Office de la Propriété Intellectuelle du Canada
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Canadian Intellectual Property Office
An agency of Industry Canada

CA 2841862 A1 2013/01/24

(21) 2 841 862

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) Date de dépôt PCT/PCT Filing Date: 2012/07/19
(87) Date publication PCT/PCT Publication Date: 2013/01/24
(85) Entrée phase nationale/National Entry: 2014/01/07
(86) N° demande PCT/PCT Application No.: EP 2012/003060
(87) N° publication PCT/PCT Publication No.: 2013/010673
(30) Priorité/Priority: 2011/07/21 (DE10 2011 108 239.9)

(51) Cl.Int./Int.Cl. *B42D 15/00* (2006.01)

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(54) Titre : SUPPORT DE DONNEES AVEC CARACTERISTIQUE DE SECURITE TACTILE
(54) Title: DATA CARRIER HAVING TACTILE SECURITY FEATURE

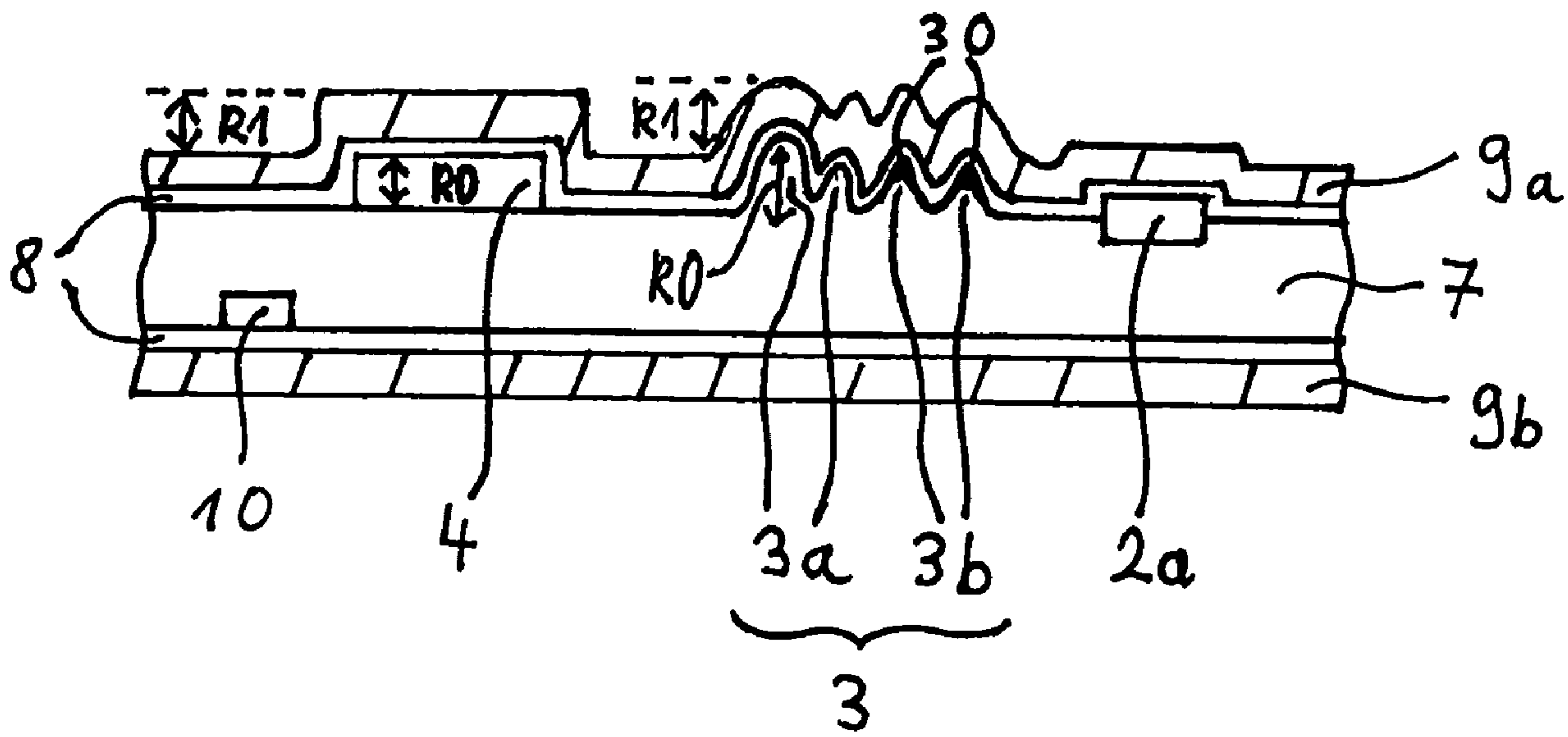

FIG. 2

(57) Abrégé/Abstract:
The invention relates to a data carrier, in particular a valuable document such as a banknote, identity card and the like, having a substrate (7), which has at least one security feature (2, 3, 4, 6, 10) which is perceivable in a tactile fashion. The invention provides for the relief height (R0) of the at least one security feature (2, 3, 4, 6, 10) which is perceivable in a tactile fashion to be 10 μm to 180 μm and for the substrate (7) having the at least one security feature (2, 3, 4, 6, 10) which is perceivable in a tactile fashion to be covered on both sides in each case over the full area by a polymer cover layer such that the tactility of the at least one security feature (2, 3, 4, 6, 10) which is perceivable in a tactile fashion is substantially maintained.

Abstract

The invention relates to a data carrier, in particular value document, such as a bank note, identification card and the like, having a substrate (7) which has at least one tactilely detectable security feature (2, 3, 4, 6, 10). According to the invention, it is provided that the relief height (R0) of the at least one tactilely detectable security feature (2, 3, 4, 6, 10) amounts to 10 μm to 180 μm, and the substrate (7) having the at least one tactilely detectable security feature (2, 3, 4, 6, 10) is covered on both sides respectively over the full area by a polymeric cover layer (9a, 9b) such that the tactility of the at least one tactilely detectable security feature (2, 3, 4, 6, 10) is substantially preserved.

Data carrier having tactile security feature

[0001] This invention relates to a data carrier, in particular a value document, such as a bank note, identification card and the like, having a substrate which has at least one tactilely detectable security feature.

[0002] The invention also relates to a method for manufacturing such a data carrier.

[0003] Data carriers, such as security documents, value documents or identity documents, but also other objects of value, are often equipped for safeguarding purposes with security features that permit a check of the data carrier's authenticity and at the same time serve as protection from unauthorized reproduction.

[0004] It is known to equip data carriers, in particular value documents, with a tactilely detectable security feature. Studies, as have been carried out by the Bank of Canada for instance, have in fact shown that tactility has great importance in rating the authenticity of bank notes.

[0005] Further, it is known to equip value documents, in particular bank notes, with a substrate material made of paper or polymer. A disadvantage of these value documents, however, regardless of the substrate used, is that in particular value documents with high circulation are subjected to considerable wear and strong soiling, so that the circulation periods of these value documents are short. In particular, it is known that substrates made of paper become soiled relatively quickly and become limp through moisture absorption, i.e. the typical sound and typical feel of these substrates are largely lost. On the other hand, substrates made of a polymer material show very low resistance to tear propagation, which is why substrates damaged by initial tears must be replaced.

[0006] On these premises, the present invention is based on the object of further improving data carriers of the kind stated at the outset with regard to their circulation resistance and their protection from imitation, while at the same time preserving as completely as possible the properties important for rating the authenticity of bank notes.

[0007] This object is achieved by the data carrier and the manufacturing method having the features of the independent claims.

[0008] Developments of the invention are the subject matter of the dependent claims.

[0009] According to the invention, a generic data carrier, in particular a value document, such as a bank note, identification card and the like, comprises a substrate which has at least one tactilely detectable security feature, wherein the relief height of the at least one tactilely detectable security feature amounts to 10 µm to 180 µm. The substrate having the at least one tactilely detectable security feature is covered on both sides respectively over the full area by a polymeric cover layer such that the tactility of the at least one tactilely detectable security feature is substantially preserved.

[0010] According to the invention, the great relief height of the tactilely detectable security feature ensures that the consumer can easily check the authenticity of the bank note according to the invention by the tactile security feature. The tactility of the at least one tactilely detectable security feature is preserved here according to the invention in spite of the polymeric cover layer applied on both sides respectively over the full area to the substrate having the tactile security feature. This finding is surprising in that, in hitherto known data carriers having a tactile security feature, the both-sided covering of the substrate with a cover layer has, sometimes drastically, reduced the tactility of a security feature arranged on the substrate.

[0011] According to the invention, however, it is now possible to state data carriers with a substrate having a tactile security feature and polymeric cover layers arranged on both sides on the substrate in which the tactility of the tactile security feature is substantially preserved and at the same time the tactile security feature, as well as all the other security features and the data-carrier substrate, are protected from wear and soiling. Furthermore, the data carrier with the security-relevant features is protected from attempts at tampering, thereby making the security against imitation of the data carriers according to the invention exceptionally high.

[0012] In a preferred embodiment, the tactilely detectable security feature of the data carrier has a relief height of 20 μm to 150 μm, preferably 30 μm to 130 μm, and very particularly preferably 35 μm to 90 μm. Security features having a relief height of 20 μm to 150 μm enable good haptic perception by the user of the data carrier, and can at the same time be made by known manufacturing processes for such data carriers. Thus, the data carrier can have a great number of known tactile security features, which makes the invention very interesting economically.

[0013] Preferably, the relief height of the tactilely detectable security feature covered by the polymeric cover layer has 40% to 100%, preferably 60% to 100%, and very particularly preferably 80% to 100%, of the relief height of the non-covered security feature. As mentioned above, preservation of the tactility of the security feature to the greatest possible extent is essential to the present invention. The surprising finding that the tactility of the security feature is substantially preserved through the suitable selection of tactile security features, covering polymeric layer and corresponding manufacture parameters will be discussed hereinbelow in connection with the individual relevant features. Without being bound to an explanation, it is currently assumed that the tactility of a security feature with great relief height is preserved to a greater extent than is the case with security features with lesser relief height. For the user of a data carrier according to the invention the complete or substantially complete preservation of tactility means ultimately that he can hardly, or not at all, distinguish between a data carrier with a polymeric cover layer and a data carrier without, at least with regard to the haptic detectability of the tactile security feature. Even though this ideal case of 100% preservation of the relief height can not always be realized in practice, an approx. 80% preservation of tactility will be sufficient for most users of the data carrier to unambiguously recognize the authenticity of the tactile security feature.

[0014] The tactilely detectable security feature is advantageously selected from the group consisting of watermark, security thread, foil strip, foil patch, imprint, embossed structure or relief structure produced by the action of electromagnetic radiation. So-called security threads that can be embedded partly or completely into a substrate are also suitable as tactile security features. A "foil strip" will hereinafter be understood to be an elongate foil element, and a "foil patch" a non-elongate foil element having e.g. a circular, elliptical or rectangular outline.

[0015] An imprint on the substrate of the data carrier, or an embossed structure formed by means of a suitable embossing tool, also has a suitable relief for recognizing authenticity. The relief structure produced by means of electromagnetic radiation may be e.g. a foamable imprint which expands to form a relief structure under the action of heat. It is further conceivable in this connection to expose an, in particular paper-based, substrate to form a relief structure in the regions exposed to radiation.

[0016] It will be appreciated that the tactile security feature in the form of a security thread, foil strip or foil patch can have per se known features, in particular a diffractive structure, matt structure, a thin-film arrangement with a color-shift effect, micromirrors, microlenses and other optically variable features.

[0017] Furthermore, it will be appreciated that every imprint with a relief height greater than 10 μm can be used as a tactile feature, with suitable printing processes being in particular offset printing, flexographic printing, screen printing or gravure printing. It is possible here e.g. by means of a screen printing process to provide a relief on the security substrate that consists only of an ink layer with a thickness of approx. 10 μm to 30 μm. Such relief structures can be manufactured e.g. with UV-drying inks. The relief produced by screen printing can fundamentally be configured in color or colorless, i.e. transparent. The imprint can comprise effect inks, which can contain in particular magnetically alignable, metallic or liquid-crystal pigments. It is further conceivable to use thermochromic and photochromic materials, whereby all the above-mentioned materials and pigments can also be enclosed in microcapsules.

[0018] It is especially advantageous when the imprint involves a gravure printing process, in particular an intaglio printing process. By the gravure printing process, in so-called "ink-carrying" gravure printing an embossed structure is produced congruently with the imprint. Such a security feature, in which the tactility is formed by the produced embossed structure and the imprint arranged congruently with the embossed structure, has a tactile structure with great stability and durability, which is further improved with regard to its circulation resistance by the cover layer provided according to the invention. The tactile security features produced by ink-carrying intaglio printing have a typical total relief height of approx. 35 μm to 90 μm for the embossed structure and the imprint, which is especially advantageous for haptic detection and thus proof of authenticity.

[0019] It is further conceivable to configure the imprint transparent, so that the viewer substantially perceives the embossed structure in the color of the embossed substrate. At the same time, the embossed structure is well protected by the transparent imprint from external influences, which is ensured in even greater measure through the covering polymeric cover layer.

[0020] It is of course also conceivable to produce, in the region of a preprint on the substrate or on a foil element arranged on the substrate, a relief that is visually distinguishable from the color of the preprint or of the foil element by means of ink-carrying gravure printing or by means of "blind embossing" (see below).

[0021] It is further advantageous when a gravure printing plate without ink is used for producing a so-called "blind embossing". In so doing, the substrate is only deformed to form an embossed structure, but no congruent imprint is produced. Such an embossed structure therefore forms a relief in the color of the substrate. If the substrate is colorless, a colorless relief is accordingly obtained. Through the blind embossing produced in a preprint or foil element there is normally produced through shadow effects a structure that is visually discernible from the non-embossed region.

[0022] With especially great advantage it is hence possible to produce by gravure printing tactilely detectable security features in which regions with imprint and congruent embossed structure as well as blind-embossed regions having only an embossed structure are produced directly side by side. Such structures have exceptionally high protection from forgery, because a spatial succession of embossed structures with and without imprint is especially hard to forge.

[0023] In a preferred embodiment, it is further provided that the substrate has at least one paper layer. In the simplest case, the substrate is a single- or multi-ply security paper, this being advantageously formed of cotton or of cotton with a polymeric content x, where x is greater than 0% and smaller than 100%. It is very advantageous to embed a tactilely detectable security feature at least partly into the paper layer during the paper manufacture. The security feature can be in particular a watermark or a security thread. It is further conceivable to use a tactile security feature, in particular a fibrous mat or a paper strip, incorporated into the paper for producing a thickness modulation in the paper substrate. It will be appreciated that further security features can be arranged on the substrate in addition to the tactile security features embedded into the substrate. The at least partly embedded security threads can in turn contain the above-mentioned, in particular optically variable, features.

[0024] The substrate may of course also involve a polymeric material, in particular a plastic foil of PET, PP, PE, PA, PC or PVC. Such polymeric materials have an especially long life, but they normally have considerably poorer embossability and thus normally lower tactility e.g. of an imprint produced thereon by intaglio printing.

[0025] The polymeric cover layer which is arranged respectively over the full area on the two surfaces of the substrate preferably consists of PET, PP, PE, LDPE, LLDPE, PA, PC, POPP, PVC, PU, polyurethane acrylates, cellophane, UV-cross-linked lacquer layers (radically cross-linking or cationically cross-linking) or of natural biopolymers. Conceivable natural biopolymers are in particular foils made of renewable raw materials, such as starch or polylactic acids (PLA). The polymeric cover layer can of course also be a mixture of one or several of the above-mentioned polymers.

[0026] The polymeric cover layer advantageously has a thickness of 0.8 μm to 20 μm, preferably 2 μm to 12 μm, and very particularly preferably 2 μm to 6 μm. In a special configuration, the thickness of the polymeric cover layer on one or on both surfaces of the substrate amounts to only approx. 3.5 μm. Cover layers with such small thicknesses can be produced by the methods described hereinbelow and bestow a substantially complete preservation of the tactility of the tactile security feature, even after covering through the polymeric cover layer. Furthermore, such a thin layer already provides a considerably improved circulation resistance in comparison with substrates without a cover layer, and likewise increases the forgery-proofness of the security features covered by the cover layer.

[0027] The polymeric cover layer is advantageously configured transparent or translucent. A transparent layer ideally has a transmittance of 100%, whereby this value is normally not obtained exactly in practice. Within the framework of the present invention, a transparent layer therefore has a transmittance of 90% to 100%. As used in the present application, transmittance designates the transmissivity to light, in particular to light in the visible wavelength region between 400 nm and 800 nm, i.e. to light as is usually perceived by the viewer. In other words, within the framework of the present invention transmittance is the quotient of the radiant flux transmitted through the material divided by the radiant flux irradiated onto the layer. Depending on the application, however, transmittance can also relate only to a single wavelength or to other wavelength regions, for example to the near UV or IR wavelength region adjacent to the visible spectral region.

[0028] A translucent or semi-transparent layer has within the framework of the present application a transmittance of 10% to 90%, and particularly preferably 20% to 80%.

[0029] It will be appreciated that a polymeric cover layer applied on a surface of the substrate need not have the same transmission properties over its total area. In particular, transparent and translucent regions can also alternate or be arranged in a certain pattern, in dependence on the manufacturing method.

[0030] In a particularly preferred embodiment, it is provided that the polymeric cover layer is not equipped with a security feature, preferably not with a tactilely detectable security feature, and in particular not with an imprint or an embossed structure. Such an embodiment advantageously enables the substrate to be equipped with the tactilely detectable security feature and all further security features provided for the data carrier, and the substrate having all the security features to be covered on both sides with the polymeric cover layers in a final step. Such an embodiment is of interest in terms of production engineering and economically because, after application of the polymeric cover layer, the data carrier need not be equipped with any further layer, in particular any further ink-receiving layer, printed layer or other security-relevant feature. Furthermore, such an embodiment has exceptional protection from forgery, because all the security features relevant for the authenticity of the data carrier, as well as all other information relevant for the recognizability of the data carrier, in particular imprints and other design elements, are protected from tampering and forgery attacks by the polymeric cover layer.

[0031] Although the polymeric cover layer has no security feature, in particular no tactile security feature and in particular no security thread, foil patch, foil strip or imprint, on both sides of the substrate in this preferred embodiment, the cover layer might have intrinsic features, such as e.g. polarization features resulting from stretching of the cover layer, or fluorescence substances that are not visible in the visible wavelength region. Such intrinsic properties of the polymeric cover layer are not excluded by the formulation that "the polymeric cover layer has no security features". The intrinsic properties are therefore detectable by machine and/or visually using suitable auxiliary means or sensors and can act as an additional authentication feature. Nevertheless, it is particularly preferable to configure the cover layer transparent or at least translucent in the visible wavelength region when such intrinsic features are present in the polymeric cover layer.

[0032] The invention also comprises a method for manufacturing a data carrier of the above-mentioned kind. In the method according to the invention,

a) there is made available a substrate having at least one tactilely detectable security feature with a relief height of 10 μm to 180 μm, and

b) the substrate having the at least one tactilely detectable security feature is covered on both sides respectively over the full area by a polymeric cover layer such that the tactility of the at least one tactilely detectable security feature is substantially preserved.

[0033] The tactilely detectable security feature is advantageously produced with a relief height of 20 μm to 150 μm, preferably 30 μm to 130 μm, and very particularly preferably 35 μm to 90 μm.

[0034] It is especially advantageous further to produce the polymeric cover layer such that the relief height of the covered, tactilely detectable security feature amounts to 40% to 100%, preferably 60% to 100%, and very particularly preferably 80% to 100%, of the relief height of the non-covered security feature.

[0035] The tactilely detectable security feature can be applied to the substrate in the method step a) in particular by means of a transfer method. For example, security threads, foil strips or foil patches can be transferred to the substrate by such a transfer method. However, the substrate can advantageously also be provided with an imprint or an embossed structure, there being employable for this purpose in particular a gravure printing process, in particular an intaglio printing process. It is further conceivable to provide the substrate with a relief structure by the action of electromagnetic radiation, which can be done e.g. by exposing a paper-based substrate to laser radiation, or a foamable imprint to heat.

[0036] In a preferred embodiment, it is further provided that the substrate is manufactured with at least one paper layer in a paper machine, and a tactilely detectable security feature, in particular a watermark or a security thread, is embedded at least partly into the paper layer preferably during the paper manufacture. Such security features embedded into the substrate are inseparably connected to the substrate and hence increase the forgery-proofness of the data carrier safeguarded therewith.

[0037] In addition to these security features at least partly embedded into the substrate, it is of course possible to apply further, in particular tactile, security features to the substrate, for example by means of the above-mentioned transfer methods.

[0038] In an advantageous embodiment, it is provided that the substrate is equipped in the method step a) with all the tactile security features provided for the data carrier. In such an embodiment, the substrate of the data carrier is equipped with all the provided tactile and, where applicable, further, security features and/or information relevant for the recognizability of the data carrier, in particular imprints and other design elements, so that in a further method step the substrate need only be covered by a polymeric cover layer on both sides. In such an embodiment, the covering by the polymeric cover layer therefore constitutes the final method step in the manufacture of the data carrier, apart from cutting the data carriers to the desired shape and other minor method steps for finishing the data carrier. Advantageously, in such an embodiment all the security elements and information of the substrate is protected from forgery attacks by the polymeric cover layer.

[0039] In a preferred method, it is further provided that the polymeric cover layer is applied to the substrate by a foil laminating method, in particular pressure-based laminating, nip laminating or air-assisted laminating method. The stated methods for foil lamination are suited for manufacturing data carriers in a process in which a multiplicity of data carriers yet to be singled have been wound on rollers (web-fed process) or are present as sheets (sheet-fed process). As the name of the laminating method says, in pressure-based lamination the web to be laminated is pressed into the carrier web at a defined pressure, while in nip lamination a predetermined nip width is used so that the desired laminating pressure can be chosen without changing the thickness of the web to be laminated. In air-type lamination, vertically adjustable carrier rollers are used to ensure a lamination that is particularly gentle on the substrate for sensitive substrates. Air-assisted lamination and, to a certain extent, also nip lamination are particularly suitable for preserving the tactility of the tactile security feature. Furthermore, it can be expedient to heat the polymeric cover layer to be laminated onto the substrate, in particular to urge it against the substrate by means of a hot-air fan, in order to obtain as complete a preservation of the relief as possible. In so doing, the temperature of the hot air should lie in the vicinity of the glass transition temperature (TG) of the foil.

[0040] According to a preferred embodiment, it is provided to emboss at least partial regions of the substrate during the arrangement of the polymeric cover layer on the substrate and thus to produce a further tactilely detectable relief. For example, such an additional embossing of the substrate can be utilized for producing embossed script and advantageously be arranged in printed or unprinted regions of the substrate.

[0041] It should further be mentioned that if the polymeric cover layer is applied in the form of a foil, it is necessary to connect the foil to the substrate. There can thus be used for connecting substrate and foil a wet adhesive (wet lamination process), a dry adhesive (dry lamination process) or no adhesive, but the action of heat and/or pressure (thermal lamination process). It is further conceivable to use the so-called "thermolamination process" by which the polymeric cover layer is produced by connecting a hot-extruded polymer layer to the substrate.

[0042] In an alternative method, it is provided that the polymeric cover layer is applied to the substrate by a curtain coating process, an extrusion coating process or by means of a flat adhesive metering system. The polymeric cover layer can furthermore be applied to the substrate by foil transfer, by spraying or by imprinting. In the curtain coating process, the coating compound provided as a polymeric cover layer is poured onto the substrate, whereby more than one layer of like or different coating substances can be applied simultaneously in this method. This manner of coating enables a uniformly thick application of the coating, in dependence on the coating material provided for the polymeric cover layer, in particular the surface tension and viscosity of the cover layer, the substrate quality, in particular the surface roughness, the absorbency and the surface tension of the substrate, as well as the adjusted machine parameters, in particular the web speed, the distance from the substrate and the nozzle design. In this coating variant, the tactility of a security feature can be especially well preserved.

[0043] In extrusion coating, flat film extruders are preferably used, the polymeric material employed being advantageously PE or PP, and the polymeric material normally being applied directly to the substrate. For flat film extruders there are offered for example foils in the thicknesses 4 μm to 60 μm (cast PP), 4 μm to 50 μm (POPP), 8 μm to 250 μm (PET) as well as PA foils in different thicknesses.

[0044] Because a curtain coating and extrusion coating process is not suited for a sheet-fed process, i.e. not for sheet stock, data carriers according to the invention can be equipped with a polymeric cover layer in a sheet-fed process advantageously by means of a flat adhesive metering system. In such a system a slot nozzle is advantageously provided in the width of the sheet to be provided with the polymeric cover layer, which in turn contains a multiplicity of data carriers to be singled later. Alternatively, it is also possible, instead of using one slot nozzle, to arrange several slot nozzles side by side such that their width in sum corresponds to the sheet width. It is further conceivable to respectively arrange several slot nozzles side by side in e.g. two rows, so that the end of a nozzle is always in the middle region of the nozzle of an adjacent row, with respect to the running direction of the sheet, thereby avoiding unwanted "seams" in the coating process.

[0045] In a further embodiment, it is further provided that during the arrangement of the polymeric cover layers on the two surfaces of the substrate there are arranged on the outer surface of the polymeric material additional features, in particular fluorescence substances not visible in the visible wavelength region. These features correspond to the above-described intrinsic features that might be contained in the polymeric cover layer, but these features are arranged on the side of the cover layer facing the substrate or the (outer) side facing away from the substrate by a suitable method during the arrangement of the polymeric cover layer on the substrate. These features can, in so doing, be arranged on the polymeric cover layer in a clocked manner and exactly positioned over the width. The exact position and the quantity of the additional feature on the polymeric cover layer of the data carrier can be used as a security-relevant feature for recognizing the authenticity of the data carrier by means of suitable sensors. For manufacturing such an additional feature there is used e.g. a metering unit which discharges the feature substance onto the polymeric cover layer in an exactly positioned manner and synchronized with the process for arranging the polymeric cover layer on the substrate. Such a positioned and synchronized metering of the additional feature is conceivable in both a web-fed process and a sheet-fed process.

[0046] In a further method variant, it is provided that the polymeric cover layers are applied to the substrate in a thickness of 0.8 μm to 20 μm, preferably 2 μm to 12 μm, and very particularly preferably 2 μm to 6 μm, whereby particularly a polymeric cover layer of approx. 3.5 μm preserves the tactility of the tactile security feature exceptionally well.

[0047] It should also be mentioned that the polymeric cover layer arranged on both sides of the substrate can be matted at least partly in an advantageous embodiment. This is advantageous when the polymeric cover layers have a relatively great luster, which is not always optically attractive to a viewer and can impede the machine detection of the data carrier. A high luster might be given in those embodiments in which the polymeric cover layers are applied to the substrate with substantially all security features in a final method step, and the polymeric cover layers hence have no matt security features, imprints, etc. In particular in such embodiments, an at least partial matting of the polymeric cover layer can be advantageous in particular for machine detection.

[0048] For reducing the luster of the polymeric cover layers it is possible, on the one hand, to arrange on the substrate a polymeric cover layer that is already matted, i.e. reduced in its luster. On the other hand, it is also possible, however, to at least partly matt the polymeric cover layer already arranged on the substrate through suitable matting methods or by means of a coating. Where applicable, a matted cover layer arranged in the region of a tactile security feature can be provided with a higher luster partially in the region of the tactile security feature e.g. through a lustrous coating, which can be advantageous for visual detectability, as to be explained hereinafter.

[0049] Matting can in particular facilitate the machine check of the authenticity of the tactile security features according to the invention, and thus increase forgery-proofness. When the polymeric cover layer is furthermore unmatted in those regions where the tactile security features according to the invention are arranged under the polymeric cover layer, the viewer's attention is thus positively drawn to the tactile security feature and the possibility of checking authenticity by the lustrous, i.e. unmatted, region in otherwise matted surroundings. Through the provision of unmatted and matted regions it is thus possible to emphasize for the viewer the tactile features relevant for the authenticity check, thus enabling an easier authenticity check. The forgery-proofness of the data carrier is therefore increased in a synergistic manner through the interaction of tactile checkability and easier findability of the tactile security features.

[0050] Further embodiment examples as well as advantages of the invention will be explained hereinafter with reference to the figures, upon whose representation a true-to-scale and true-to-proportion rendition has been dispensed with in order to increase clearness.

[0051] There are shown:

Fig. 1 a schematic representation of a data carrier according to the invention having tactilely detectable security features in plan view, and

Fig. 2 a cross section through the data carrier of Fig. 1 along the line A-A'.

[0052] The invention will now be explained by the example of a data carrier in the form of a so-called "foil composite bank note". Fig. 1 thus shows in plan view a schematic representation of the bank note 1, having several tactilely detectable security features 2, 3, 4 and 6 which are arranged on the substrate or embedded partly or completely into the substrate. Furthermore, the bank note 1 also has authentication features, e.g. the imprint marked by reference sign 5, which is not necessarily configured so as to be tactilely detectable. The substrate having the security features 2, 3, 4, 5 and 6 is covered on both sides respectively over the full area by a polymeric cover layer 9a, 9b, which will now be explained more closely with reference to Fig. 2.

[0053] The representation according to Fig. 2 shows, on the one hand, the security thread 2 partly embedded into the bank-note substrate, which is a so-called "windowed security thread" with a thickness of approx. 6 µm to 60 µm. The windowed security thread 2 has regions 2b which are embedded substantially completely in the substrate, in the present case a paper-based substrate. Furthermore, the windowed security thread 2 passes to the surface of the paper substrate in the regions 2a, so that the features for authentication assurance, in particular holograms, diffractive structures, thin-film elements, etc., which are arranged on the security thread can be visually checked by the viewer for checking authenticity. Fig. 2 shows the cross section through such a region 2a, it also being recognizable that the security thread is only partly embedded in the substrate in the region 2a and hence protrudes out of the surface of the bank note by the amount R0 (not drawn in specifically), thus forming a tactile security feature of the present invention at least in the regions 2a.

[0054] The security feature 3 shown in Fig. 1 is a haptically detectable security feature produced by an intaglio printing process. As to be recognized in Fig. 2, the data carrier has, on the one hand, relief structures 3b with an imprint 30 arranged congruently therewith in the region of the security feature 3. For producing such tactile structures, the imprint 30 and, congruently therewith, the embossed structure 3b are produced simultaneously by ink-carrying intaglio printing. The relief height R0 of the embossed structure 3b amounts, with the imprint 30, to approx. 35 µm to 110 µm.

[0055] Besides the hereinabove described tactile feature comprising embossed structure 3b and imprint 30, there has been produced in the substrate a tactile structure 3a which has no inking. Such an embossed structure obtained by blind embossing of the substrate can likewise be produced with an engraving plate, whereby no ink is provided in the regions of the engraving plate corresponding to the regions 3a, and the plate is pressed into the substrate without ink. As a result there is produced an embossed structure 3a having good haptic detectability. The relief height of the embossed structure 3a is designated with the reference sign R0 in Fig. 2 and amounts to approx. 35 μm to 90 μm. As shown in Fig. 2, embossed structure 3a and embossed structure 3b with imprint 30 are arranged in immediate vicinity and produced in one method step by means of a printing plate. This procedure makes it possible to produce a tactile security element with great protection from forgery, because so closely adjacent tactile regions with and without inking are very hard to imitate. But even if embossed structure 3a and embossed structure 3b with imprint 30 are slightly spaced apart, e.g. by approx. 2 mm to 5 mm, the resulting structure is very forgery-proof.

[0056] On the surface of the substrate 7 there has further been applied by means of a transfer method the foil strip 4, which is arranged as an elongate foil element across the total width of the bank note. The foil strip has the relief height R0 of approx. 20 μm to 50 μm relative to the surface of the substrate.

[0057] The bank note 1 further has a tactilely detectable watermark 6 (see Fig. 1).

[0058] As shown in Fig. 2, R0 is defined as the height of the tactile security feature 2, 3, 4, 6 relative to the substrate surface. R0 thus states how far the security feature 2, 3, 4, 6 projects relative to the substrate surface.

[0059] As can be seen in Fig. 2, the tactile security elements 2, 3 and 4 are covered on one side of the substrate with the polymeric cover layer 9a. In the shown exemplary embodiment, a foil 9a has thus been applied to the surface of the substrate 7 having the tactile security elements by means of an adhesive 8 with a thickness of approx. 0.5 μm to 8 μm. The application of adhesive can amount to e.g. 2 g/m^2, which corresponds to a thickness of only a few micrometers. On the second surface of the substrate, on which further tactile security features can be located, as shown by way of example by the windowed security thread 10 embedded in the cross-sectional representation of Fig. 2, there is also arranged a foil 9b as a polymeric cover layer by means of an adhesive 8. The foils 9a, 9b may each be a PET foil with a thickness of 0.8 μm to 12 μm, in particular approx. 6 μm. It is also conceivable in such a case that one foil is made of a first material and the other foil of a second material, for example POPP or PET, with the same or a different thickness. Further, the polymeric cover layers 9a and 9b can also be arranged directly on the substrate with security features without adhesive, e.g. through extrusion, in contrast to the view in Fig. 2.

[0060] As readily recognized in Fig. 2, the relief height of the embossed structure 3a has the value R1 after covering through the cover layer 9a. The foil strip 4 and the security thread 2 also have a tactilely detectable relief with the relief height R1 after covering through the polymer cover layer 9a. R1 is defined in connection with the tactile security features of the present invention as the height of the polymeric cover layer in the region of the covered security feature relative to the polymeric cover layer arranged on the substrate surface (without a tactile security feature) (see Fig. 2).

[0061] According to the invention, the relief height R0 of the tactile security features arranged on the substrate 7 is preserved substantially completely after covering through the polymeric cover layer 9a, as Fig. 2 illustrates. The quotient of R1 and R0 amounts to 1 upon complete preservation of tactility, particularly preferably lying at least in the range of from 0.8 to 1. In such a case the user of the bank note can perceive practically no difference with regard to the relief height of the tactile security feature without and with covering through the polymeric cover layer. In other words, the tactile detectability of the security feature covered with the polymeric cover layer is guaranteed in any case according to the invention, while the circulation resistance and the protection from forgery are simultaneously increased considerably by the polymeric cover.

[0062] It will be appreciated that, as an alternative to the polymeric cover layers 9a, 9b shown in Fig. 2, cover layers can also be provided by likewise very advantageous application methods, such as e.g. curtain coating, extrusion coating, or by means of a flat adhesive metering system. Such methods can also be used to make data carriers according to the invention having security features that are readily detectable haptically, great protection from forgery and great circulation resistance.

Claims

1. A data carrier, in particular value document, such as bank note, identification card and the like, having a substrate which has at least one tactilely detectable security feature, wherein the relief height of the at least one tactilely detectable security feature amounts to 10 μm to 180 μm, and wherein the substrate having the at least one tactilely detectable security feature is covered on both sides respectively over the full area by a polymeric cover layer such that the tactility of the at least one tactilely detectable security feature is substantially preserved.

2. The data carrier according to claim 1, characterized in that the tactilely detectable security feature has a relief height of 20 μm to 150 μm, preferably 30 μm to 130 μm, and very particularly preferably 35 μm to 90 μm.

3. The data carrier according to claim 1 or 2, characterized in that the relief height of the tactilely detectable security feature covered by the polymeric cover layer amounts to 40% to 100%, preferably 60% to 100%, and very particularly preferably 80% to 100%, of the relief height of the non-covered security feature.

4. The data carrier according to at least one of claims 1 to 3, characterized in that the tactilely detectable security feature is selected from the group consisting of watermark, security thread, foil strip, foil patch, imprint, embossed structure or relief structure produced by the action of electromagnetic radiation.

5. The data carrier according to claim 4, characterized in that the imprint is an imprint produced by gravure printing, in particular intaglio printing, and has an embossed structure arranged congruently with the imprint.

6. The data carrier according to at least one of claims 1 to 5, characterized in that the substrate has at least one paper layer which preferably has a tactilely detectable

security feature, in particular a watermark or a security thread, at least partly embedded into the paper layer during the paper manufacture.

7. The data carrier according to at least one of claims 1 to 6, characterized in that the substrate is a polymeric material, in particular a plastic foil of PET, PP, PE, PA, PC or PVC.

8. The data carrier according to at least one of claims 1 to 7, characterized in that the polymeric cover layer is formed from PET, PP, PE, LDPE, LLDPE, PA, PC, BOPP, PVC, PU, polyurethane acrylates, cellophane, UV-cross-linking lacquer layers or natural biopolymers.

9. The data carrier according to at least one of claims 1 to 8, characterized in that the polymeric cover layer has a thickness of 0.8 µm to 20 µm, preferably 2 µm to 12 µm, very particularly preferably 2 µm to 6 µm, and in particular approx. 3.5 µm.

10. The data carrier according to at least one of claims 1 to 9, characterized in that the polymeric cover layer is configured transparent or translucent and/or not equipped with a security feature, preferably not with a tactilely detectable security feature, and in particular not with an imprint or an embossed structure.

11. A method for manufacturing a data carrier, in particular a value document, such as bank note, identification card and the like, wherein

a) a substrate having at least one tactilely detectable security feature with a relief height of 10 µm to 250 µm is made available, and

b) the substrate having the at least one tactilely detectable security feature is covered on both sides respectively over the full area by a polymeric cover layer such that the tactility of the at least one tactilely detectable security feature is substantially preserved.

12. The method according to claim 11, characterized in that the tactilely detectable security feature is produced with a relief height of 20 µm to 150 µm, preferably 30 µm to 130 µm, and very particularly preferably 35 µm to 90 µm.

13. The method according to claim 11 or 12, characterized in that the polymeric cover layer is produced such that the relief height of the covered tactilely detectable security feature amounts to 40% to 100%, preferably 60% to 100%, and very particularly preferably 80% to 100%, of the relief height of the non-covered security feature.

14. The method according to at least one of claims 11 to 13, characterized in that the substrate is equipped in the method step a) with a tactilely detectable security feature, in particular a security thread, foil strip or foil patch applied by means of a transfer method, an imprint produced by means of a gravure printing process, or an embossed structure and/or a relief structure produced by means of electromagnetic radiation.

15. The method according to at least one of claims 11 to 14, characterized in that the substrate is manufactured with at least one paper layer in a paper machine, and a tactilely detectable security feature, in particular a watermark or a security thread, is embedded at least partly into the paper layer preferably during the paper manufacture.

16. The method according to at least one of claims 11 to 15, characterized in that the substrate is equipped in the method step a) with all the tactile security features provided for the data carrier.

17. The method according to at least one of claims 11 to 16, characterized in that the polymeric cover layer is applied to the substrate by a foil laminating, in particular pressure-based laminating, nip laminating or air-assisted laminating, process.

18. The method according to at least one of claims 11 to 17, characterized in that the polymeric cover layer is applied to the substrate by a curtain coating process, an extrusion coating process, by means of a flat adhesive metering system, by foil transfer, by spraying or by imprinting.

19. The method according to at least one of claims 11 to 18, characterized in that the polymeric cover layer is applied to the substrate in a thickness of 0.8 µm to 20 µm, preferably 2 µm to 12 µm, very particularly preferably 2 µm to 6 µm, and in particular approx. 3.5 µm.

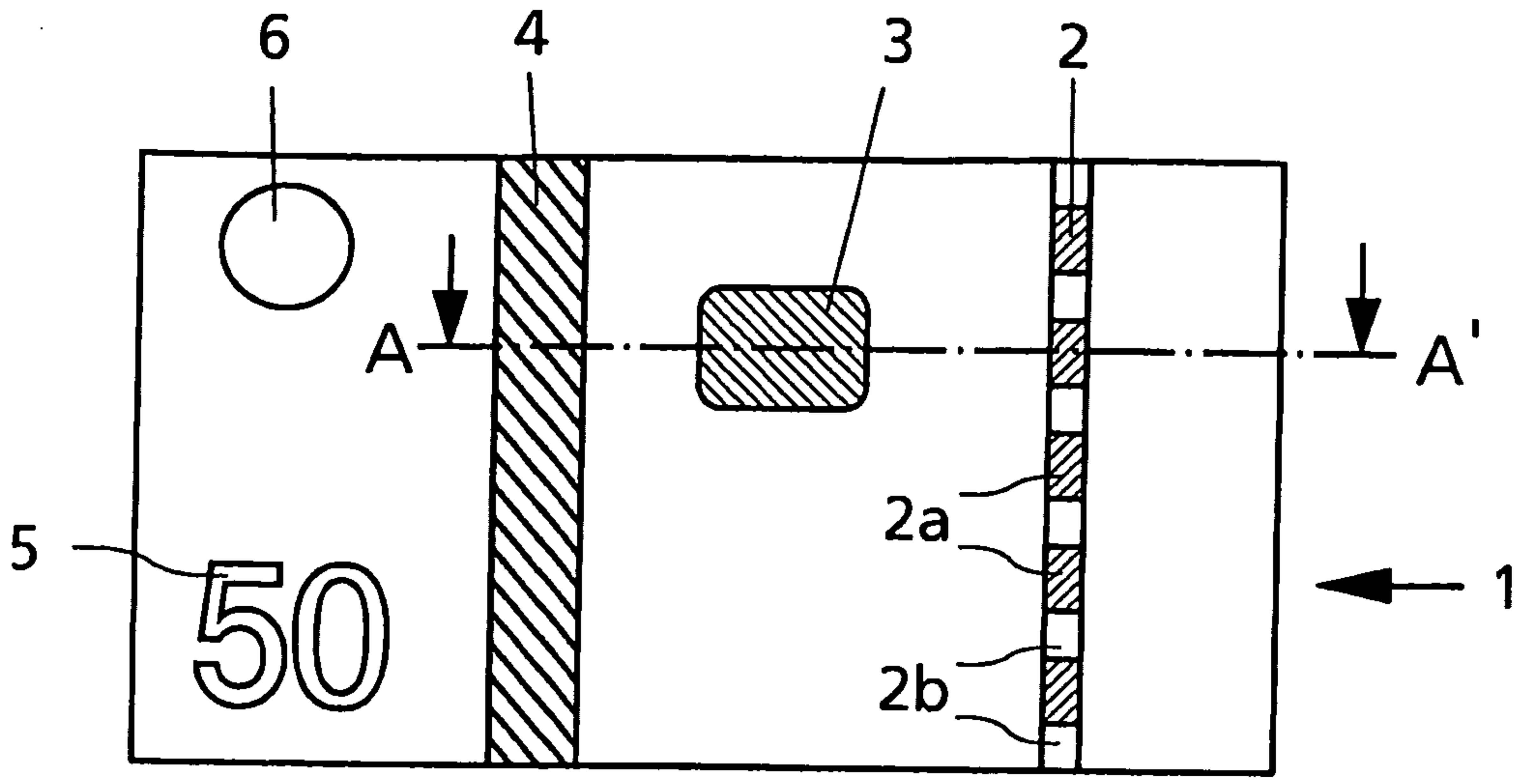

FIG.1

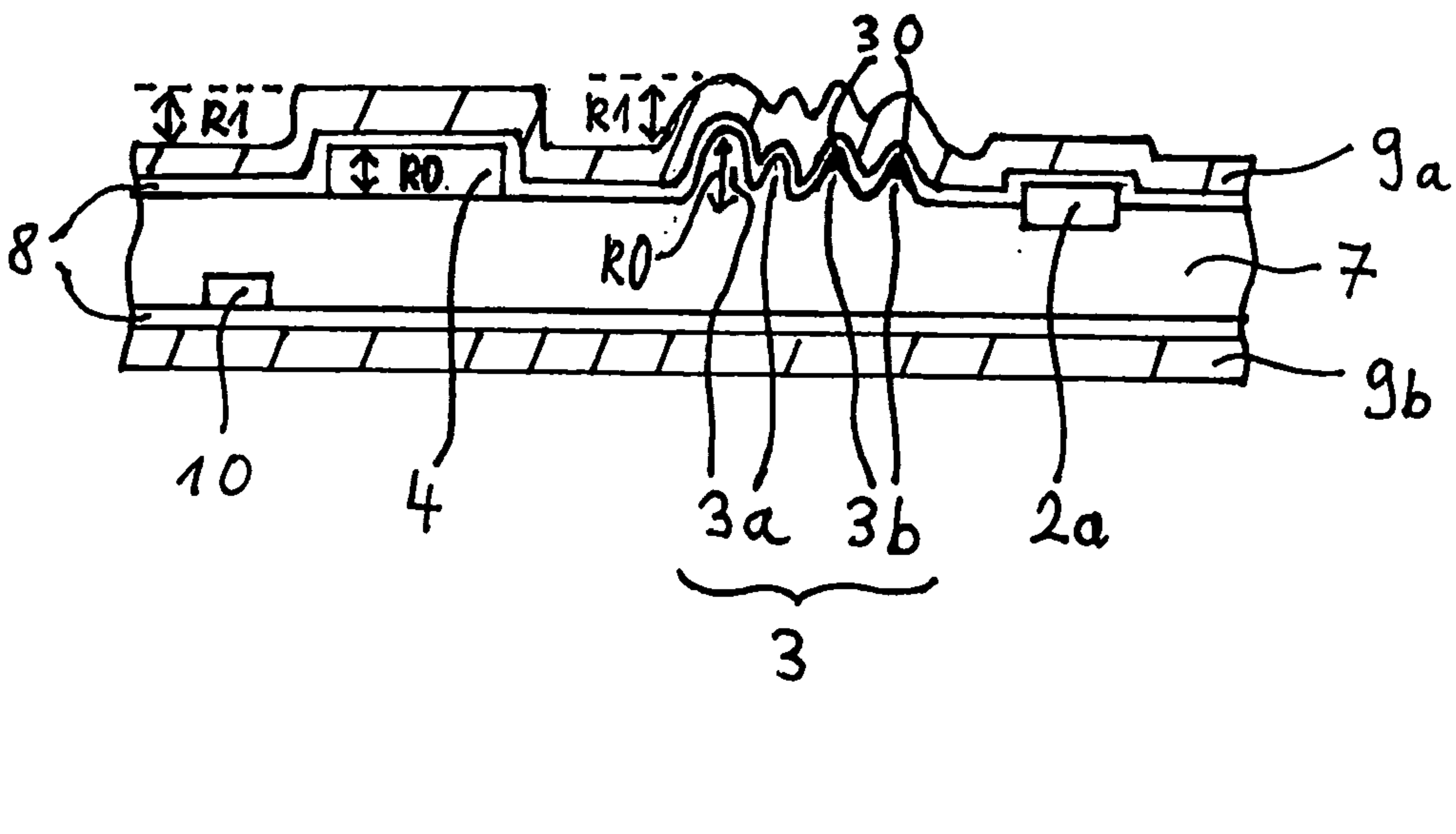

FIG. 2

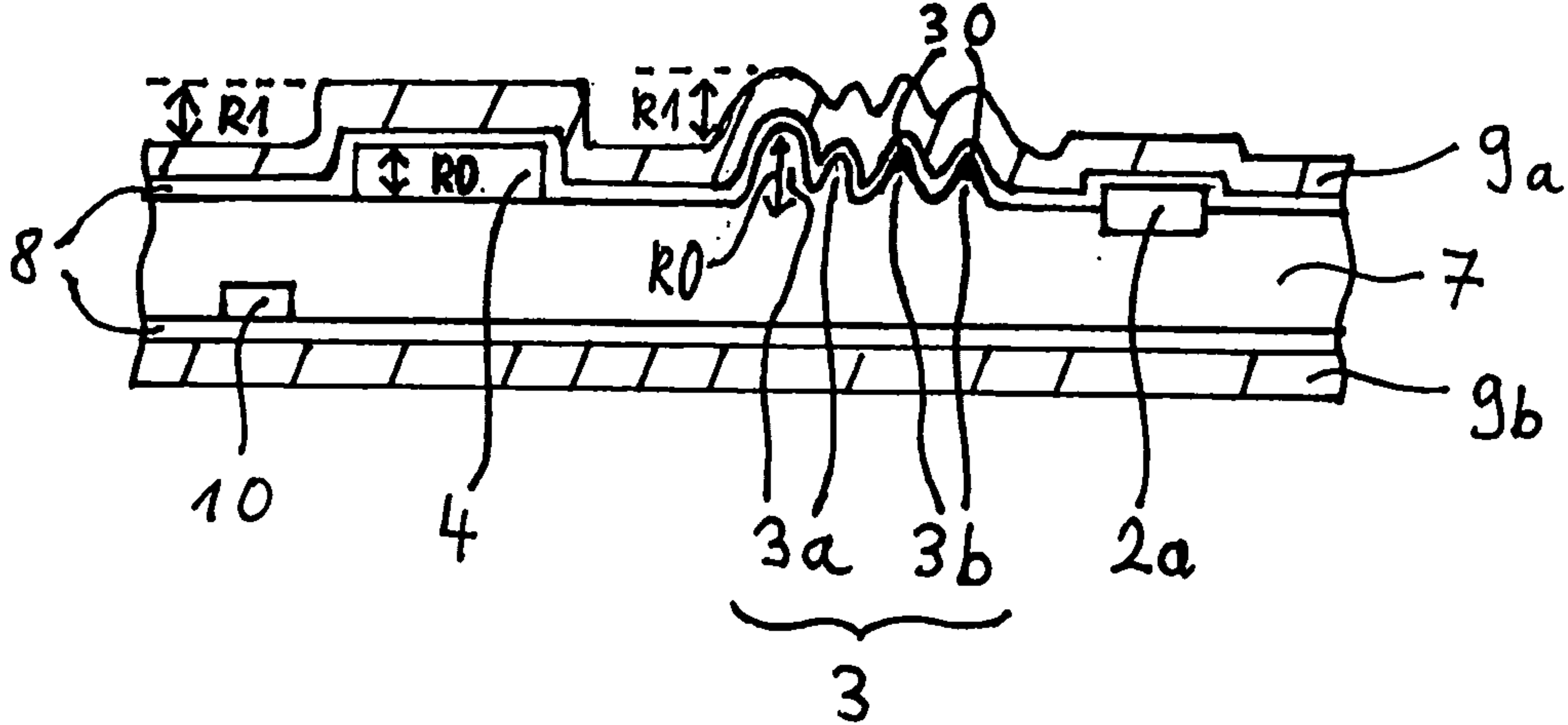

FIG. 2