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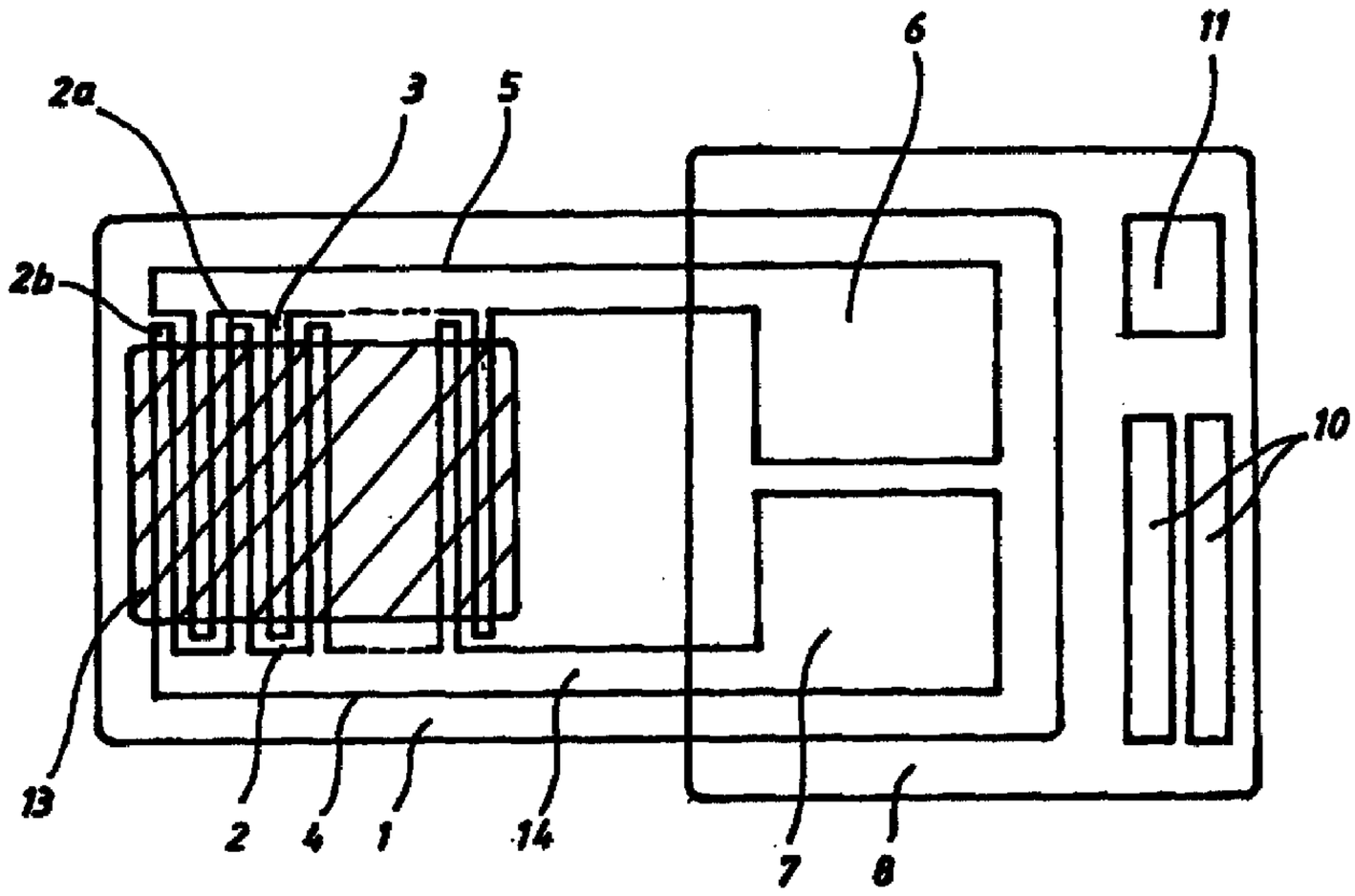
(54) **PRODUIT DE VALEUR ET DE SECURITE A ELEMENT LUMINESCENT**

(54) **VALUE AND SECURITY PRODUCT WITH A LUMINESCENT ELEMENT**



(57) L'invention concerne un produit de valeur et de sécurité à élément luminescent, constitué d'un matériau de support mono- ou multicouche, au moins un élément d'authentification étant disposé sur ou à l'intérieur de ce matériau de support. Dans le but de pouvoir effectuer un simple contrôle d'authentification visuel ou mécanique du document de sécurité dans toutes les conditions d'éclairage, un élément luminescent est disposé au-dessous de la couche faisant office d'élément d'authentification, l'élément luminescent se mettant à briller sous l'action d'une source d'énergie externe électrique, optique ou mécanique. Cet élément luminescent sert d'éclairage de fond à l'élément d'authentification disposé au-dessus.

(57) The invention relates to a value and security product with a luminescent element, consisting of a carrier material having one or multiple layers. An authentication element is arranged on or inside said carrier material. According to the invention, a luminescent element is provided underneath the layer configured as the authentication element, thereby enabling a simple visual or mechanical authentication check of the security document to be carried out under any lighting conditions. Said luminescent element is illuminated by an external electrical, optical or mechanical energy source. The luminescent element serves as background illumination for the authentication element arranged thereon.

ABSTRACT OF THE DISCLOSURE

The invention relates to a value and security product with a luminescent element, consisting of a carrier material having one or multiple layers. An authentication element is arranged on or inside said carrier material. According to the invention, a luminescent element is provided underneath the layer configured as the authentication element, thereby enabling a simple visual or mechanical authentication check of the security document to be carried out under any lighting conditions. Said luminescent element is illuminated by an external electrical, optical or mechanical energy source. The luminescent element serves as background illumination for the authentication element arranged thereon.

Value and Security Product With A Luminescent Element

The object of the present invention is a value and security product with a luminescent element according to the preamble of claim 1.

The production and application of electroluminescent foils and elements is known from the prior art.

In DE 43 10 082 A1, electroluminescent foils are introduced that are manufactured from inorganic, electroluminescent pigment(s) and thermoplastic synthetic material by means of extrusion or coextrusion. In principle, the extrusion or coextrusion of a system of this type on security papers is conceivable, however, the graphic design possibilities by process logistics appear restricted and the entire manufacturing process for the production of a security document and the arrangements for an authentication check required therefor very extensive.

In DE 43 15 244 A1, a method for producing an electroluminescing film by using the sputtering method is described. This method would also, in principle, be conceivable for producing security documents, however, a manufacturing process of this type represents an extremely high expenditure with respect to the vacuum chambers required for this method and is, furthermore, difficult to integrate in a possible production run and, in addition, produces film layers that must be furnished with additional special coatings for the high mechanical requirements on security documents.

In DE 41 26 051 A1, on the other hand, a security document

having an embedded areal security element (security thread) is introduced which is multilayered and has electroluminescing properties. The disadvantage of this arrangement is that a relatively high surface structure must be put up with, since the electrodes required for exciting the electroluminescent substances are superimposed on one another.

D1 already describes a holohedral structure of the electrodes which are arranged on top of and underneath a holohedral electroluminescent layer. An alternating voltage is applied to both electrode surfaces for excitation. This presumes an ohmic contacting of the electrode surface and this, in turn, a relatively high layer thickness which affects the visibility of the electroluminescent layer found below the electrode surface.

The object of the invention is to obtain a better luminous density.

To solve the object, the invention is characterized by the technical teaching of claim 1.

A self-illuminating arrangement in the form of a luminescent element is provided underneath a layer configured as an authentication element, which is preferably illuminated by an electric field or by an electron source. This luminescent element serves as background illumination for the authentication element provided on top of it.

According to the invention, this background illuminating layer is configured as an electroluminescent layer. An electroluminescent system is used hereby in which an electric field is preferably built up laterally, i.e. so as to be flat,

so that an advantage of this arrangement thus lies therein that the overall structure on the carrier material only adds a little.

In another embodiment of the invention, however, it is provided that the electric field for exciting the electroluminescent layer consists of flat electrodes that are arranged on top of one another, whereby the electroluminescent layer is then arranged between the electrodes.

For an electroluminescent plate condenser design (in which the two condenser "plates" lie essentially in a common plane), a transparent, electrically conductive layer is required that is obtained by means of so-called ITO pastes (Indium Tin Oxide). Moreover, the same is also obtained by precoated transparent foils or glasses.
Typically, biaxially oriented and thermally stabilized polyester foils are used with electrically conductive tin oxide, indium tin oxide (ITO) or quite generally transparent, electrically conducting, metallized surfaces, that are coated by an evaporation or by a sputtering method, that have surface-resistance values in the range of less ohm/square in glass substrates and typically 20 ohm/square up to 300 ohm/square and more.

High-grade electroluminescent systems require a uniform luminous density and a maximum luminous yield. Due to high thermal load capacity in coating processes, glass substrates generally offer a high-grade solution with higher transparency in the visible wavelength range with simultaneously improved surface conductivity. The essential advantage of printing with the ITO pastes, however, is the relatively simple application and the possibility of any graphic design desired,

which can be especially advantageous with respect to the electrical connections in complex systems.

Since ITO screen-printing pastes of this type scarcely allow surface resistance values of less than 300 to 400 ohm/square, so-called busbars are used in the invention which are electrically good conductive borders. As a result, uniform electric fields are obtained and thus a uniform luminous density. Furthermore, the connection of the ITO electrode can be configured so as to be functionally advantageous with this technology and, finally, the ITO electrode layer thickness is reduced to a minimum to the benefit of a higher transparency in thickness. According to the invention, busbars are printed in the printing field by means of silver, carbon, copper, etc. pastes or a combination of these elements and surface resistance values obtained in the range of some 100 milliohm/square values.

The following embodiments are described:

- The luminescent element has a lateral electrode arrangement on the value and security product,

- an electrically conductive coating on the back of the security document (prior to the graphic design processes) and application of electroluminescent security elements on the front side and formation of a transparent cover substrate with electrically conductive coating on the side pointing toward the security element,
- excitation of the electroluminescent element by an electromagnetically alternating field
- excitation by a system based on photoluminescence excitation via appropriate light sources, in particular

in the UV wavelength range and the use of suitable luminescing substances based primarily on silicates, phosphates, tungstates, germanates, borates, etc., activated with Mn, however, especially based on Zn_2SiO_4:Mn and the excitation by the 253,65 nm line of a Hg low-pressure discharge lamp (visible light eliminated by means of short-pass filter) and the excited emission of light in the visible green range,

- excitation of the luminescent system described by an extremely narrow band light source in the form of a frequency-tripled or quadrupled Nd:YAG laser with the wavelengths 266 nm and 213 nm, further, of a solid laser used with corresponding frequency-doubled or quadrupled on 236 nm and also excimer laser with light in the UV B (320 to 260 nm as per USA FDA) or UV C (260 to 200 nm) wavelength range for excitation of special lighting substances tuned to the respective wavelength, whereby, in addition, lighting substances or so-called phosphorus powders are added, so that radiation is produced therewith in the visible wavelength range and can be perceived by the human eye without additional aids.
- In an alternative embodiment, the excitation is instead provided by IR radiation with suitable wavelengths for materials with specific IR absorption and emission in the visible range. OVI pigments (optically variable pigments) or liquid crystals can be used or added in addition to the electroluminescent pigments.

In one embodiment, the value and security product has security elements based on so-called microencapsulated, inorganic compounds of the group II and VI of the periodic system (e.g. ZnS, CdS) which are doped or activated with metals such as Cu, Mn, Ag and suitable for printing by means of intaglio

printing. Electroluminescing security elements can also be built up on the basis of organic polymers.

The electrodes are made lateral (i.e. lie flat beside one another) by means of conductive intaglio inks, whereby an electromagnetic alternating field is produced in the resultant field gap, also arranged so as to be more or less flat, between the electrodes, the field lines of said alternating field penetrating at least partially the typography produced by the electroluminescent substances and thus illuminating the electroluminescent security elements and these can thus be referred to visually and mechanically for the authentication check.

An electrically conductive intaglio ink is used that is based on carbon and/or silver or a mixture thereof or silver-plated and/or gold-plated metallic pigments or mica pigments in association with suitable binding agents based on polyurethanes and/or aliphatic polyesters and corresponding diluents, whereby especially the two electrode connections are in the form of a non-oxidizing surface.

An aqueous polyurethane layer is preferably applied as a dielectricum to the unprepared surface of the security document - e.g. of a banknote - prior to the actual graphical design and is then printed in order to thus obtain a good elastic adhesive connection with excellent surface stability.

The luminescing security element is hereby preferably graphically formed from individual dots and lines.

Moreover, translucent inks can also be applied above/below/beside the luminescent elements, graphically

formed accordingly and various colour/fluorescent effects obtained as a result.

According to the invention, the electroluminescent layer described above is used as a background illumination for an authentication element. An authentication element of this type is e.g. a laser-type polycarbonate foil which is also called a PC overlay foil in the following. A foil of this kind can e.g. be provided with authentication elements by a laser treatment in such a way that blushings and/or discolorations can be applied in a controlled and directed manner in the thick area of this foil, as a result of which the background illumination arranged underneath this foil then radiates through these various zones of the authentication element in a correspondingly varying manner. In this way, a characteristic authentication feature, such as a passport picture, a logo, coat of arms, a personalized signature or the like, can be visible on the face side of the authenticiation element.

In a second embodiment of the present invention, it is provided that bores or recesses are made in the layer of the laser-type overlay foil that are also preferably produced by a laser treatment. However, the invention is not restricted to this; recesses of this type can also be made by etching processes, stamping processes, embossing processes, by electrode radiation, water jet treatment and the like.

It is hereby important that, in the present invention, the composition of the authentication element is not of primary importance but the fact that the authentication element is given an active background illumination.

Of course, the authentication features allocated to the authentication element can not only be made by a laser treatment or by the other previously described physical processes and treatment methods, but this foil can also be printed. In this case, there are various printing processes such as e.g. offset printing, screen printing, thermosublimation printing, intaglio as well as all non-impact printing processes.

What is important in all the described processes and applications is that the authentication element can be changed within relatively broad limits and that various authentication elements can be provided and that, however, a background illumination is allocated to this authentication element.

It was noted above that an electroluminescent substance is used as a preferred embodiment for this self-illuminating background illumination.

In another embodiment of the present invention, it is provided that a self-illuminating substance is excited by an electron source. In this case, there are various embodiments:

In a first embodiment, it is provided that the electron source is placed over the previous overlay foil, so that the electrode radiation passes through the overlay foil and excites the layer producing the background illumination lying below it.

In another embodiment, it is provided that the electron source is placed on the opposite side of the arrangement, i.e. lying opposite the overlay foil, so that the existing card is in principle radiated from the back.

On the other hand, there are various possibilities for radiating with an electron source that are all included in the present invention.

In a first embodiment, it is provided that a heated anode is used as electron source, said anode sending an electrode field against the self-illuminating layer in a known manner, whereby a structure as known in tube technology is preferred.

In another embodiment, it is provided that an electrode ray be provided as electron source, said electrode ray line-scanning the entire self-illuminating layer or parts thereof and illuminating it.

In a third embodiment, it is provided that a matrix-shaped electrode field be provided which illuminates the layer in pixel form in a controlled manner.

In addition to the use of an electron source, an X-ray source or another radiation source can, of course, also be used which is capable of exciting the layer used as background illumination.

Are there also other excitation mechanisms in addition to the excitation by corresponding energy-rich corpuscular radiation. There is the so-called sonoluminescence which provides an excitation by sound radiation as well as triboluminescence which, when excited by mechanical deformation, also attains excitation of the illuminating layer by rubbing or breaking the crystals.

Insofar as it is an electroluminescing substance that forms the background illumination, the important thing is that this

electroluminescent layer is excited in the electromagnetic alternating field whereby a planar electrode arrangement is preferably used. A planar electrode arrangement of this type consists of digitally interlocking electrodes which form a field gap between them, the electrical alternating field being produced in said field gap and exciting the electroluminescent layer above or between it and illuminating it.

The electroluminescent layer can hereby be applied directly to the electrodes and, in another embodiment, the electroluminescent layer can be separated by an insulating layer placed between the underside of the electroluminescent layer and the upper side of the electrode surface.

In the event that the electrode arrangement is first covered by an insulating layer on which the electroluminescent layer is then placed, it is preferred if the dielectricity constant of this electroluminescent layer be selected as high as possible. The advantage of this is that the field lines that form as stray flux between the electrodes penetrate into the electroluminescent layer with high efficiency and illuminate it.

In all cases, the point is that the electromagnetic alternating field be registered on the card in as simple and reliable manner as possible. According to the invention, a capacitive coupling is provided for this purpose. This capacitive coupling preferably takes place by at least two electrode surfaces on the security document that are spaced and insulated from one another and form the one side of a plate condenser. The other, opposite side of the plate condenser is formed by allocated electrode surfaces of a read-out device.

The advantage of this arrangement is that the electromagnetic alternating field is coupled in a contactless manner. As a result, the production of the luminescent element becomes very simple because the electrodes can be printed or applied in a single step together with the field-generating electrode arrangement (for the field excitation of the electroluminescent layer).

The read-out device that is responsible for recording the electromagnetic alternating field on the electrode surface can be constructed in an especially simple manner. In this case, it is sufficient to provide the read-out device with an appropriate battery, to provide an inverter/oscillator which then passes to an allocated electrode arrangement with its connecting arrangement, the said electrode arrangement in turn being the aforementioned one side of the plate condenser, the other side of which being the electrode arrangement on the card.

The advantage of the background illumination according to the invention in association with the simple read-out device now lies therein that security and value documents can now be checked in an especially simple manner. These types of controls or checks can also take place at night because the background illumination ensures that the self-illuminating authentication element can be illuminated under any conditions.

Thus, in a single step, the authentication element is made visible, which does not necessarily have to be otherwise optically visible, and, at the same time, this authentication element is read out in one and the same operation.

As a result, there is therefore the advantage that non-visible, secondary security features can be made visible in a simple manner.

A further advantage lies therein that additional features can also be allocated to the authentication element (of the aforementioned polycarbonate foil), e.g. in the form that additional microlenses can be placed on the recesses in the laser-treated foil in which there are corresponding recesses. Microlenses of this type can, of course, not only be mounted in a subsequent operation on the previously made recesses but they can already be applied during the first laser treatment of the overlay foil by appropriate treatment steps. Due to the arrangement of such microlenses, the readability of the authentication features is improved because the solid angle of the readability is enlarged and an angular dependency when viewing is reduced. Moreover, there is also a general enlargement of the authentication feature due to the lens effect.

The microlenses are preferably inserted in the laser-treated foil by a high-melting lamination process. Similarly, appropriate polymers can be applied to the foil by photopolymerization. The overlay foil can also be made as a holographically modulated photorefractive polymer layer.

A frequency range of about 1 - 10 kHz and voltages in the range of about 100 - 1500 V are preferred as a preferred frequency for the electromagnetic alternating field of the electroluminescent layer.

The invention will be described in greater detail in the following with reference to the drawings showing only one

embodiment.

The drawings show:

Figure 1: top view onto a value and security document in a first embodiment of the invention with an associated read-out device;

Figure 2: the side view of the arrangement according to Figure 1;

Figure 3: a schematically illustrated section through the value and security document according to Figure 1 with the addition of further embodiments of the invention;

Figure 4: a further section through another embodiment of a value and security document.

In Figure 1, reference number 1 designates generally a value document that consists of a plastic substrate, a paper substrate or another carrier material. In this case, it does not matter whether the value document 1 is built up in one or more layers.

An electrode arrangement 2 is placed on the value document 1, said electrode arrangement 2 consisting of a plurality of digitally interlocking electrodes 2a, 2b that form a winding field gap 3 between them and in which the electromagnetic alternating field becomes active.

An electroluminescent layer 13 is now applied to or inserted into this electrode arrangement 2 or between the electrode

arrangement 2 and is at least partially penetrated by the electric alternating field that is generated in the field gap 3.

The electrode arrangement 2 is is contacted by allocated leads 4, 5 that are placed on the value document 1, said leads being connected with allocated electrode surfaces 6,7 in an electrically conductive manner.

The electromagnetic alternating field is coupled capacitively on these electrode surfaces 6, 7, i.e. via an electrode arrangement 9 of a read-out device 8 which has electrode surfaces opposite the electrode surfaces 6, 7 and which, as a whole, form the electrode arrangement 9 (Figure 2).

In this case, in the read-out device 8, one or more power supplies are arranged, e.g. batteries 10, which are connected with an inverter/oscillator 11 which is, in turn, connected with the electrode arrangement 9 of the read-out device 8 via a connection arrangement 12.

Thus, a coupling surface 17, through which the electromagnetic alternating field is coupled to the electrode surface 6, 7, forms between the electrodes 6, 7 and the electrode arrangement 9 of the read-out device 8.

Further particulars of the invention can be found in Figures 2 - 4. First of all, it can be seen in Figure 2 that an overlay foil 14 which can consist of various materials is arranged above the eletroluminescent layer 13. Although a polycarbonate foil is preferred, any other materials desired can be used, namely those which are suitable for carrying an appropriate authentication feature in or on themselves or

which can be formed in themselves, whereby secondary coupling mechanisms can be used.

The aforementioned layer can even consist of a conductive metal foil which carries the authentication feature accordingly. An authentication feature can be obtained e.g. by the application of appropriate structures 15 on and/or in an overlay foil 14 of this type. Structures of this type are - as per the general description part - embedded as blushings or discolorations in the structure of the overlay foil 14, e.g. by laser treatment, X-ray treatment or electrode radiation treatment.

In another embodiment, it is possible that such structures are also made as recesses 16, as shown on the right in Figure 3. Recesses 16 of this type do not necessarily have to be through bores, instead, they can be blind-end bores or irregularly shaped openings, e.g. rhombic, square or rectangular openings.

Of course, written character can also be formed directly from such recesses. In particular, a digitalized signature can be formed as written characters by recesses of this type.

Furthermore, in Figure 3, the excitation of the electroluminescent layer 13 by an electron source 19 is shown. The electron source 19 is hereby driven by a generator 18 and sends an electron cloud 21 via a focussing device 20 to the value document 1. In this case, it is provided that the electrons can pass through the overlay foil in sufficient numbers and illuminate the electroluminescent layer 13 underneath it.

Of course, it is provided that the overall excitation

arrangement can be placed on the opposite side of Figure 3, so that the electroluminescent layer 13 can also be excited by the underside of the value document 1.

The generation of an electron cloud 21 of this type is, in itself, known and not an object of the present invention. It is only important that the electroluminescent layer is not only excited by an electromagnetic alternating field, but also by other excitation mechanisms that have already been described above.

Moreover, Figure 4 shows an embodiment that is constructed similar to the one in Figure 3 (right side). The overlay foil 14 is provided with recesses 16, whereby, in addition, lenses 22 are placed on the recesses 16. The function and manufacture of these lenses were described in detail in the general part of the description.

A further embodiment of the invention lies therein that the electrode surface 6, 7 is used as transponder coil or an additional transponder coil is inserted to enable the structure to have an inductive, contactless coupling of the electromagnetic alternating field.

A design of a value document of this type is especially preferred when used in transponder chip cards because an additional authentication feature is given that can be read out especially easily.

Of course, it is possible to not only place the electroluminescent layer on the value document 1 as a separate layer but it is also possible, as per DE 43 10 083, to also form this electroluminescent

foil, whereby a corresponding electroluminescent-active pigment portion is embedded in an extruded or coextruded foil.

KEY TO DRAWINGS

1. Value document
2. Electrode arrangement, 2a electrode, 2b electrode
3. Field gap
4. Lead
5. Lead
6. Electrode surface
7. Electrode surface
8. Read-out deivce
9. Electrode arrangement (read-out device)
10. Batteries
11. Inverter/oscillator
12. Connecting arrangement
13. Electroluminescent layer
14. Overlay foil
15. Structure
16. Recess
17. Coupling surface
18. Generator
19. Electron source
20. Focussing device
21. Electron cloud
22. Lens

Patent Claims

1. Value and security product with a carrier material having one or more layers, with at least one layer-shaped authentication element arranged on or inside a layer of the carrier material and a luminescent element comprising a luminescent layer (13) and an electrode arrangement (2) andarranged underneath the authentication element, whereby the electrode arrangement (2) is contacted with leads (4, 5) placed on the value document, said leads being connected with the allocated electrode surfaces (6, 7) in which an electromagnetic alternating field is coupled capacitively or inductively so as to be electrically conductive.

2. Value and security product according to claim 1, characterized therein that the luminescent element consists of a planar electrode arrangement (2) with electrodes (2a, 2b) adjacent to one another and a luminescent layer (13) applied on or under the electrode arrangement in an insulating manner.

3. Value and security product according to claim 2, characterized therein that at least one of the electrodes consists of an electrically conductive and translucent tin oxide or indium tin oxide layer.

4. Value and security product according to any one of the claims 1 to 3, characterized therein that the leads (4, 5) and the electrode surfaces (6, 7) consist of silver, carbon or copper pastes.

5. Value and security product according to any one of the claims 1 to 6 *[sic]*, characterized therein that the electroluminescent layer is separated by an insulating layer arranged between the underside of the electroluminescent layer and the upper side of the electrode surface and that an insulating layer has as large a dielectricity constant as possible.

6. Value and security product according to any one of the claims 1 to 5, characterized therein that the leads (4, 5) and the electrode surfaces (6, 7) consist of electrically, highly conductive metal and/or carbon pastes.

7. Value and security product according to any one of the claims 1 to 6, characterized therein that photoluminescing substances are added to the luminescent layer.

8. Value and security product according to claim 7, characterized therein that the luminescent layer is also illuminated by an electromagnetic radiation source of a defined wavelength.

9. Value and security product according to any one of the claims 1 to 8, characterized therein that the authentication element consists of a plastic or metal foil (14) applied to the carrier material (1) and changeable in its structure (15) and/or ink.

10. Value and security product according to claim 9, characterized therein that recesses and/or bores (16), of which the authentication features are composed, are

provided in the plastic or metal foil (14).

11. Value and security product according to claim 10, characterized therein that microlenses (22) are placed on or in the recesses and/or bores (16).

12. Value and security product according to any one of the claims 1 to 11, characterized therein that the authentication element has self-illuminating properties.

13. Value and security product according to any one of the claims 1 to 12, characterized therein that an additional transporter coil is inserted into the electric surface (6, 7).

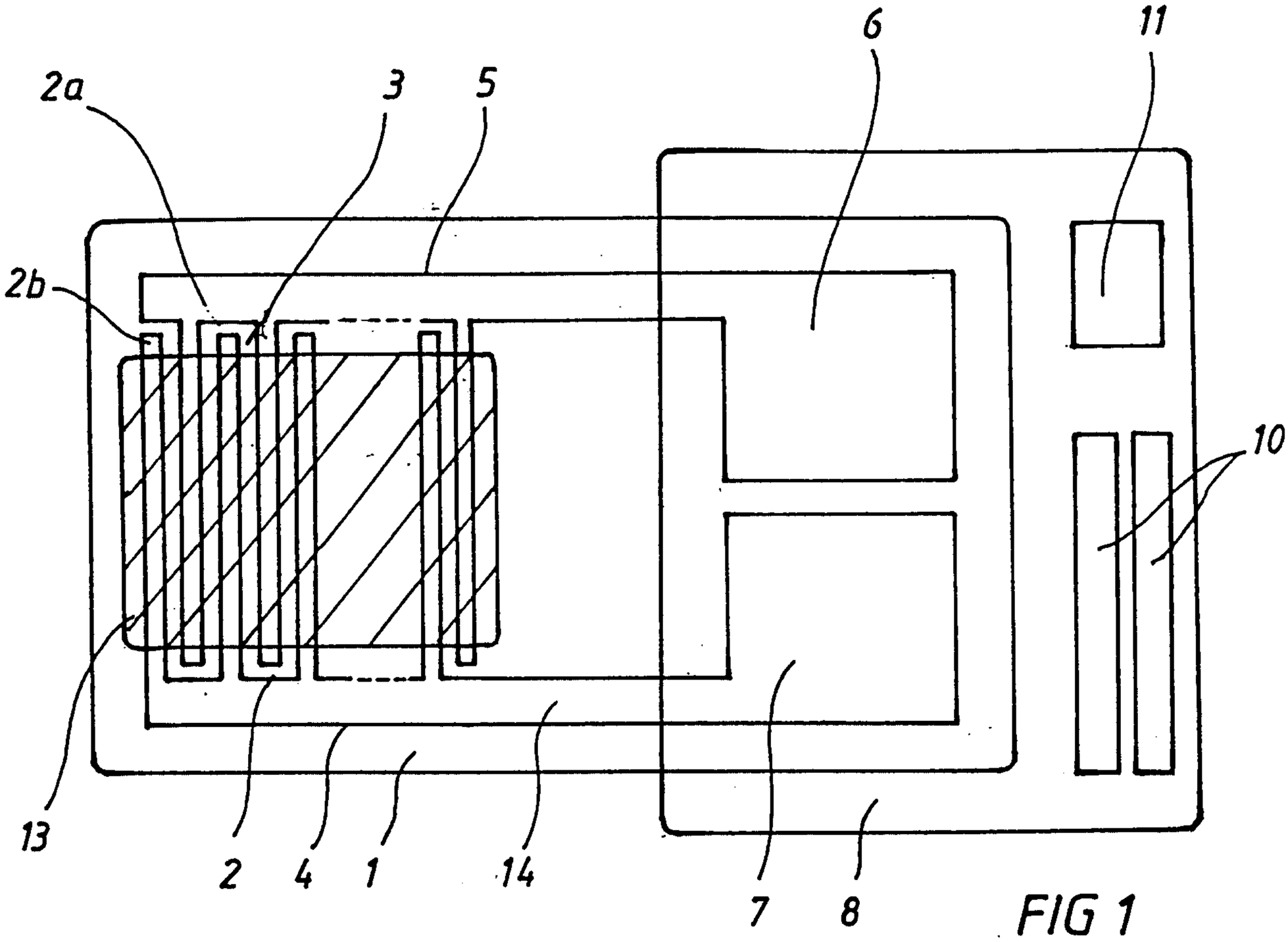


FIG 1

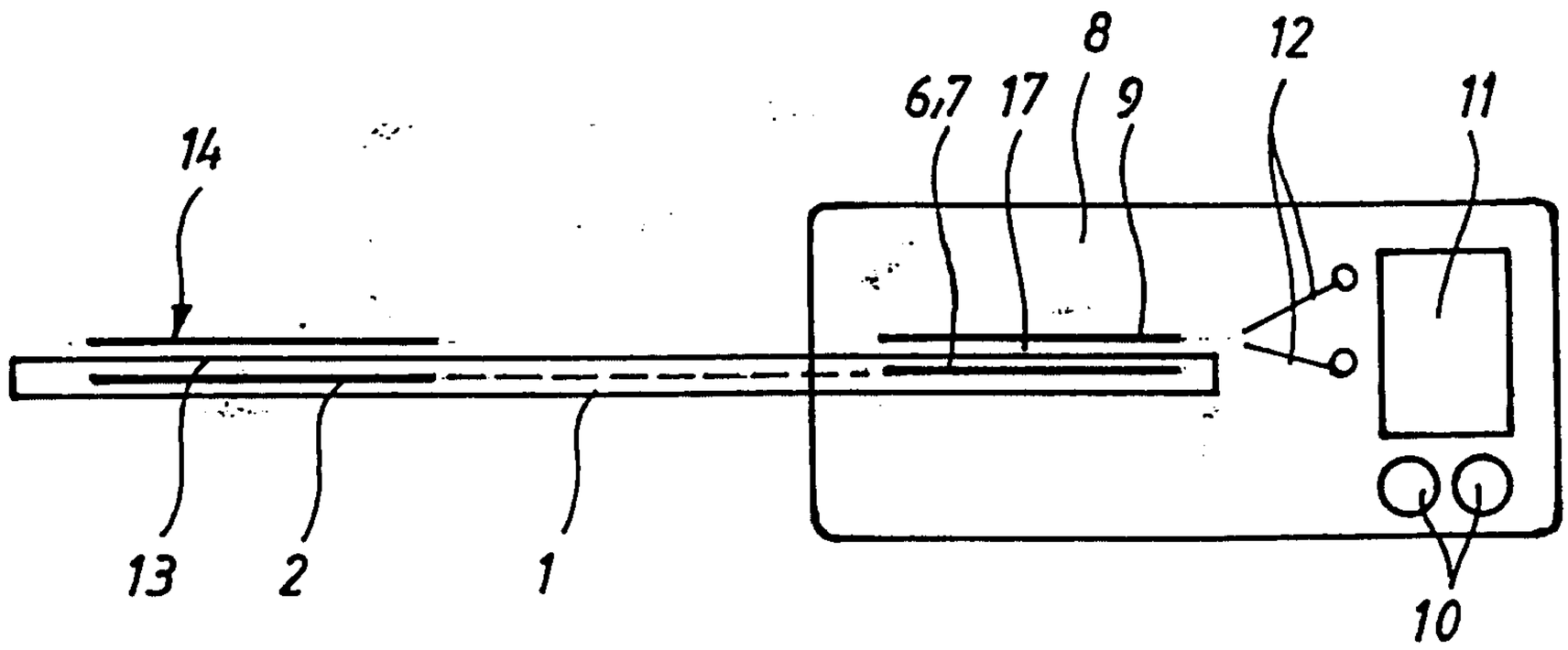


FIG 2

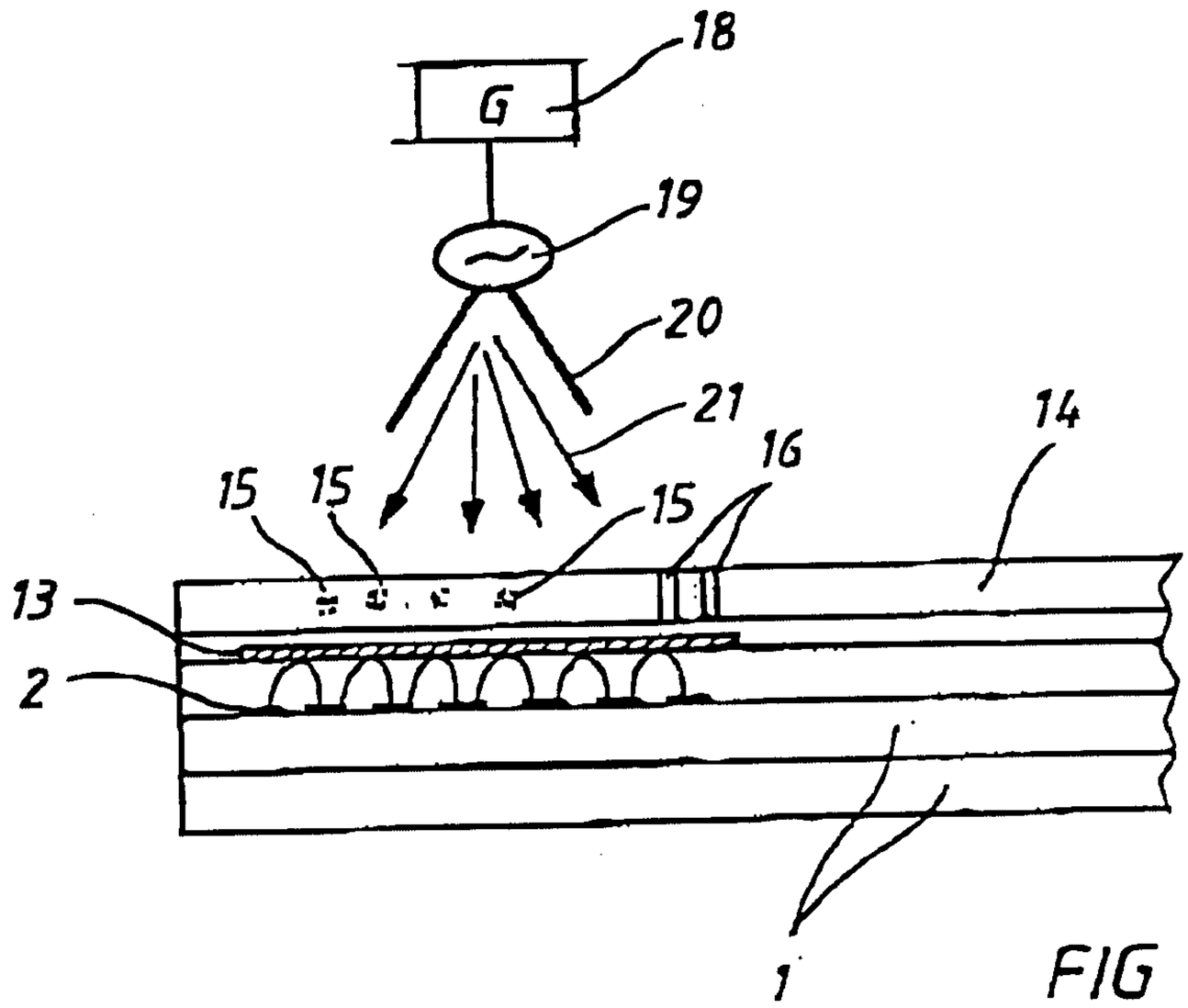


FIG 3

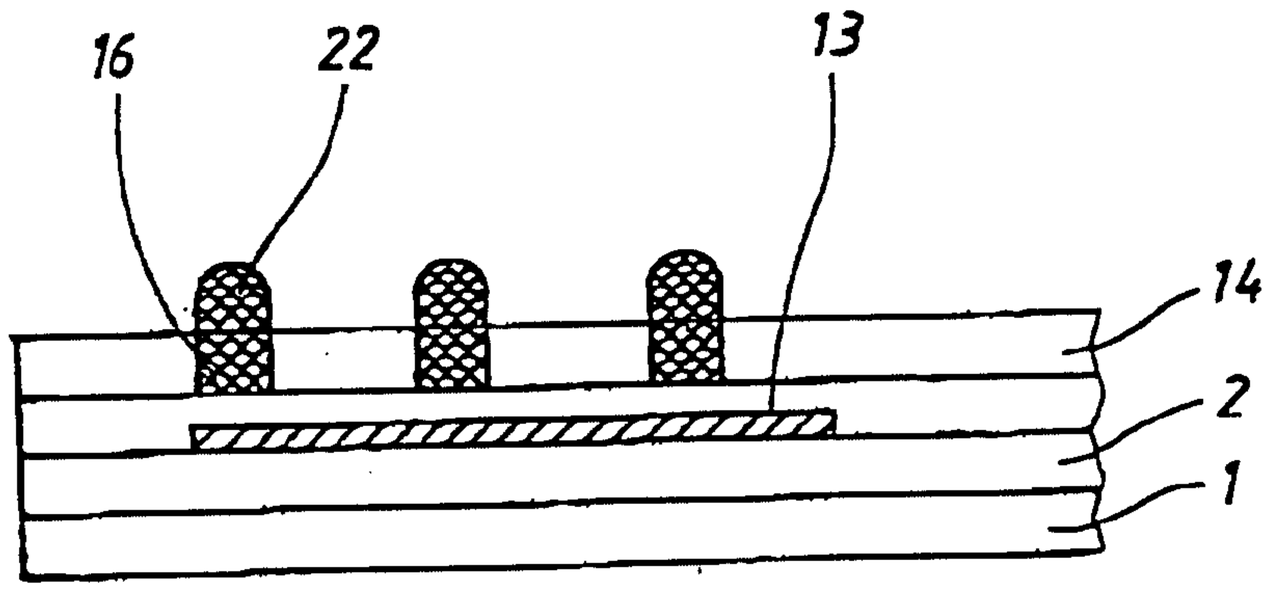


FIG 4