectrum preferably essentially corresponds to the radiating element emission spectrum and/or to the further radiating element emission spectrum.

[0032] That is to say, the further blocking element is preferably also either configured to block electromagnetic radiation that can excite the radiating element and/or the further radiating element or to block electromagnetic radiation that is emitted by the excited radiating element and/or the excited further radiating element upon its relaxation. The further blocking element is thus analogous to the blocking element and likewise comprises at least one unblocking region, wherein the radiating element and/or the further radiating element being arranged after the unblocking region of the further blocking element with respect to the extension direction is revealed by the unblocking region of the further blocking element. In this way, it is possible to cancel the blocking effect of the further blocking element at the position of the unblocking region. The provision of different blocking elements and corresponding different radiating elements enables the generation of emission patterns having different emission spectra and/or the generation of emission spectra upon excitation with different excitation wavelengths, i.e. with different excitation spectra.

[0033] Different arrangements of said blocking element and further blocking element are conceivable, too. For example, the blocking element and the further blocking element could be arranged on a same height with respect to the extension direction, for example on a same layer of the data carrier. However, it is likewise conceivable that the blocking element and the further blocking element are arranged on a different height with respect to the extension direction, for example one after the other when seen along the extension direction and on different layers of the data carrier. Furthermore, said blocking element and further blocking element could be arranged immediately adjacent or spaced apart from one another with respect to the transverse direction.

[0034] Likewise, different arrangements of the unblocking regions in the blocking element and the further unblocking regions in the further blocking element are conceivable. Namely, the unblocking region provided in the blocking element and the further unblocking region in the further blocking element could be arranged after one another and/or congruent with one another when seen along the extension direction. Likewise, the unblocking region and the further unblocking region could be arranged immediately adjacent to one another or spaced apart from one another with respect to the transverse direction.

[0035] In a further aspect a security document comprising a data carrier as described above is provided, the security

document preferably being an identity card, a passport, a credit card, a bank note or the like. At this point it should be understood that the data carrier *per se* can correspond to a security document. This is the case if the data carrier is provided in the form of an identity card, for example. However, it is likewise conceivable to introduce or incorporate the data carrier into a security document. In the case of a passport for example the data carrier could be incorporated into a page of the passport.

[0036] In a further aspect a method of producing at least one security element in a data carrier, preferably a data carrier as described above, is provided, the method comprising the steps of providing at least one blocking element, providing at least one radiating element, and generating at least one unblocking region in the blocking element. The radiating element is arranged after the blocking element with respect to an extension direction extending from the blocking element towards the radiating element. At least one region of the radiating element is uncovered by the at least one unblocking region of the blocking element, whereby the least one security element is formed. The blocking element is configured to block impinging electromagnetic radiation constituting a blocking element spectrum. The radiating element is configured to emit electromagnetic radiation constituting a radiating element emission spectrum upon irradiation by electromagnetic radiation constituting a radiating element excitation spectrum, the radiating element excitation spectrum differing from the radiating element emission spectrum. The blocking element and the radiating element are further configured such, i) that the blocking element spectrum essentially corresponds to the radiating element excitation spectrum, or ii) that the blocking element spectrum essentially corresponds to the radiating element emission spectrum.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] Preferred embodiments of the invention are described in the following with reference to the drawings, which are for the purpose of illustrating the present preferred embodiments of the invention and not for the purpose of limiting the same. In the drawings,

- Fig. 1 shows an example of an electronic absorption spectrum and a fluorescence spectrum of the same chemical species, where the absorption and fluorescence spectral bands are located in different spectral regions;
- Fig. 2 shows an example of a blocking element selection so that it is configured to block the absorption spectrum according to figure 1;
- Fig. 3 shows an example of a blocking element selection so that it is configured to block the fluorescence spectrum according to figure 1;
- Fig. 4 shows a radiating element emission band, an excitation source emission band and a blocking element spectrum configured according to the invention
- Fig. 5a shows a sectional view through a data carrier comprising a blocking element and a radiating element in an unprocessed state;
- Fig. 5b shows a sectional view through a data carrier comprising a blocking element and a radiating element during processing;
- Fig. 5c shows a sectional view through a data carrier comprising a blocking element and a radiating element in a processed state;
- Fig. 5d shows a sectional view through a data carrier comprising a blocking element and a radiating element in a processed state;
- Fig. 6 shows a sectional view through a data carrier comprising a blocking element, a radiating element and further elements that can be laser marked during processing;
- Fig. 7a shows a front view on a schematic security document comprising a data carrier before personalization;
- Fig. 7b shows a front view on the schematic security document according to figure 7a after personalization and upon illumination with ambient light;
- Fig. 7c shows a front view on the schematic security document according to figure 7a after personalization and upon illumination with UV light;
- Fig. 8 shows a sectional view through a data carrier comprising a blocking element, a further blocking element, a radiating element and a further radiating element during processing;
- Fig. 9a shows a front view on a schematic security document comprising a data carrier before personalization;
- Fig. 9b shows a back view on the schematic security document according to figure 9a before personalization;
- Fig. 9c shows a front view on the schematic security document according to figure 9a after personalization and upon illumination with UV light;
- Fig. 9d shows a back view on the schematic security document according to figure 9b after personalization and upon illumination with UV light;
- Fig. 9e shows a front view on the schematic security document according to figure 9a when its photograph is taken after personalization using a NIR light detection equipment;
- Fig. 9f shows a back view on the schematic security document according to figure 9b when its photograph is taken

after personalization using a NIR light detection equipment.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0038] The present invention is based on the fact that certain components are able to absorb electromagnetic radiation at one or more wavelengths, whereby said components are excited, and to then emit electromagnetic radiation at one or more wavelengths being different from the one or more wavelengths absorbed by the components during their relaxation. Such components are commonly referred to as luminescent or photoluminescent species. In the following the one or more wavelengths that are absorbed by the components during their excitation are referred to as excitation spectrum, and the one or more wavelengths that are emitted during the relaxation of the excited components into their ground state are referred to as emission spectrum.

[0039] Figures 1 to 4 depict excitation spectra and emission spectra of a radiating element and their selective blocking by means of an appropriate blocking element in order to illustrate the general physical principle behind the radiating element and the blocking element used in data carriers according to the present invention. With respect to figures 5a to 9f their implementation in several embodiments of a data carrier according to the invention are discussed.

[0040] In particular, figure 1 depicts an example of an electronic excitation spectrum and of an electronic emission spectrum that are absorbed and emitted by a fluorescent species. The absorption and fluorescence spectral bands are located in significantly different spectral regions. The excitation spectrum is depicted as full line and has an absorption maximum at a wavelength of about 400 nanometers. The emission spectrum is depicted as dashed line and has a fluorescence maximum at a wavelength of about 580 nanometers. As readily follows from these spectra, the emission spectrum is at longer wavelengths than the excitation spectrum. This difference in wavelengths is used in the present invention. Namely, and as follows from figures 2 and 3, it is possible to selectively block either the wavelengths constituting the excitation spectrum (figure 2) or the wavelengths constituting the emission spectrum (figure 3) by an appropriate blocking element. This principle is further illustrated in figure 4, which depicts a real fluorescence spectrum of a fluorescent ink by means of dashed lines, which ink is excited upon illumination with ultraviolet (UV) light at 350 nanometers, and which emits at about 620 nanometers. Furthermore, figure 4 also depicts an absorption spectrum by means of a full line and that has been recorded for a blocking element in the form of a blue photo-bleachable colorant which is used here to selectively block, i.e. filter off, the emission of the fluorescent ink at about 620 nanometers. Hence, a luminescent element, hereafter referred to as radiating element, can be placed in a data carrier such as a multilayer structure that constitutes an ID document, and wherein the appearance of luminescence of the radiating element can be blocked if a properly selected masking or filtering overlay, hereafter referred to as blocking element, is applied over the radiating element.

[0041] Figure 5a depicts a data carrier 1 comprising a transparent cover layer 8 and a base layer 9, between which a radiating element 3 and a blocking element 2 are provided. To this end the cover layer 8 forms an uppermost layer or top layer, which is followed by the blocking element 2, the radiating element 3, and the base layer 9. These components are successively arranged one after the other with respect to an extension direction E that extends from the cover layer 8 towards the base layer 9. Hence, the radiating element 3 is arranged after the blocking element 2 with respect to the extension direction E. As mentioned initially, the radiating element 3 is a luminescent element, preferably a luminescent ink or additive, particularly preferably a fluorescent ink or a phosphorescent ink. Hence, depending on the chemical constitution of the radiating element 3, the radiating element 3 is configured to absorb electromagnetic radiation constituting a radiating element 3 excitation spectrum REX being in the ultraviolet region, in the visible region and/or in the infrared region of the electromagnetic spectrum. Furthermore, after excitation, the radiating element 3 is configured to emit electromagnetic radiation constituting a radiating element 3 emission spectrum REM being in the ultraviolet region, in the visible region and/or in the infrared region of the electromagnetic spectrum. Additionally, and as has also been mentioned, the blocking element 2 is configured to block, for example to absorb, reflect and/ or scatter impinging electromagnetic radiation constituting a blocking element spectrum RB.

[0042] In the unprocessed state depicted in figure 5a the blocking element 2 prevents, depending on its absorbing, scattering or reflecting properties, either an excitation of the radiating element 3 by preventing incoming electromagnetic radiation from impinging on the radiating element 3, or a transmission of the electromagnetic radiation being emitted from the excited radiating element 3 towards an outside. This blocking effect exhibited by the blocking element 2 is removed upon processing of the data carrier 1, in particular upon processing of the blocking element 2.

[0043] In figure 5b the processing of a data carrier 1 is depicted. The processing of the data carrier 1 corresponds to the irradiation by electromagnetic radiation R in order to generate unblocking regions 4 in the blocking element 2 in the regions of impingement of the irradiated electromagnetic radiation R. In the present example the unblocking region 4 corresponds to a recess or a transparent or a translucent region that is formed within the blocking element 2. Regions 5 of the radiating element 3 which are arranged after the unblocking regions of the blocking element 2 with respect to the extension direction E are thereby uncovered. In other words, the unblocking regions 4 of the blocking element 2 reveal below-lying regions 5 of the radiating element 3. By selectively uncovering or revealing regions 5 of the radiating

element 3 a security element 7 can be formed.

[0044] Two different data carriers 1 are depicted in figures 5c and 5d. Both data carriers 1 in each case comprise a cover layer 8, a base layer 9, a blocking element 2 with an unblocking region 4, and a radiating element 3 with an uncovered region 5. In the present example the cover layer 8 corresponds to a transparent layer which does not interact with impinging electromagnetic radiation. The base layer 9 in turn corresponds to an opaque layer. The uncovered region 5 of the radiating element 3 is uncovered by the unblocking region 4 of the blocking element 2. The blocking element 2 and the radiating element 3 of the data carrier 1 in figure 5c are configured such, that a blocking element spectrum RB that comprises electromagnetic radiation being blocked by the blocking element 2, and a radiating element emission spectrum REM that comprises electromagnetic radiation being emitted by the radiating element 3 upon its relaxation are essentially the same. In this case the blocking element 2 blocks the emission radiation being radiated by the radiating element 3 towards an outside of the data carrier 1 everywhere except in the unblocking regions 4. In other words, the radiating element emission spectrum REM will radiate only through the unblocking regions 4 of the blocking element 2 and will be detectable outside of the data carrier 1. In this case a security element 7 being constituted by the unblocking regions 4 of the blocking element 2 and the below-lying uncovered regions 5 of the radiating element 3 is generated, which security element 7 appears with the corresponding fluorescence properties, i.e. with the radiating element emission spectrum REM. For example, the radiating element 3 could correspond to a fluorescent ink which is excited upon absorbing ultraviolet light and which emits visible red light upon its relaxation. Furthermore, the blocking element 2 could correspond to a cyan colored layer which absorbs visible red light. Hence, if ultraviolet radiation is irradiated onto the data carrier 1 and if the cyan blocking layer has low absorbance in the UV region (does not prevent the UV radiation from impinging onto the radiating element), then red light being emitted from the radiating element 3 will only be visible through the unblocking regions 4 of the blocking element 2.

[0045] This is in contrast to the blocking element 2 and the radiating element 3 of the data carrier 1 in figure 5d, wherein the blocking element spectrum RB that comprises electromagnetic radiation being blocked by the blocking element 2 and the radiating element excitation spectrum REX that comprises electromagnetic radiation being configured to excite the radiating element 3 are essentially the same. In this case, electromagnetic radiation that is configured to excite the radiating element 3 will be prevented from reaching the radiating element 3 by the blocking element 2 except in the regions of the unblocking regions 4. Also in this case a security element 7 being constituted by the unblocking regions 4 of the blocking element 2 and the below-lying uncovered regions 5 of the radiating element 3 is generated, which security element 7 appears with the corresponding fluorescence properties, i.e. with the radiating element emission spectrum REM. Hence, in both cases a security element 7 emitting its radiating element emission spectrum REM upon excitation is generated, however with the differences, that in the former case an excitation of the entire radiating element 3 is possible but an emission of the radiating element 3 towards an outside is only possible at the locations of the unblocking regions 4 of the blocking element 2, whereas in the latter case an excitation of the radiating element 3 is only possible at the locations of the unblocking regions 4 of the blocking element 2. In the present examples the radiating element 3 and the blocking element 2 are in each case provided as layers which extend entirely along a width W of the data carrier 1 with respect to a transverse direction T running perpendicularly to the extension direction E. However, other arrangements such as a radiating element 3 and/or a blocking element 2 extending only partially along the transverse direction T or having the form of a pixelated pattern are likewise conceivable.

[0046] Moreover, the data carrier 1 can comprise two or more radiating elements 3, 3', two or more blocking elements 2, 2', and two or more layers constituting the layer structure of the data carrier 1. For example, the data carrier 1 depicted in figure 6 comprises the transparent cover layer 8, the base layer 9, a blocking element 2 and a radiating element 3 as just described. However, it additionally comprises intermediate layers 6 which are transparent and which are arranged before and after the radiating element 3 with respect to the extension direction E. Moreover, a laserable layer 10 is arranged before the opaque base layer 9 layer with respect to the extension direction E. The laserable layer 10 is here a layer reactive to a laser radiation R' different from the impinging electromagnetic radiation R used to generate the unblocking region 4. The laserable layer in this example is composed of a conventional material such as those supplied for personalization by near-infrared laser sources, for example an Nd:YAG laser, with generating grey or black marking. At the same time, the laserable layer 10 is mostly non-absorbing or transparent in the near-UV and visible wavelength regions used for generating the security element according to the present invention such as in the data carrier example in figure 5c. By irradiating laser radiation R' onto said laserable layer 10 black marks 11 are generated in the regions of impingement. Furthermore, between the transparent intermediate layers 6 several imprints 12 are provided. Besides, transparent layers 6 with imprints 12 and another laserable layer 10 are also provided on a backside of the data carrier 1, namely after the base layer 9 with respect to the extension direction E. That is to say, the data carrier 1 according to the invention can comprise conventional security elements known in the art such as imprints 12 or black markings 11 in addition to the security elements 7 according to the invention.

[0047] These possibilities shall be illustrated by means of the schematic security documents depicted in figures 7a to 7c. In fact, figure 7a depicts a security document 13 in the form of an identity card which comprises personalized data in the form of the name and signature of the card holder. These personalized data is made here by conventional black

laser marking 11 in a laserable layer as just described. The security document 13 further comprises a data carrier 1 according to the invention, which is provided within a rectangular area of the security document 13. Here, the data carrier 1 comprises a blocking element 2 of e.g. blue color, such as a photobleachable blue colorant, below which a fluorescent radiating element 3 is arranged. The radiating element 3 can be excited upon irradiation by ultraviolet light, whereupon it emits visible red light. The data carrier 1 depicted in figure 7a has not been personalized, i.e. no security element according to the invention has been generated. Thus, upon illumination of the data carrier 1 with ambient light merely the blue colored blocking element 2 present in the corresponding rectangular area will be visible for an observer. Illumination with a UV light constituting the radiating element emission spectrum REX will not reveal detectable fluorescence. Figures 7b and 7c depict the data carrier 1 after it has been personalized, i.e. after a security element 7 has been generated. Said security element 7 in this case corresponds to the expiration date "29/05/2025" which has been generated by selectively generating unblocking regions 4, 4' within the blocking element 2, in this example *via* photo-induced discoloration or destruction of the blue colorant. To this end, figure 7b depicts the security document 13 being viewed under ambient light. Since the radiating element 3 is not excited upon an illumination with ambient light it will not fluoresce. Instead, it will appear as an "off-white" element between the remaining parts of the blocking element 2. However, if the data carrier 1 is illuminated with ultraviolet light as depicted in Figure 7c, the radiating element 3 is excited and emits a red colored radiating element emission spectrum REM upon its relaxation. Since the blocking element 2 is configured to block such electromagnetic radiation, the emission of the radiating element 3 is only visible in the regions of the unblocking regions 4, 4' of the blocking element 2. Since said unblocking regions 4, 4' constitute the expiration date "29/05/2025", said date appears in red color REM.

[0048] As already mentioned, the data carriers 1 according to the invention can comprise, inter alia, two or more radiating elements 3, 3' and/or two or more blocking elements 2, 2'. For example, and as follows from figure 8, it is conceivable to provide a data carrier 1 comprising a transparent cover layer 8, a transparent base layer 9, a radiating element 3 and a further radiating element 3' that are arranged between a blocking element 2 and a further blocking element 2'. Further layers such as transparent intermediate layers 6 can be present in the data carrier 1, as well. Here, the radiating element 3 and the further radiating element 3' are combined within the same layer and are arranged on a same height with respect to the extension direction E, e.g. by mixing two different fluorescent inks. Said inks could correspond to a double-emitting fluorescent print, with a first radiating element excitation spectrum REX being in the near-ultraviolet region of the electromagnetic spectrum, a first radiating element emission spectrum REM being in the visible region of the electromagnetic spectrum, a further radiating element excitation spectrum REX' being in the visible region of the electromagnetic spectrum, and a further radiating element emission spectrum REM' being in the near-infrared region of the electromagnetic spectrum.

[0049] The implementation of such a data carrier 1 into a security document 13 such as an identity card is explained with reference to figures 9a to 9f. Said security document 13 again comprises additional features such as the image and the name of the card holder which correspond to black marks 11. However, it also comprises a window within which the data carrier 1 according to the invention is arranged. Figure 9a depicts a front view and 9b depicts a back view of said data carrier 1. Because both, the cover layer 8 and the base layer 9 are provided as transparent layers, the first blocking element 2 is visible or detectable through the cover layer 8 in the front view (figure 9a) and the further blocking element 2' is visible or detectable through the base layer 9 in the back view (figure 9b). The first blocking element 2 corresponds here to a layer that is configured to absorb electromagnetic radiation being in the ultraviolet region of the electromagnetic spectrum and the further blocking element 2' corresponds here to a layer that is configured to absorb electromagnetic radiation being in the infrared region of the electromagnetic radiation. Figures 9a and 9b depict the data carrier 1 in an unprocessed state, i.e. before the generation of one or more unblocking regions in the blocking elements 2, 2'. In figures 9c to 9f the data carrier 1 has been personalized. That is, a first security element 7 in the form of an image of the holder has been generated by means of corresponding unblocking regions 4 in the first blocking element 2 and a second security element 7' in the form of a birth date of the holder has been generated by means of corresponding unblocking regions 4' in the second blocking element 2'. Figure 9c depicts a front view onto the data carrier 1 being viewed under ultraviolet light. As readily follows from figure 9c, the first security element 7 in the form of the image of the holder is visible as emitted light of a radiating element emission spectrum REM being in the visible range of the electromagnetic spectrum. However, if the back side of the data carrier 1 is viewed under ultraviolet light, said first security element is not visible, see figure 9d. Instead, the whole window is either uniformly fluorescent or uniformly non-fluorescent, depending on whether the further blocking element 2' in the form of an infrared filter also blocks ultraviolet light. Figure 9e again depicts the front side of the data carrier 1, which is exposed to ambient light overlapping with the further radiating element excitation spectrum REX' and is photographed using a NIR detection equipment, such as a forensic NIR viewer or a photo camera with an IR filter. Supposing that the first blocking element 2 does not block infrared radiation but only ultraviolet radiation, the entire data carrier 1 will be detected as uniformly emitting luminescent infrared radiation. However, when the back side of the data carrier 1 is photographed under the same conditions, the further blocking element 2' will block any infrared radiation that is emitted from the further radiating element 3' except in regions of the unblocking regions 4'. Hence, the second security element 7' in the form of the birth date will emit detectable radiation corresponding

to the radiating element emission spectrum REM'.

LIST OF REFERENCE SIGNS

5	1	data carrier	13	security document
	2, 2'	blocking element		
	3, 3'	radiating element	E	extension direction
	4, 4'	unblocking region	T	transverse direction
	5, 5a, 5'	uncovered region	W	width
10	6	intermediate layer	R, R'	radiation
	7, 7'	security element	RB, RB'	blocking element spectrum
	8	cover layer	REM, REM'	radiating element emission spectrum
	9	base layer	REX, REX'	radiating element excitation spectrum
	10	laserable layer		
15	11	mark		
	12	imprint		

Claims

1. A data carrier (1) comprising:

- at least one blocking element (2);
- at least one radiating element (3);
- at least one unblocking region (4) being provided in the blocking element (2); and
- at least one security element (7),

wherein the radiating element (3) is arranged after the blocking element (2) with respect to an extension direction (E) extending from the blocking element (2) towards the radiating element (3);

wherein at least one region (5) of the radiating element (3) is uncovered by the at least one unblocking region (4) of the blocking element (2) when seen along the extension direction (E), whereby the at least one security element (7) is formed;

wherein the blocking element (2) is configured to block impinging electromagnetic radiation constituting a blocking element spectrum (RB),

wherein the radiating element (3) is configured to emit electromagnetic radiation constituting a radiating element emission spectrum (REM) upon irradiation of electromagnetic radiation constituting a radiating element excitation spectrum (REX), the radiating element excitation spectrum (REX) differing from the radiating element emission spectrum (REM),

characterized in that the blocking element (2) and the radiating element (3) are further configured such,

- i) that the blocking element spectrum (RB) essentially corresponds to the radiating element excitation spectrum (REX), or
- ii) that the blocking element spectrum (RB) essentially corresponds to the radiating element emission spectrum (REM).

2. The data carrier (1) according to claim 1, wherein the radiating element (3) is luminescent, preferably a luminescent ink or additive, particularly preferably a fluorescent ink or a phosphorescent ink.

3. The data carrier (1) according to any one of the preceding claims, wherein the radiating element (3) is configured to absorb electromagnetic radiation constituting the radiating element excitation spectrum (REX) being in the ultraviolet region, preferably in the near-ultraviolet region, and/or in the visible region and/or in the infrared region, preferably in the near-infrared region, of the electromagnetic spectrum and to emit electromagnetic radiation constituting the radiating element emission spectrum (REM) being in the ultraviolet region, preferably in the near-ultraviolet region, and/or in the visible region and/or in the infrared region, preferably in the near-infrared region, of the electromagnetic spectrum.

4. The data carrier (1) according to any one of the preceding claims, wherein the blocking element (2) is configured

to absorb and/or reflect and/ or scatter the impinging electromagnetic radiation constituting the blocking element spectrum (RB).

5 5. The data carrier (1) according to any one of the preceding claims, wherein the radiating element (3) and/or the blocking element (2) extends entirely or partially along a width (W) of the data carrier (1) with respect to a transverse direction (T) running perpendicularly to the extension direction (E).

10 6. The data carrier (1) according to any one of the preceding claims, wherein the radiating element (3) and/or the blocking element (2) has the form of a pixelated pattern, and/or wherein two or more unblocking regions (4) are provided in the blocking element (2) in the form of a pixelated pattern.

15 7. The data carrier (1) according to any one of the preceding claims, wherein the blocking element (2) is configured to interact with electromagnetic irradiation, preferably with laser radiation (R) or LED light or other sources of electromagnetic radiation, such that the unblocking region (4) is generated upon the interaction with said electromagnetic irradiation (R).

8. The data carrier (1) according to any one of the preceding claims, wherein the unblocking region (4) corresponds to a recess or a transparent or a translucent region within the blocking element (2).

20 9. The data carrier (1) according to any one of the preceding claims, further comprising at least one preferably transparent intermediate layer (6), wherein the radiating element (3) and/or the blocking element (2) is arranged on and/or within the intermediate layer (6).

25 10. The data carrier (1) according to any one of the preceding claims, comprising at least one further radiating element (3'), wherein the further radiating element (3') is configured to emit electromagnetic radiation constituting a further radiating element emission spectrum (REM') upon irradiation by electromagnetic radiation constituting a further radiating element excitation spectrum (REX'), the further radiating element excitation spectrum (REX') differing from the further radiating element emission spectrum (REM'); and

30 wherein the radiating element excitation spectrum (REX) and the further radiating element excitation spectrum (REX') differ from one another, and/or wherein the radiating element emission spectrum (REM) and the further radiating element emission spectrum (REM') differ from one another.

35 11. The data carrier (1) according to claim 10, wherein the radiating element (3) and the further radiating element (3') are arranged on a same height with respect to the extension direction, or wherein the radiating element (3) and the further radiating element (3') are arranged spaced apart from one another with respect to the extension direction.

40 12. The data carrier (1) according to any one of the preceding claims, comprising at least one further blocking element (2'),

45 wherein the at least one further blocking element (2') comprises at least one further unblocking region (4') that uncovers at least one further region (5a, 5') of the radiating element (3) and/or of the further radiating element (3'), wherein the further blocking element (2') is configured to block impinging electromagnetic radiation constituting a further blocking element spectrum (RB'), wherein the blocking element spectrum (RB) and the further blocking element spectrum (RB') differ from one another; and

50 wherein the further blocking element (2') and the radiating element (3) and/or the further radiating element (3') are configured such, that the further blocking element spectrum (RB') essentially corresponds to the radiating element excitation spectrum (REX) and/or to the further radiating element excitation spectrum (REX'), or wherein the further blocking element spectrum (RB') essentially corresponds to the radiating element emission spectrum (REM) and/or to the further radiating element emission spectrum (REM').

55 13. The data carrier (1) according to claim 12, wherein the unblocking region (4) provided in the blocking element (2) and the further unblocking region (4') provided in the further blocking element (2') are arranged after one another and/or congruent with one another when seen along the extension direction, and/or wherein the unblocking region (4) and the further unblocking region (4') could be arranged immediately adjacent to one another or arranged spaced apart from one another with respect to a transverse direction running perpendicularly

to the extension direction.

14. A security document (13) comprising a data carrier (1) according to any one of the preceding claims, the security document preferably being an identity card, a passport, a credit card, a bank note or the like.

15. A method of producing at least one security element (7) in a data carrier (1), preferably a data carrier according to any one of the preceding claims 1-13, the method comprising the steps of:

- Providing at least one blocking element (2);
- Providing at least one radiating element (3); and
- Generating at least one unblocking region (4) in the blocking element (2),

wherein the radiating element (3) is arranged after the blocking element (2) with respect to an extension direction extending from the blocking element (2) towards the radiating element (3);

wherein at least one region of the radiating element (3) is uncovered by the at least one unblocking region (4) of the blocking element (2), whereby the least one security element (7) is formed;

wherein the blocking element (2) is configured to block impinging electromagnetic radiation constituting a blocking element spectrum (RB),

wherein the radiating element (3) is configured to emit electromagnetic radiation constituting a radiating element emission spectrum (REM) upon irradiation of electromagnetic radiation constituting a radiating element excitation spectrum (REX), the radiating element excitation spectrum (REX) differing from the radiating element emission spectrum (REM),

characterized in that the blocking element (2) and the radiating element (3) are further configured such,

- i) that the blocking element spectrum (RB) essentially corresponds to the radiating element excitation spectrum (REX), or
- ii) that the blocking element spectrum (RB) essentially corresponds to the radiating element emission spectrum (REM).

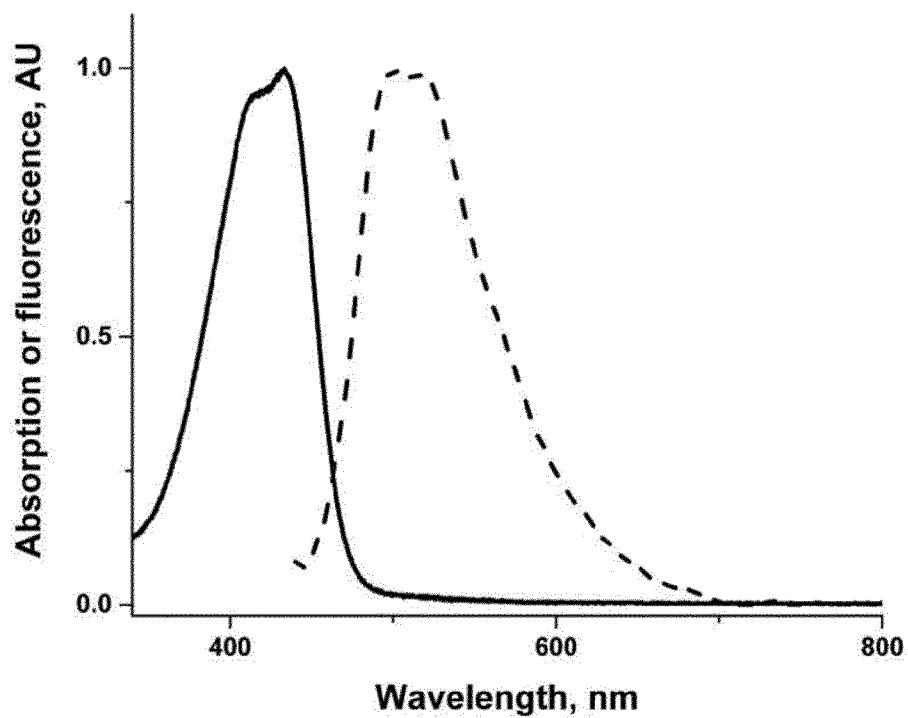


FIG. 1

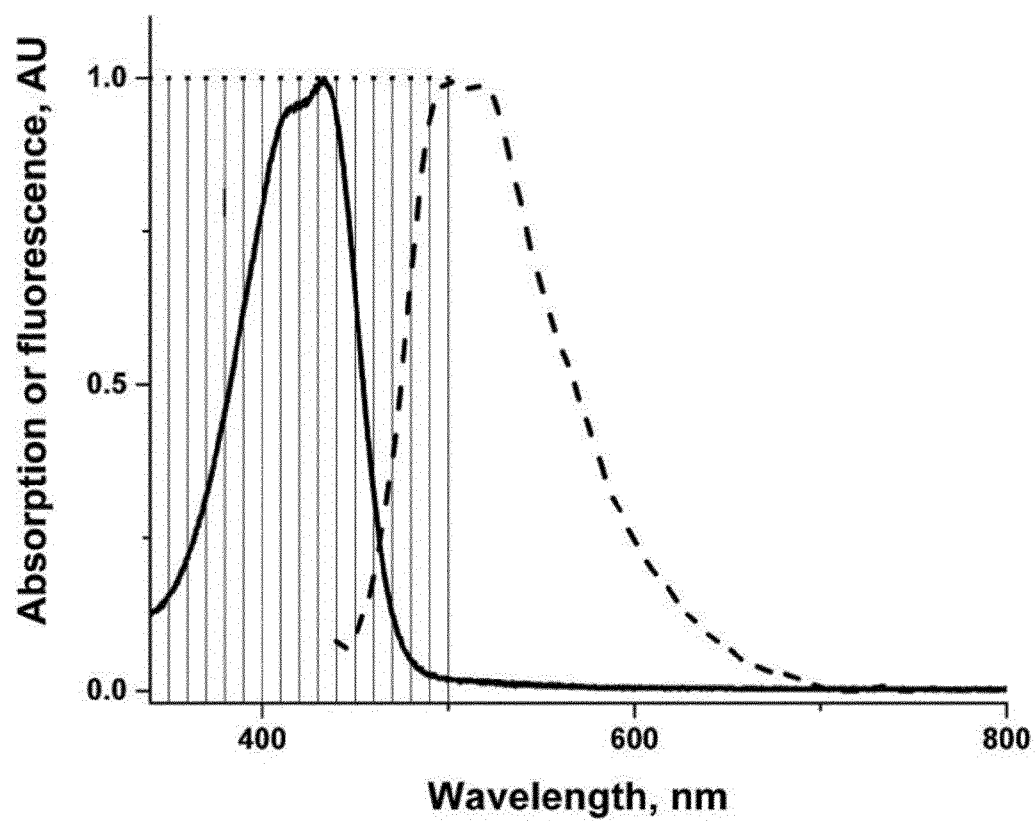


FIG. 2

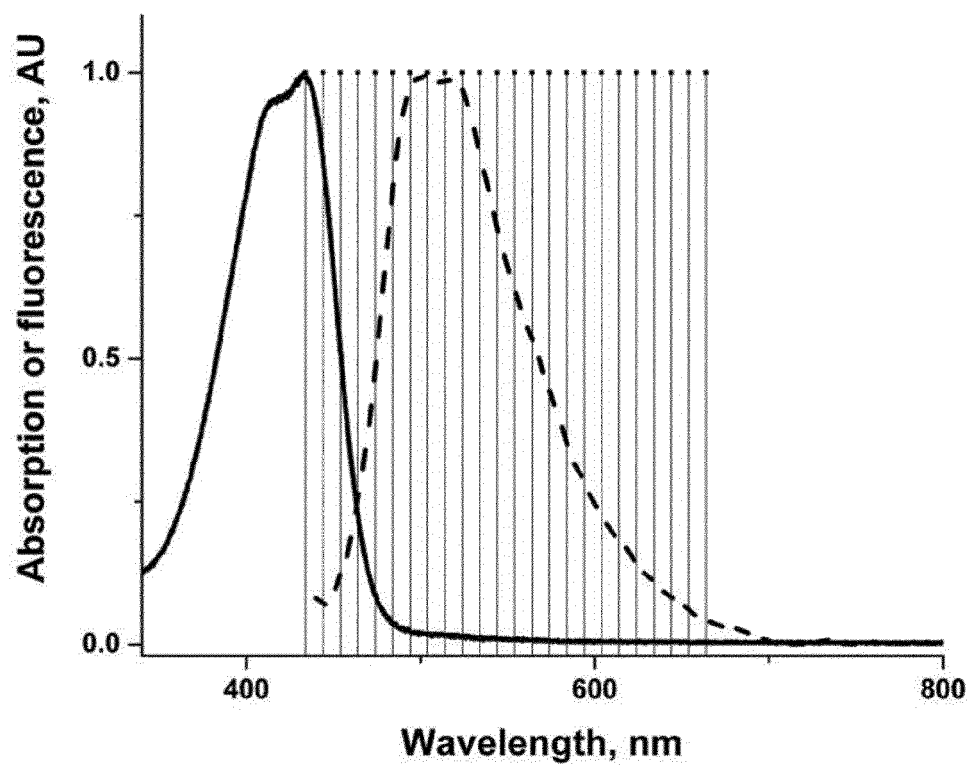


FIG. 3

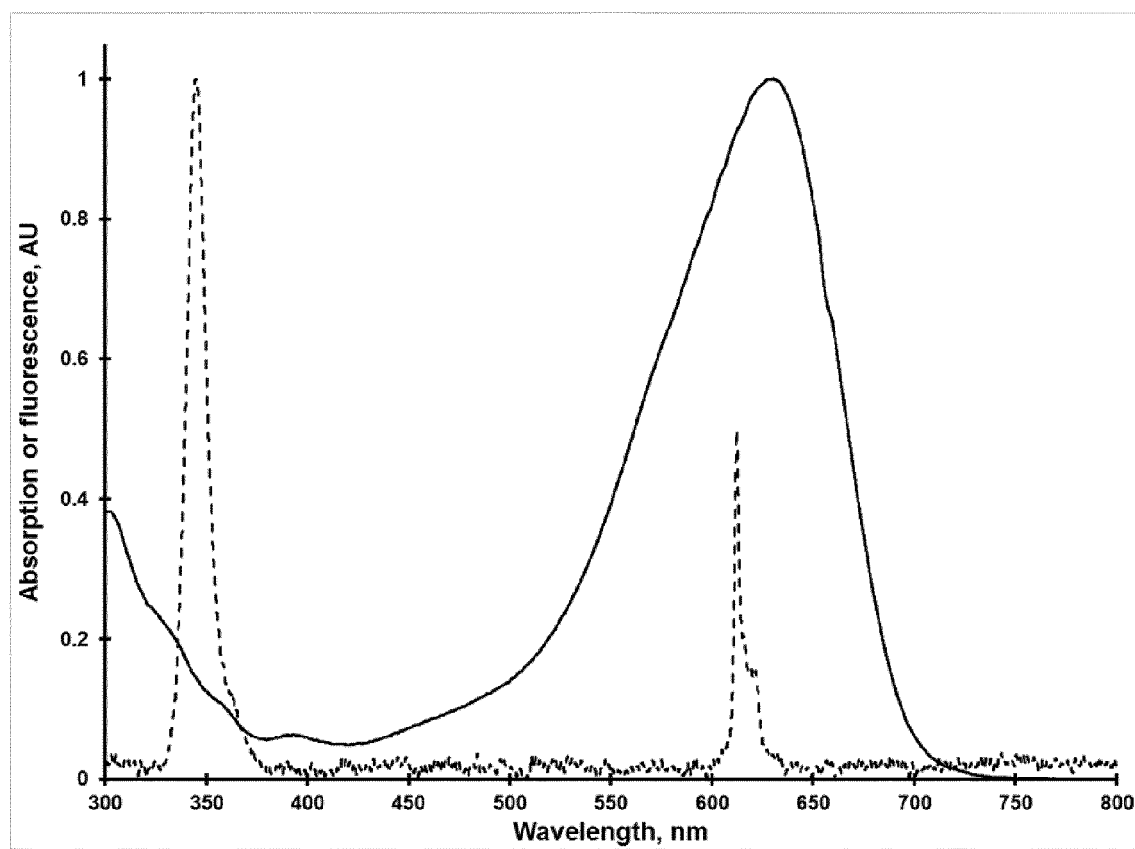
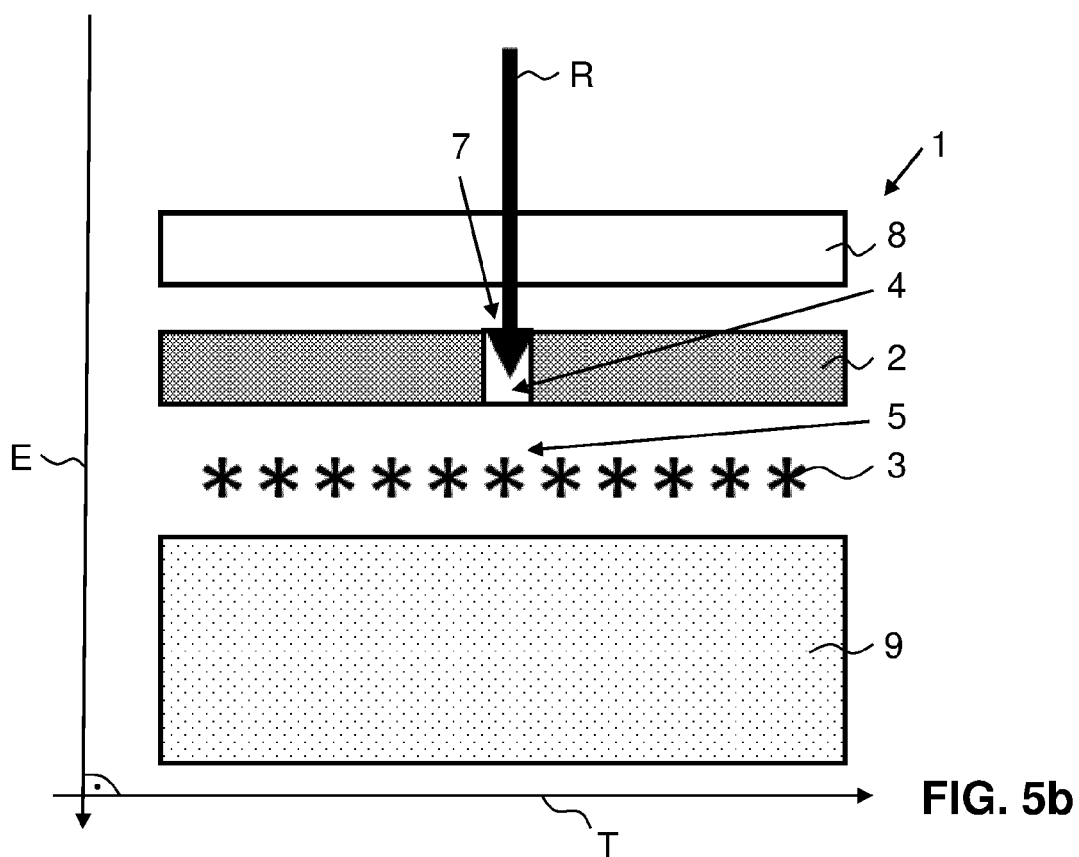
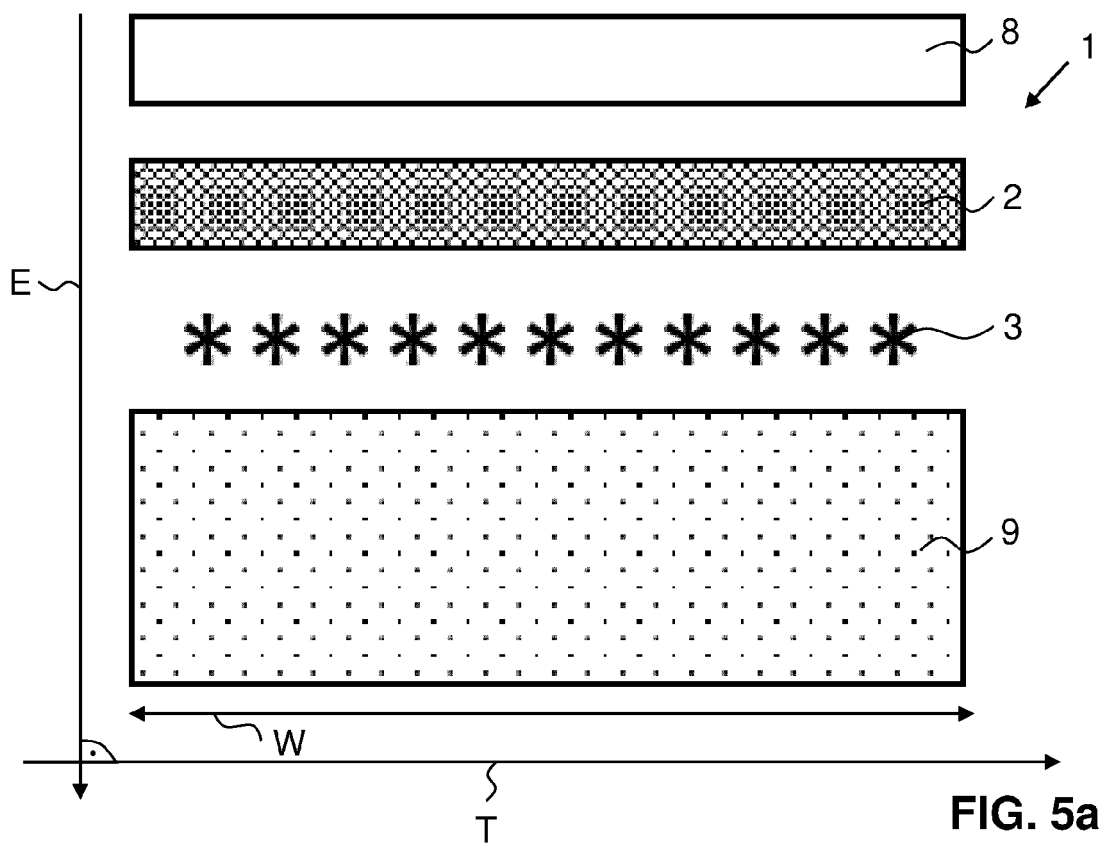
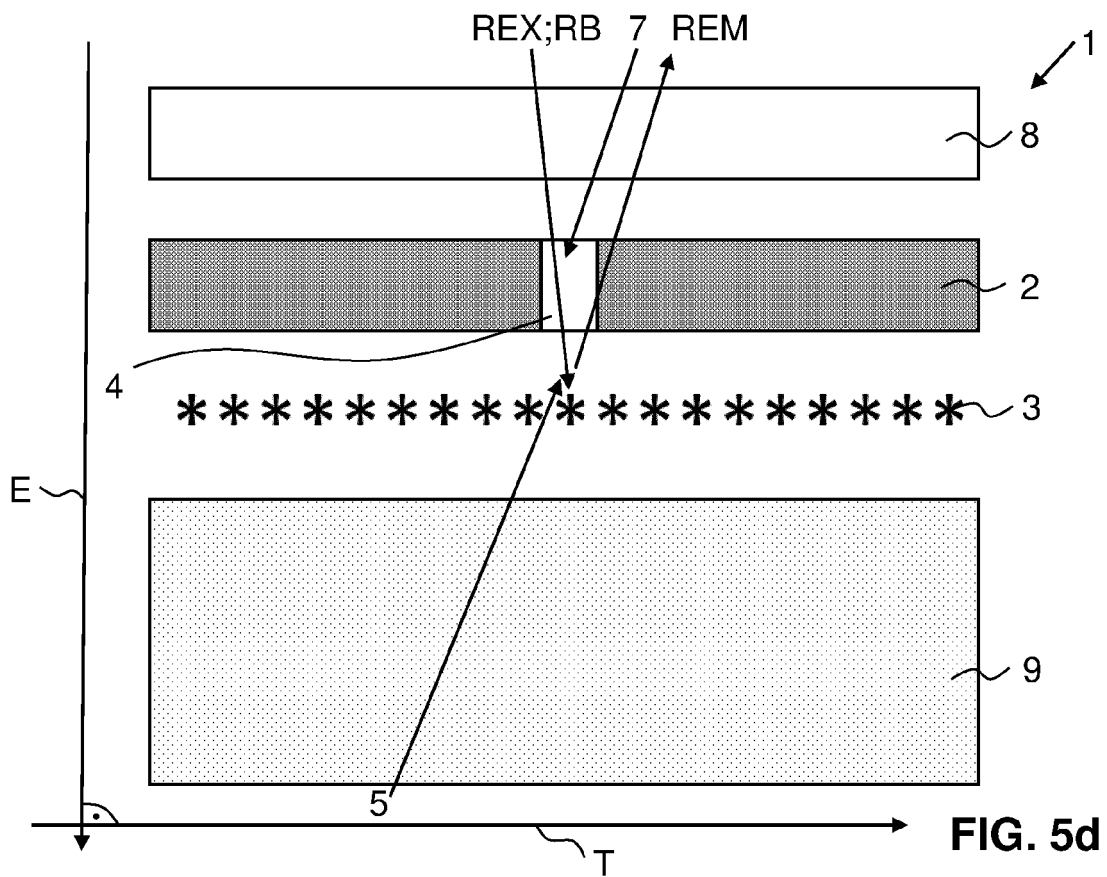
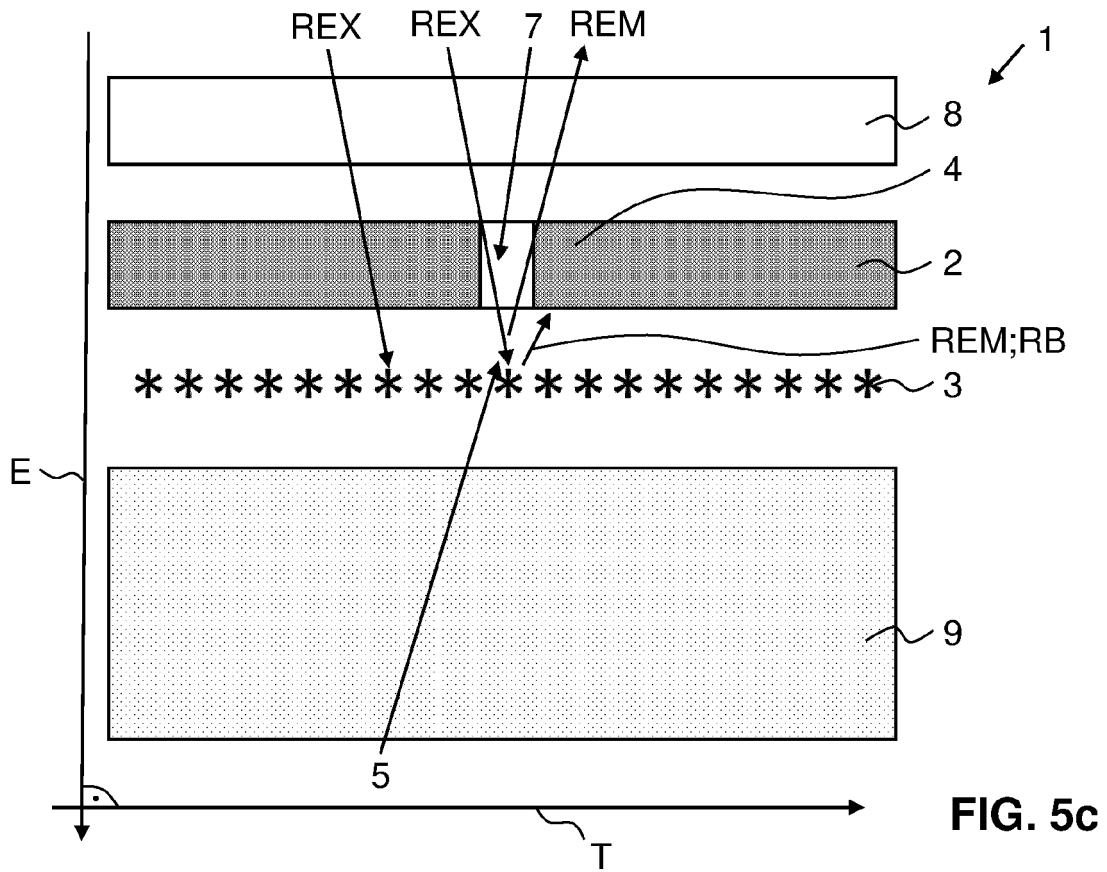


FIG. 4





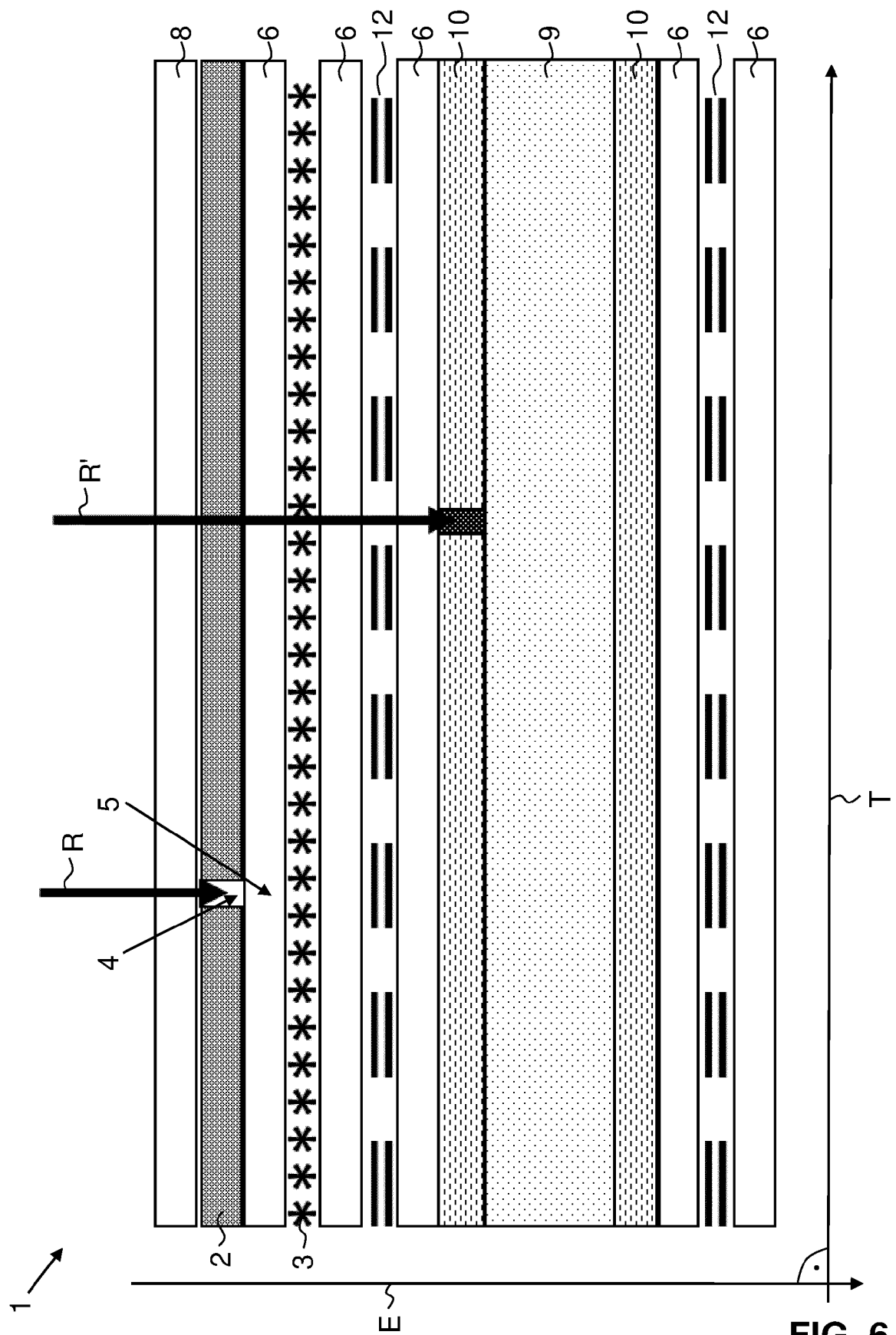


FIG. 6

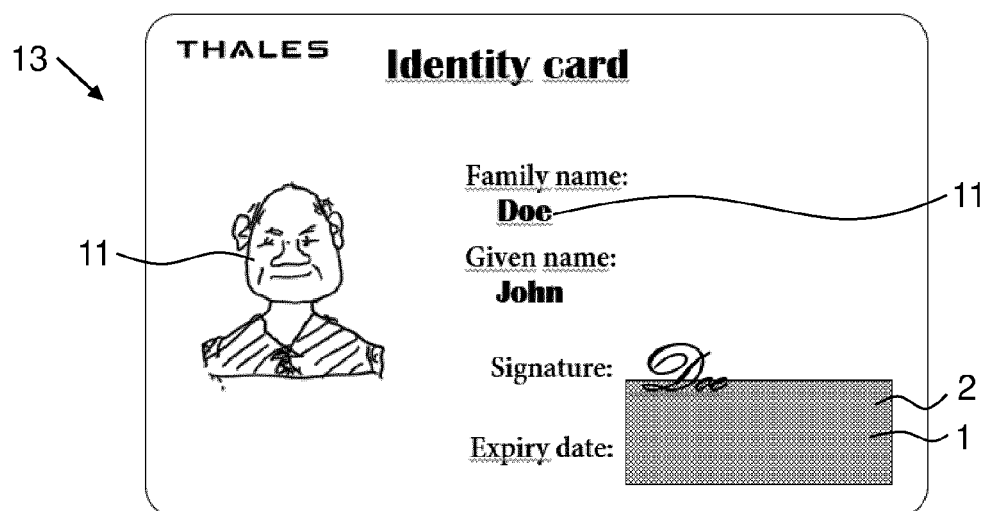


FIG. 7a

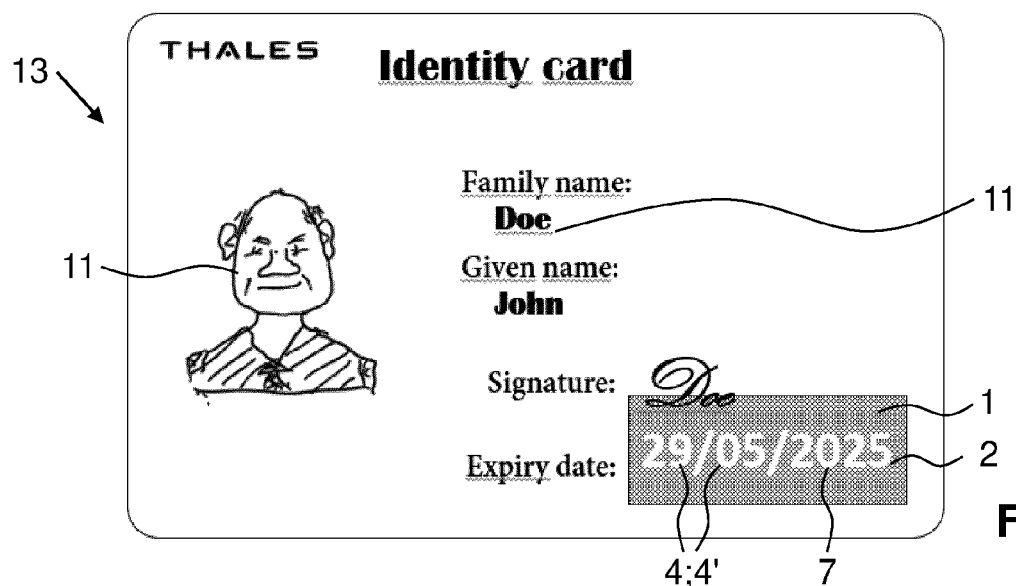


FIG. 7b

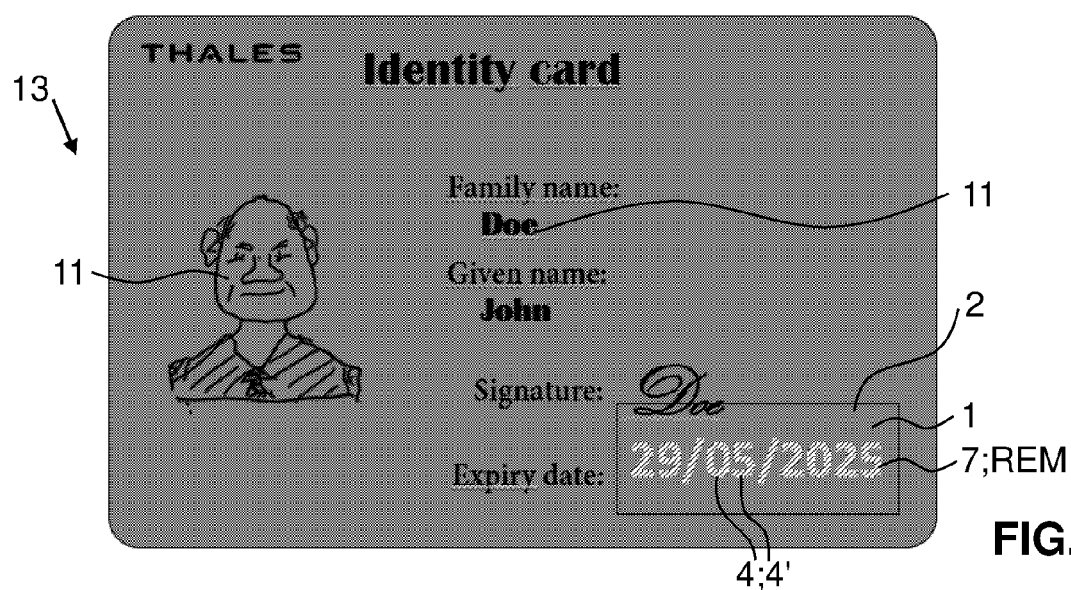


FIG. 7c

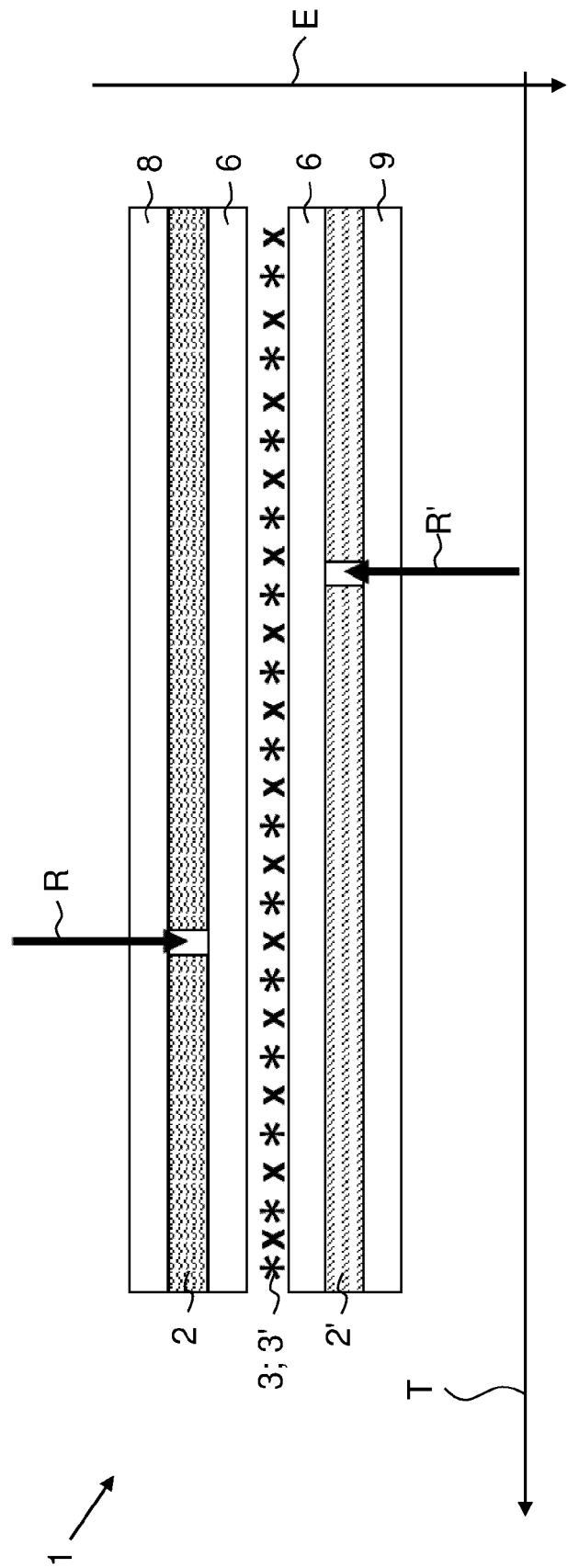


FIG. 8

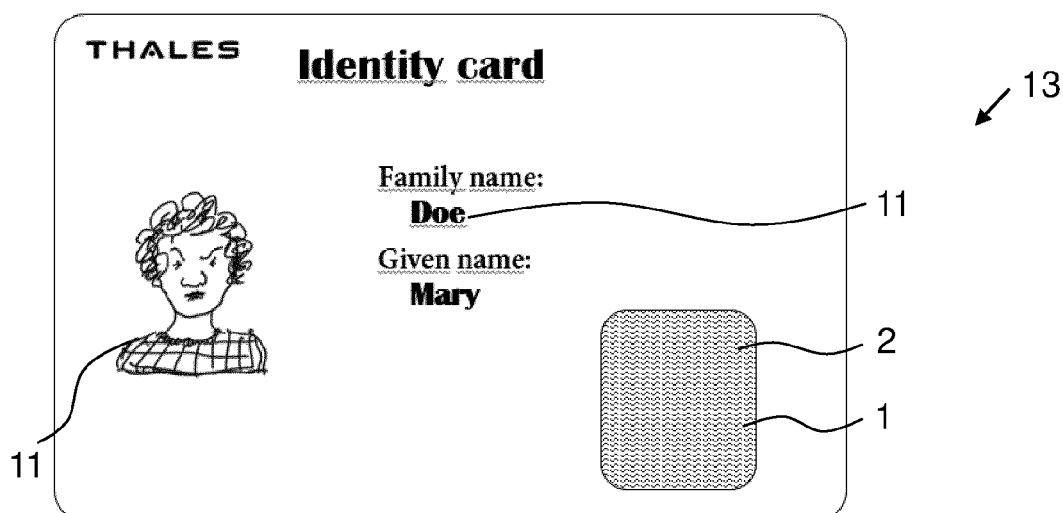


FIG. 9a

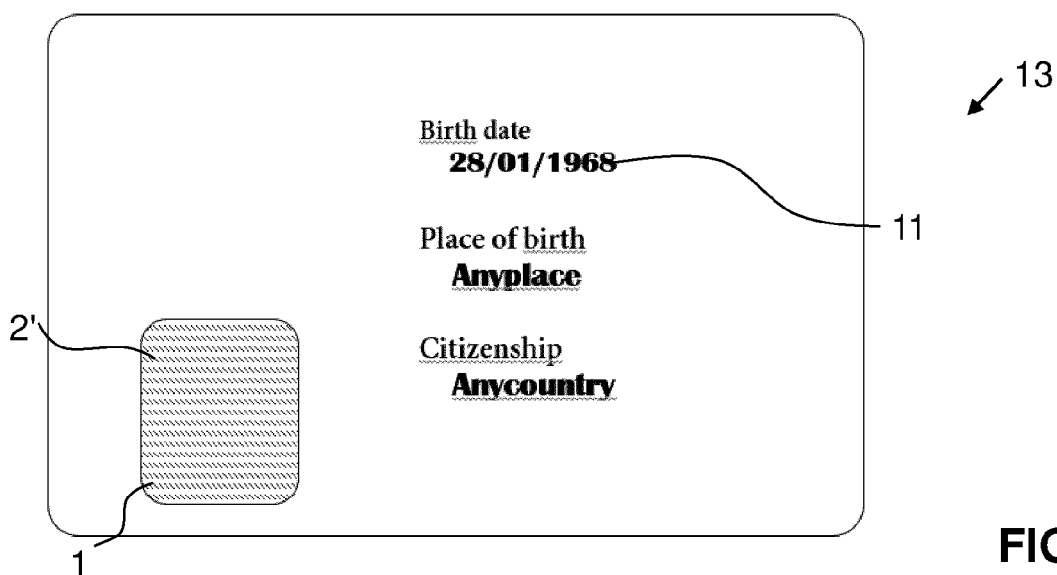


FIG. 9b

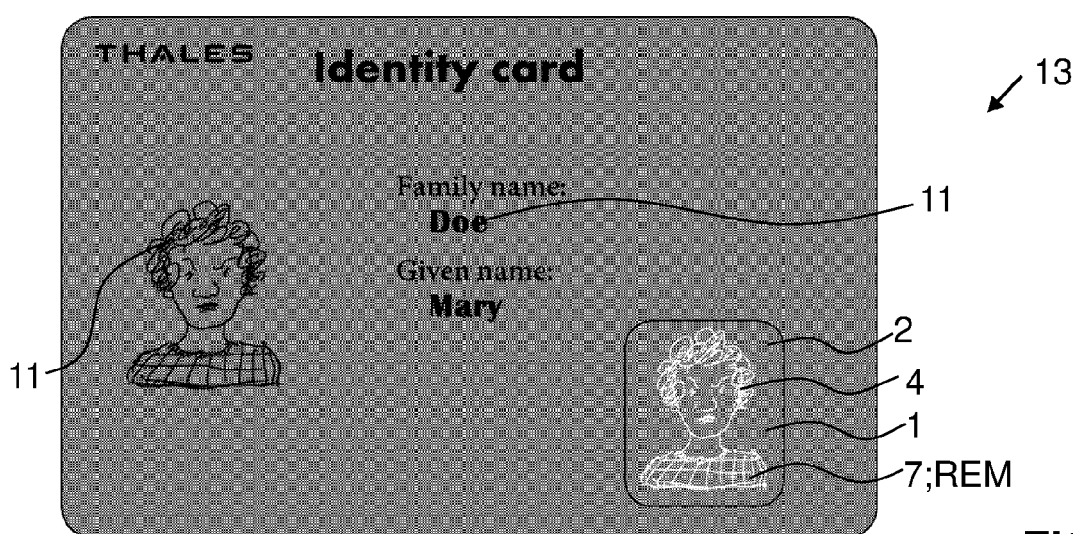


FIG. 9c

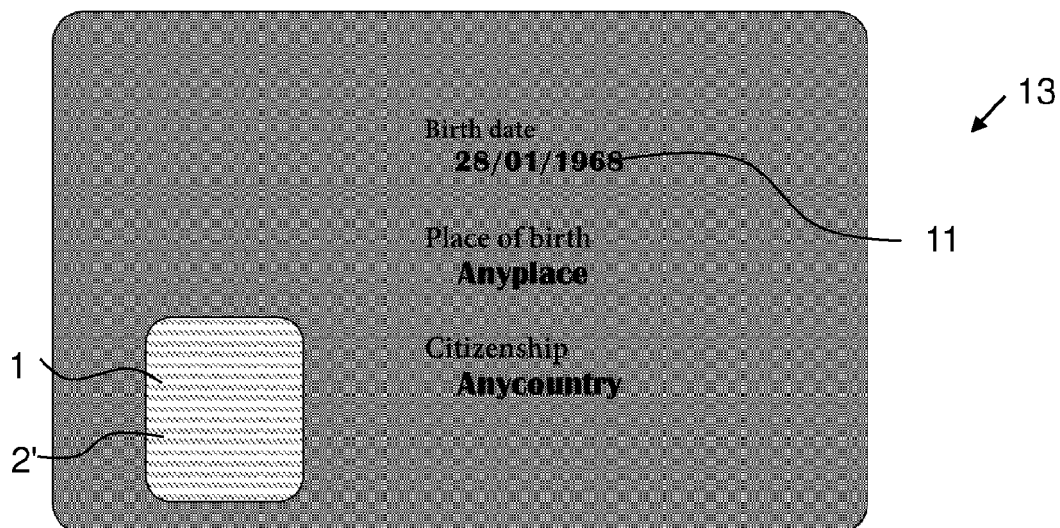


FIG. 9d

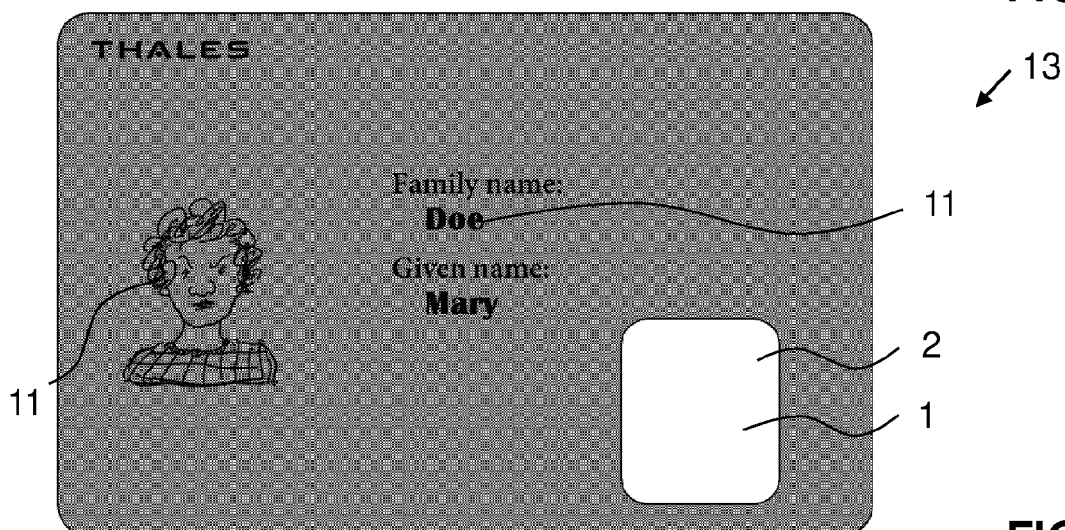


FIG. 9e

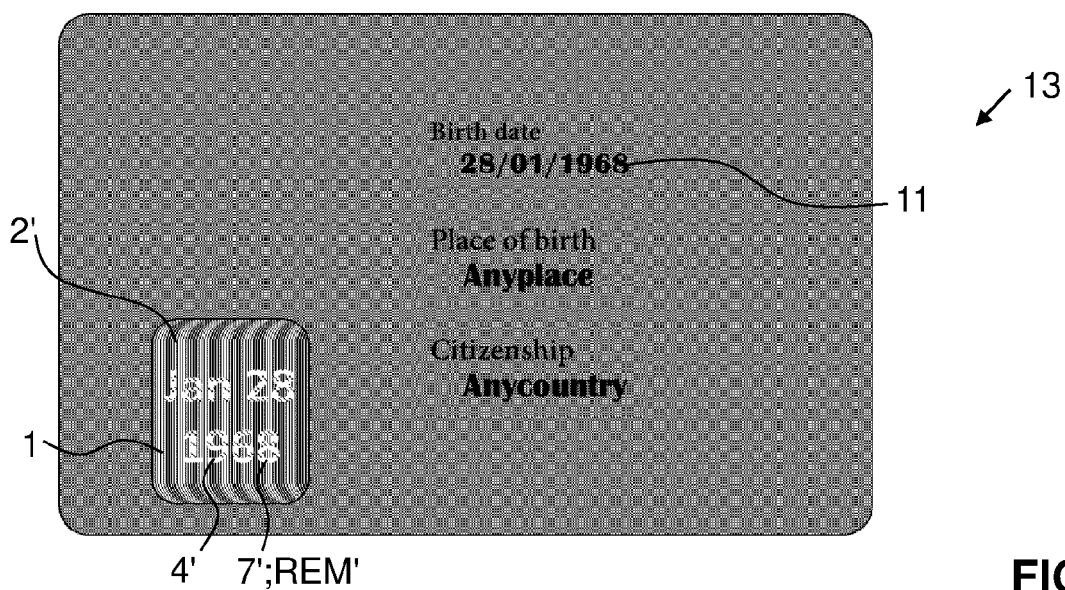


FIG. 9f



EUROPEAN SEARCH REPORT

Application Number
EP 19 30 6768

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2017/005633 A1 (BUNDESDRUCKEREI GMBH [DE]) 12 January 2017 (2017-01-12) * page 5, line 1 - page 44, line 33; claims 1-12; figures 1-8 *	1-6,8,9, 12-15	INV. B42D25/387 B42D25/382 B42D25/346 B42D25/351 B42D25/309 B42D25/23 B42D25/24 B42D25/41 B42D25/435 B42D25/45 B42D13/00
X	EP 3 578 380 A1 (GIESECKE DEVRIENT CURRENCY TECH GMBH [DE]) 11 December 2019 (2019-12-11) * paragraph [0004] - paragraph [0094]; claims 1-16; figures 1-11 *	1-6,8, 14,15	
X	WO 2019/081984 A2 (ASSA ABLOY AB [SE]) 2 May 2019 (2019-05-02) * paragraph [0008] - paragraph [0046]; claims 1-21; figures 1-3 *	1-5,8,9, 14,15	
X	WO 2016/096285 A1 (GEMALTO SA [FR]) 23 June 2016 (2016-06-23) * page 3, line 29 - page 31, line 3; claims 1-15; figures 1-14 *	1-8, 12-15	
X	WO 2014/111405 A1 (BUNDESDRUCKEREI GMBH [DE]) 24 July 2014 (2014-07-24) * page 2, line 31 - page 25, line 17; claims 1-12; figures 1-8 *	1-6,8,9, 14,15	TECHNICAL FIELDS SEARCHED (IPC) B42D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 3 July 2020	Examiner Seiler, Reinhold
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 30 6768

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

03-07-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2017005633 A1	12-01-2017	DE 102015212492 A1	05-01-2017
		EP 3317114 A1	09-05-2018
		WO 2017005633 A1	12-01-2017
EP 3578380 A1	11-12-2019	DE 102018004439 A1	05-12-2019
		EP 3578380 A1	11-12-2019
WO 2019081984 A2	02-05-2019	AR 113409 A1	29-04-2020
		US 2019126661 A1	02-05-2019
		WO 2019081984 A2	02-05-2019
WO 2016096285 A1	23-06-2016	EP 3034318 A1	22-06-2016
		EP 3233515 A1	25-10-2017
		WO 2016096285 A1	23-06-2016
WO 2014111405 A1	24-07-2014	DE 102013200895 A1	24-07-2014
		EP 2945808 A1	25-11-2015
		WO 2014111405 A1	24-07-2014

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 20050098636 A1 [0003]
- EP 2424735 B1 [0004]