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(54) **SECURITY ELEMENT WITH LIGHT SCATTERING ELEMENT**

(57) A data carrier (1) for a secure article (10) extends along an extension direction (E) and along a transverse direction (T) extending perpendicularly to the extension direction (E) and comprises at least one light guiding element (2) and at least one security element (3). The light guiding element (2) is configured to guide light such that light illuminating the light guiding element (2) is guided along the light guiding element (2). The light guiding element (2) and the security element (3) are arranged such, that light being guided along the light guiding element (2) is illuminating the security element (3). The security element (3) comprises or consists of at least one light scattering element (4) being configured to scatter light upon an illumination with light by the light guiding element (2).

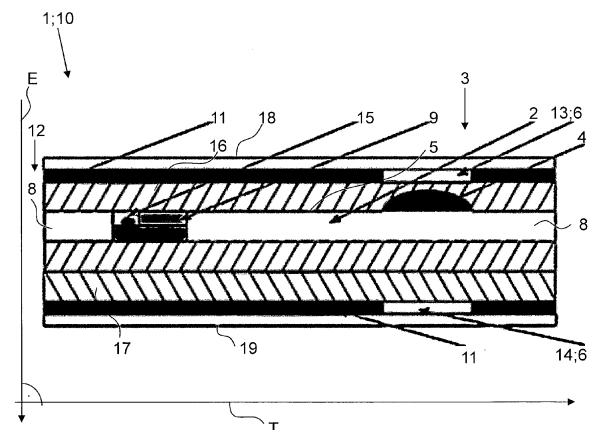


FIG. 1

Description

TECHNICAL FIELD

- 5 **[0001]** The present invention relates to a data carrier according to claim 1, to a secure article comprising or consisting of such a data carrier according to claim 14, and to a method of producing such a data carrier according to claim 15.

PRIOR ART

- 10 **[0002]** Data carriers for secure articles such as smart cards are susceptible to forgery. Various types of security elements exist that serve the purpose of protecting the data carriers against forgery. For instance, data carriers that provide a visual feedback such as an illumination have been developed. However, many data carriers provide insufficient protection such as insufficient illumination.

15 SUMMARY OF THE INVENTION

[0003] It is an object of the present invention to provide a data carrier that provides increased security against forgery.

- [0004]** This object is achieved with a data carrier according to claim 1. In particular, a data carrier for a secure article is provided, wherein the data carrier extends along an extension direction and along a transverse direction extending perpendicularly to the extension direction. The data carrier comprises at least one light guiding element and at least one security element. The light guiding element is configured to guide light such that light illuminating the light guiding element is guided along the light guiding element. The light guiding element and the security element are arranged such, that light being guided along the light guiding element is illuminating the security element. The security element comprises or consists of at least one light scattering element being configured to scatter light upon an illumination with light by the light guiding element.

- [0005]** That is, upon an illumination of the light guiding element with light, said light is preferably guided along the light guiding element. A direction along which the light is guided preferably depends on an orientation of the light guiding element within the data carrier. For instance, and as will be explained in greater detail further below, the light guiding element can be extending along the transverse direction of the data carrier. In this case, the light being guided along the light guiding element is preferably guided along the transverse direction of the data carrier as well. It should be noted that that said guiding of light by the light guiding element can be in a directed manner or in an undirected manner. That is, the light guiding element is preferably configured to allow the light to go through it and could be, for instance, simply a transparent layer, see also further below. In other words, the light guiding element can be seen as a being configured to pass light in order to illuminate the security element. That is, the light guiding element is preferably configured to illuminate the security element, in particular the light scattering element. That is, light that is guided along the light guiding element is preferably illuminating the light scattering element. Hence, light being guided along the light guiding element is preferably incident on the light scattering element, whereby the light scattering element is illuminated. Upon illumination, the light scattering element is configured to scatter said incident light. In other words, the light scattering element is configured to generate scattered light.

- [0006]** Said scattered light is preferably detectable, for instance by an observer of a data carrier or by a detection device. As such, it is preferred that the data carrier is preferably configured such that the scattered light can reach an outside of the data carrier. Being detectable by an observer means that the observer perceives, in particular sees, the scattered light. The observer can be a security officer of the like. Being detectable by a detection device means that the scattered light is detected by a physical device such as a camera.

- 45 **[0007]** In any case, said scattered light preferably serves the purpose of verifying the authenticity of the data carrier. In fact, if the security element emits scattered light upon an illumination of the light guiding element, the presence of said scattered light is indicative of the authenticity of the data carrier.

- [0008]** To this end it is conceivable that the security element consists of at least one light scattering element. In other words, the light scattering element can provide or form the security element. In this case, any statements made with regard to the light scattering element as such likewise apply to the security element and vice versa. However, it is likewise conceivable that the security element comprises further component(s), in particular at least one masking element that will be described in greater detail below, and wherein said further component(s) together with the light scattering element provide the security element.

- 50 **[0009]** The security element, in particular the light scattering element, preferably comprises or consists of a print that is preferably printed on the light guiding element, in particular on a surface of the light guiding element.

- 55 **[0010]** The security element, in particular the light scattering element, preferably comprises or consists of a light scattering ink and/or light scattering particles. Additionally or alternatively, the security element, in particular the light scattering element, is preferably transparent and/or photochromic.

[0011] That is, the light scattering element can comprise a light scattering ink. The light scattering ink preferably is a commercially available ink such as Eptaink LDI. The light scattering ink may be invisible or transparent in natural or artificial light condition or without any illumination by the light guiding element, but can be configured to diffusively scatter upon illumination. As such, a light scattering element can be provided that is naked to the bare eye unless when being illuminated with light. It is likewise conceivable that the light scattering ink is composed of at least two non-miscible liquids that create micelles that are configured to scatter incident light. Other light scattering inks are likewise conceivable, for instance a photoluminescent ink. Additionally or alternatively, it is likewise conceivable that the light scattering element comprises light scattering particles such as nanoparticles that scatter impinging light. Various particles or nanoparticles are conceivable such as metals, metalloids or metal oxides, for example gold, silver, or silicon. Other particles or nanoparticles are however likewise conceivable, for instance non metallic or non-oxyde materials. In particular, a size of the particles is preferably such that they are configured to scatter the impinging light. As such, it is preferred that the particles are nanoparticles, i.e. have a size in the nanometer regime. A photochromic security element preferably comprises or consists of a photochromic ink. That is, the security element can be configured sensitive to illumination by a particular wavelength or wavelength region. The light scattering element is preferably configured to direct scattered light, for example, towards an outside of the data carrier or, and as will be explained in greater detail below, towards further components of the security element such as a masking element. Said direction of scattered light by the light scattering element could be caused by Mie scattering or Rayleigh scattering, for instance. In the event of the light scattering element comprising or consisting of a photoluminescent ink, the light scattering element is preferably configured to scatter incident light by 360°. The light scattering element can be configured such that it scatters impinging light of particular wavelengths only. In other words, depending on a wavelength of the impinging light at least part of said impinging light is not scattered by the light scattering element but, for instance, absorbed. Additionally or alternatively, the light scattering element can be configured such that a wavelength of the scattered light being scattered by the light scattering element differs from a wavelength of the light being incident on the light scattering element. For instance, light being impinging on the light scattering element could have the colour green, whereas the light scattering element scatters light of the colour red.

[0012] The light guiding element is preferably transparent. Additionally or alternatively, the light guiding element preferably comprises or consists of at least one polymer, preferably a thermoplastic polymer and/or a transparent polymer such as polyethylene terephthalate (PET), polyvinyl chloride (PVC), or polycarbonate (PC).

[0013] That is, the light guiding element particularly preferably comprises or consists of a transparent polymer, in particular a transparent thermoplastic polymer.

[0014] Upon illumination with light, the light guiding element is preferably configured to guide said light along the transverse direction of the data carrier.

[0015] The light is preferably guided along the light guiding element via internal reflection of the light within the light guiding element. In fact, the light is preferably reflected on surfaces of the light guiding element, in particular on a top surface and an opposing bottom surface of the light guiding element.

[0016] At least some of the light is preferably reflected through one or more surfaces of the light guiding element, in particular the top and/or bottom surface of the light guiding element, and wherein said reflected light is preferably illuminating the light scattering element.

[0017] The light guiding element is preferably provided as a layer that extends along the transverse direction of the data carrier. Additionally or alternatively, the security element, in particular the light scattering element, is preferably provided as a layer that extends along the transverse direction.

[0018] That is, the light guiding element can be provided in the form of a layer. Said layer preferably defines a top surface and an opposing bottom surface. It is furthermore preferred that the layer extends along the transverse direction of the data carrier, wherein the light being guided along the light guiding element will be guided along the transverse direction as well. Said layer could be a polymer layer as mentioned earlier.

[0019] The security element, in particular the light scattering element, can have the shape of a layer as well. For instance, a light scattering ink could be printed in the form of a layer. It is furthermore preferred that the security element, in particular the light scattering element, in the form of the layer defines a top surface and an opposing bottom surface and/or extends along the transverse direction of the data carrier.

[0020] The data carrier preferably comprises a transparent region. The security element, in particular the light scattering element, is preferably at least partially arranged on and/or in said region. Additionally or alternatively, the light guiding element is preferably arranged at least partially on and/or in said region.

[0021] That is, the data carrier preferably comprises a transparent region. Within the field of the card industry, said transparent region is commonly referred to as a clear window, i.e. one or more transparent materials, typically transparent polymers such as those used in a carrier body.

[0022] That is, said transparent region is preferably at least partially arranged, in particular provided, by a carrier body. Hence, the data carrier preferably comprises a carrier body. The carrier body preferably comprises or consists of at least one polymer, preferably a thermoplastic polymer and/or a transparent polymer, the at least one polymer particularly preferably being polyvinyl chloride and/or polyethylene terephthalate and/or recycled polyvinyl chloride (rPVC) and/or

recycled polyethylene terephthalate (rPET) and/or polylactic acid (PLA). That is, the carrier body can comprise or consist of recycled materials. It is likewise conceivable that the carrier body comprises or consists of bio-sourced materials. Additionally or alternatively, the carrier body preferably comprises or consists of one or more layers. If two or more layers are present said layers are preferably arranged above one another, particularly preferably stacked, when seen along the extension direction. The extension direction can be seen as vertical direction and the transverse direction can be seen as horizontal direction. To this end, it is preferred that the carrier body comprises or consists of one or more layers of one or more polymers. In fact, the carrier body preferably corresponds to a multi-layer structure. The layers of the carrier body are preferably connected to one another by a lamination process as it is known in the art as well.

[0023] The light guiding element and/or the security element, in particular the light scattering element, are preferably at least partially arranged on and/or in the carrier body. For example, the light guiding element can be arranged such as embedded within the carrier body. In particular, the light guiding element can be part of the carrier body. Namely, and as mentioned earlier, the light guiding element could be a polymer layer, and wherein it is conceivable that said polymer layer forms part of the carrier body. In other words, the transparent region can partially or entirely comprise the light guiding element. Again in other words, the light guiding element can partially or entirely extend through the transparent region and/or form the transparent region. Likewise, the security element, in particular the light scattering element, could be arranged such as embedded within the carrier body for instance by printing a light scattering ink onto the light guiding element in the form of the polymer layer that forms part of the carrier body. However, it is likewise conceivable that the light guiding element and/or the security element are provided at least partially outside of the carrier body. For instance, the light guiding element could be arranged as an additional layer that is arranged above the carrier body with respect to the extension direction, and wherein said additional layer is glued or otherwise attached to the carrier body. Likewise, the security element such as the light scattering element could be printed on the light guiding element in the form of the separate polymer layer being arranged outside of the carrier body and thereby be arranged outside as well. Within the field of the card industry said carrier body is commonly referred to as card body.

[0024] The light guiding element is preferably arranged so as to be illuminated by an external light source being provided outside of the data carrier. Additionally or alternatively, the data carrier preferably comprises at least one edge region being in connection with and/or being at least partially provided by the light guiding element, said edge region being at least partially transparent.

[0025] That is, the light guiding element is preferably arranged within the data carrier such that it can be illuminated with an external light source from an outside of the data carrier. In other words, an illumination of the light guiding element and thus the generation of the scattered light by the light scattering element can take place from an outside of the data carrier. The external light source can be a flashlight, a lamp of mobile phone, etc. that allows an illumination of the light guiding element.

[0026] The light guiding element is preferably illuminated through the at least partially transparent edge region. That is, the data carrier preferably comprises side edges extending along the extension direction, and wherein a number of side edges depends on a shape of the data carrier. For instance, if the data carrier has a square or rectangular shape it has four side edges. The term "side edge" thus refers to a surface that runs from a top side of the data carrier to a bottom side of the data carrier along the extension direction and provides a thickness of the data carrier. A region of the data carrier that comprises a side edge of the data carrier is understood as an edge region of the data carrier. One or more of said edge regions can be at least partially transparent. That is, when seen along the extension direction of the data carrier only part of the edge region can be transparent, for instance a middle part of the edge region, wherein a part above and below said middle region can be non-transparent such as opaque. However, it is likewise conceivable that not only a part such as the middle part is transparent but that the entire edge region is transparent. The transparent edge region in any case serves the purpose of allowing light from an external light source to enter the data carrier, in particular the light guiding element. To this end it is conceivable that the data carrier comprises at least one transparent edge region that is in connection with the light guiding element. For instance, the transparent region or clear window mentioned earlier could be arranged in the edge region of the data carrier or any other transparent material that has the ability to guide the light from the external light source into the light guiding element. Additionally or alternatively, it is likewise conceivable that the edge region is at least partially provided by the light guiding element. For instance, the light guiding element can be arranged in the data carrier such as to extend from the side edge of the data carrier at least partially into the data carrier, and wherein the light guiding element in the region of the edge region of the data carrier forms the edge region.

[0027] The data carrier preferably further comprises at least one internal light source that is configured to illuminate the light guiding element. The internal light source preferably is an LED module. Additionally or alternatively, the internal light source is preferably configured to be passively powered for instance upon communication of the data carrier with a remote device.

[0028] That is, the data carrier can comprise an internal light source that forms part of the data carrier. Said internal light source can be provided in addition or in the alternative to the ability of the data carrier to be illuminated with an external light source as described above.

[0029] The internal light source preferably is an LED module. The internal light source, in particular the LED module, is

preferably passively powered. Said internal light source is preferably powered by RFID upon usage of the data carrier, when the data carrier is communicating with a remote device such as an RF reader or the like. A passive powering of the internal light source by RFID can be achieved by providing an antenna exhibiting RF performance. That is, the data carrier preferably comprises a radio-frequency (RF) antenna. The RF antenna is preferably in connection with such as connected to the internal light source such as the LED module. The antenna is preferably configured to communicate with the remote device being arranged remotely from the data carrier in a wireless manner, in particular via electromagnetic radiation such as the just-mentioned radio waves. The antenna is preferably configured to power the internal light source upon its communication with the remote device. Thus, the remote device preferably is configured to emit electromagnetic radiation, in particular radio waves. The remote device particularly preferably corresponds to an RF reader as it is known in the field of the art. Other RFID devices are likewise conceivable and well-known in the state of the art. For instance, the data carrier could comprise a transponder module exhibiting RF performance, wherein the principle of operation is a just described. That is, the data carrier preferably lacks a source of energy such as a battery in order to power the light source. Nevertheless, the data carrier can comprise a source of energy such as a battery to power the internal light source. Moreover, sources other than RFID sources for lighting the internal light source are likewise conceivable. For example, the data carrier could comprise at least one capacitive sensor that is in connection with the internal light source and which powers the internal light source upon the capacitive sensing of a finger touching the capacitive sensor. Said capacitive sensor is preferably a fingerprint sensor module as it is known in the art and which provides the data carrier with a fingerprint recognition.

[0030] The security element, in particular the light scattering element, is preferably arranged at least partially overlapping with the light guiding element when seen along the extension direction of the data carrier.

[0031] That is, when seen along the extension direction of the data carrier the security element, in particular the light scattering element, is preferably arranged above or below the light scattering element. That is, when the extension direction is seen as vertical direction of the data carrier, a vertical position of the security element and a vertical position of the light guiding element preferably differ from one another. With respect to the horizontal direction, it is however preferred that a horizontal position of the security element and a horizontal position of the light guiding element are at least partially coinciding.

[0032] The light scattering element is preferably arranged directly on the light guiding element, in particular on a surface of the light guiding element. Alternatively, the light scattering element is preferably arranged at a distance from the light guiding element with respect to the extension direction.

[0033] The security element, in particular the light scattering element, being directly arranged on the light guiding element is preferably arranged such as printed on the top surface and/or the bottom surface of the light guiding element. In this case a surface contact is preferably established between the surface of the security element, in particular the light scattering element, and the surface of the light guiding element.

[0034] However, it is likewise conceivable that the security element, in particular the light scattering element, and the light guiding element are arranged separated from one another with respect to the extension direction of the data carrier. In this case it is preferred that one or more transparent components, in particular one or more transparent layers such as transparent polymer layers of a carrier body or card body are arranged between the security element and the light guiding element with respect to the extension direction, see further below.

[0035] The light guiding element preferably extends partially or entirely along the transverse direction of the data carrier. Additionally or alternatively, the security element, in particular the light scattering element, preferably extends at partially or entirely along the transverse direction of the data carrier.

[0036] That is, a width of the light guiding element can be equal to or smaller than a width of the data carrier when seen along the transverse direction. Likewise, a width of the security element, in particular of the light scattering element, can be equal to or smaller than a width of the data carrier when seen along the transverse direction. It is furthermore preferred that a width of the security element, in particular of the light scattering element, is equal to or smaller than a width of the light guiding element when seen along the transverse direction. In other words, a spatial expansion of the light guiding element and/or of the security element, in particular of the light scattering element, can be equal to or smaller than the width or spatial expansion of the width of the data carrier along the transverse direction.

[0037] The security element preferably comprises at least one masking element. The masking element is preferably at least partially overlapping the light scattering element with respect to the extension direction. The masking element is preferably configured to block part of the light being scattered by the light scattering element towards an outside of the data carrier. Additionally or alternatively, the masking element is preferably at least partially overlapping the light guiding element with respect to the extension direction and is configured to block part of the light being guided along the light guiding element towards an outside of the data carrier. Additionally or alternatively, the masking element is preferably configured to be at least regionally illuminated by the light guiding element and/or the light scattering element.

[0038] In this case, the security element is preferably provided by the combination of the light scattering element and the masking element. The masking element is preferably configured to absorb part of the light being scattered by the light scattering element and/or being guided along the light guiding element. The masking element preferably is opaque. The

masking element can be a print, a metallic foil or the like. For example, the masking element can be an opaque ink that is printed on a surface of one of the layers of the carrier body mentioned earlier. The masking element is preferably illuminated with the scattered light of the light scattering element. In this case, the light scattering element can merely serve the purpose of an illuminable element that illuminates the masking element which can be of any shape, and wherein the masking element defines the actual shape of the security element. For example, the light scattering element can be provided as a squared layer and the masking element can define an image of the holder of the data carrier. That is, the masking element defining the actual shape of the security element can be patterned to block and permit passage of predetermined portions of the scatter light of the light scattering element to define the image and/or alphanumeric character. Additionally or alternatively, the masking element can serve the purpose of delimiting the light scattering element in order to define, for instance, a shape of the security element such as an alphanumeric character or image, see also further below. When seen along the extension direction and along the top side of the data carrier towards the bottom side of the carrier body, it is preferred that the light scattering element is arranged after the masking element, and that the light guiding element in turn is arranged after the light scattering element. In other words, the light scattering element is preferably arranged between the masking element and the light guiding element with respect to the extension direction. It is furthermore preferred that the masking element and/or the light scattering element and/or the light guiding element are at least partially overlapping with respect to the extension direction. That is, these elements are preferably arranged at least partially above one another, i.e. at least partially congruent, with respect to the extension direction.

[0039] The security element, in particular the light scattering element and/or the masking element, preferably has the shape of an image and/or of an alphanumeric character.

[0040] That is, the security element preferably has the shape of an image and/or of an alphanumeric character. Non-exhaustive examples of an image are a portrait or photograph or biometric information such as a fingerprint e.g. of a holder of the data carrier, an outline of a country, a state coat of arms, a state flag, a signature, geometric objects such as lines, circles, etc. Non-exhaustive examples of an alphanumeric character are a date of birth, a name, a social security number e.g. of the holder of the data carrier, an expiry date, etc. In the event that the light scattering element constitutes the security element, it is preferred that the light scattering element has the shape of an image and/or of an alphanumeric character. In the event of the security element additionally comprising the masking element, it is preferred that the masking element defines a shape in the form of an image and/or of an alphanumeric character. The data carrier can comprise at least one coating such as a back reflecting coating that serves the purpose of increasing a light yield of the data carrier. Additionally or alternatively, the data carrier can comprise an optical refractive index adaption being provided by at least two of its layers, wherein said adaption serves the purpose of increasing the light yield of the data carrier as well.

[0041] In another aspect, a secure article comprising or consisting of at least one data carrier as described above is provided. The secure article preferably is a smart card such as a banking card or an identify card, a passport, an electronic tag, a travel ticket or the like.

[0042] Any statements made herein regarding the data carrier *per se* preferably likewise apply to the secure article and vice versa.

[0043] At this point it should be understood that the data carrier *per se* can correspond to the secure article. For instance, the secure article can be an identity card, and wherein the data carrier itself provides the identity card, for example. However, it is likewise conceivable to introduce or incorporate the data carrier into a secure article. For example, the secure article can be a passport, and wherein the data carrier is incorporated into a page of the passport.

[0044] In another aspect, a method of producing a data carrier extending along an extension direction and along a transverse direction extending perpendicularly to the extension direction is provided. The data carrier preferably is a data carrier as described above. The method comprises the steps of i) providing at least one light guiding element, and ii) providing at least one security element. The light guiding element is configured to guide light such that light illuminating the light guiding element is guided along the light guiding element. The light guiding element and the security element are arranged such, that light being guided along the light guiding element is illuminating the security element. The security element comprises or consists of at least one light scattering element being configured to scatter light upon an illumination with light by the light guiding element.

[0045] Any explanations made herein regarding the data carrier *per se* or the secure article preferably likewise apply to the method of producing the data carrier and vice versa.

BRIEF DESCRIPTION OF THE DRAWINGS

[0046] Preferred embodiments of the invention are described in the following with reference to the drawings, which are for the purpose of illustrating the present preferred embodiments of the invention and not for the purpose of limiting the same. In the drawings,

Fig. 1 shows a cross-sectional view of a data carrier according to the invention;

Fig. 2a shows a top view of a data carrier according to the invention in the absence of an illumination with light;

Fig. 2b shows a top view of the data carrier according to figure 2a upon an illumination with light;
 Fig. 3a shows a photograph of data carriers according to the invention in the absence of an illumination and in the presence of illumination an illumination;
 Fig. 3b shows a photograph of data carriers according to the invention in the absence of an illumination and in the presence of illumination an illumination.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0047] Aspects of a secure article 10 comprising a data carrier 1 according to the invention shall now be illustrated with reference to the figures.

[0048] Figure 1 depicts a secure article 10 consisting of a data carrier 1 that extends along an extension direction E and along a transverse direction T extending perpendicularly to the extension direction E. The data carrier 1 comprises a light guiding element 2 and a security element 3.

[0049] The light guiding element 2 is configured to guide light such that light illuminating the light guiding element 2 is guided along the light guiding element, here along the transverse direction T of the data carrier 1. Moreover, the light guiding element 2 and the security element 3 are arranged such, that light being guided along the light guiding element 2 is illuminating the security element 3, see e.g. figures 2a to 3b. The security element 3 comprises a light scattering element 4 being configured to scatter light upon an illumination with light by the light guiding element 2.

[0050] In the example depicted in figure 1 the light guiding element 2 is provided as a transparent layer that extends entirely along the transverse direction T of the data carrier 1. The light scattering element 4 consists of a print that is printed on a surface 5 of the light guiding element 2 and extends partially along the transverse direction T of the data carrier 1. The security element 3, in particular the light scattering element 4, is arranged overlapping with the light guiding element 2 when seen along the extension direction E of the data carrier 1.

[0051] The data carrier 1 comprises transparent regions 6, and wherein the light scattering element 4 is at least partially arranged on and in said transparent regions 6. Said transparent regions 6 are provided by a carrier body 12, in particular by transparent layers 13, 14 of the carrier body 12 that extend partially along the transverse direction T. In fact, and as follows from figure 1, the data carrier 1 comprises a carrier body 12 that comprises several layers being arranged above one another when seen along the extension direction E.

[0052] As furthermore follows from figure 1, the light guiding element 2 is arranged so as to be illuminated by an external light source 7 being provided outside of the data carrier 1. In fact, the data carrier 1 comprises transparent edge regions 8 being provided by the light guiding element 2. Hence, by illuminating the data carrier 1 from said edge regions 8, the light is allowed to enter the light guiding element 2 and to pass through the light guiding element 2 in order to illuminate the security element 3, in particular the light scattering element 4.

[0053] In the depicted example the data carrier 1 further comprising an internal light source 9 in the form of an LED module that is configured to additionally illuminate the light guiding element 2. Said LED module 9 is configured to be passively powered for instance upon communication of the data carrier 1 with a remote device. To this end the data carrier 1 comprises an antenna such as an RFID antenna (not shown) being in connection with the LED module 9 via connection elements 15 well-known in the art. Upon communication of the RFID antenna with a remote device, in particular an RF reader (not shown) the LED module emits 9 light into the light guiding element 2 and thereby illuminates the security element 3 via light being scattered at the light scattering element 4.

[0054] In the depicted example the data carrier 1 comprises two masking elements 11, wherein said masking elements 11 are partially overlapping the light guiding element 2 with respect to the extension direction E. The masking elements 11 are configured to block part of the light being guided along the light guiding element 2 towards an outside. Here, said masking elements 11 are opaque inks that are printed on a surface of two layers 16, 17 of the carrier body 12 and serve the purpose of delimiting a shape of the security element 3.

[0055] When seen along the extension direction E and along a top side 18 of the data carrier 1 towards a bottom side 19 of the data carrier 1, the light scattering element 4 is arranged after the first masking element 10, the light guiding element 2 in turn is arranged after the light scattering element 4, and the second masking element 10 is arranged after the light guiding element 2. In other words, the light scattering element 4 and the light guiding element 2 are arranged between the masking elements 10 with respect to the extension direction E. However, it is likewise conceivable that the light scattering element 4 serves the purpose of illuminating the masking elements 11. The masking elements 11 can thus be seen as so-called artworks that are commonly known in the field of the art.

[0056] Figures 2a and 2b show photographs of a data carrier 1 according to the invention that comprises a security element 3 in the form of the alphanumeric character "THALES". Upon an illumination of the data carrier 1 through the transparent edge regions 8 of the light guiding element 2, the security element 3 lightens up.

[0057] Similarly, figures 3a and 3b depict photographs of a data carrier comprising a security element 3 in the form of the image of a globe. Upon illumination of the edge regions 8 of light guiding element 2, the security element lightens up.

[0058] In figures 2a to 3b an illumination of the data carrier 1 has been performed with an external light source, in

particular with a flashlight of a mobile phone.

LIST OF REFERENCE SIGNS

[0059]

1	data carrier	12	carrier body
2	light guiding element	13	layer
3	security element	14	layer
4	light scattering element	15	connection element
5	surface	16	layer
6	transparent region	17	layer
7	external light source	18	top side
8	edge region	19	bottom side
9	internal light source		
10	secure article	E	extension direction
11	masking element	T	transverse direction

Claims

1. A data carrier (1) for a secure article (10), the data carrier (1) extending along an extension direction (E) and along a transverse direction (T) extending perpendicularly to the extension direction (E) and comprising:

- at least one light guiding element (2); and
 - at least one security element (3),
- wherein the light guiding element (2) is configured to guide light such that light illuminating the light guiding element (2) is guided along the light guiding element (2),
- wherein the light guiding element (2) and the security element (3) are arranged such, that light being guided along the light guiding element (2) is illuminating the security element (3), and
- wherein the security element (3) comprises or consists of at least one light scattering element (4) being configured to scatter light upon an illumination with light by the light guiding element (2).

2. The data carrier (1) according to claim 1, wherein the security element (3), in particular the light scattering element (4), comprises or consists of a print that is preferably printed on the light guiding element (2), in particular on a surface (5) of the light guiding element (2).

3. The data carrier (1) according to any one of the preceding claims, wherein the security element (3), in particular the light scattering element (4), comprises or consists of a light scattering ink and/or light scattering particles, and/or wherein the security element (3), in particular the light scattering element (4), is transparent and/or photochromic.

4. The data carrier (1) according to any one of the preceding claims, wherein the light guiding element (2) is transparent, and/or wherein the light guiding element (2) comprises or consists of at least one polymer, preferably a thermoplastic polymer and/or a transparent polymer such as PET, PVC, or PC.

5. The data carrier (1) according to any one of the preceding claims, wherein the light guiding element (2) is provided as a layer that extends along the transverse direction (T) of the data carrier (1), and/or wherein the security element (3), in particular the light scattering element (4), is provided as a layer that extends along the transverse direction (T).

6. The data carrier (1) according to any one of the preceding claims, wherein the data carrier (1) comprises a transparent region (6), and

wherein the security element (3), in particular the light scattering element (4), is at least partially arranged on and/or in said transparent region (6), and/or

wherein the light guiding element (2) is arranged at least partially on and/or in said transparent region (6).

7. The data carrier (1) according to any one of the preceding claims, wherein the light guiding element (2) is arranged so as to be illuminated by an external light source (7) being provided outside of the data carrier (1), and/or
5 wherein the data carrier (1) comprises at least one edge region (8) being in connection with and/or being at least partially provided by the light guiding element (2), said edge region (8) being at least partially transparent.

8. The data carrier (1) according to any one of the preceding claims, further comprising at least one internal light source (9) that is configured to illuminate the light guiding element (2), and
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wherein the internal light source (9) preferably is an LED module, and/or

wherein the internal light source (9) is preferably configured to be passively powered for instance upon communication of the data carrier (1) with a remote device.

9. The data carrier (1) according to any one of the preceding claims, wherein the security element (3), in particular the light scattering element (4), is arranged at least partially overlapping with the light guiding element (2) when seen along the extension direction (E) of the data carrier (1).
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10. The data carrier (1) according to any one of the preceding claims, wherein the light scattering element (4) is arranged directly on the light guiding element (2), in particular on a surface of the light guiding element (2), or
20 wherein the light scattering element (4) is arranged at a distance from the light guiding element (2) with respect to the extension direction (E).

11. The data carrier (1) according to any one of the preceding claims, wherein the light guiding element (2) extends partially or entirely along the transverse direction (T) of the data carrier (1), and/or
25 wherein the security element (3), in particular the light scattering element (4), extends at partially or entirely along the transverse direction (T) of the data carrier (1).

12. The data carrier (1) according to any one of the preceding claims, wherein the security element (3) comprises at least one masking element (11),
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wherein the masking element (11) is at least partially overlapping the light scattering element (4) and/or the light guiding element (2) with respect to the extension direction (E), and

wherein the masking element is configured to block part at least part of the light being scattered by the light scattering element (4) or being guided along the light guiding element (2) towards an outside of the data carrier (1) and/or is configured to be at least regionally illuminated by at least one of the light guiding element (2) or the light scattering element (4).
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13. The data carrier (1) according to any one of the preceding claims, wherein the security element (3), in particular the light scattering element (4) and/or the masking element (11), has the shape of an image and/or of an alphanumeric character.
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14. A secure article (10) comprising or consisting of at least one data carrier (1) as claimed in any one of the preceding claims, the secure article (10) preferably being a smart card such as a banking card or an identify card, a passport, an electronic tag, a travel ticket or the like.
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15. A method of producing a data carrier (1) extending along an extension direction (E) and along a transverse direction (T) extending perpendicularly to the extension direction (E), preferably a data carrier (1) as claimed in any one of claims 1 to 13, wherein the method comprises the steps of:
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- Providing at least one light guiding element (2); and

- Providing at least one security element (3),

wherein the light guiding element (2) is configured to guide light such that light illuminating the light guiding element (2) is guided along the light guiding element (2),
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wherein the light guiding element (2) and the security element (3) are arranged such, that light being guided along the light guiding element (2) is illuminating the security element (3), and

wherein the security element (3) comprises or consists of at least one light scattering element (4) being configured to scatter light upon an illumination with light by the light guiding element (2).

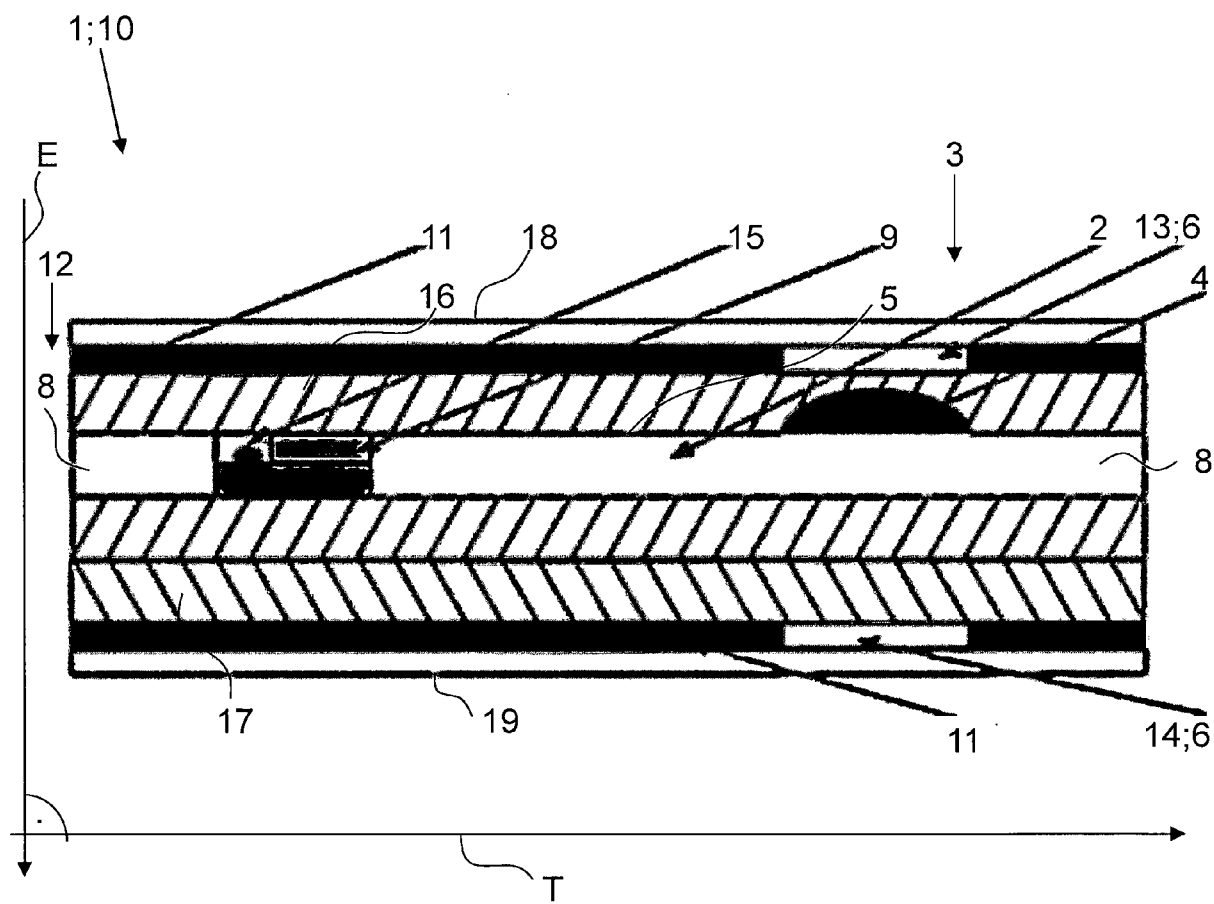


FIG. 1

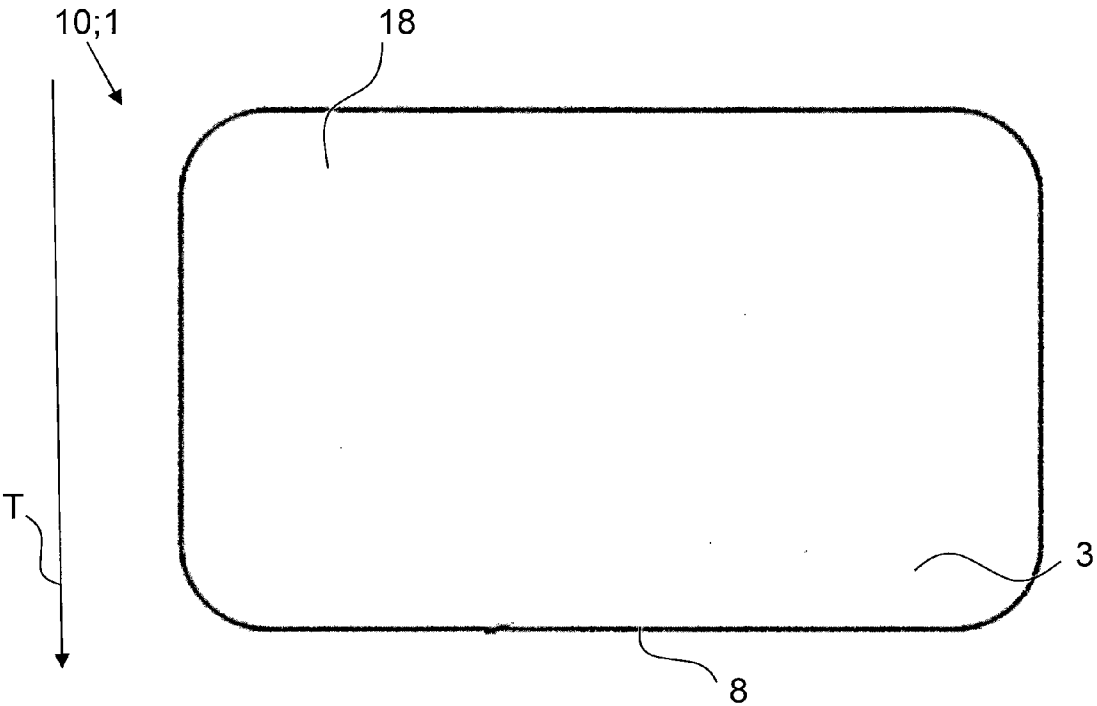


FIG. 2a

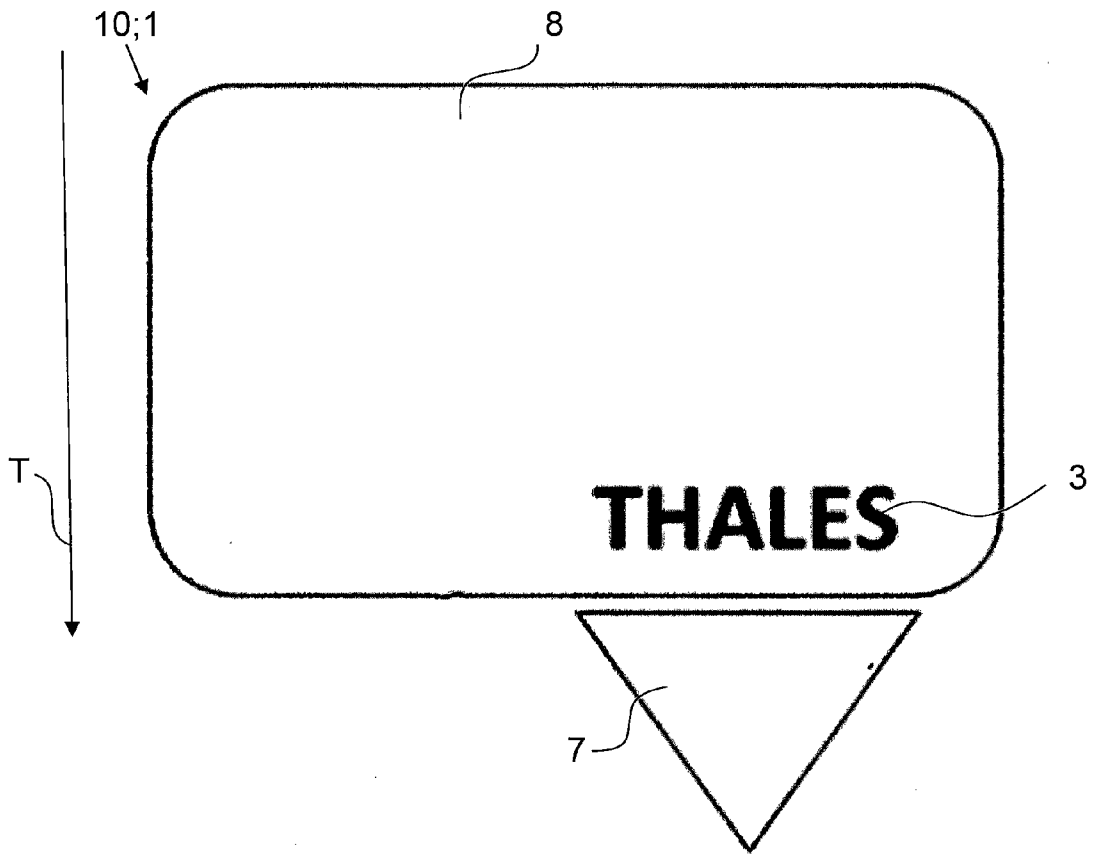


FIG. 2b

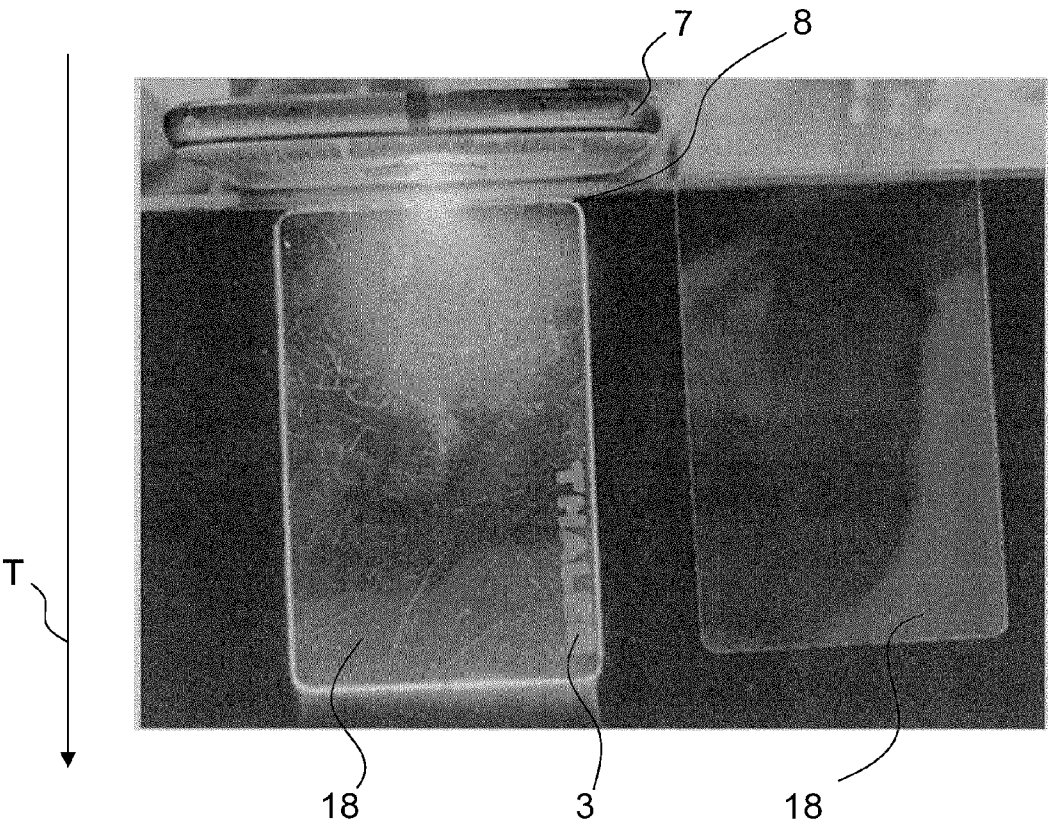


FIG. 3a

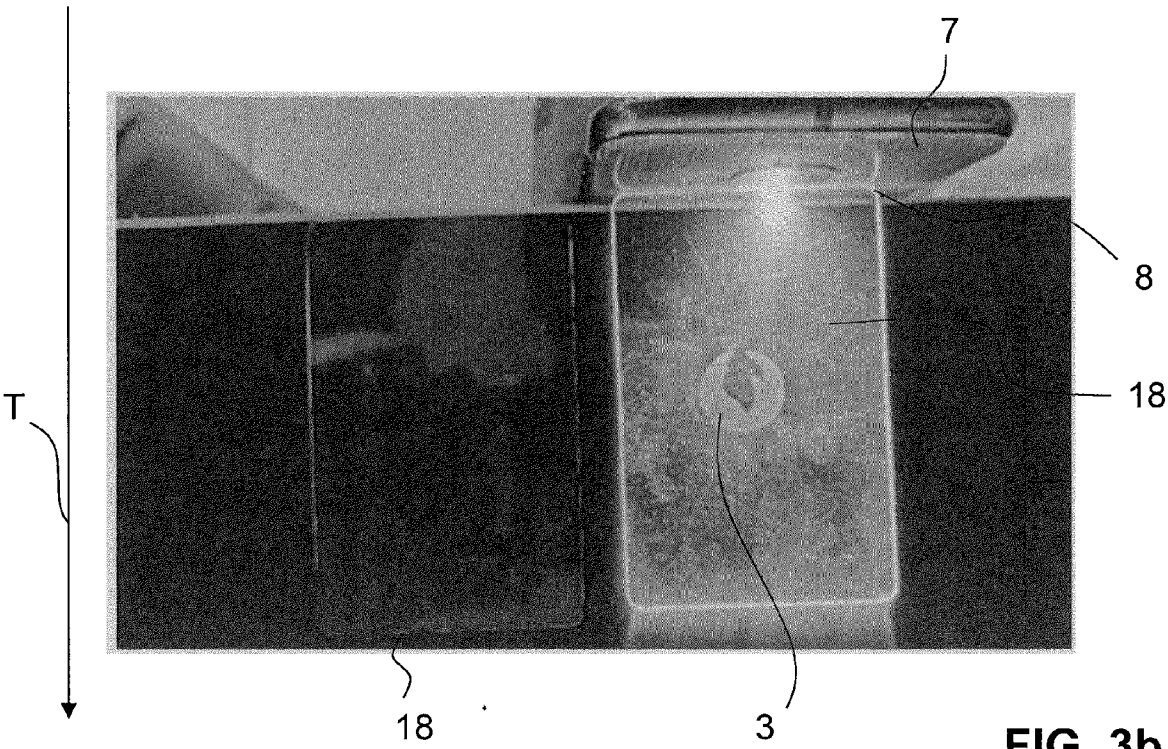


FIG. 3b



EUROPEAN SEARCH REPORT

Application Number

EP 23 31 5311

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 2011/147520 A1 (HUECK FOLIEN GMBH [AT]; MUELLER MATTHIAS [DE] ET AL.) 1 December 2011 (2011-12-01) * page 3, line 31 - page 19, line 13; claims 1-29; figures 1-10 * -----	1-7, 9-11, 13-15	INV. B42D25/23 B42D25/24 B42D25/25 B42D25/351 B42D25/373 B42D25/378 B42D25/455 B42D25/46 G07D7/12
X	EP 2 893 515 B1 (ASSA ABLOY AB [SE]) 9 May 2018 (2018-05-09) * paragraph [0019] - paragraph [0041]; claims 1-15; figures 1-6 * -----	1-7, 9-11, 13-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			B42D G07D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		10 January 2024	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)



Application Number

EP 23 31 5311

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

2-7, 9-11 (completely); 1, 13-15 (partially)

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

EP 23 31 5311

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 2-7, 9-11 (completely); 1, 13-15 (partially)

A data carrier according to claim 1 having a specifically defined security element and a specifically defined light guiding element, and a method of producing such a data carrier.

2. claims: 8 (completely); 1, 13-15 (partially)

A data carrier according to claim 1 having an internal light source, and a method of producing such a data carrier.

3. claims: 12 (completely); 1, 13-15 (partially)

A data carrier according to claim 1 having at least one masking element, and a method of producing such a data carrier.

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

EP 23 31 5311

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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
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10-01-2024

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