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(71) Applicant: **DE NEDERLANDSCHE BANK N.V.**
1017 ZN Amsterdam (NL)

(72) Inventor: **BALKE, Peter**
1017 ZN AMSTERDAM (NL)

(74) Representative: **Peters, Sebastian Martinus**
Octrooibureau Vriesendorp & Gaade B.V.
Koninginnegracht 19
2514 AB Den Haag (NL)

(54) OPTICAL SECURITY FEATURE AND CARRIER PROVIDED WITH SUCH AN OPTICAL SECURITY FEATURE

(57) The invention relates to a carrier provided with an optical security feature, wherein the carrier comprises a planar body having a first view side and a second view side opposite to the first view side, and an optical security feature, wherein the optical security feature comprises a body with a light entrance with an entrance area provided at the first view side of the planar body, and a light exit with an exit area provided at the second view side of the body, wherein the exit area is smaller than the entrance area, and wherein the body is configured to redirect light captured at the entrance area towards the exit area for providing an increased radiance exitance at the light exit.

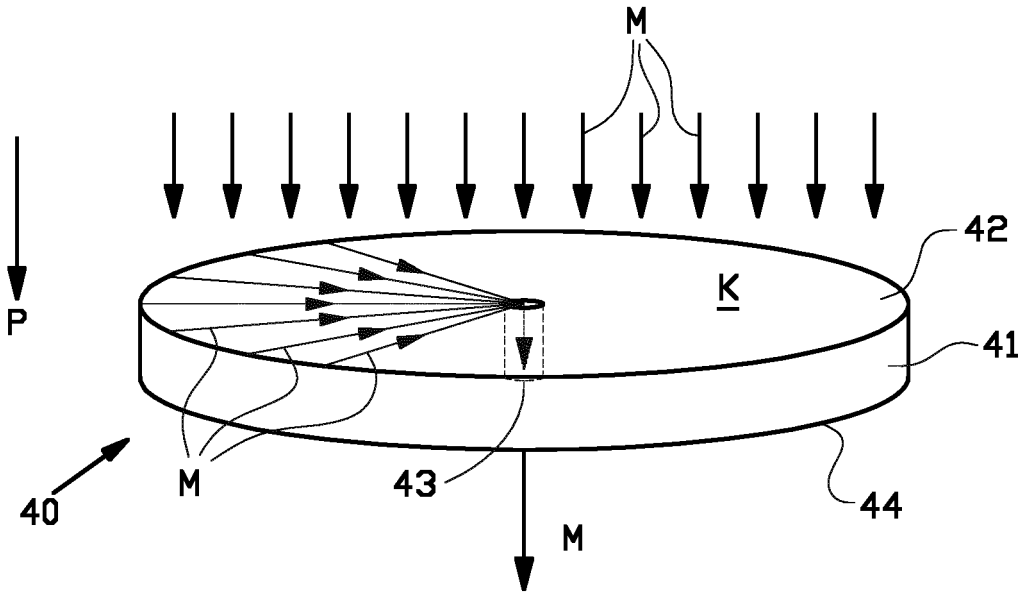

FIG. 2

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Description

BACKGROUND

[0001] The invention relates to a carrier provided with an optical security feature. The carrier is in particular a document, a banknote, a passport, an ID card, a bank card or a credit card. The carrier comprises a planar body having a first view side and a second view side opposite to the first view side, and an optical security feature.

[0002] Bank notes comprising an optical security features are known in the art. For example, EP1260381 describes a document, preferably a bank note, provided with an authenticity characteristic comprising a series of holes and a series of markings of the same order of size as the holes. The series of holes and the series of markings together form one pattern. As a result of the combination of the holes and the markings an authenticity characteristic can be obtained that is hard to forge.

[0003] A disadvantage of such a security feature is, that the series of holes is detectable by detecting the light transmitted through said holes, whereas the series of markings is detectable by a reflective measurement. So in order to detect such a combined security feature, Banknote Equipment must be provided with devices for imaging a bank note both in transmission and in reflection, which makes such equipment relatively costly.

[0004] Using only the holes as security characteristic, has the disadvantage that a pattern of holes is rather easy to imitate, which is not desired for a security characteristic of course.

[0005] It is an object of the present invention to ameliorate one or more of these problems or to at least provide an alternative optical security feature.

SUMMARY OF THE INVENTION

[0006] According to a first aspect, the invention provides a carrier provided with an optical security feature, wherein the carrier comprises a planar body having a first view side and a second view side opposite to the first view side, and an optical security feature, wherein the optical security feature comprises a body with a light entrance with an entrance area provided at the first view side of the planar body, and a light exit with an exit area provided at the second view side of the body, wherein the exit area is smaller than the entrance area, and wherein the body is configured to redirect light captured at the entrance area towards the exit area for providing an increased radiance exitance at the light exit.

[0007] It is noted that the radiant exitance is the radiant flux emitted by a surface per unit area.

[0008] The authenticity of a carrier, for example a banknote, according to the invention can be checked by means of a measurement in transmission. The carrier can be illuminated at the first view side, thereby capturing light in the entrance area of the light entrance of the optical security feature. The captured light is than redirected by the body towards the exit area of the light exit at the second view side, which exit area is smaller than the entrance area. At the exit area the captured light is brought together to provide an increased radiance exitance at the light exit. In particular, the radiance exitance at the light exit of the security feature of the invention is larger than the radiance exitance of a through hole in the carrier. The captured light is densified at the exit area through which the densified light exits the optical security feature. Thus, the light exit of the security feature of the present invention provides a brighter spot of light than a through hole in the carrier. The brighter spot of light at the light exit of the security feature of the present invention can be observed in transmission by means of for example a camera and thereafter it is possible to determine whether the banknote is authentic by means of post-processing the observation data, for example by comparing the brightness of the light exit area of the security feature of the carrier with the brightness of a through hole of approximately the same size as the exit area of the security feature. The carrier according to the invention effectuates advantageously that a Banknote Equipment requires illumination at only one side of the carrier and one camera system at the other side of the carrier, thereby potentially reducing the costs for Banknote Equipment significantly.

[0009] In an embodiment the optical security feature comprises a filter in order to filter the light that enters or has entered the body of the optical security feature. In an embodiment thereof, the filter is a color filter. Such a color filter is arranged to absorb light with a wavelength outside a specific wavelength range and to allow light with a wavelength within said specific wavelength range to exit the optical security feature at the light exit thereof. Preferably the color filter is arranged to transmit light with a wavelength range corresponding to substantially one of the standard color filters used for constructing a color image, such as the Red, Green and Blue filters in a color camera for example. Due to the filter, the optical security feature is unique for one color channel for constructing a color image. For instance out of red, green and blue, only blue is allowed to pass. In this example, only a high intensity blue light is visible and/or detectable at the second view side. It is therefore possible to discriminate the optical security feature from a hole which might be present in the carrier, in particular in case the camera is already substantially saturated by light transmitted through a hole in the carrier.

[0010] In an embodiment the filter is provided within the body of the optical security feature, at the light entrance, and/or at the light exit. It is advantageous that every available light source can be used for illuminating the carrier. Since no special light source is required due to the filter being provided with the optical security feature, the costs for Banknote Equipment may be reduced or kept at a certain level.

[0011] In an embodiment the entrance area of the light entrance and/or the exit area of the light exit has a dis-

tinguishable shape. In an embodiment, the shape is selected from the group comprising: circular, triangular, polygon and quadrangular. In this case the security feature is also identifiable by the shape of the security feature, in addition to the enhance radiance exitance of the security feature.

[0012] In an embodiment the entrance area of the light entrance and/or the exit area of the light exit has a shape which is substantially rotationally symmetrical. In an embodiment the shape is substantially rotationally symmetrical for a rotation around an axis substantially perpendicular to the entrance and/or exit area. During determining whether the carrier is authentic, skew and alternating of the long-edge and short-edge of the carrier may occur. Due to the substantially rotationally symmetrical shape of at least the exit area of the light exit, the shape of the light spot observable at the light exit is substantially the same in all or at least a number of orientations. Thus, the authenticity of the carrier can be determined advantageously in substantially every orientation of the carrier. Due to the substantially rotationally symmetrical shape of the entrance area in addition to the exit area, the intensity of the light spot observable at the light exit is substantially the same in all or at least a number of orientations. Thus, the authenticity of the carrier can be determined advantageously in substantially every orientation of the carrier by the shape and intensity of the light spot.

[0013] In an embodiment the optical security feature comprises an additional light entrance with an additional entrance area, and an additional light exit with an additional exit area, wherein the additional light entrance is provided at the second view side and the additional light exit is provided at the first view side. In an embodiment thereof the additional exit area of the additional light exit is smaller than the additional entrance area of the additional light entrance, and wherein the body is configured to redirect light captured at the additional light entrance towards the additional exit area for providing an increased radiance exitance at the additional light exit. Due to the additional light entrance and light exit, this embodiment allows to perform a transmission measurement wherein the light travels through the optical security feature in the direction from the first view side towards the second view side, but also to perform a transmission measurement wherein the light travels in the opposite direction. The authenticity of the carrier can be determined independently of the orientation thereof. Accordingly, the carriers do not need to be sorted to bring all carriers with the same view side oriented in the same, for example upwards, position, before subjecting said carriers to a light transmission measurement.

[0014] In an embodiment the additional light entrance is provided opposite to the light entrance, and the additional light exit is provided opposite to the light exit. The light exit at the second view side is therefore positioned at the same position as the additional light exit at the first view side. The optical security feature of this embodiment provides the same light densifying effect, substantially at the same position of the carrier, and independent of the illuminated view side. Thus, the carriers do not need to be sorted to bring all carriers with the same view side oriented in the same, for example upwards, position. Therefore, the Banknote Equipment may be kept relatively simple.

[0015] In an embodiment the carrier comprises two or more optical security features. In an embodiment thereof one or more optical security features have a light entrance provided at the first view side of the planar body, and a light exit provided at the second view side of the body, and one or more optical security features have a light entrance provided at the second view side of the planar body, and a light exit provided at the first view side of the body. Advantageously, this allows to perform a transmission measurement wherein the light travels through the optical security feature in the direction from the first view side towards the second view side, but also to perform a transmission measurement wherein the light travels in the opposite direction. Due to the use of at least two optical security features with a opposite orientation, the authenticity of the carrier can be determined independently of the orientation thereof. Accordingly, the carriers do not need to be sorted to bring all carriers with the same view side oriented in the same position, before subjecting said carriers to a light transmission measurement.

[0016] In an embodiment the optical security features are spread through the planar body in order to form a pattern. The pattern formed by the optical security features, in particular the light exits thereof, are arranged to be observed by a Banknote Equipment. The observed pattern can be compared with an expected pattern which is programmed into for example a memory of the Banknote equipment, such that the authenticity of the carrier can be determined. Further, the pattern can be kept secret, such that it is impossible or at least very difficult to forge the pattern and thus the carrier.

[0017] In an embodiment the carrier comprises a strip or patch with optical security features. Such a strip or patch can be included into or onto the carrier relatively easily during manufacturing thereof.

[0018] In an embodiment the optical security feature comprises an optical element provided at the first and/or second view side of the carrier, within the body of the optical security feature or constituting the body thereof at least partly, wherein the optical element is configured to redirect the light that has entered the body via the light entrance towards the light exit. In an embodiment thereof the optical element comprises an optic fiber, a mirror, a lens, or the like, or any combination thereof. The optical element is placed at a certain distance from the center of the body of the optical security feature. In case there are more optical elements present, the optical elements may be placed at several distances from the center. The optical element(s) is (are) arranged for directing the captured light from the entrance area towards the center of the light exit, thereby forming the exit area which is small-

er than the entrance area. Due to the optical elements being oriented to direct the captured light towards the center, the measurement by the Banknote Equipment is substantially not influenced by skew and/or alternating of the long-edge and short-edge of the carrier.

[0019] In an embodiment, the carrier is further provided with a through opening, which through opening is preferably arranged adjacent to said optical security feature, and wherein the through opening preferably comprises an area substantially equal to the exit area of the optical security feature. In an embodiment wherein the optical security feature is provided with a color filter, said through opening is preferably provided with substantially the same color filter as the optical security feature. This embodiment allows a direct comparison between the optical security feature of the present invention and a through opening in substantially the same measurement at a single carrier. Accordingly, the presence of an optical security feature according to the present invention can be established by a comparative measurement.

[0020] In a second aspect the invention provides a carrier provided with an optical security feature, wherein the carrier comprises a planar body having a first view side and a second view side opposite to the first view side, and an optical security feature, wherein the optical security feature comprises a body having a light entrance with an entrance area at the first view side of the body, and a light exit with an exit area at the first view side of the body, wherein the exit area is smaller than the entrance area, and wherein the body is configured to redirect light captured at the entrance area towards the exit area for providing an increased radiance exitance at the light exit.

[0021] The carrier has at least one of the advantages as described in relation to the carrier according to the first aspect of the invention.

[0022] In an embodiment the carrier is one of a document, a banknote, a passport, an ID card, a bank card or a credit card. Such carriers are interesting to be forged and therefore need to be provided with security features. In a further aspect the invention provides an optical security feature for use in a carrier according to the first or second aspect of the invention. The optical security feature provides at least the same advantages as described above in relation to the carrier.

[0023] In a further aspect the invention provides a method for determining whether a carrier according to the first or second aspect of the invention is authentic, wherein the method comprises the steps of: illuminating the first view side of the carrier; acquiring radiance data from the light exiting one of the first and second view side; processing the radiance data to determine whether a light spot of increased radiance exitance is present within the radiance data; and, if the light spot of increased radiance exitance is present, indicating that the carrier is authentic.

[0024] In an embodiment the method comprises the step of, if two or more light spots of which at least one with an increased radiance exitance are present, determining a pattern of the light spots; comparing the determined pattern with an expected pattern, preferably for a certain color; and, if the determined pattern correspond to the expected patterns, preferably for all colors, indicating that the carrier is authentic.

[0025] The various aspects and features described and shown in the specification can be applied, individually, wherever possible. These individual aspects, in particular the aspects and features described in the attached dependent claims, can be made subject of divisional patent applications.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] The invention will be elucidated on the basis of exemplary embodiments shown in the attached drawings, in which:

Figures 1A and 1B show respectively a top view and a schematic isometric view of an embodiment of a carrier according to the invention, having a planar body and an optical security feature;
Figure 2 shows a detailed overview of the optical security feature of figure 1 with a schematic path of light;
Figure 3 shows a cross-section view of the optical security feature of figure 2;
Figures 4A-C show alternative embodiments of the optical security feature;
Figure 5 shows a top view of another embodiment of a carrier according to the invention, having a planar body and a plurality of security features;
Figure 6 shows a top view of the plurality of security features of figure 5 in detail;
Figure 7 shows a top view of another embodiment of a carrier according to the invention, having a planar body and a pattern formed by security features;
Figures 8A-C show partially another embodiment of a carrier in cross-section view, top view and bottom view, respectively;
Figures 9A-C show partially another embodiment of a carrier in cross-section view, top view and bottom view, respectively;
Figures 10A-B show partially another embodiment of a carrier in cross-section view and top view, respectively; and
Figure 11 shows schematically an overview of an embodiment of a carrier according to the invention, having a planar body and multiple optical security features.

DETAILED DESCRIPTION OF THE INVENTION

[0027] A carrier, in particular a banknote 1 according to an embodiment of the invention is shown in figures 1A and 1B. As shown in figures 1A and 1B, the banknote 1 comprises a planar body 2 with a first view side 3 and a second view side 4 which is opposite to the first view side

3. The banknote 1 comprises ornamental images 5 which are provided at both the first and second view sides 3, 4 of the planar body 2. Further, usually a number 6 is printed on at least one of the first and second view sides 3, 4 indicating the value of the banknote 1.

[0028] As is best shown in figures 1A and 1B, the banknote 1 comprises an optical security feature 40 that is provided within or onto the planar body 2 of the banknote 1. As is shown in figure 2, the optical security feature 40 comprises a body 41 with a light entrance 42 and a light exit 43. The light entrance 42 is provided at the first view side 3 and the light exit 43 is provided at the second view side 4 of the banknote 1. As is best shown in figure 3, the light entrance 42 has an entrance area K and the light exit 43 has an exit area L, which is smaller than the entrance area K.

[0029] The authenticity of the banknote 1 can be checked by means of a measurement in transmission. The banknote 1 can be illuminated at the first view side 3 by means of a non-shown light source, such that light is captured in the entrance area K of the light entrance 42. The body 41 or non-shown optical elements within the body redirect(s) substantially all the captured light towards the exit area L of the light exit 43. The captured light is brought together at the exit area L for providing an increased radiance exitance at the light exit 43. The captured light is densified at the exit area L through which the densified light exits the optical security feature 40, thereby providing a bright spot of light. The path of the light lines M is schematically shown in figures 2 and 3. Radiance data from light exiting the second view side 4 of the banknote 1 can be acquired by means of for example a non-shown camera or sensor. By post-processing the radiance data, it is possible to determine whether a light spot with increased radiance exitance is present.

[0030] In this embodiment, the material of the body 41 is adapted to filter the light that has been captured in the entrance area K of the optical security feature 40. The body 41 is for example arranged such that for instance out of red, green and blue, only blue that has a wavelength range of 450-495 nm , for example, is allowed to pass. In that case, light with for example a wavelength of 470 nm that is within the wavelength range of blue is allowed to pass, and light with for example a wavelength of 570 nm that is outside the wavelength range of blue is absorbed. Only a high intensity blue light is observable at the second view side 4.

[0031] It is noted that the body 41 of the optical security feature 40 can be formed from the same material as the planar body 2 of the banknote 1 or from another material.

[0032] In figures 4A-C, an alternative of the optical security feature is shown which substantially corresponds to the optical security feature of figures 1-3. Similar parts are referred to by the same reference number.

[0033] The alternative optical security feature 140 shown in figure 4A is also intended to be provided within the planar body 2 of the banknote 1, which body 2 is not shown in figure 4A. The optical security feature 140 comprises an additional light entrance 152 and an additional light exit 153, wherein the additional light entrance 152 is provided at the second view side 4 of the banknote 1 and the additional light exit 153 is provided at the first view side 3 of the banknote 1. As shown in figure 4A, the light entrance 142 and the additional light entrance 152 are positioned opposite to each other, as is also the case for the light exit 143 and the additional light exit 153. In this embodiment, a light spot can be observed by means of for example a non-shown camera at the first view side 3 and at the second view side 4. Therefore, it is possible to perform a transmission measurement wherein the light travels through the optical security feature in the direction P from the first view side 3 towards the second view side 4, but also to perform a transmission measurement wherein the light travels in the opposite direction R, such that the orientation of the banknote 1 is less important.

[0034] The optical security feature 40 of the embodiment shown in figures 1 to 3, or at least the light entrance 42 and/or the light exit 43 thereof, has a substantially circular contour 44, such that the optical security feature 40 is substantially rotationally symmetrical around an axis substantially perpendicular to the entrance area K and the exit area L. Figures 4B and 4C show alternative shapes for the contour 144 of the optical security feature 140 or at least the light entrance 142 and/or the light exit 143 thereof, which alternative shapes are rotationally symmetrical. The contour 144 of the optical security feature 140 as shown in figure 4B is quadrangular, and the contour 144 of the optical security feature 140 as shown in figure 4C is triangular.

[0035] Referring to the embodiment shown in figure 4A, it is alternatively possible that the light entrance 142 and the additional light exit 153 have a contour 144 with a shape that differs from the contour of the additional light entrance 152 and the light exit 143. It is than possible to determine which view side 3, 4 of the banknote 1 is oriented in the upwards position for example.

[0036] In figure 5, an alternative of the optical security feature is shown which substantially corresponds to the optical security feature of figures 1-3. Similar parts are referred to by the same reference number. The banknote 1 comprises a planar body 2 with a first view side 3 and a second view side 4 which is opposite to the first view side 3. The banknote 1 comprises ornamental images 5 which are provided at both of the first and second view sides 3, 4 of the planar body 2. In figure 6, the optical security feature 240 comprises a body 241, 261 with a light entrance 242 and a light exit 243 (not shown).

[0037] The banknote 1 as shown in figure 5 comprises a strip 254 with a plurality of optical security features 240, 260 as shown in figure 6. The optical security features 240, 260 are spread throughout the strip 254 such that a pattern is formed by the optical security features 240, 260. As best shown in figure 6, the plurality of optical security features 240, 260 is divided into two groups. Each optical security feature 240 of the first group has a light entrance 242 at the first view side 3, in this figure

the top side of the banknote 1, and a light exit 243 (not shown) at the second view side 4 of the banknote 1, in this figure the bottom side of the banknote 1. Each optical security feature 260 of the second group 260 has a light entrance 262 at the second view side 4 and a light exit 263 at the first view side 3 of the banknote 1. In this alternative embodiment, each of the optical security features 240, 260 is configured such that light is able to travel through in one direction only.

[0038] Figure 7 shows an alternative embodiment of the banknote 1 according to the invention. The banknote 1 comprises a planar body 2 with a first view side 3 and a second view side 4 which is opposite to the first view side 3. The banknote 1 comprises ornamental images 5 which are provided at both of the first and second view sides 3, 4 of the planar body 2. The banknote 1 comprises a plurality of optical security features 340 having a body 341 with a light entrance 342 and a light exit 343 (not shown). The optical security features 340 are spread over the body 2 of the banknote 1, thereby forming a pattern. The optical security features 340 are configured such that light is able to travel only through the optical security features 340 in the direction from the first view side 3 towards the second view side 4 for example, as is the case for the optical security feature 40 described in relation to figure 1.

[0039] In figures 8A-C, an alternative of the carrier is partly shown which substantially corresponds to the carrier of figures 1-3. Similar parts are referred to by the same reference number. The banknote 1 comprises a planar body 2 with a first view side 3 and a second view side 4 which is opposite to the first view side 3. The banknote 1 comprises ornamental images 5 which are provided at both of the first and second view sides 3, 4 of the planar body 2.

[0040] The optical security feature 740 comprises a body 741 with a light entrance 742 and a light exit 743. The light entrance 742 is provided at the first view side 3 and the light exit 743 is provided at the second view side 4 of the banknote 1, as is indicated in figures 8B-C. As is best shown in figures 8B-C, the light entrance 742 has an entrance area K and the light exit 743 has an exit area L, which is smaller than the entrance area K. The body 741 of the optical security feature 740 comprises optical elements in the form of a first mirroring surface 771 at the circumference thereof, a second mirroring surface 772 in the center thereof and an optical waveguide 773 therebetween. As best shown in figure 8A, the first mirroring surface 771 is placed adjacent to the entrance area K, such that light entering the optical security feature 740 through the entrance area K of the light entrance 742 incidents onto the first mirroring surface 771. Subsequently, the light is reflected by the first mirroring surface 771 towards the second mirroring surface 772, thereby travelling through the optical waveguide 773. The reflected light that incidents onto the second mirroring surface 772 is reflected again and directed towards the exit area L of the light exit 743, thereby providing an increased radiance exitance at the light exit 743. It is noted that the reflection of the light by the first and second mirroring surface 771, 772 is based on the law of reflection, in which the angle of incidence is equal to the angle of reflection.

[0041] In figures 9A-C, an alternative of the carrier is partly shown which substantially corresponds to the carrier of figures 8A-C. Similar parts are referred to by the same reference number. The banknote 1 comprises a planar body 2 with a first view side 3 and a second view side 4 which is opposite to the first view side 3. The banknote 1 comprises ornamental images 5 which are provided at both of the first and second view sides 3, 4 of the planar body 2.

[0042] The optical security feature 940 comprises a body 941 with a light entrance 942, a light exit 943, an additional light entrance 952 and an additional light exit 953. The light entrance 942 and the additional light exit 953 are provided at the first view side 3 and the light exit 943 and the addition light entrance 952 are provided at the second view side 4 of the banknote 1, as is shown in figures 9B-C. As is best shown in figures 9B-C, the light entrance 942 and the additional light entrance 952 have an entrance area K and the light exit 743 and the additional light exit 753 have an exit area L, which is smaller than the entrance area K. The optical security feature 940 comprises optical elements in the form of a first mirroring surface 971, a second mirroring surface 972, an optical waveguide 973, a third mirroring surface 974 and a fourth mirroring surface 975. As shown in figure 9A, the first and the third mirroring surface 971, 974 are provided on top of each other at the circumference of the body 941 of the optical security feature 940. The second and the fourth mirroring surface 972, 975 are provided on top of each other in the center of the body 941 of the optical security feature 940.

[0043] As best shown in figure 9A, the first mirroring surface 971 is placed adjacent to the entrance area K of the light entrance 942, such that light entering the optical security feature 940 through the entrance area K of the light entrance 942 incidents onto the first mirroring surface 971. Subsequently, the light is reflected by the first mirroring surface 971 towards the second mirroring surface 972, thereby travelling through the optical waveguide 973. The reflected light that incidents onto the second mirroring surface 972 is reflected again and directed towards the exit area L of the light exit 943, thereby providing an increased radiance exitance at the light exit 943. The light pad is indicated by arrows M.

[0044] As best shown in figure 9A, the third mirroring surface 974 is placed adjacent to the entrance area K of the additional light entrance 952, such that light entering the optical security feature 940 through the entrance area K of the light entrance 952 incidents onto the third mirroring surface 974. Subsequently, the light is reflected by the third mirroring surface 974 towards the fourth mirroring surface 975, thereby travelling through the optical waveguide 973. The reflected light that incidents onto

the fourth mirroring surface 975 is reflected again and directed towards the exit area L of the additional light exit 953, thereby providing an increased radiance exitance at the additional light exit 953.

[0045] In figures 10A-B, an alternative of the carrier is partly shown which substantially corresponds to the carrier of figures 8A-C. Similar parts are referred to by the same reference number. The banknote 1 comprises a planar body 2 with a first view side 3 and a second view side 4 which is opposite to the first view side 3. The banknote 1 comprises ornamental images 5 which are provided at both of the first and second view sides 3, 4 of the planar body 2.

[0046] The optical security feature 1040 comprises a body 1041 with a light entrance 1042 and a light exit 1043. The light entrance 1042 and the light exit 1043 are provided at the first view side 3 of the banknote 1, as is indicated in figures 10A-B. As is best shown in figure 10B, the light entrance 1042 has an entrance area K and the light exit 1043 has an exit area L, which is smaller than the entrance area K. The optical security feature 1040 comprises optical elements in the form of a first mirroring surface 1071 at the circumference thereof, a second mirroring surface 1072 in the center thereof and an optical waveguide 1073. As best shown in figure 10A, the first mirroring surface 1071 is placed adjacent to the entrance area K, such that light entering the optical security feature 1040 through the entrance area K of the light entrance 1042 incidents onto the first mirroring surface 1071. Subsequently, the light is reflected by the first mirroring surface 1071 towards the second mirroring surface 1072, thereby travelling through the optical waveguide 1073. The reflected light that incidents onto the second mirroring surface 1072 is reflected again and directed towards the exit area L of the light exit 1043, thereby providing an increased radiance exitance at the light exit 1043 at the first view side 3.

[0047] Figure 11 shows a passport 801 with a planar body 802 with a first view side 803 and a second view side 804 which is opposite to the first view side 803. The passport 801 comprises a picture 805 of the owner thereof which is provided at the first view side 803 of the planar body 802. Further, data is usually printed on at least one of the first and second view sides 803, 804 indicating for example a name of the owner of the passport 801. Further, the passport 801 comprises a strip 854 having a number of optical security features 840. The optical security features 840 corresponds to at least one of the optical security features described in relation to the banknote 1.

[0048] The banknote 1 or passport 801 as described above can be checked to determine whether it is authentic. The banknote 1 or passport 801 can thereto be placed in a non-shown testing device with a supporting surface, a light source and a camera. For the testing the banknote 1 or passport 801, the latter is placed onto the supporting surface with for example the second view side 4. The first view side 3 is illuminated by means of the light source and the second view side 4 is observed by the camera in transmission. In case the banknote 1 or passport 801 is authentic, the camera acquires radiance data from light exiting the optical security features. A processor can process the radiance data to determine whether light spots with increased radiance exitance are present, and, if present, to determine the pattern of the light spots. Based on a comparison between the determined pattern and the expected pattern, the processor can determine whether the banknote 1 or passport 801 is authentic. The observed light spots are compatible with at least 25 DPI (Dots Per Inch).

[0049] It is to be understood that the above description is included to illustrate the operation of the preferred embodiments and is not meant to limit the scope of the invention. From the above discussion, many variations will be apparent to one skilled in the art that would yet be encompassed by the scope of the present invention.

Claims

1. Carrier provided with an optical security feature, wherein the carrier comprises a planar body having a first view side and a second view side opposite to the first view side, and an optical security feature, wherein the optical security feature comprises a body with a light entrance with an entrance area provided at the first view side of the planar body, and a light exit with an exit area provided at the second view side of the body, wherein the exit area is smaller than the entrance area, and wherein the body is configured to redirect light captured at the entrance area towards the exit area for providing an increased radiance exitance at the light exit.

2. Carrier according to claim 1, wherein the optical security feature comprises a filter in order to filter the light that enters or has entered the body of the optical security feature, wherein the filter is preferably a color filter, and/or wherein the filter is preferably provided within the body of the optical security feature, at the light entrance, and/or at the light exit.

3. Carrier according to any one of the preceding claims, wherein the entrance area of the light entrance and/or the exit area of the light exit has a distinguishable shape.

4. Carrier according to any one of the preceding claims, wherein the entrance area of the light entrance and/or the exit area of the light exit has a shape which is substantially rotationally symmetrical, wherein the shape is preferably substantially rotationally symmetrical for a rotation around an axis substantially perpendicular to the entrance and/or exit area and/or wherein the shape is preferably selected from the group comprising: circular, triangular, polygon and

quadrangular.

5. Carrier according to any one of the preceding claims, wherein the optical security feature comprises an additional light entrance with an additional entrance area, and an additional light exit with an additional exit area, wherein the additional light entrance is provided at the second view side and the additional light exit is provided at the first view side, and/or wherein the additional exit area is preferably smaller than the additional entrance area, and wherein the body is configured to redirect light captured at the additional entrance area towards the additional exit area for providing an increased radiance exitance at the additional light exit.

6. Carrier according to claim 5, wherein the additional light entrance is provided opposite to the light entrance, and wherein the additional light exit is provided opposite to the light exit.

7. Carrier according to any one of the preceding claims, comprising two or more optical security features, wherein one or more optical security features preferably have a light entrance provided at the first view side of the planar body, and a light exit provided at the second view side of the body, and wherein one or more optical security features have a light entrance provided at the second view side of the planar body, and a light exit provided at the first view side of the body.

8. Carrier according to claim 7, wherein the optical security features are spread through the planar body in order to form a pattern.

9. Carrier according to any one of the claims 7-8, comprising a strip or patch with optical security features.

10. Carrier according to any one of the preceding claims, the optical security feature comprises an optical element provided at the first and/or second view side of the carrier, within the body of the optical security feature or constituting the body thereof at least partly, wherein the optical element is configured to redirect the light that has entered the body via the light entrance towards the light exit, wherein the optical element preferably comprises an optic fiber, a mirror, a lens, or the like, or any combination thereof.

11. Carrier according to any one of the preceding claims, wherein the carrier is further provided with a through opening, which through opening is preferably arranged adjacent to said optical security feature, and wherein the through opening preferably comprises an area substantially equal to the exit area of the optical security feature.

12. Carrier provided with an optical security feature, wherein the carrier comprises a planar body having a first view side and a second view side opposite to the first view side, and an optical security feature, wherein the optical security feature comprises a body having a light entrance with an entrance area at the first view side of the body, and a light exit with an exit area at the first view side of the body, wherein the exit area is smaller than the entrance area, and wherein the body is configured to redirect light captured at the entrance area towards the exit area for providing an increased radiance exitance at the light exit.

13. Carrier according to any one of the preceding claims, wherein the carrier is one of a document, a banknote, a passport, an ID card, a bank card or a credit card.

14. Method for determining whether a carrier according to any one of the claims 1-13 is authentic, wherein the method comprises the steps of:

- illuminating the first view side of the carrier;
- acquiring radiance data from the light exiting one of the first and second view side;
- processing the radiation data to determine whether a light spot of increased radiance exitance is present within the radiance data; and
- if the light spot of increased radiance exitance is present, indicating that the carrier is authentic.

15. Method according to claim 14, further comprising the step of, if two or more light spots of which at least one with increased radiance exitance are present, determining a pattern of the light spots; comparing the determined pattern with an expected pattern, preferably for a certain color; and, if the determined pattern correspond to the expected patterns, preferably for all colors, indicating that the carrier is authentic.

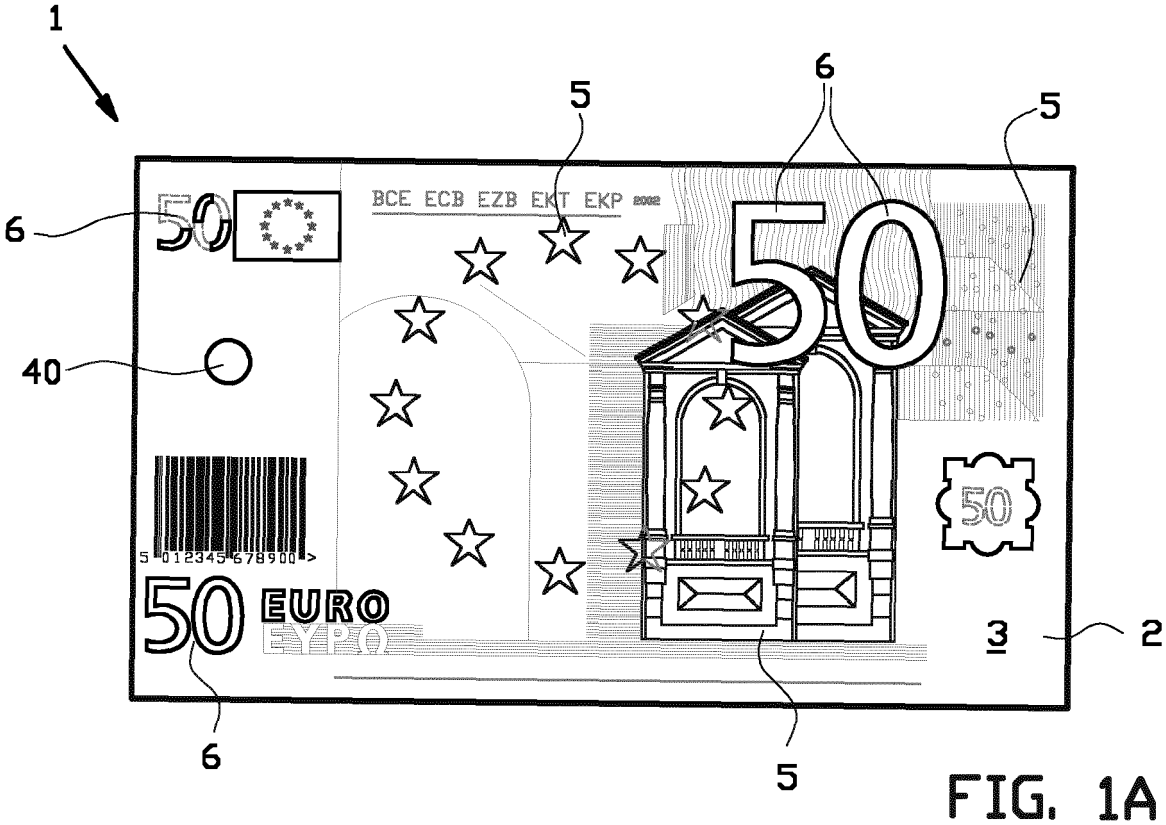
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FIG. 1A

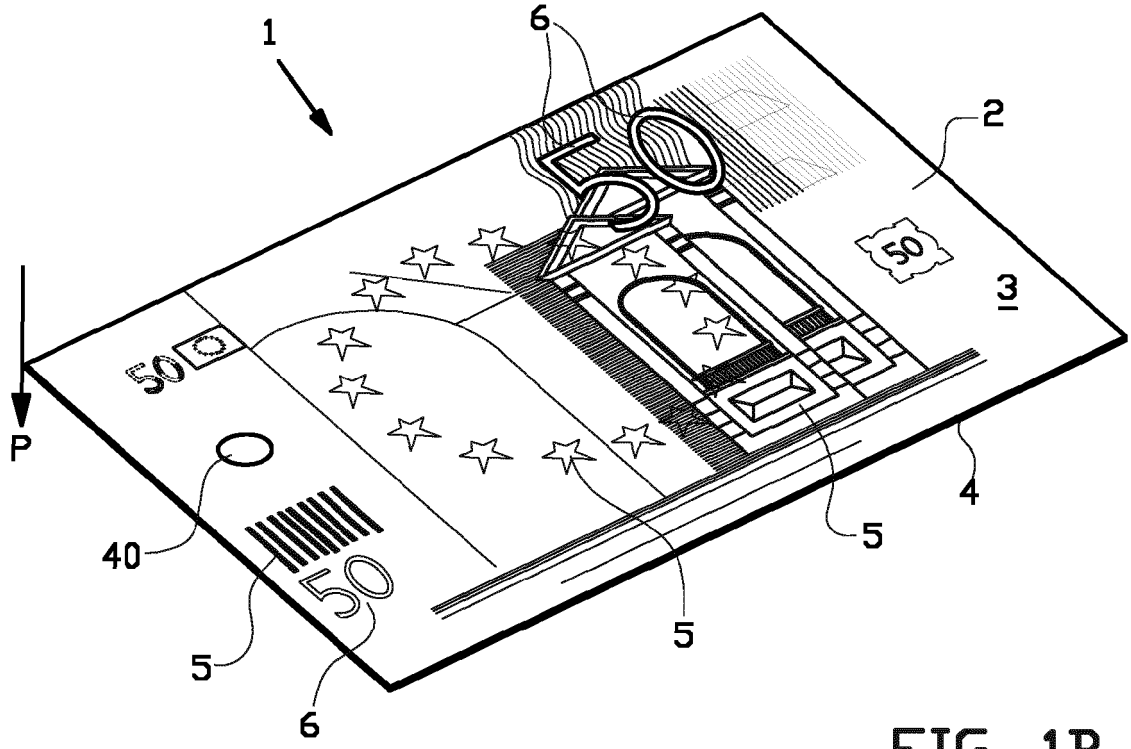
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FIG. 1B

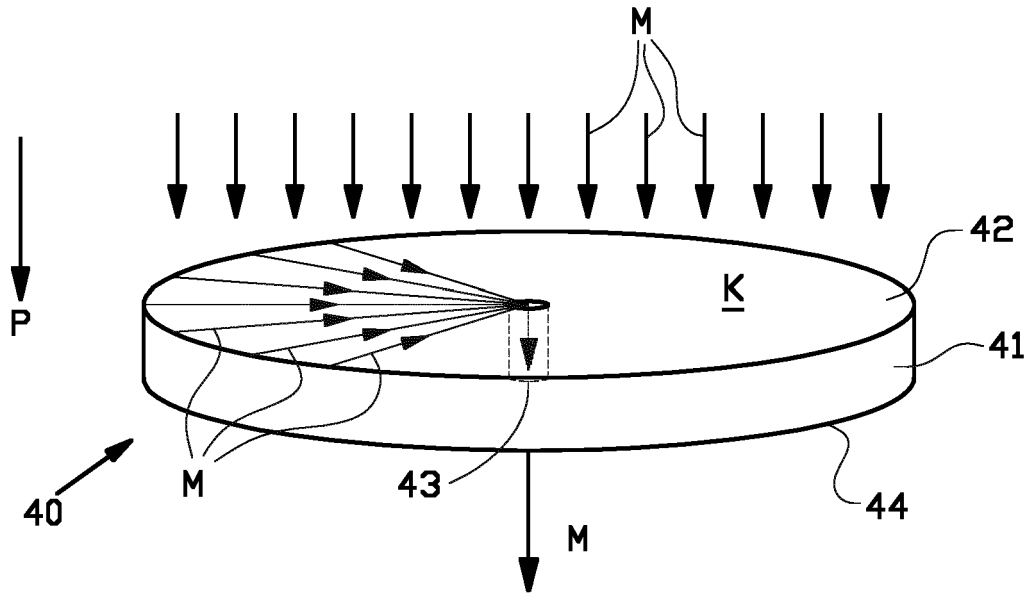

FIG. 2

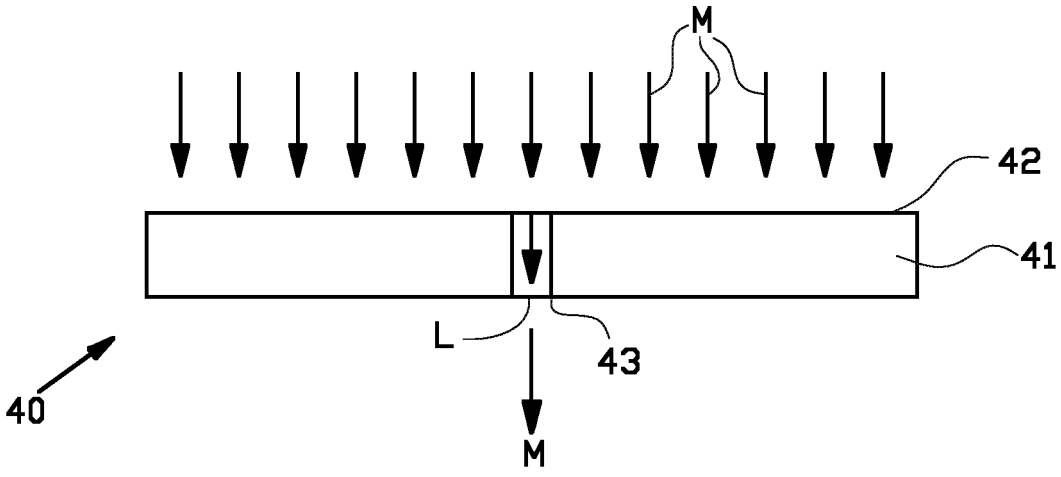

FIG. 3

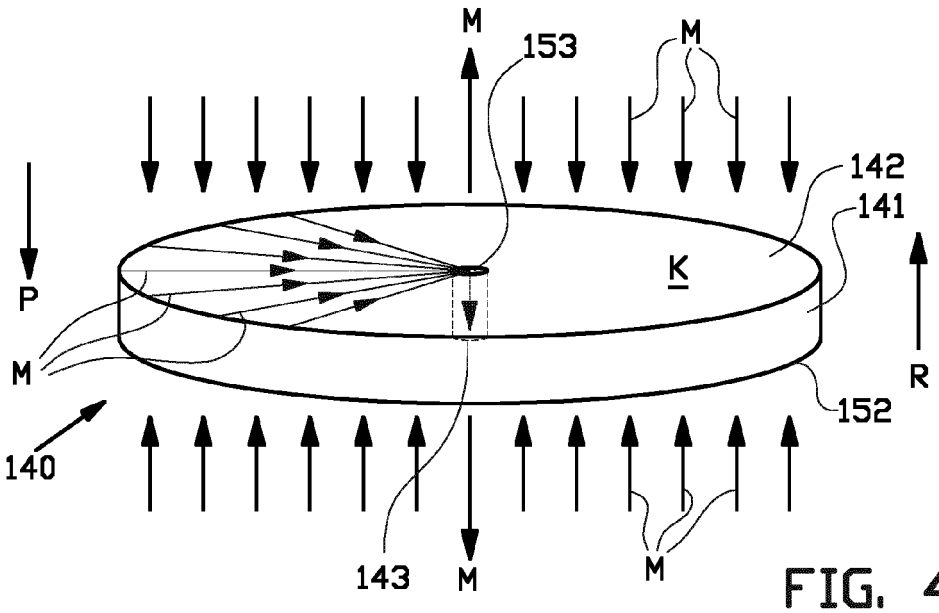

FIG. 4A

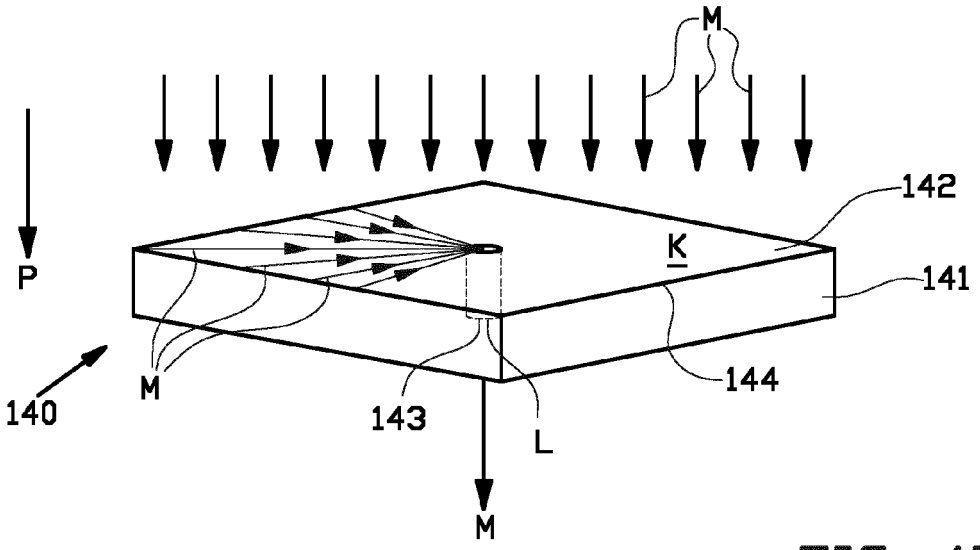

FIG. 4B

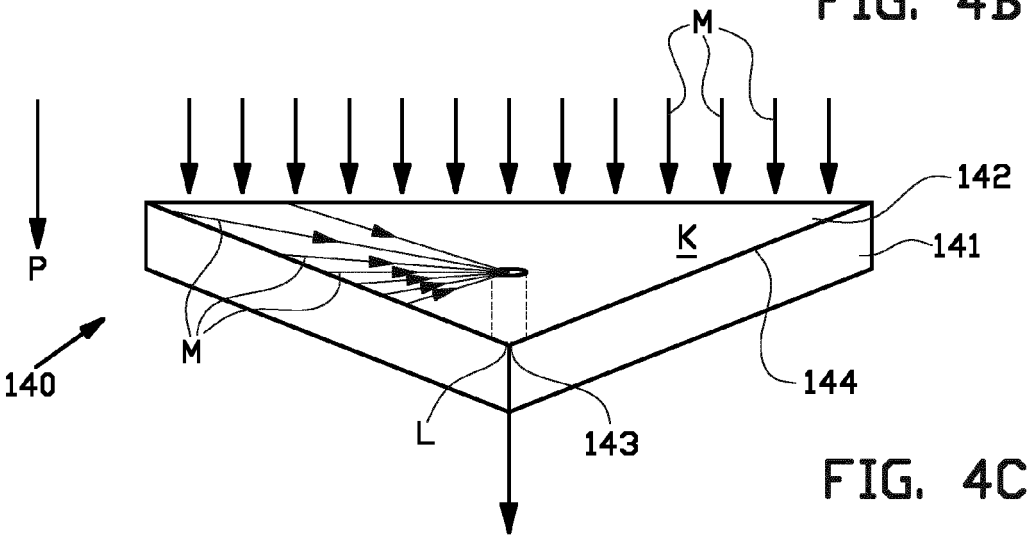

FIG. 4C

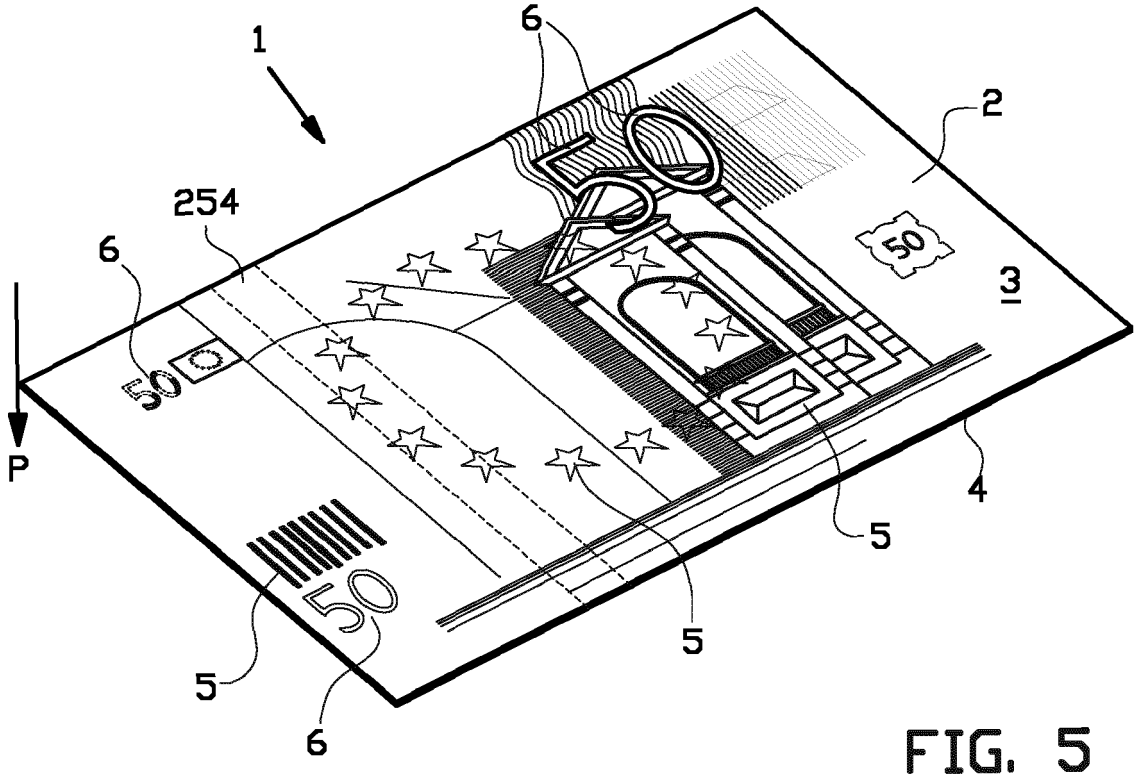
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FIG. 5

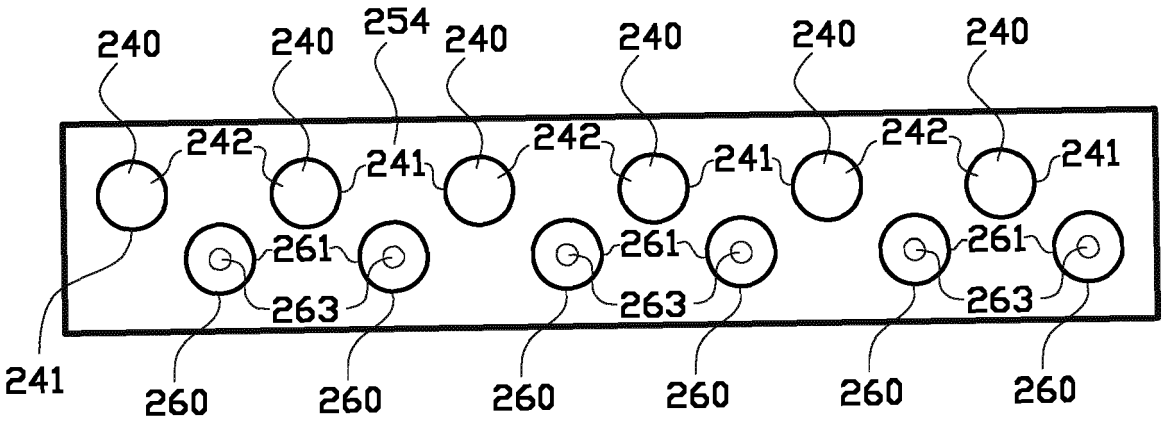
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FIG. 6

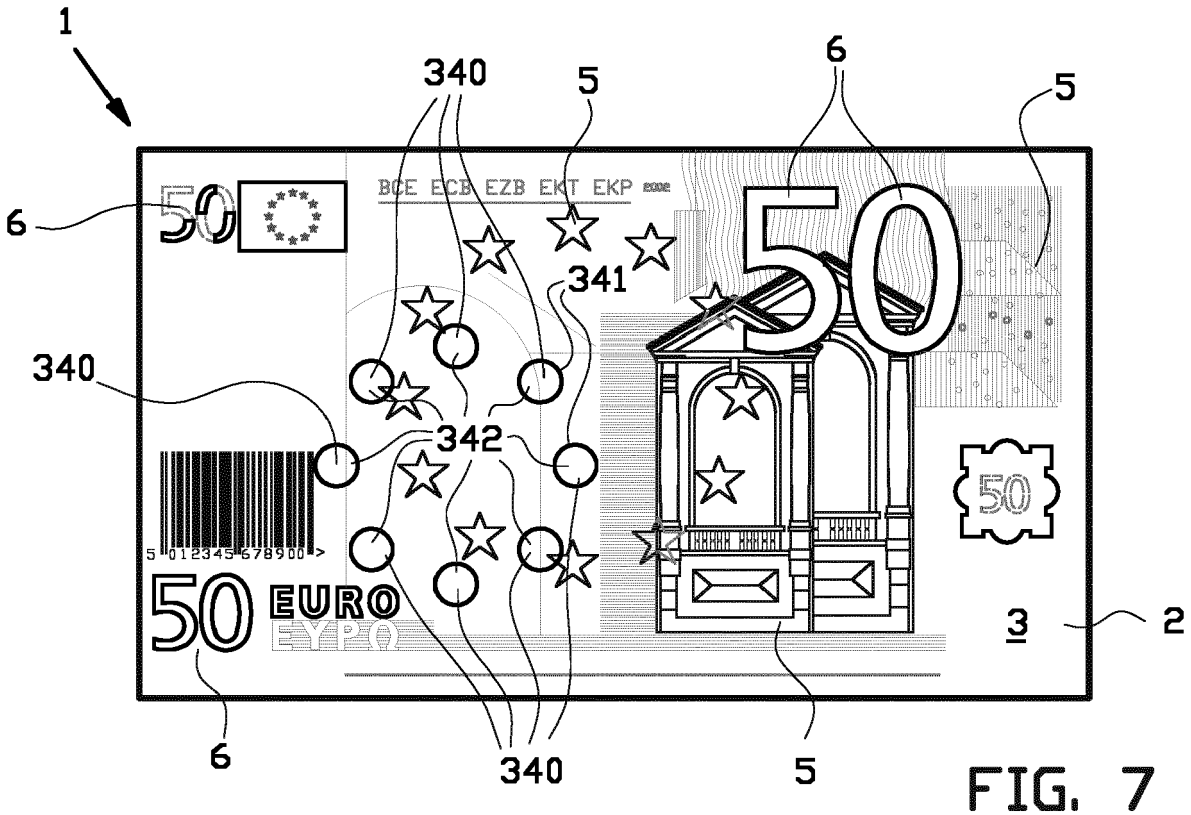
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FIG. 7

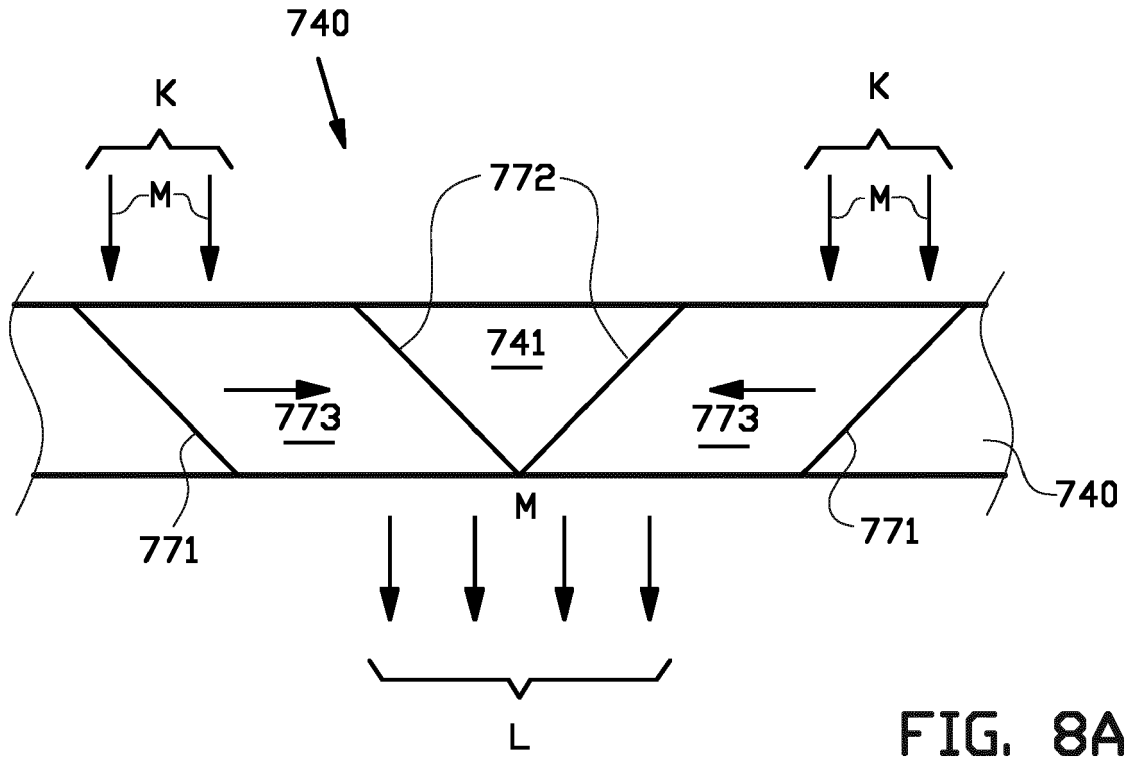
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FIG. 8A

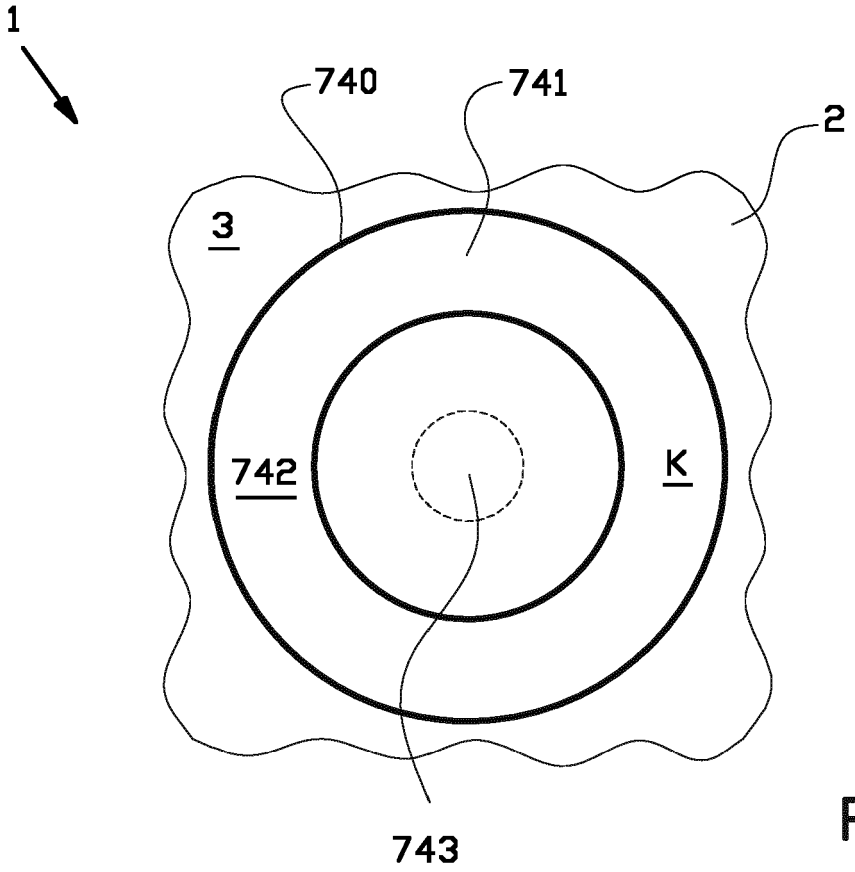

FIG. 8B

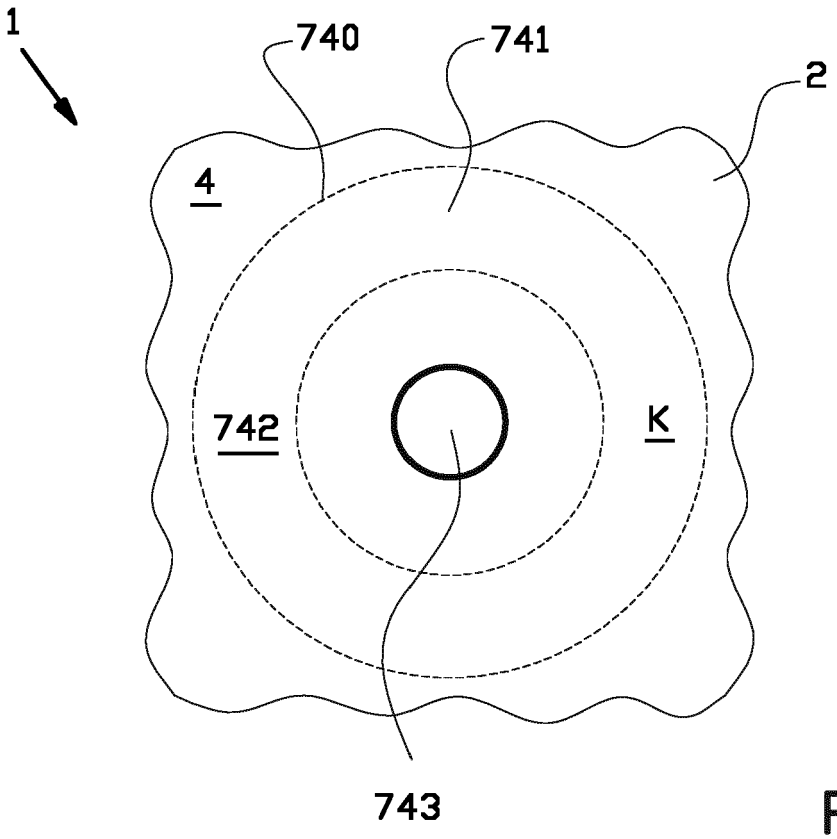

FIG. 8C

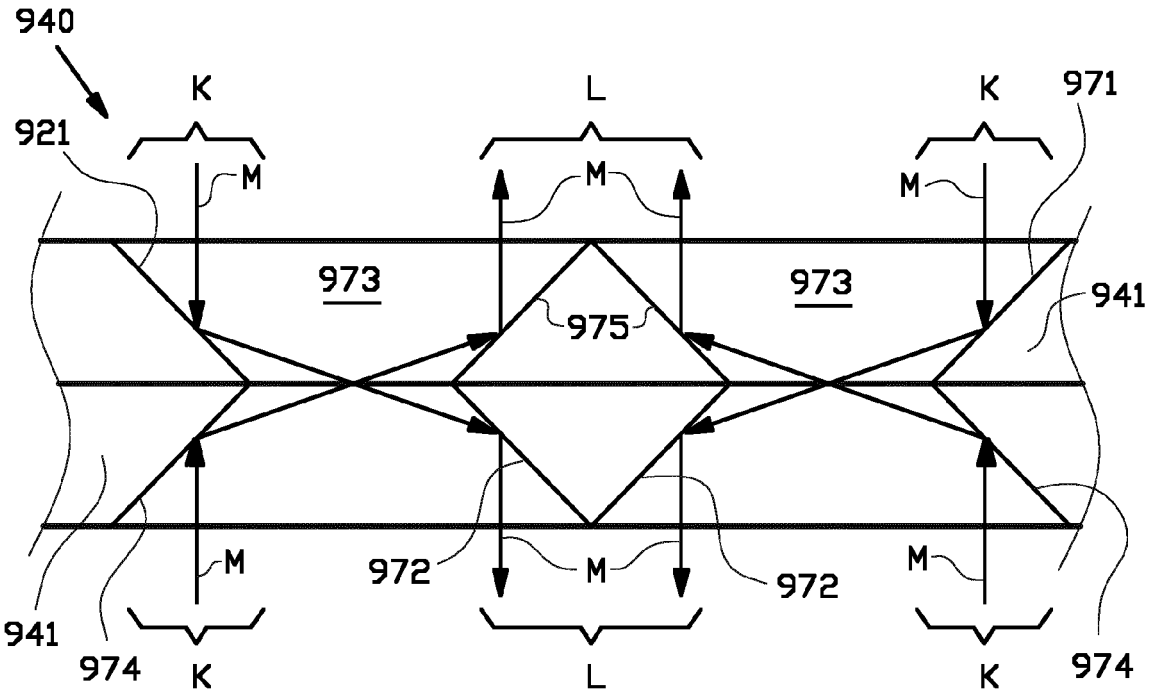
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FIG. 9A

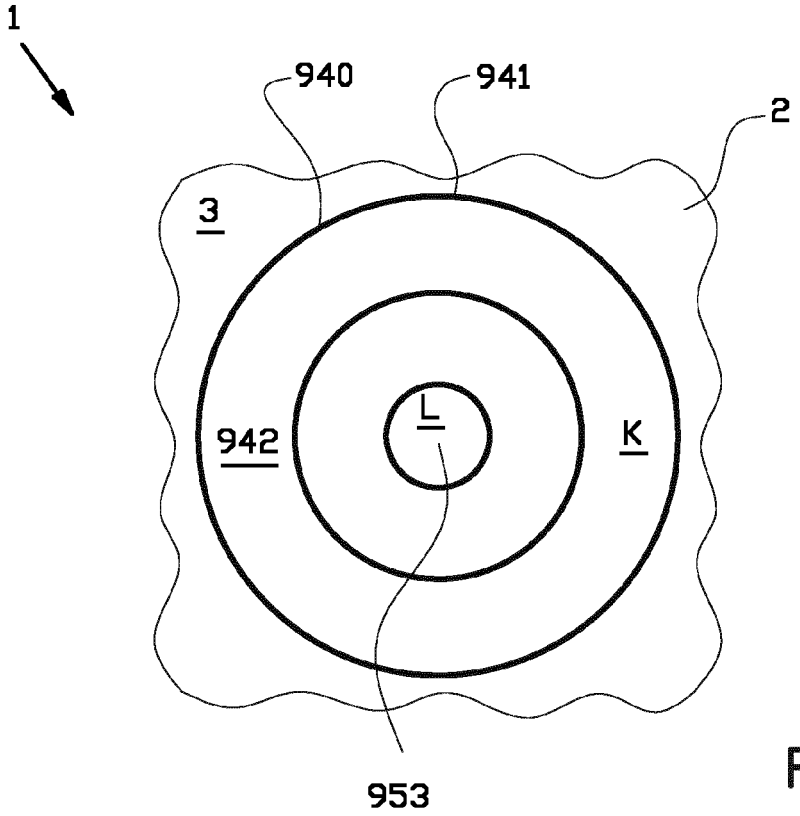
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FIG. 9B

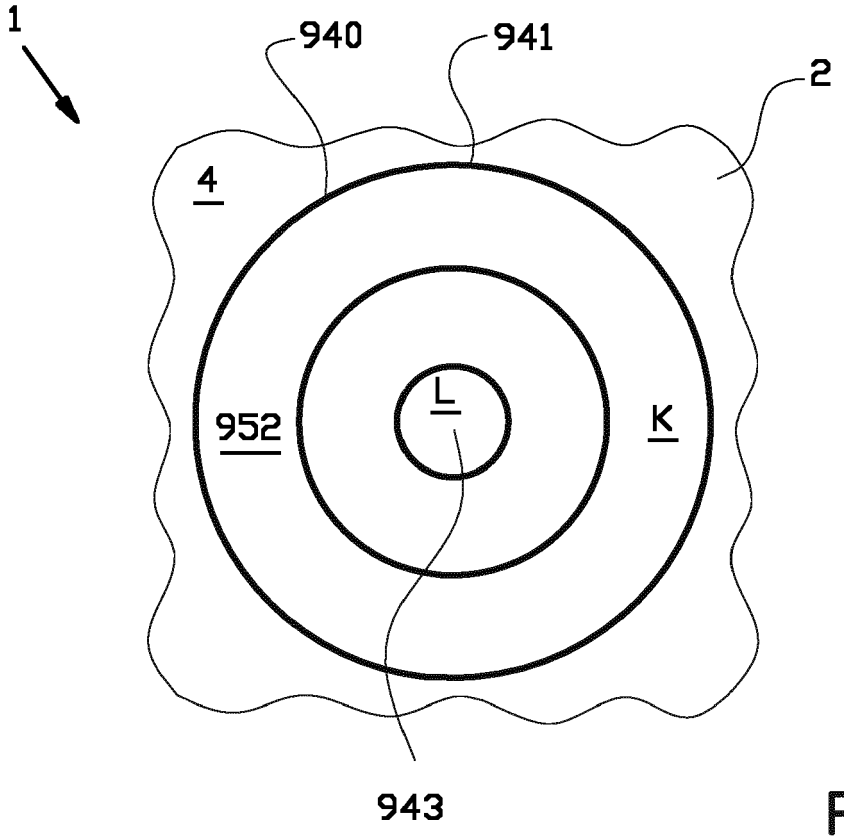

FIG. 9C

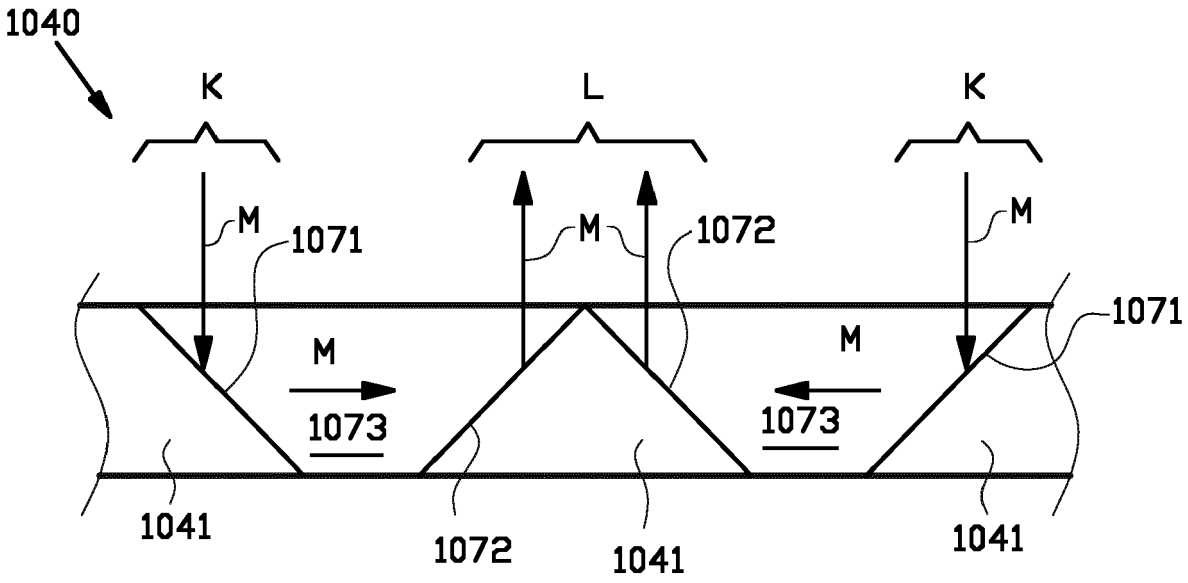

FIG. 10A

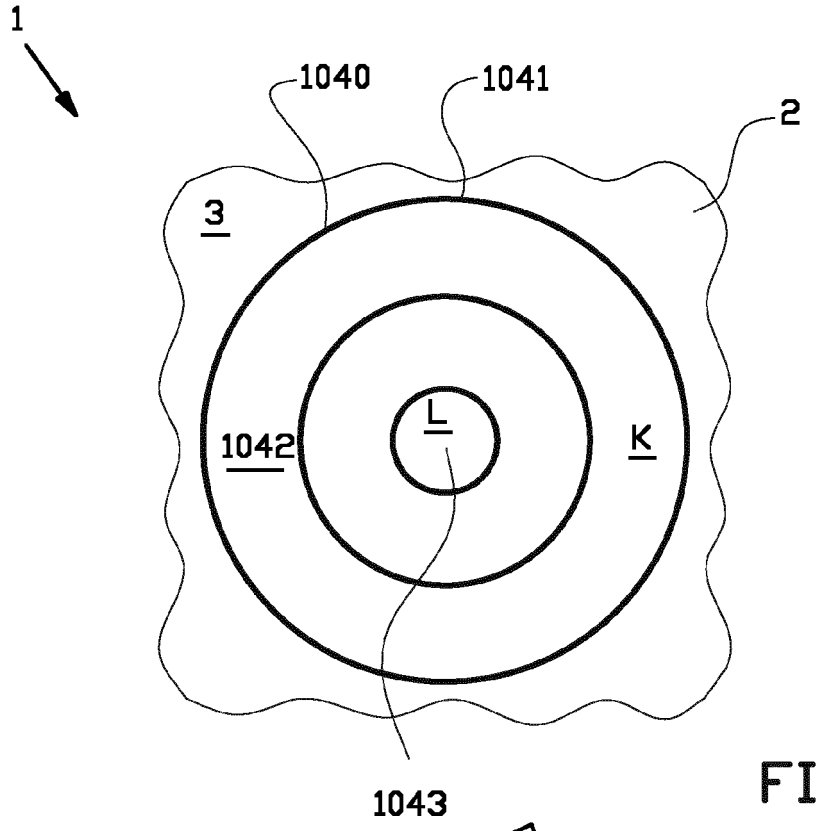

FIG. 10B

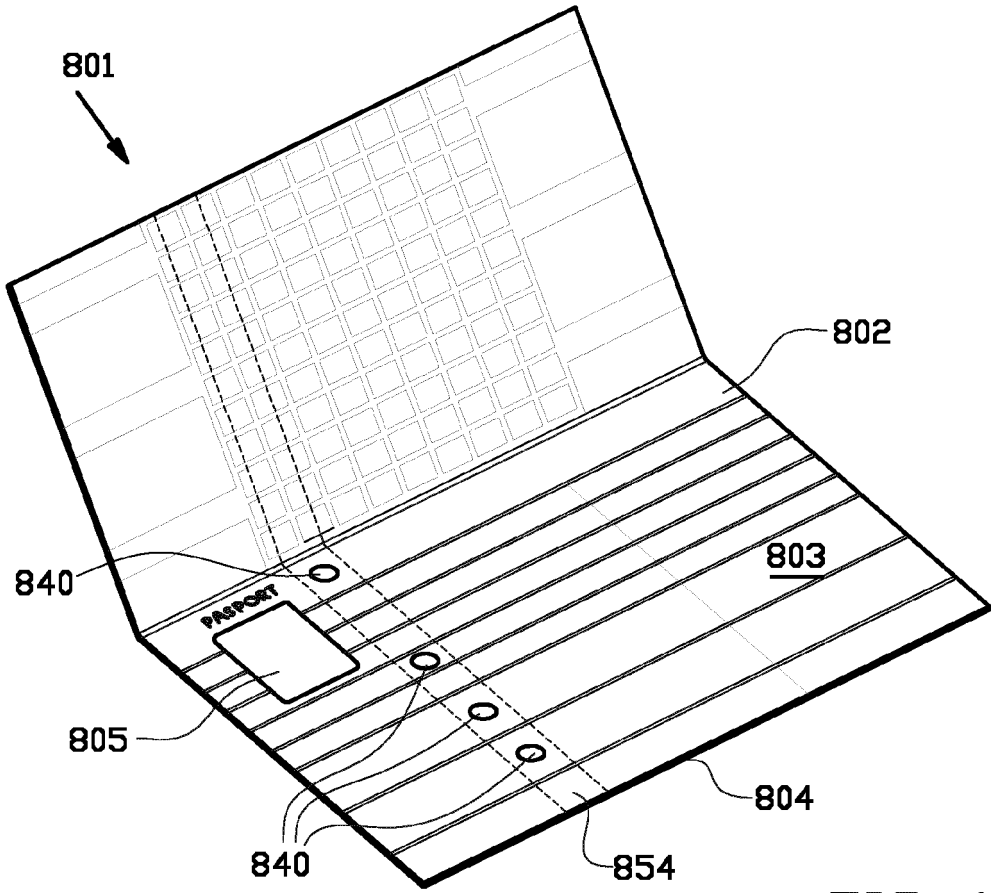

FIG. 11

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EUROPEAN SEARCH REPORT

Application Number
EP 16 19 6402

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TECHNICAL FIELDS SEARCHED (IPC)

B42D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 December 2016	Langbroek, Arjen

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L : document cited for other reasons

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EPO FORM 1503 03.82 (P04C01)

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06-12-2016

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