



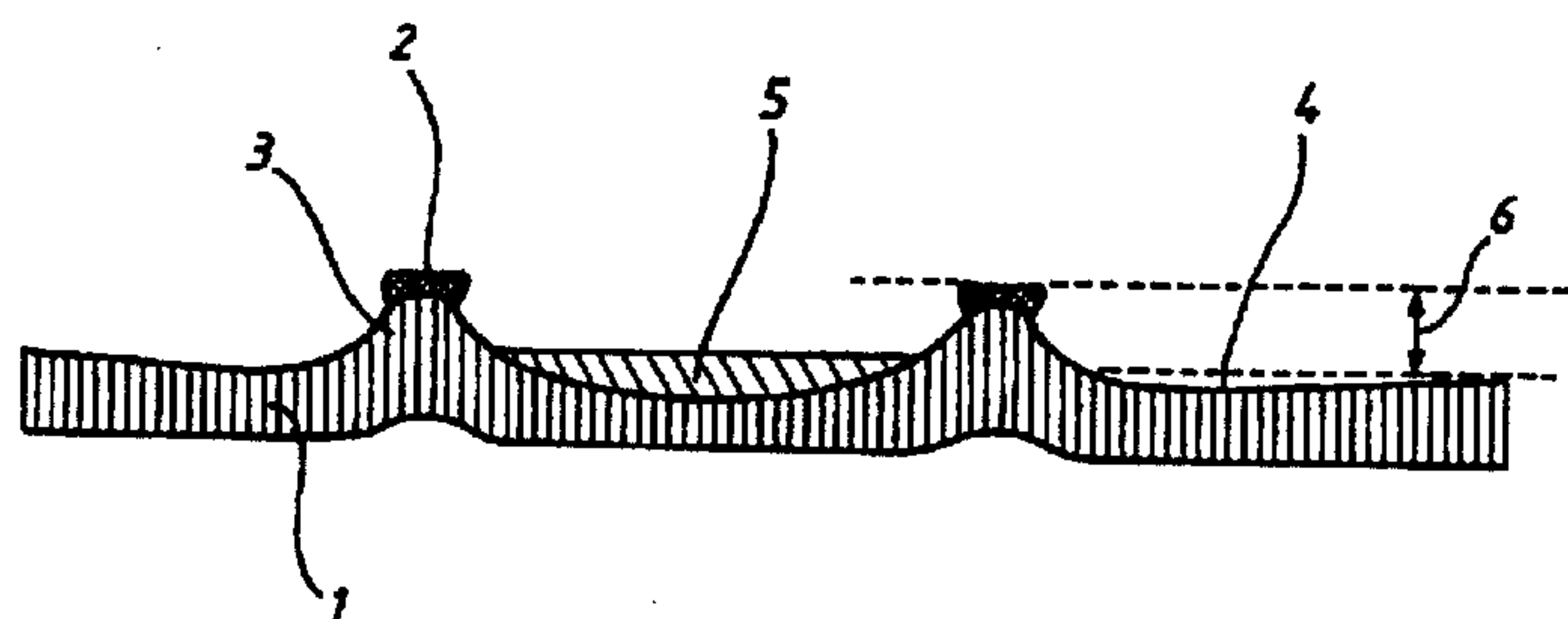
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(54) **PRODUIT DE VALEUR ET DE SECURITE AVEC ELEMENTS
DE SECURITE LUMINESCENTS, PROCEDE DE
FABRICATION ASSOCIE, ET DISPOSITIF POUR VERIFIER
VISUELLEMENT ET MECANIQUEMENT LEUR
AUTHENTICITE**

(54) **VALUE OR SECURITY PRODUCT WITH LUMINESCENT
SECURITY ELEMENTS AND METHOD FOR THE
PRODUCTION AND USE THEREOF IN RESPECT TO VISUAL
AND MACHINE-OPERATED DETECTION OF
AUTHENTICITY**



(57) L'invention concerne un produit de valeur et de sécurité, tel qu'un billet de banque, une pièce d'identité, etc., qui comporte des éléments de sécurité luminescents pouvant être excités dans un champ électromagnétique alternatif. Elle concerne également un procédé permettant de le fabriquer, selon lequel on applique les couleurs et les substances nécessaires sur ledit produit. Elle concerne aussi un dispositif conçu selon la technologie de sécurité correspondante, et destiné à vérifier visuellement et mécaniquement l'authenticité dudit produit, dans lequel on utilise notamment des champs électriques et un rayonnement optique, de préférence compris dans la plage de longueur d'onde des UV, pour exciter ce qu'on appelle des couleurs phosphorescentes, et qui permet d'obtenir, par des mécanismes excitateurs secondaires, des effets optiques supplémentaires dans la plage des longueurs d'onde visibles.

(57) The invention relates to a value or security product such as a banknote, ID card or the like, which is provided with luminescent security elements which are excitable in an electromagnetic alternating field. The invention further relates to a production method of applying the required colours and substances to said value or security product. Also disclosed is a respective security technology arrangement for visual and machine-operated detection of authenticity, wherein electrical fields in particular and optical radiation, preferably in the UV wavelength range, are used to excite so-called phosphorus colours and additional optical effects in the visible UV wavelength range can be achieved by means of secondary excitation mechanisms.

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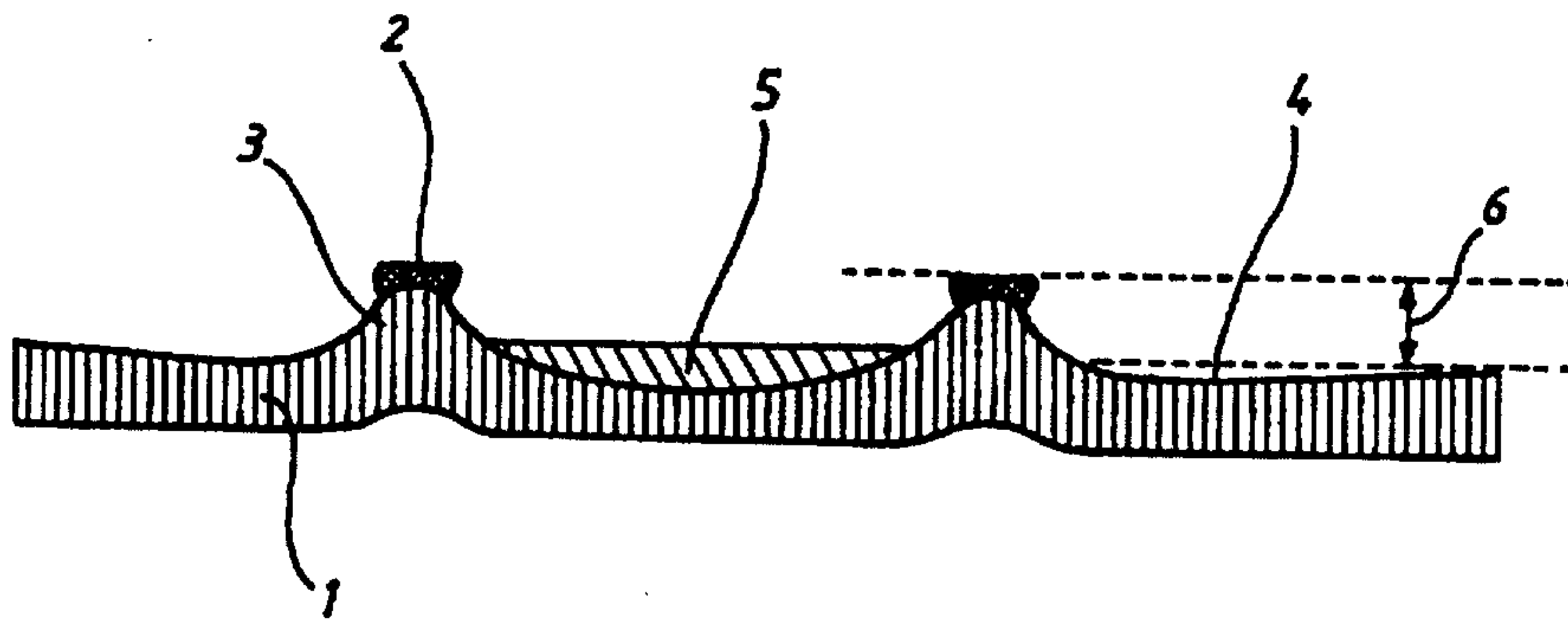
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(57) Abstract

The invention relates to a value or security product such as a banknote, ID card or the like, which is provided with luminescent security elements which are excitable in an electromagnetic alternating field. The invention further relates to a production method of applying the required colours and substances to said value or security product. Also disclosed is a respective security technology arrangement for visual and machine-operated detection of authenticity, wherein electrical fields in particular and optical radiation, preferably in the UV wavelength range, are used to excite so-called phosphorus colours and additional optical effects in the visible UV wavelength range can be achieved by means of secondary excitation mechanisms.

Value or Security Product with Luminescent Security Elements and Method for the Production and Use thereof with Respect to Visual and Machine-operated Check for Authenticity

The subject of the respective invention concerns security documents with graphic (preferably gravure) security characteristics that are caused to glow in dot, line or surface form in such a manner that wavelengths can be striven for, and attained, not only in the invisible UV range to the range visible to the human eye typically between 360 to 780 nm, but also in the IR range.

Electro-luminescent foils are introduced in DE 43 10 082 that are fabricated by means of extrusion, or co-extrusion from inorganic, electro-luminescent pigments and thermoplastic plastic. The extrusion, or co-extrusion of such a system on security documents would be possible in principle; however, the possibilities realizing this graphically appear limited due to the process logistics, while the entire fabrication process for producing a security document and the configuration it requires to check its authenticity seem to become very costly.

A process for producing an electro-luminescent film using sputter technology is described in DE 43 15 244 A1. This process would be basically conceivable also for fabricating security documents, however, a manufacturing process of this type is extremely costly with regard to the vacuum coating chambers needed for this technology and is, moreover, very difficult to integrate into a potential manufacturing process and furthermore produces film layers that would have to be augmented by additional, special layers to withstand the extensive mechanical demands to which security documents are exposed.

In DE 41 26 051 A1, on the other hand, a security document with embedded two-dimensional security element (security thread) is introduced that is multi-layered and has electro-luminescent properties. The disadvantage of this configuration is that a relatively high surface build-up must be taken into account, as the electrodes needed to excite the electro-luminescent (hereinafter abbreviated as EL) substances are arranged one on top of the other.

The invention, deriving from DE 26 051 A1, thus has the task of developing a value or security product in such a way that the EL-active security characteristics achieve a considerably thinner build-up of layers on the surface of the security document.

This task is solved by means of the technical theory set forth in Claim 1, which provides for the EL-active elements to be applied to the surface of the substrate directly during the printing process.

This process involves a range of different possibilities, all of which are claimed as inventions. In addition to the application of the substances during steel gravure, other printing processes using the theory described herein are also claimed as inventions, namely and in particular, waterless offset printing, wet offset printing, silk-screen printing, non-impact printing techniques and recently developed digital printing processes.

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The same task is, by the way, also solved by means of the technical theory set forth in Claim 7 which, instead of stacking layers of electrodes on top of one another (as is familiar in the current state of the technology), provides for the plane configuration of such electrodes side by side at least partially on the value or security product and/or on the test device.

The advantage of the invention is, therefore, that the formation of a multi-layered, stacked, plane-configured EL-system can be dispensed with.

It is to be feared, given the present state of the technology and in light of the long-term wear-and-tear to which it is exposed, that the familiar laminate structure will not exhibit the required level of durability. One further disadvantage: a security thread is not an integral component of a value and security product and can be removed. This configuration requires contacts to be affixed to the value and security product, whereas, in the case of the invention, a part of the model examples do not require a contact on the value or security product.

In contrast to the customary EL-systems, which are installed between flat electrodes, the subject invention dispenses with this, after all, relatively thick structure in one model variant to the extent that the electrical field is structured laterally i.e. plane.

For an EL plate condenser structure in accordance with the invention (in which per invention the condenser "plates" are now arranged lying basically side by side in the same plane and, in the field-gap situated between them, the field needed for excitation is produced) a transparent, electrically conductive layer is required that is achieved by means of so-called ITO pastes (indium-tin-oxides). The same effect can, incidentally, also be achieved by using pre-coated, transparent foils or glasses.

Typically, biaxially oriented and thermally stabilized polyester foils are used with electrically conductive stannic oxide, indium-tin-oxide (ITO) pastes, applied using vacuum metallizing or in layers using sputter technology, or generally transparent, electrically conductive metallized surfaces with surface resistance values in the range of a few ohms/square in the case of glass substrates and typically 20 ohms/square up to 300 ohms/square and beyond.

High-quality EL systems need an even light intensity and a maximum luminosity factor. Glass substrates, by virtue of their high thermal load-bearing capacity during coating processes, afford among other things a high-quality solution with higher transmission in the visible spectral range, together with simultaneously superior surface conductivity. The fundamental advantage of the ITO paste printing technology (used in accordance with the invention) lies, however, in the relatively simple application and in the virtually free choice of graphic creative options, something that, especially in the case of complex systems, can be advantageous with regard to electrical connections.

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Since ITO silk-screen pastes of this type scarcely allow surface resistance values below 300 to 400 ohm/square, so-called bus bars i.e. electrically efficient conductive borders are used in the invention. This produces even electrical fields and correspondingly even luminance. Moreover, this technology permits functionally the ITO electrode connections to be configured favourably and ultimately the ITO electrode thickness can be reduced to a minimum in favour of a higher level of transparency. According to the invention, bus bars are printed during the printing process using silver, carbon, copper etc. pastes and/or a combination of these elements, thereby achieving surface resistance values in the range of some 10 milliohm/square values.

According to the invention, the following versions are, therefore, described for which, however, as individual versions or in combination with each other, protection is claimed:

1. A lateral electrode configuration on the value and security document,
2. An electrode configuration in a lateral, or opposite configuration outside the security document i.e. in a sorting device,
3. A lateral electrical configuration on a transparent masking substrate, in the sorting device,
4. An electrically conductive coating on the reverse of the security document (prior to the formative processes) and affixing of EL elements on the front and formation of a transparent masking substrate with electrically conductive coating on the side pointing toward the security element,
5. Excitation via an electromagnetic alternating field,
6. Excitation by means of a system based on photoluminescence excitation via corresponding light-sources, particularly in the UV wavelength range and using suitably luminescent substances based mainly on the Mn-activated substances silicates, phosphates, tungstates, germanates, borates etc., however, in particular based on $\text{Zn}_2\text{SiO}_4\text{:Mn}$ and excitation via the 253.65 nm band of an Hg low-voltage discharge lamp (visible light eliminated by means of a cut-off filter) and the stimulated emission of light in the visible green range.
7. Excitation of the EL system via an extremely narrow-band light-source in the form of a frequency-tripled, or –quadrupled Nd-YAG laser described with the wavelengths 266 nm and 213 nm, furthermore, a solid-state laser with corresponding frequency-doubling or –quadrupling to 236 nm, as well as excimer lasers emitting light in the UV-B (320 nm to 260 nm per USA-FDA) or UV-C (260 to 200 nm) wavelength ranges with excitation of luminescent substances matched specifically to the respective wavelengths, whereby supplementary luminescent substances or so-called phosphorous powders are added, in similar fashion to fluorescent tubes, in such a manner that radiation in the visible range is produced and can be perceived by the unaided human eye.
8. In an alternative version, the excitation by IR radiation is instead provided for, with a wavelength suitable for materials with specific IR absorption and emission in the visible range. OVI pigments (optically variable pigments), or liquid crystals can also be used, or added to supplement the EL pigments.

In a preferred version, the value and security product shows security elements based on so-called micro-encapsulated, inorganic combinations of Group II and IV of the periodic system of elements (e.g. ZnS, CdS) that are doped with , or activated by metals such as Cu, Mn, Ag and which are suitable for formative printing processes by means of gravure. EL security elements based on organic polymers can also be constructed.

The electrodes are formed laterally (i.e. located flat, side by side) by means of conductive gravure inks in which in the resulting, likewise plane-configured field gap between the electrodes, an electromagnetic alternating field is produced whose lines of electric flux penetrate at least partially through the printed image produced by the EL substances and thus cause the EL security substances to luminesce and so can be implemented for visual and machine-operated authenticity tests.

In a preferred version, an electrically conductive gravure ink based on carbon and/or silver or a mixture of both, or silver- and/or gold-plated metallic pigments or mica pigments is used in combination with suitable media based on polyurethanes and/or acyclic polyesters and corresponding thinners, whereby, in particular, the two electrode connections are configured in a non-oxidizing surface shape.

A watery polyurethane coating is preferred as a dielectric and insulation coating which is applied to the unprepared surface of the security document (preferably a banknote) prior to the actual formative graphic process. The phosphorus paste is then printed, thus achieving a good, elastic bond with outstanding surface durability.

In this process, the luminescent security feature should preferably be graphically configured using individual dots and lines.

Besides this, correspondingly graphically configured glazing inks can be applied over/beneath/adjacent to the luminescent elements, thus achieving diverse colour and light effects.

A process for fabricating the security document comprises the following procedural steps:

- graphic configuration of the substrates, particularly special security papers, ranging in basic weight from about 80 to 200g/m² by means of graphic printing processes, specifically gravure, waterless offset, wet offset, silk-screen, non-impact printing and other, modern digital printing processes.
- Possibly printing of a bonding agent in the form of watery polyethylene dispersion to achieve optimal bonding and embedding of the following printing layers.
- Printing of the lateral electrodes using conductive pastes and, depending on the system, repetition of this procedure several times to achieve a surface resistance for the respective selected geometry of the security elements which will achieve an adequate current supply or a sufficiently low surface resistance

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- Printing of an insulating ink, especially one with the characteristic of high elasticity, a good bond with the substrate, the conductive coating and with the following phosphorous ink, as well as with as high a dielectric constant as possible, whereby especially watery polyurethane dispersion systems and/ or filled with barium titanate (BaTiO_3) should be used to raise the dielectric constant.
- Printing of the phosphorous paste or the multicoloured luminescent phosphorous pastes (possibly with an admixture of so-called "spreaders" that are supposed to prevent damage to the micro-encapsulated luminescent pigments caused by excessive pressure during the printing process
- Printing, as required, of translucent inks to achieve additional graphic and security-technological formation.
- Printing, as required, of passivating, electrically conductive inks onto the electrical wiring points in the form of specially conductive inks or pastes, especially those that are carbon- and gold-based.
- Printing of an elastic, transparent, abrasion-resistant and efficiently-bonding protective coating, especially one that is watery polyurethane dispersion-based.
- Curing of the printing processes called out, subsequent to the printing process in each and every case.
- Optionally, a form of thermopressure can be effected to stabilize and enhance the quality of the security document at temperatures of up to 200 degrees C and pressures of up to 50 kp/cm².

The form of the invention as described, therefore, affords benefits including the fact that, for the first time, laterally configured electrodes are arranged by means of electrically conductive gravure inks or pastes in such a manner that, in accordance with the extremely high resolution or fine structures of the printed image, geometries become possible by means of the gravure technology that make possible the high electrical field strength and thus the excitation of the electroluminescence of typical zinc-sulphide phosphorous coatings.

In this sense the gravure technology proposed in the invention, by reason of the extremely high potential resolution and the, after all, several micrometer-thick coating thickness, represents a very advantageous solution for the subject invention. Admittedly, the formation of the various gravure inks or pastes requires special matching to considerably thinner pigment diameters as compared to silk-screen inks.

The application of micro-encapsulated elements with EL elements in rotogravure is fundamental to the invention. For this, capsule-diameters of a few microns (e.g. in the order of 0.2 to 40 microns) are used.

In a continuation of the version, innovative substances can be used, namely, luminescent substances based mainly on Mn-activated silicates, phosphates, tungstenates, germanates, borates etc., but especially based on $\text{Zn}_2\text{SiO}_4\text{:Mn}$ (=typical substances for fluorescent tubes). Such materials are excited by the 253.65 nm wave band of a low-pressure discharge lamp (visible light removed by means of a cut-off filter) and the emission of light takes place in the visible green range. Laser light-

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sources are, therefore, used to excite photo-luminescence to stimulate UV light-emission which is then caused to emit visible light by means of customary luminescent substances.

Besides excimer lasers with their known UV emission bands, above all diode lasers and Nd:YAG laser sources are available with corresponding frequency multipliers as potential, additional light-sources in accordance with the invention. Alternatively, corresponding discharge lamps with bandpass filters can be used.

Additionally, certain EL substances can be masked by UV filter layers in the form of printing inks e.g. with TiO₂-filled pigments in such a way that no excitation of the EL substances by UV light takes place, but instead solely by excitation in the electro-magnetic field. This is advisable especially for a machine-operated check of the security document using the test device called out in the invention with which (in a preferred form) visible light is no longer necessary to perform the check.

The status of the subject invention results not only from the object of the individual patent claims, but also from the combination of the individual patent claims among themselves.

All data and characteristics disclosed in the documents, including the summary, in particular, the spatial shape are claimed as integral to the invention insofar as they, individually or in combination, represent an innovation in the current state of technology.

In the following, the invention will be explained in greater detail with the aid of several sketches showing several approaches. These drawings and their descriptions will show further characteristics and benefits germane to the invention.

The following is shown:

- Fig. 1: Cross-section through a banknote according to the invention with an EL substance.
- Fig.2: An enlarged cross-section of a banknote per Fig. 1 in an initial version
- Fig.3: A second version
- Fig.4: A third version
- Fig.5: A fourth version
- Fig.6: Top view of a value and security product with security features
- Fig.7: A further version of a security document with security features
- Fig.8: Cross-section of a value and security product per the invention in a further version.

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Fig.9:

to

Fig.11: Further versions of value and security documents

Fig.12: Cross-section of a value and security product with lateral electrodes installed on the surface.

Fig.13: Top view of the configuration per Fig.12.

Fig.14: A further version of a security document with a flat electrode

Fig.15: The configuration of a security document in a test device in an initial version.

Fig.16: The configuration of a security document in a test device in a second version

Fig.17: The enlarged view of lateral electrodes

Fig.18: A further version showing the configuration of a security document in a test device as a variation of Fig.16

Fig.19: A further example of the configuration of a security document in a test device

Fig.20,

Fig.21: Further versions of the creation of a security document in combination with various versions of the test device

Fig.22: Sectional drawing of the constructional features of a test device

Fig.23: The top view of the configuration per Fig.22

Fig.24: The top view of an electrode configuration for use in a test device

Fig.25,

Fig.26: Different versions of electrode configurations in the test device

Fig.27,

Fig.28: Different possibilities for constructing test devices

Fig. 29. (no text provided in original for this sketch – shows “Configuration of electrodes in a test device”? -translator)

Fig. 30,

Fig: 31 The top view and enlarged top view of an electrode configuration in a test device

A value and security product 1 is described in the following description in the form of a banknote, although the invention is not restricted to this. The value and security product in Fig. 1 to 14 consists, therefore, of a paper, which in the example shown, consists of cotton fibre.

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Embossings have been made in the surface such that these embossings are distinguished by different raised levels 3 and a corresponding embossing base 4 in cross-section which shows that the gravure printing ink 2 used to print the banknote (value and security product 1) is deposited on the raised levels 3.

According to the invention, provision is made in an initial version for the EL-effective substances 5 on the embossing base 4 to be applied outside the gravure ink 3. The depth of the embossing in the case of a value and security document 1 of this type can be given as about 1 – 80 microns with the depth of the gravure printing ink stamp impression on the paper corresponding to about 20% of the depth of the embossing i.e. about 1 to 20 microns.

The distance 6 thus measures about 1 to 80 microns.

Figure 2 shows the enlarged view of Fig. 1 in which can be seen that the EL-substances 5 are located outside the gravure area.

Fig. 3 shows a modified version in which the EL-substances 5 can also be configured underneath the gravure printing ink 2 in the area of the raised levels 3 and, consequently, are covered by the gravure printing ink 2.

Fig. 3 also shows that the EL-substances project into a surface coating 7 of the security document or, as shown in Fig. 4, are configured on the coating 7 and below the gravure printing ink 2.

Fig. 5 shows as a further example that these EL-effective substances 5 are mixed into the gravure printing ink from micro-capsules 8 and are printed along with it.

Based on the examples of the versions given per the aforementioned drawings, characteristics 9, 10 according to Figs. 6 through 7 can be realized. In Fig. 6, such EL-substances are formatted as a wreath of stars in the EC symbol, whereas in Fig. 7 these EL-effective substances can be formatted as digits in the wreath of stars.

It is obvious that unlimited options are possible for creating shapes and configurations on the value and security product, either in visible, or also in concealed form.

Figs. 8 and 9 show, moreover, that the EL-effective substances in pigment form are mixed with the gravure printing ink 2 and that a bonding agent 11 is used in this procedure.

Luminescent inks 12 can also be added per Fig. 9 to cause the light emission of the EL-substances, together with the luminescent inks 12, to produce a characteristic glow of the security features 9.

The Figs. 10 and 11 show that, besides luminescent inks, translucent printing inks 13, 14 can also be employed whereby different colorations e.g. green and red printing inks can be applied at separate points to produce a different, visible coloration in EL-substances glowing in one, single color.

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In addition, per Fig. 11, the stated inks can also be masked with a translucent printing ink with the addition of a UV filter, or the translucent inks 13, 14 can also be applied under the EL-coating.

All of the previously described examples are relevant to the version according to the invention, namely, that the value and security product is used without electrodes to excite the EL substances electro-magnetically and that the excitation of the EL-substances 5 is effected by means of an external electro-magnetic alternating field in a test device.

In the following examples, a further version is now described in which the electrodes necessary to produce the electro-magnetic alternating field are attached entirely to the value and security product, or at least one electrode is configured on the value and security product, while the other electrode is located in the test device.

It is shown in Figs. 12 and 13 that one electrode configuration 19, consisting of two electrodes 24, 25 is configured on the surface of the security document 1 such that both electrodes 24, 25 are configured as two-dimensional elements, lying adjacent to one another and, between them, form an insulating zigzag field-gap 26 in whose area the aforementioned electro-magnetic field required to excite the EL-substances is produced.

In the example shown, both electrodes 24, 25 are covered at least partially by an insulating printing ink 17 and the two electrodes 24, 25 are produced by means of conductive printing inks 16 to which corresponding contacts 18 are attached, whereby an alternating current is supplied to contacts 18. This is shown in Fig. 13, in which it can be seen that the aforementioned alternating current is supplied to the connections 20.

The EL-effective substance 5 is embedded in the gravure printing ink 2 and is located at least partially above the field-gap 26 in such a way that the lines of electric flux produced in the field-gap permeate the security characteristic configured on the field-gap and cause it to glow.

Figs. 14 show, in contrast to the examples per Figs. 12 and 13, that it suffices, in the one or the other version, to affix an approximately two-dimensional electrode 32 on the underside of the security document 1 in the form of a conductive printing ink 16 and likewise to connect this, in which case the value and security product 1 bears a printed image 29 in accordance with the examples per Figs. 1 to 11. The counter-electrode (not shown in drawing) is in this case configured on a carrier in the test device, on which will be described in greater detail in combination with the remaining drawings.

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The alternating field 36 produced between the electrodes then permeates the EL-effective substances and causes these to glow. It can be cited here as a typical example that the height of the gravure printing ink above the base of the security document 1 (height 21) is typically 10 to 20 microns, while the thickness 22 of the security document 1 measures typically 100 microns at a surface weight of 90g per square meter and the thickness 23 of the lower surface electrode 23 measures about 3 to 10 microns.

With the aid of Figs. 15 to 31, various models of test device are outlined and at the same time yet further formatting examples of security documents are shown with different configurations of EL-effective substances.

From Fig. 15 it can be seen that a test device consists basically of two carriers 28, 30 located opposite and at a distance from each other whereby preferably the upper carrier 27 facing the viewer is transparent and e.g. of glass or plastic with a transparent, integral electrically conductive coating which forms the one electrode 33. On this electrode rests the one contact 34, connected with its one pole to the connection 31.

The opposite electrode 32 is e.g. in the form of aluminum anodizing is mounted on the inner surface of the lower carrier 30 and is likewise connected with the other pole of the connection 31 via the contact 34.

Thus an electro-magnetic alternating field is produced between the two electrodes 32, 33. This alternating field permeates the value and security product 1 introduced between the carriers 28, 30 such that this alternating field permeates also the EL-effective substances and causes the EL-printed image thus created to glow.

Fig. 16 shows by contrast with the model example per Fig. 15 that an electrode configuration 35 can also be configured on only one, single carrier 28, in which case an electrode configuration is used as, shown, for example, with the electrode configuration 19 per Fig. 13, or in another version, as shown with the electrode configuration per Fig. 17.

The upper carrier 28 consists, on the other hand, of transparent glass or plastic in which case a planar electrode configuration 35 is described and shown in detail in Fig. 17. This electrode configuration is formed from intertwined finger-shaped electrode "fingers" 39, 40, in which case the electrode fingers 39, 40 combine to form the field-gap 26 and are insulated against one another. The entire configuration is mounted on an insulating coating e.g. of Si-oxide while the electrode fingers 40 are interconnected to one another conductively via a base conductor 38 and the electrode fingers 39 are interconnected conductively with one another via a base conductor 38a (cf. Fig. 24). The base conductors 38, 38a should preferably consist of a gold coating, whereas the electrode fingers 39, 40 should consist of the previously described ITO paste or of a transparent gold coating.

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Fig. 18 shows in contrast to the model example per Fig. 16 that a fluorescent coating 21 can be configured additionally on the inside of the upper carrier 28 which is caused to glow by the emission given off by the EL printed image. It is hereby claimed as an invention that the glow of the fluorescent coating 42 takes place not only in the visible range, but also in the invisible range.

Fig. 19 shows a modified model example in which by comparison with Fig. 16 it can be discerned that the previously-described electrode configuration 35 is now affixed to a carrier 28 mounted underneath and that the alternating fields produced by the electrode configuration permeate the value and security product 1 from below, such that it can readily be viewed from above through the transparent carrier 30 without having to arrange an electrode configuration itself in the line of sight.

Figs. 16, 17 and 19 show that the alternating field 37 produced by the electrode configuration 35 permeates the security document 1 (at least in the area of the EL printed image 29) in each and every case.

Fig. 20 shows that emission 43 given off by the EL-printed image 29 strikes the fluorescent coating 42 as a primary emission which, in turn, produces a secondary emission 44 that can be registered either by an observer 27 in the visible range, or evaluated in the invisible range by a test device.

Fig. 21 shows with reference to the model example in Fig. 14 that the value and security product can be coated also on its side e.g. the underside with an electrode 32 which is connected to the one contact 34.

The other contact is configured as a planar contact from the inside of the upper, transparent carrier 28 whereby the stated electrode configuration is covered by an insulation layer such that the fully plane ITO, or gold coating shaped as an electrode is covered as fully plane as possible by the insulation layer 41. The other contact 34 rests conductively on this layer. Figs. 22 through 31 show different, more concrete model examples of a test device to register the emission of the EL printed image 29.

The test device per Figs. 22 to 34 consists on the other hand basically of the two carriers 28, 30 facing each other, in the space between which an electro-magnetic alternating field is formed whereby a housing 49 is configured on the one side of these two carriers 28, 30 that has a switch 50 on its upper side and accommodates corresponding batteries 46 as power supply and an electronic PC board 47 on which the electronics 48 are set up. Pressure on the switch 50 thus produces the electro-magnetic field which permeates at least partially the EL-printed image 29 forming the security features 9, 10 and causes them to glow.

Fig. 24 shows now that the previously described electrode configuration 35 can be configured either on the inside of the lower carrier 30, or on the upper carrier 28.

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Figs. 25 and 26 show that the electrode fingers 39,40 are configured and spaced opposite each other and form approximately parallel field-gaps 26 between themselves. The entire configuration is then connected via specially installed conductive contact surfaces 52 to the contacts 34. Additionally, a further luminescent coating 51 can be configured on the inside of the carrier 28. The function of this luminescent coating was already explained with the aid of Fig. 20.

In contrast to the intertwined, finger-like electrodes previously described, Figs. 27 and 28 describe the electrodes 53, 54 that are likewise configured opposite each other and connected via corresponding contacts 31.

A further illumination source 55 of any desired type (see the general description re low-pressure gas discharge lamps, laser configuration etc.) can be used as well (per Fig. 26) to achieve additional excitation of the EL printed image. In all cases, the value and security product 1 to be checked is introduced through the insertion slot 56 in the test device.

Figs. 30 and 31 show in this case how the electrode configuration 35 is integrated into the test device. One can discern here that the contact surfaces 52 touch the contacts 34 and then lead directly into the electronics 48 to which the mains power supply 57 can be connected. In a preferred model the electrode configuration 35 shows mounted electrode fingers 39, 40 spaced reciprocally and insulated independently of each other. Here strip conductor widths 58 typically of 100 microns are preferred with a strip conductor spacing 59 preferably of 50 microns.

As insulation, an oxide coating is applied by vacuum metallizing technology over the entire configuration.

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Drawing Legend

1	Value and Security Product	50	Switch
2	Gravure Ink	52	Contact Surface
3	Raised Level	53	Flat Electrodes
4	Stamping Base	54	Flat Electrodes
5	EL-Substance	55	Illumination Source
6	Space	56	Insertion Slot
7	Surface Coating	57	Power Supply
8	Micro-Capsule	58	Width
9	Security Characteristic/Feature	59	Spacing
10	Ditto		
11	Bonding Agent		
12	Glowing Ink		
13	Translucent Printing Ink		
14	Ditto		
15	Translucent Printing Ink With UV Filter		
16	Conductive Printing Ink		
17	Insulating Printing Ink		
18	Contact		
19	Electrode Configuration (Fig. 14)		
20	Connection		
21	Height		
22	Thickness		
23	Thickness		
24	Electrode		
25	Electrode		
26	Field Gap		
27	Viewer		
28	Carrier		
29	EL-Printed Image		
30	Carrier		
31	Connections		
32	Electrode		
33	Electrode		
34	Contact		
35	Electrode Configuration (Fig. 17)		
36	Alternating Field		
37	Alternating Field		
38	Base Conductor 38a		
39	Electrode Fingers		
40	Ditto		
41	Insulation coating		
42	Fluorescent Coating		
43	Emission		
44	Emission		
45	Coating		
46	Battery		
47	PC Board		
48	Electronics		
49	Housing		

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PCT/EP98/01059

NEW Patent Claims

- 1 Value and Security Products such as banknotes, identity cards or similar documents with embedded security elements which contain substances exhibiting electro-luminescent characteristics and which emit radiation due to excitation in an electro-magnetic field, characterized thus, that on the value and security product 1, an essentially planar electrode configuration (19) with electrodes configured in approximately the same plane and lying side by side (24, 25) is located and forms a field gap between them, such that the EL-substances (5) are permeated by the lines of electric flux of the electro-magnetic field produced in the field gap.
- 2 Value and Security Products per Claim 1, characterized thus, that the EL-substances (5) are configured approximately flat and parallel to the electrodes (24, 25), at least in the area of the field gap (26).
- 3 Value and Security Products per Claim 1 or 2, characterized thus, that the EL-substances (5) are configured approximately flat beneath and parallel to the electrodes (24, 25), at in the area of the field gap.
- 4 Value and Security Product per Claims 1 through 3, characterized thus, that the electrode configuration (35) consists of comb-like electrode fingers, (39, 40) entwined in one another and which between them form a zigzag-form field gap.
- 5 Value and Security Product per one of the Claims 1 through 4, characterized thus, that the EL-printed image (29) emits visible, or non-visible primary radiation.
- 6 Value and Security Product per one of the Claims 1 through 5, characterized thus, that additional luminescent inks (12) in the form of pigments are added to the mixture of printing inks (2) and bonding agent (11).
- 7 Value and Security Product per one of the Claims 1 through 6, characterized thus, that a printed image (29) showing the EL-substances (5) is covered with translucent printing inks (13)
- 8 Value and Security Product per Claim 7, characterized thus, that an additional UV filter (15) is mixed with the translucent printing inks (13), or that a UV filter in the form of an encapsulation of pigments is provided for.
- 9 Process for the production of a Security Document printed either in steel gravure with several gravure printing inks (2) which comprises the following procedural steps:
 1. Graphic formatting of substrates, in particular special security papers of up to 200 g/m² basic weight by means of gravure techniques, silk-screen techniques and other printing techniques,

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2. Printing of lateral electrodes by means of conductive pastes,
 3. Printing of an insulating ink,
 4. Printing of an EL-substance at least partially over the electrodes,
 5. Printing of passivating, electrically conductive inks onto the electrical contacts in the form of conductive inks or pastes, in particular, carbon- or gold-based,
 6. Printing of an elastic, transparent, abrasion-resistant protective coating, in particular, based on watery polyurethane dispersions,
 7. Curing of the aforementioned prints following each and every printing process,
-
- 10 Process per Claim 9, characterized thus, that prior to printing, a bonding agent in the form of a watery polyurethane is applied for the purpose of bonding and embedding the following layers of print.
 - 11 Process per Claim 9, characterized thus, that the insulating ink processed per procedural step 3 during printing contains watery polyurethane dispersion systems and/or barium titanate (BaTiO₃) for the purpose of raising the dielectric constant.
 - 12 Process per Claim 9, characterized thus, that EL-substance processed per procedural step 4 during printing consists of different-coloured electro-magnetic pastes with which as required so-called spreaders are added during encapsulation of the pigments, that prevent damage to the micro-encapsulated glowing pigments from excessive pressure during the printing process.
 - 13 Process per Claim 9, characterized thus, that the EL-substance has been processed per procedural step 4 during printing, translucent inks are printed on, or underneath for the purpose of additional graphic formatting and for technical security purposes.
 - 14 Process per Claim 9, characterized thus, that after the last procedural step, thermopressure takes place at temperatures of up to 200 degrees C and pressures of up to 500 N/cm² in order to stabilize and enhance the quality of the security document.
 - 15 Test device for visual and/or machine-operated authenticity check of value and security documents which exhibit security characteristics featuring electro-luminescent substances, characterized thus, that the test device has two carriers (28, 30) located parallel to each other, between which the document to be checked is introduced, with at least one of the carriers (28, 30) being transparent and that an electrode configuration (35) is provided for on at least one of the carriers (28, 30) which is suitable for producing and electro-magnetic field that permeates the value and security product (1) at least at those points at which the EL-active security characteristics (9, 10, 29) are configured in such a way, that the EL-active substances (9, 10, 29) are excited such that they emit photons that can be evaluated visually, or by machine.

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- 16 Test device per Claim 15, characterized thus, that both electrodes are configured in the form of a common electrode configuration (35) on the side of a fixed carrier (28 or 30).
- 17 Test device per Claim 15 or 16 characterized thus, that the electrode configuration (35) is constructed essentially planar with electrodes (39, 40) lying side by side in approximately the same plane which between them form a field gap (26), whereby the EL-active characteristics are permeated by the lines of electric flux of the electro-magnetic alternating field produced in the field gap (26).
- 18 Test device per Claim 17 characterized thus, that the electrode configuration (35) consists of comb-like, entwined electrode fingers (39, 40) which electrode fingers (39, 40) between them form a zigzag-shaped field gap (26).
- 19 Test device per one of the Claims 15 to 18 characterized thus, that the electrode configuration is applied to an insulation layer (41).
- 20 Test device for visual and/or machine-operated authenticity checking of value or security documents showing security characteristics provided with electro-luminescent substances characterized thus, that the test device has two carriers (28, 30) located parallel to each other between which the document to be checked is introduced, whereby at least one of the carriers is transparent and, that electrodes (32, 33; 53, 54) are configured on both carriers (28, 30) that in a manner similar to that of plate capacitors produce between them an electro-magnetic field which permeates the value and security product (1) at least at those points where the EL-active security characteristics (9, 10, 29) are configured and which, in so doing, excites the EL-active security characteristics in such a manner that they emit photons that can be evaluated either visually or by machine.
- 21 Test unit per Claim 20 characterized thus, that both electrodes (32, 33) are configured opposite to each other on the carriers (28, 30) and that the value and security product (1) can be introduced into an insertion slot (56) between the electrodes (32, 33).
- 22 Test device for visual and/or machine-operated authenticity checking of value or security documents showing security characteristics provided with electro-luminescent substances characterized thus that the test device has two carriers (28, 30) located parallel to each other, between which the document to be checked can be introduced, whereby at least one of the carriers is transparent and that a first electrode (16, 32) is configured on the value and security product (1) and a second electrode (45) is configured on one of the carriers (28) which, between them, produce an electro-magnetic field that permeates the value and security product (1) at least at those points where the EL-active security characteristics (9, 10, 29) are configured such that the EL-active security characteristics are excited in such a manner that they emit photons that can be evaluated either visually, or by machine.

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- 23 Test device per one of the Claims 15 through 22 characterized thus that a fluorescent coating (42) is configured on one of the carrier plates (28 or 30) that emits a secondary radiation in the visible range from a visible, or non-visible primary radiation emitted by the the EL-active security characteristic (29).

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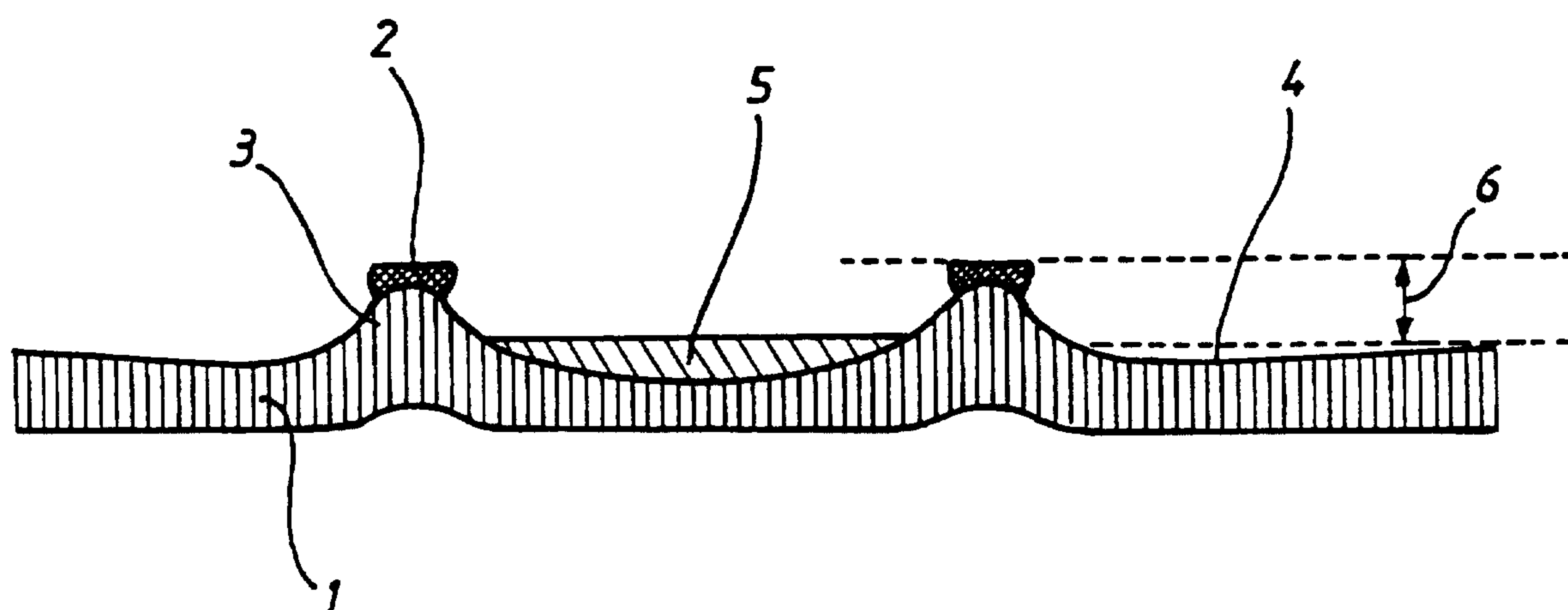
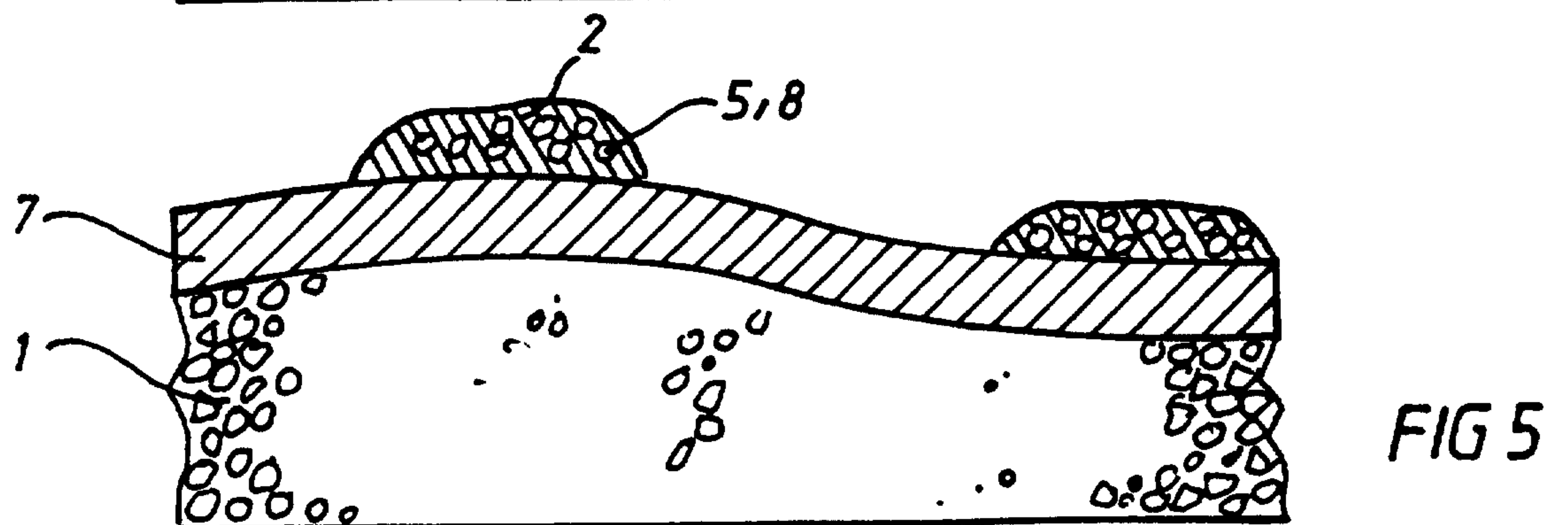
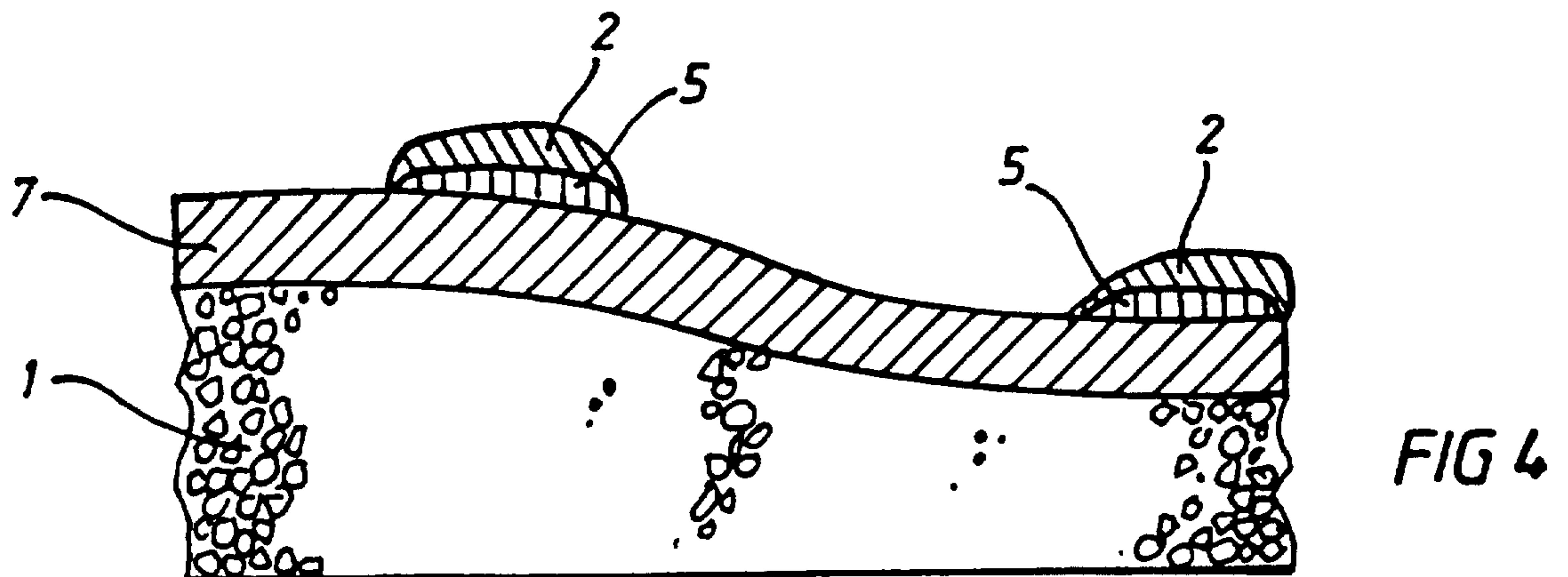
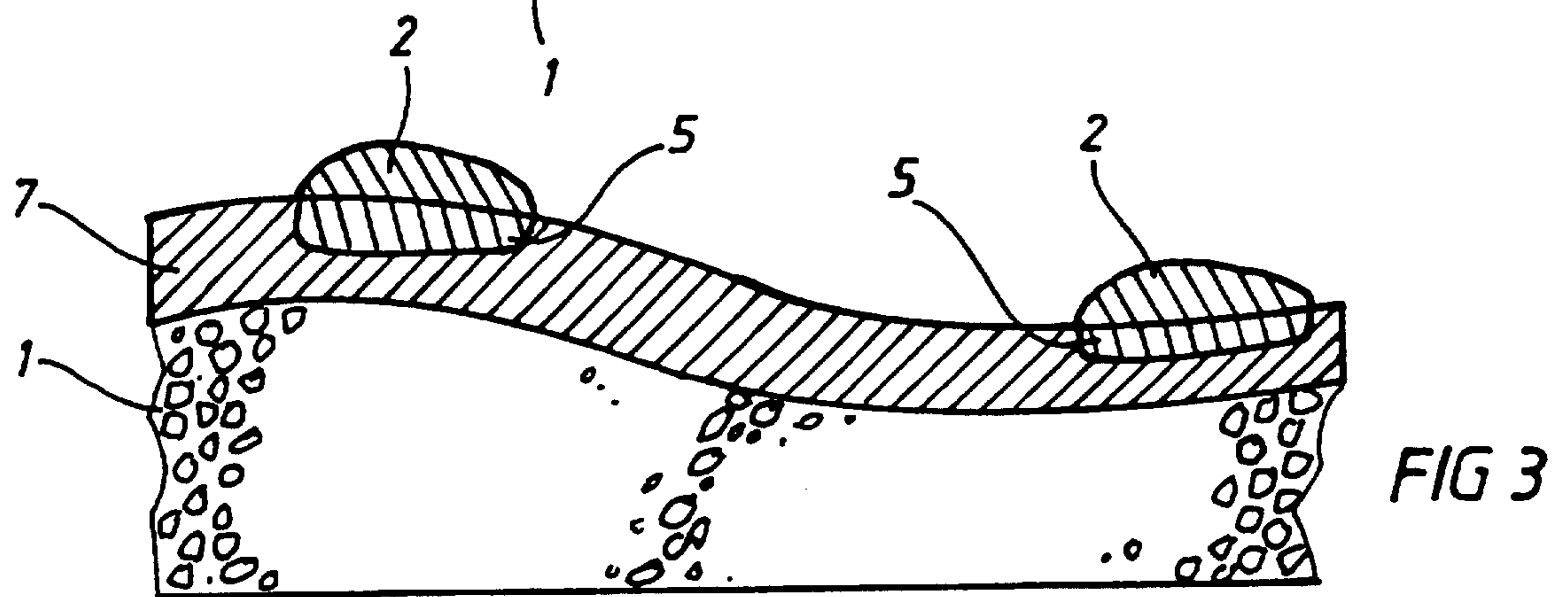
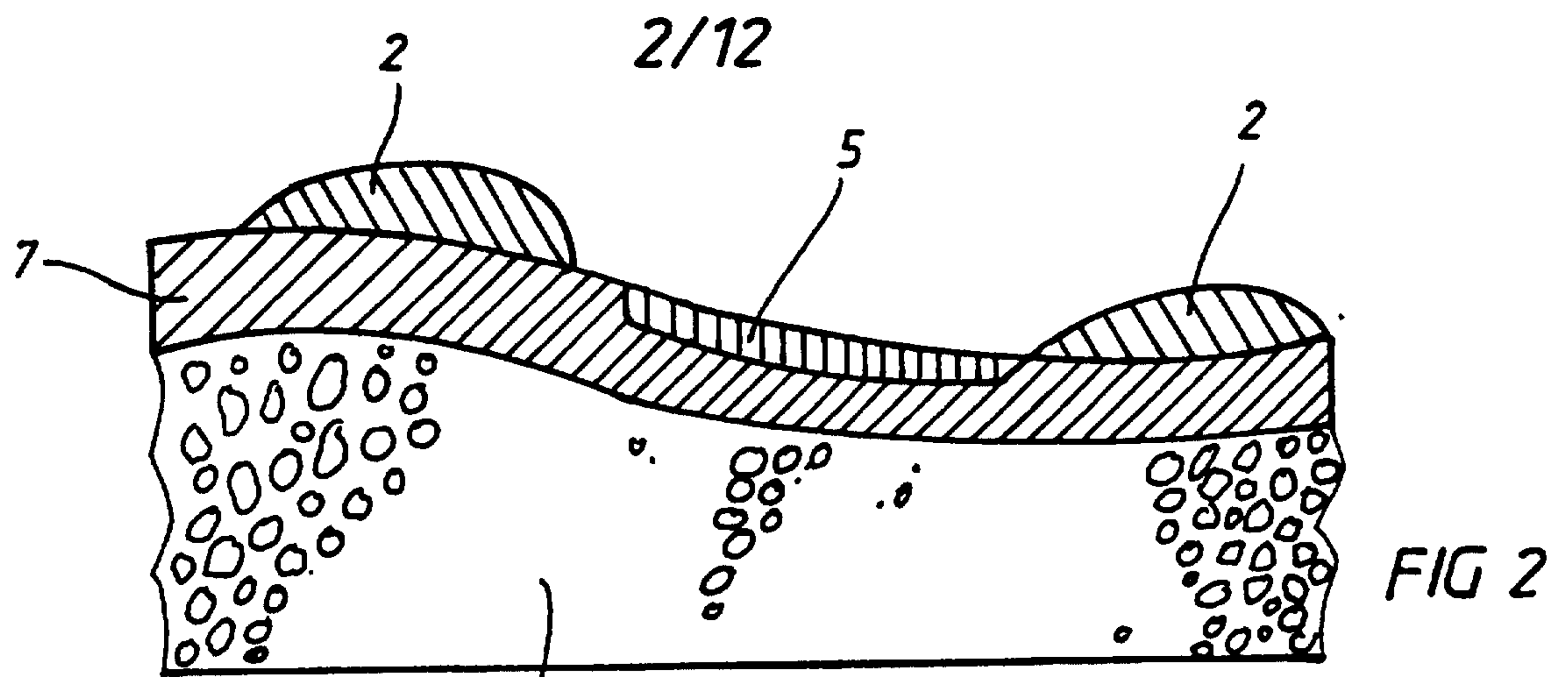


FIG 1



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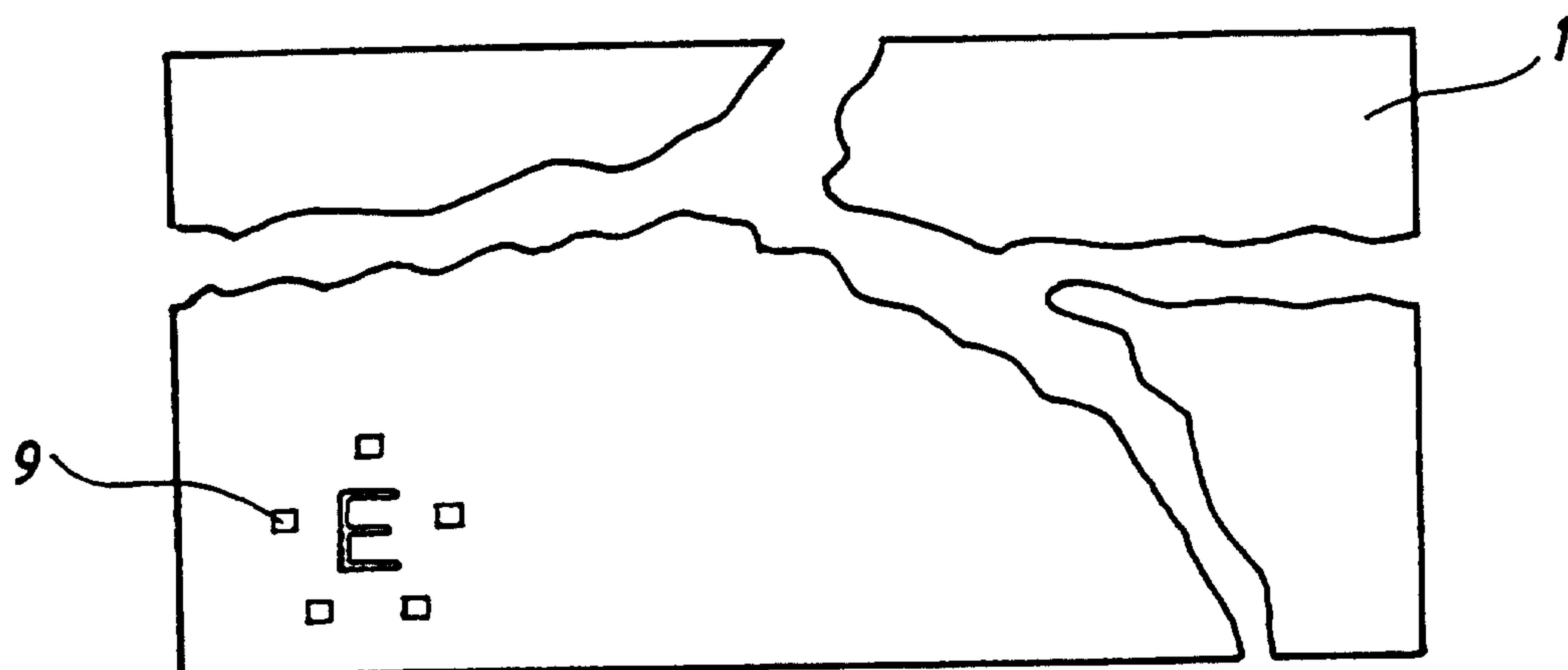


FIG 6

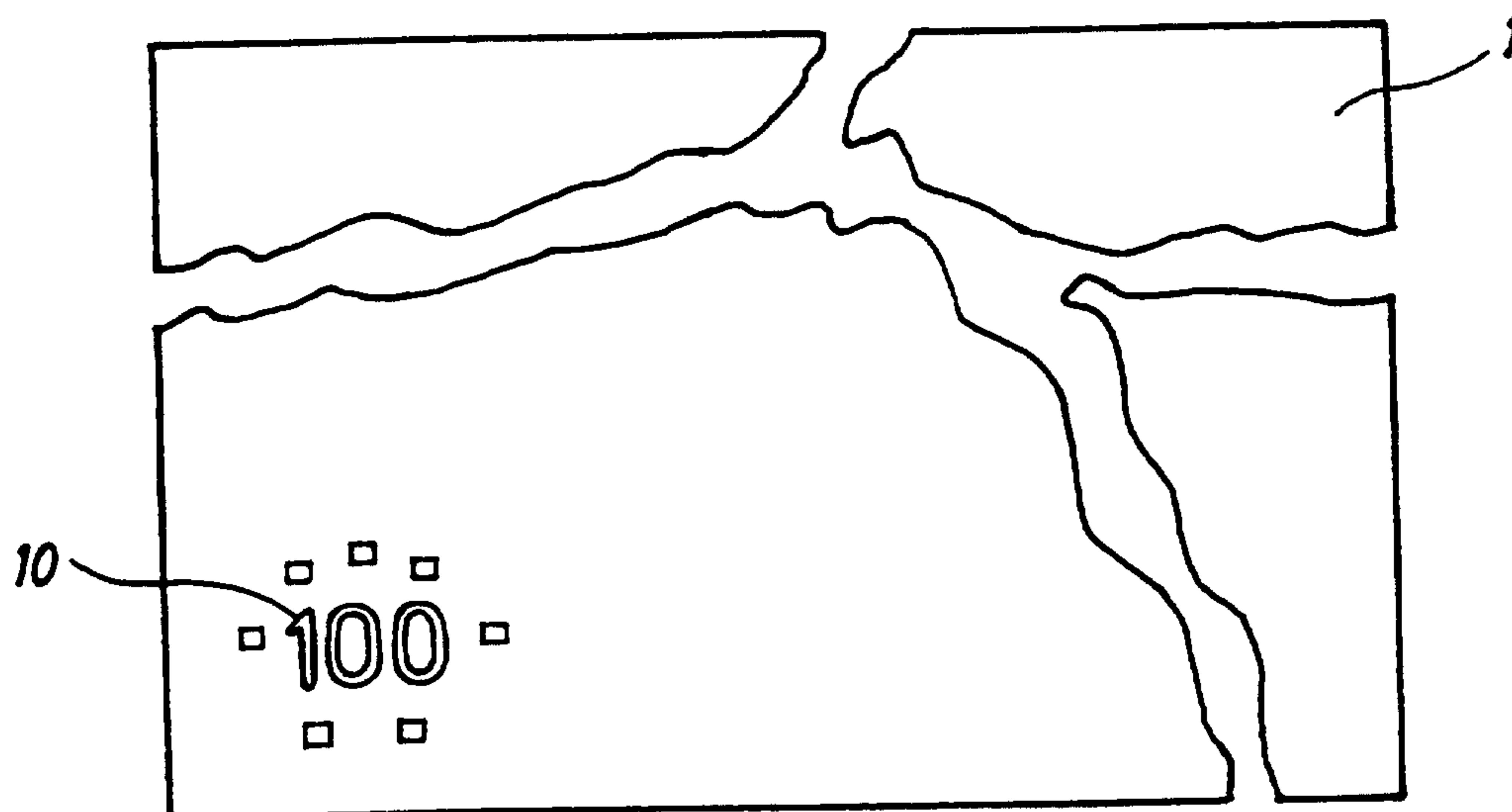


FIG 7

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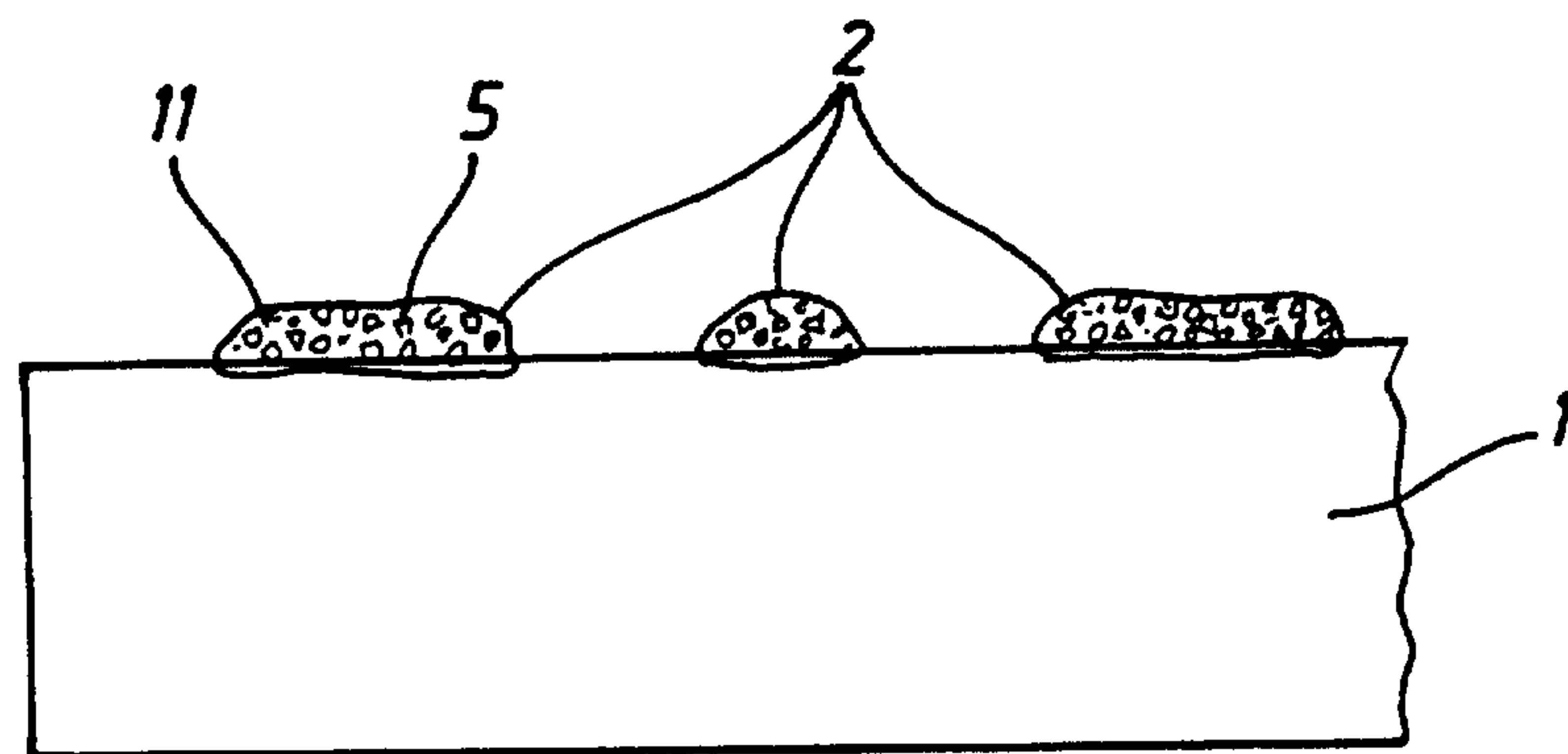


FIG 8

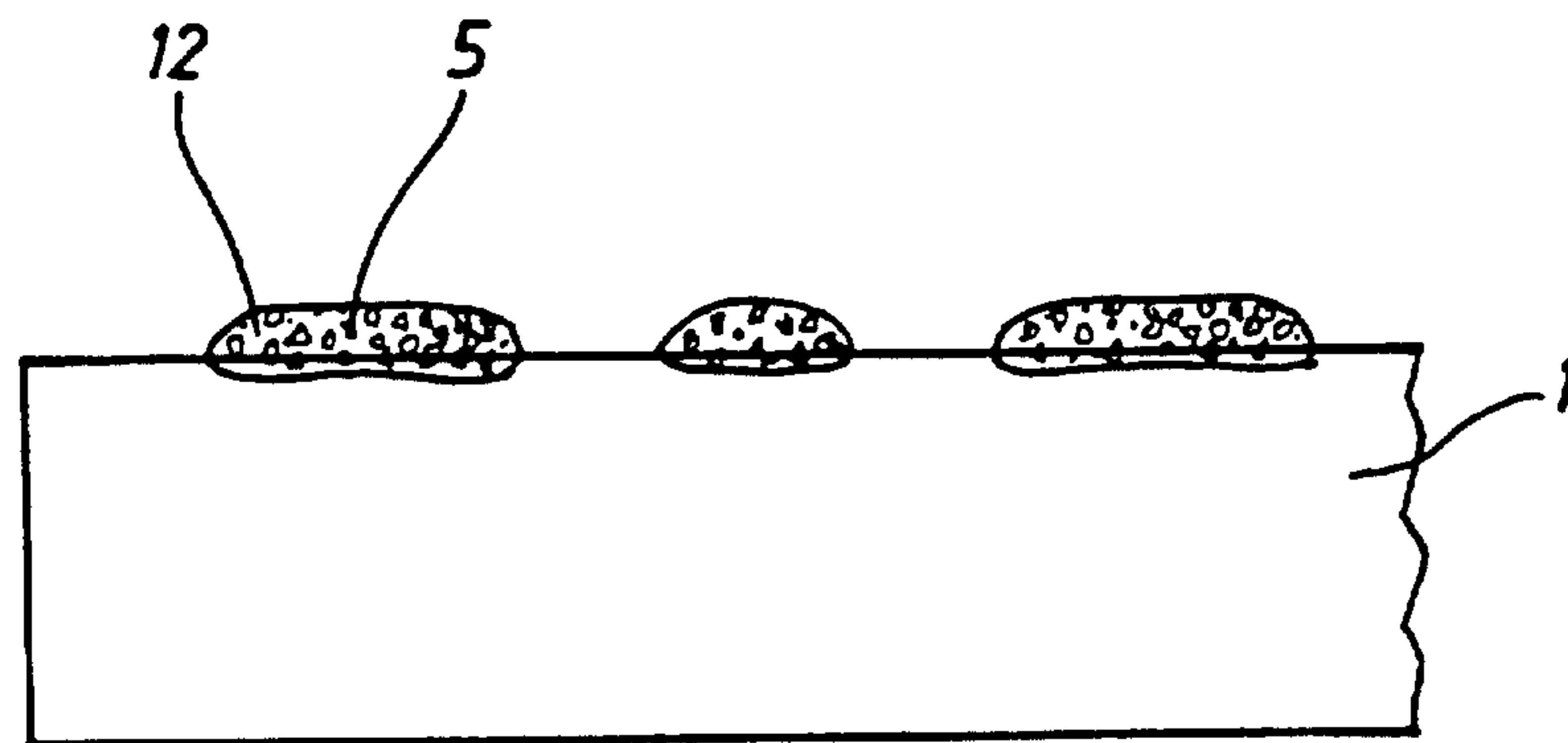


FIG 9

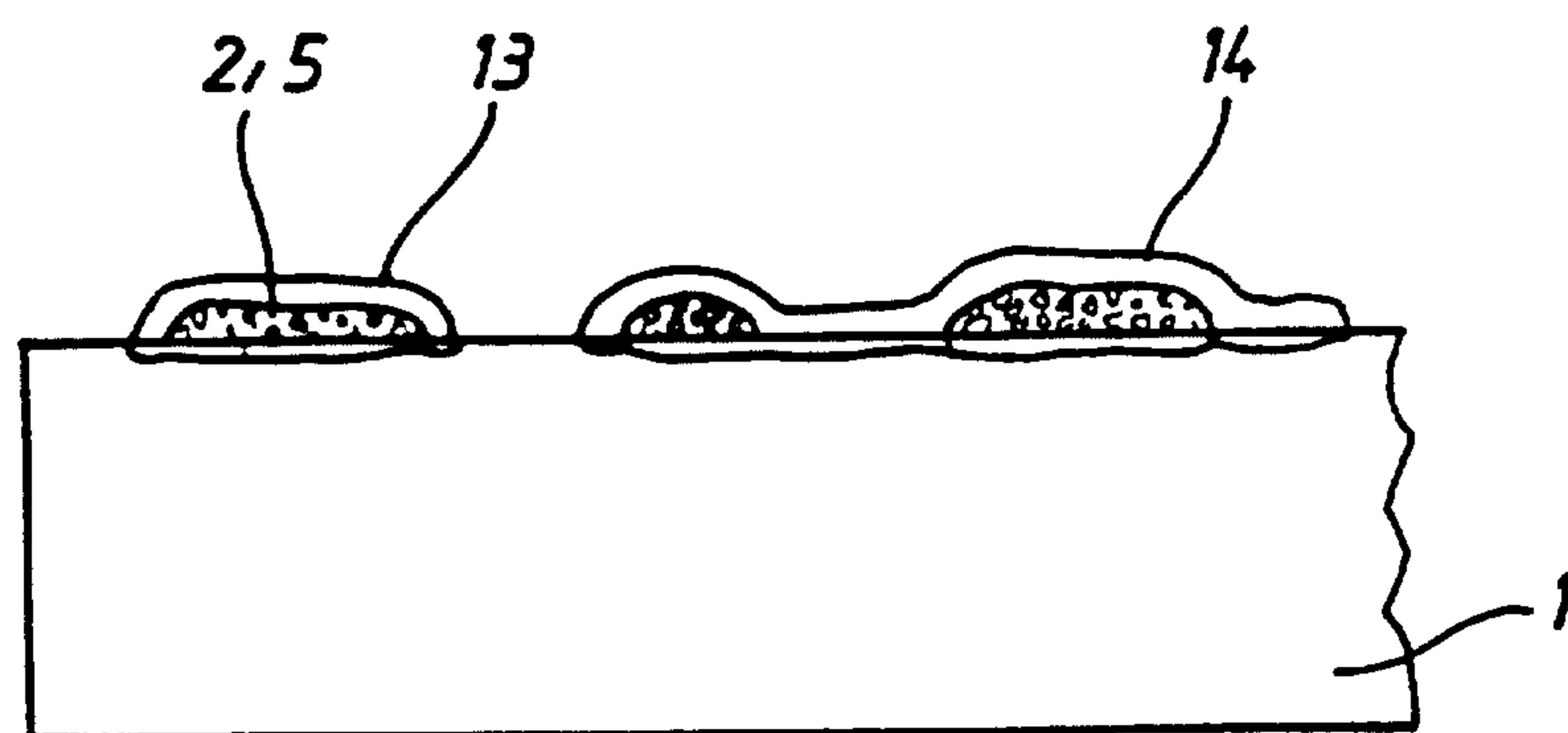


FIG 10

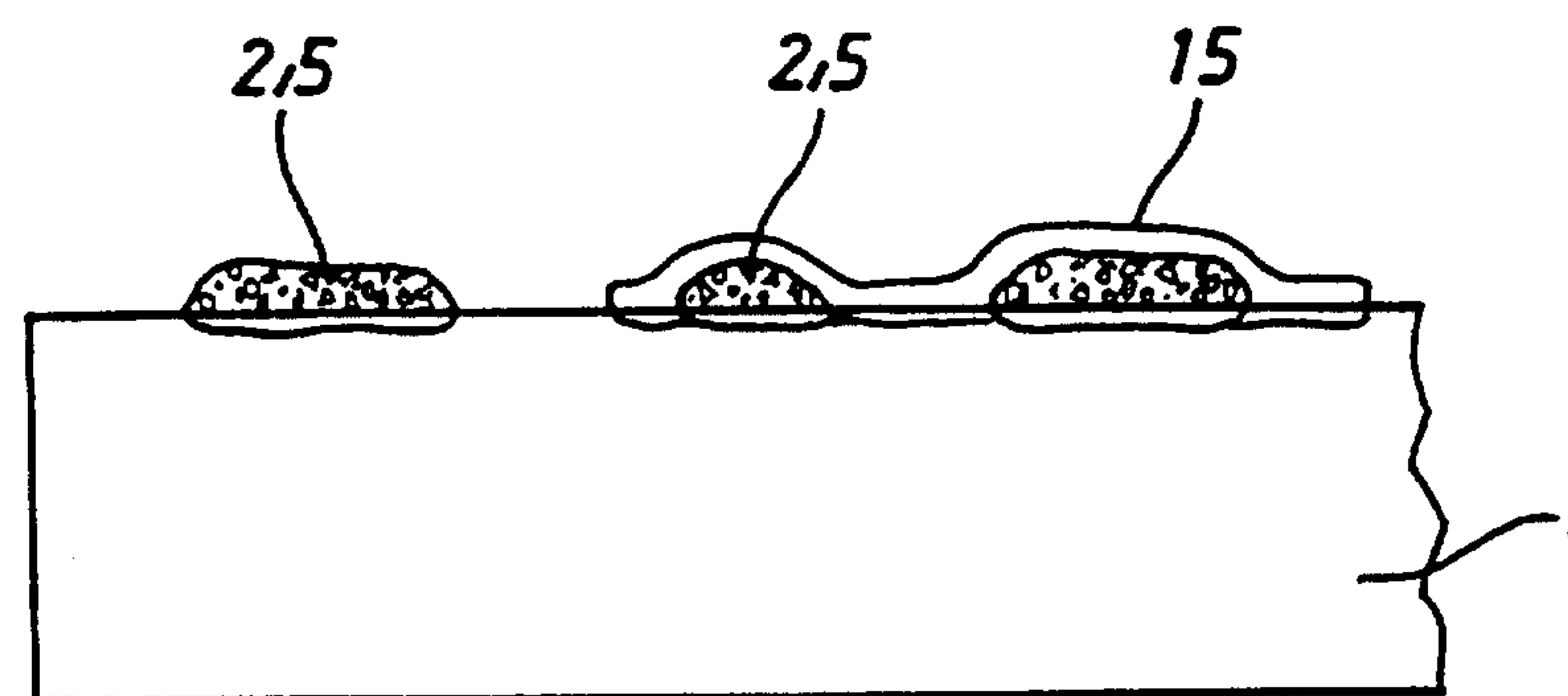


FIG 11

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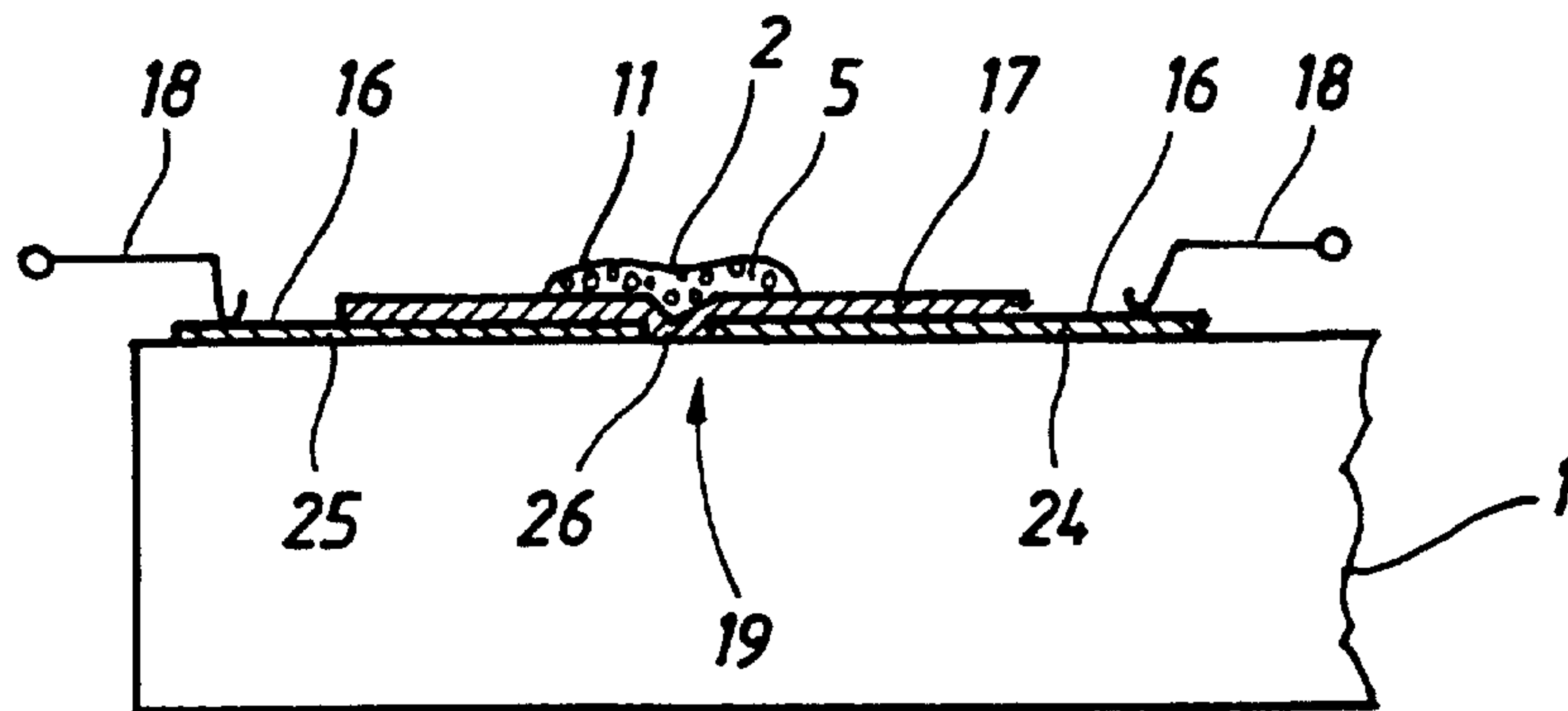


FIG 12

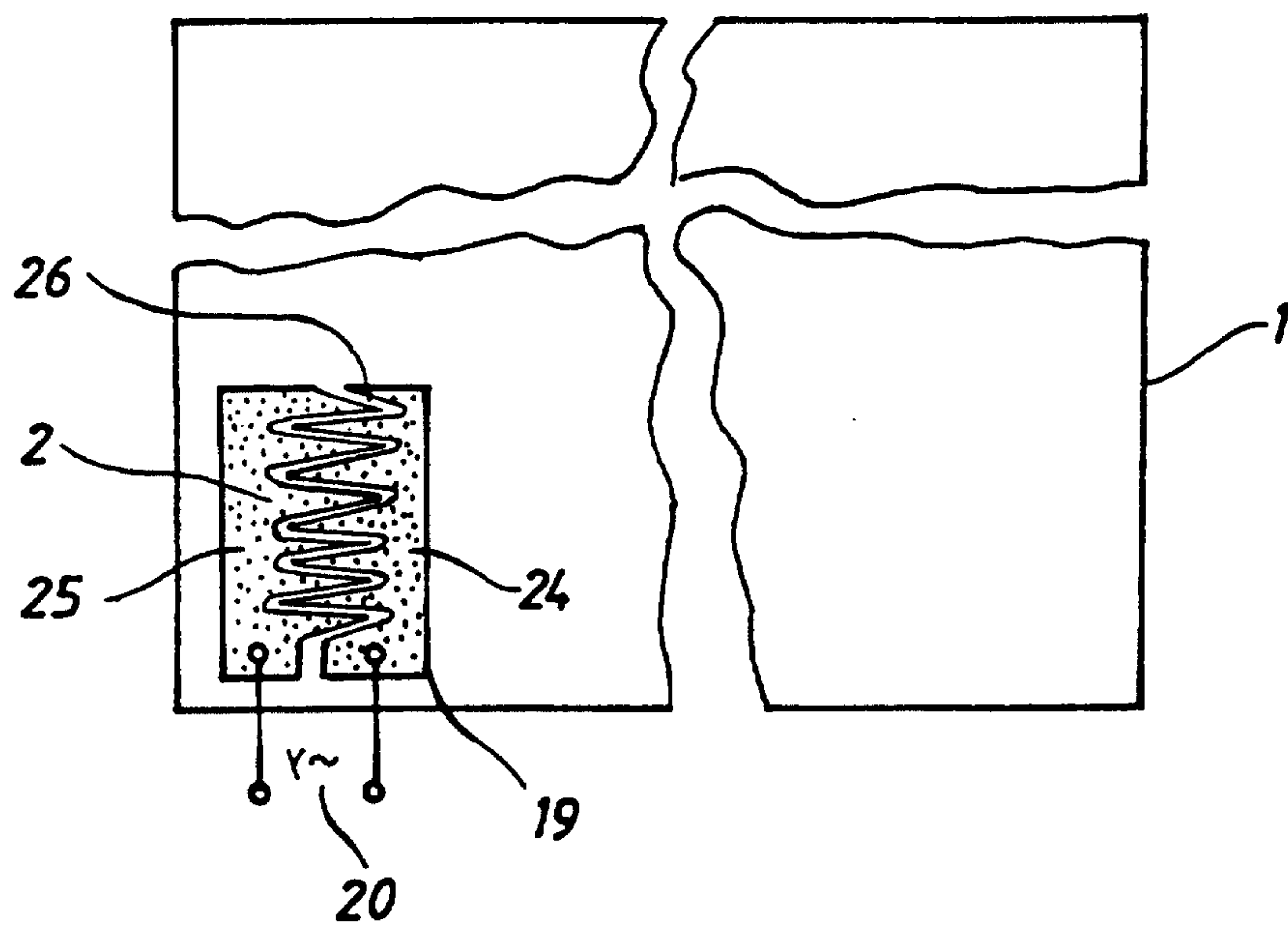


FIG 13

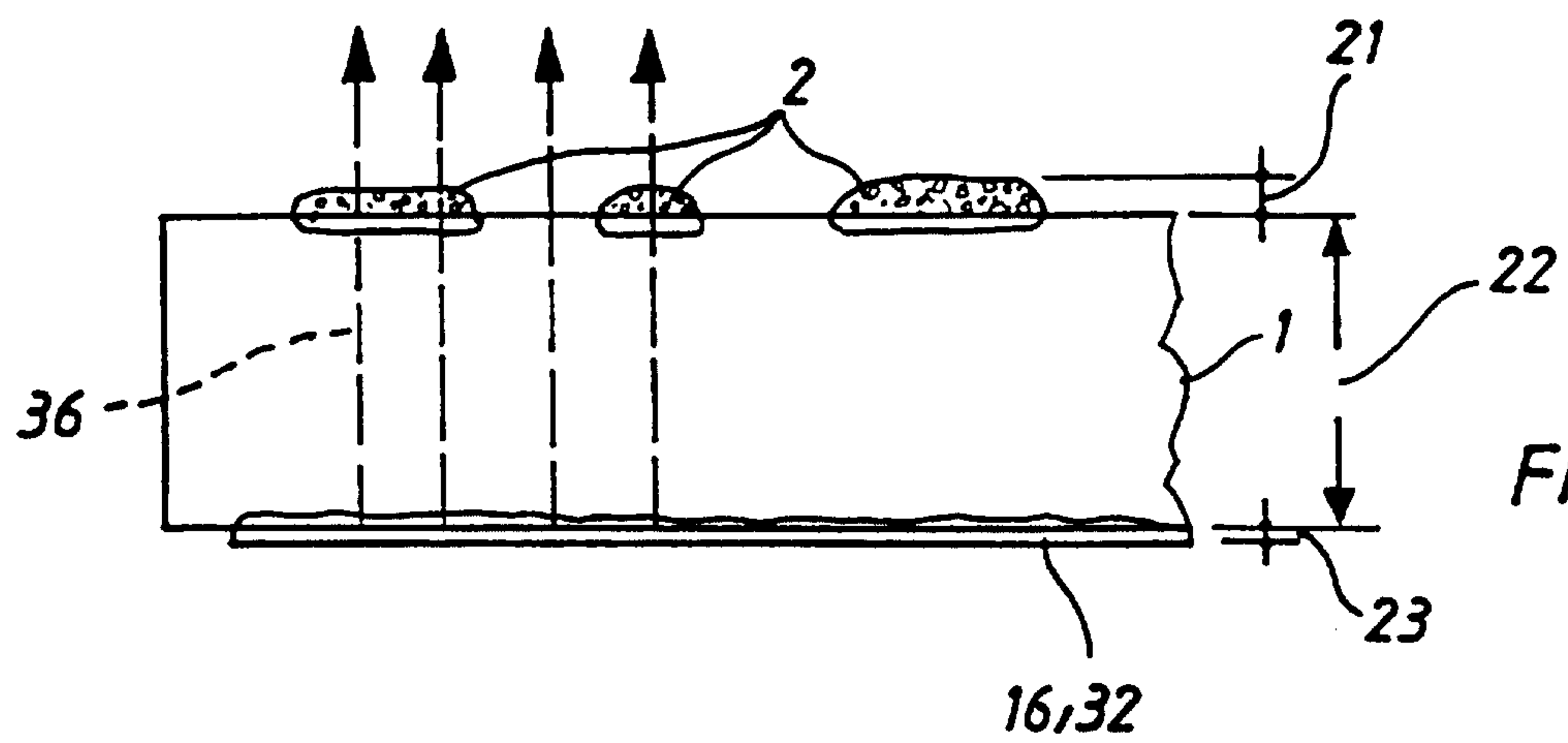
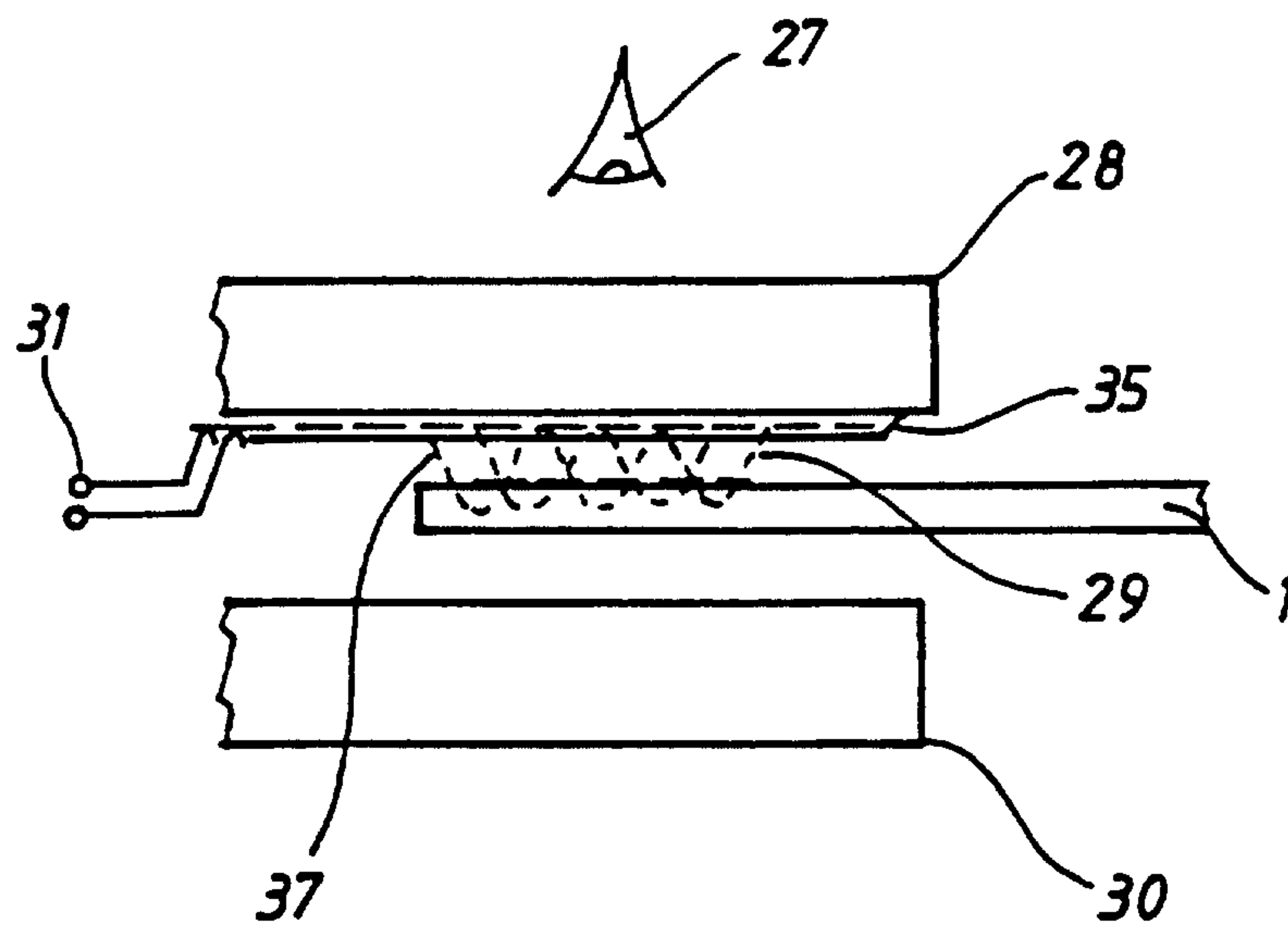
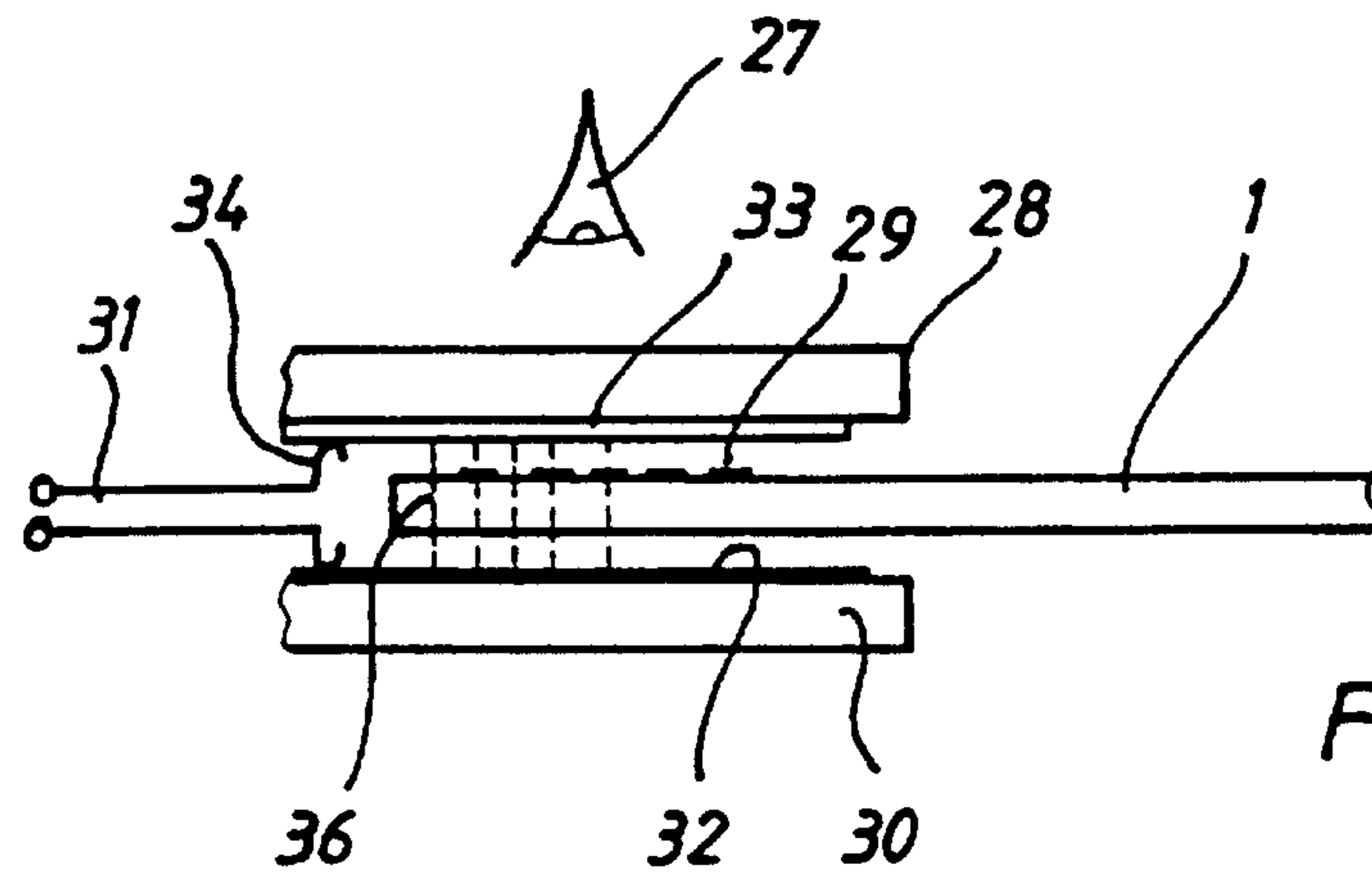


FIG 14

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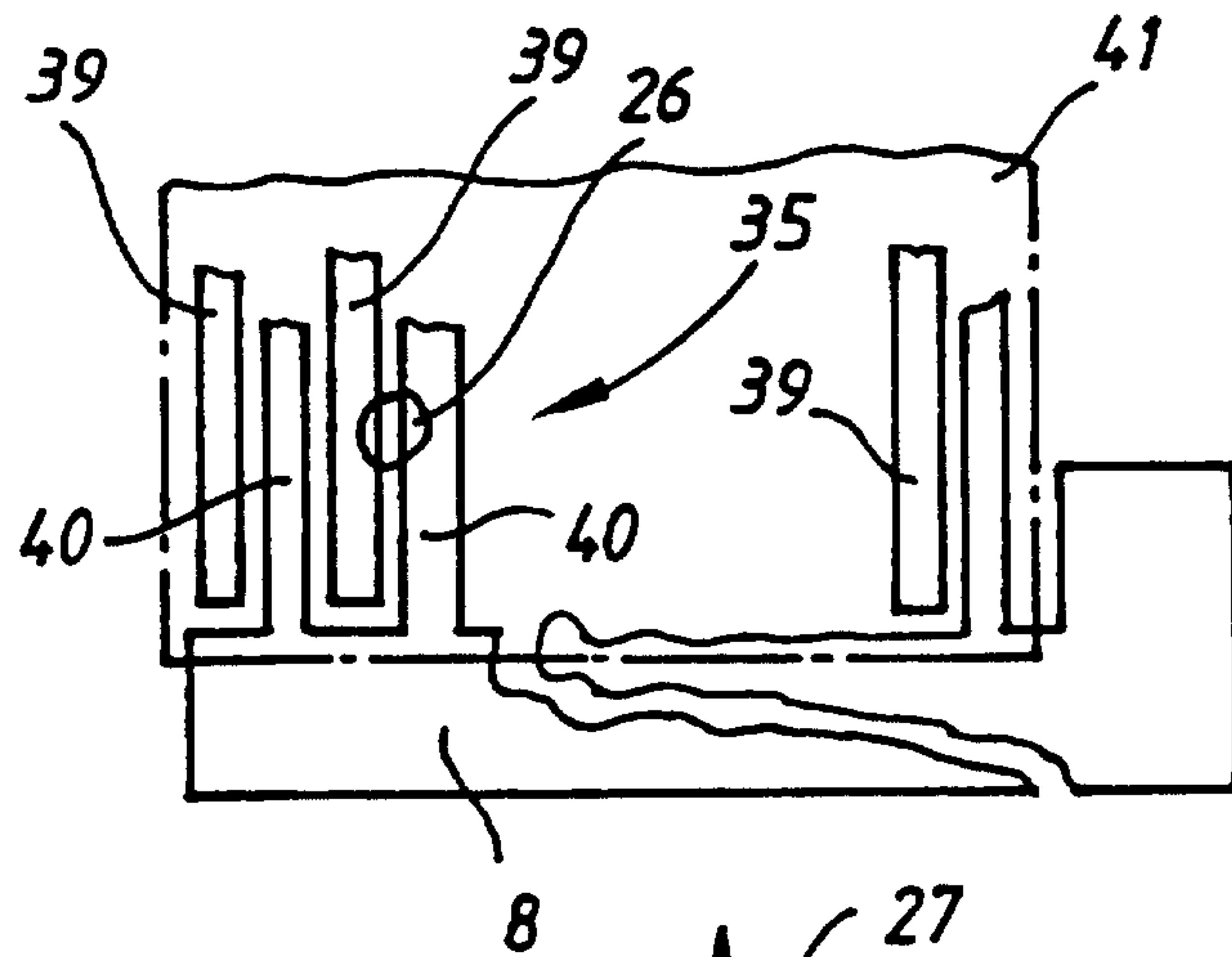


FIG 17

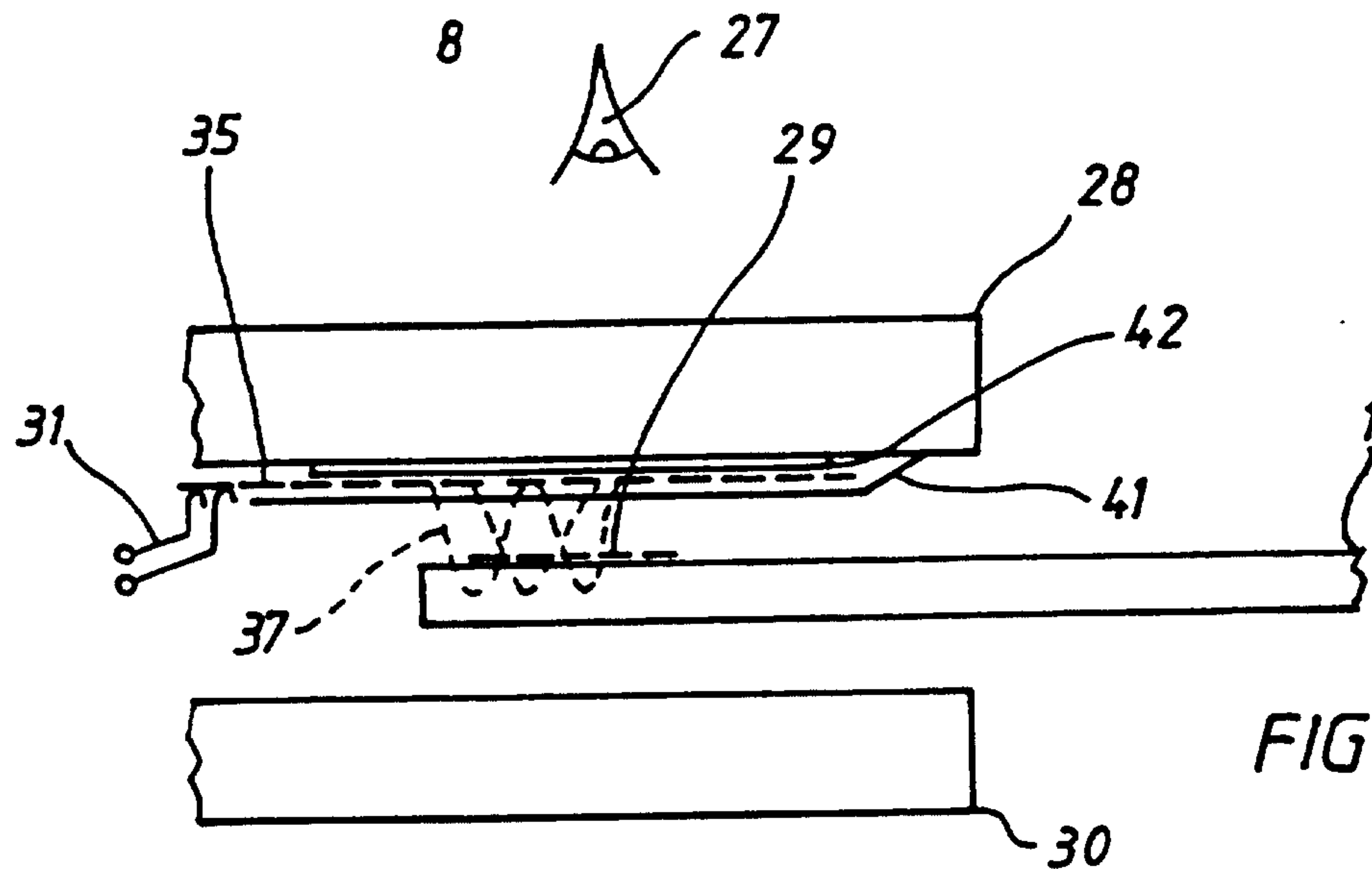


FIG 18

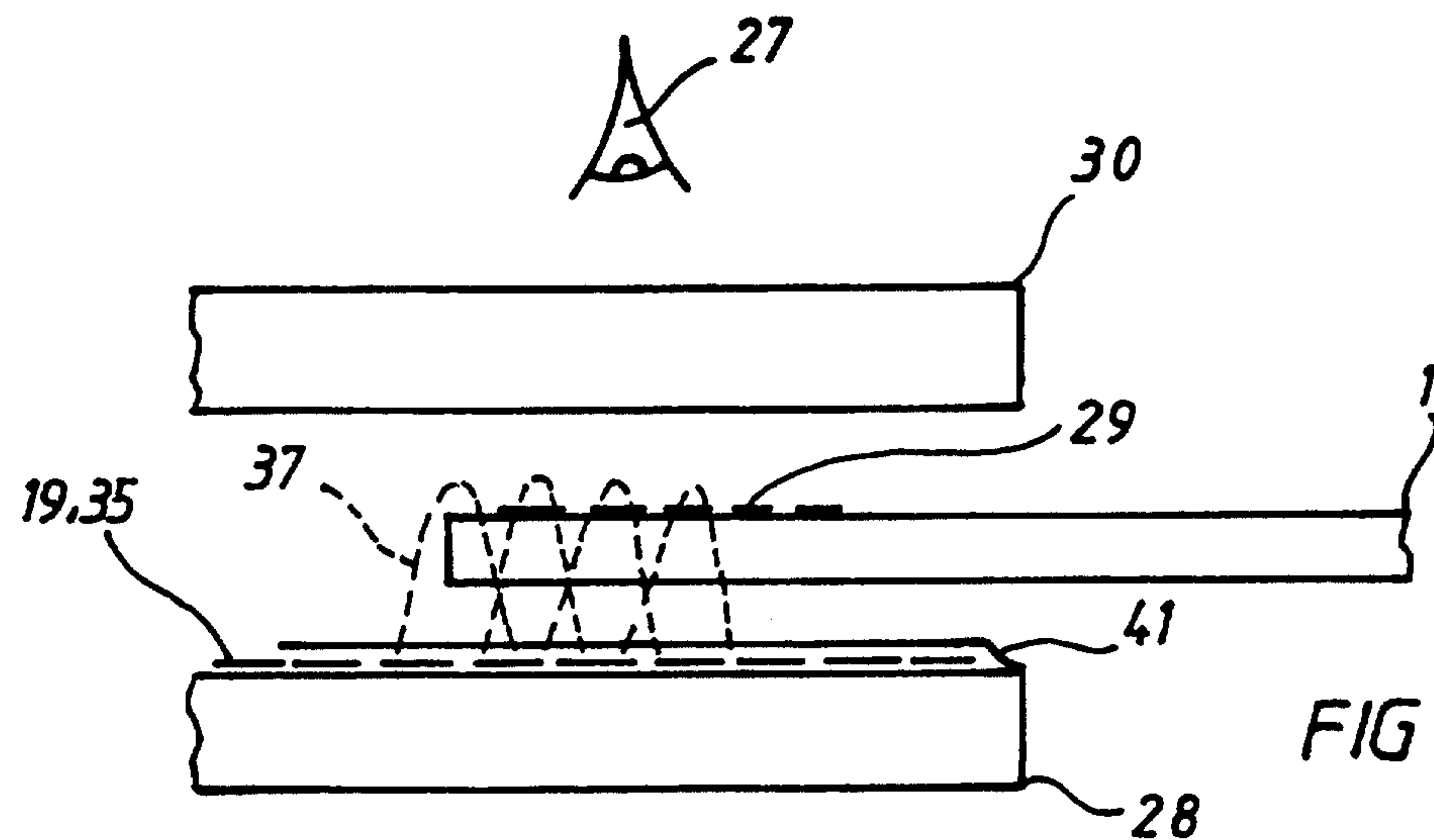
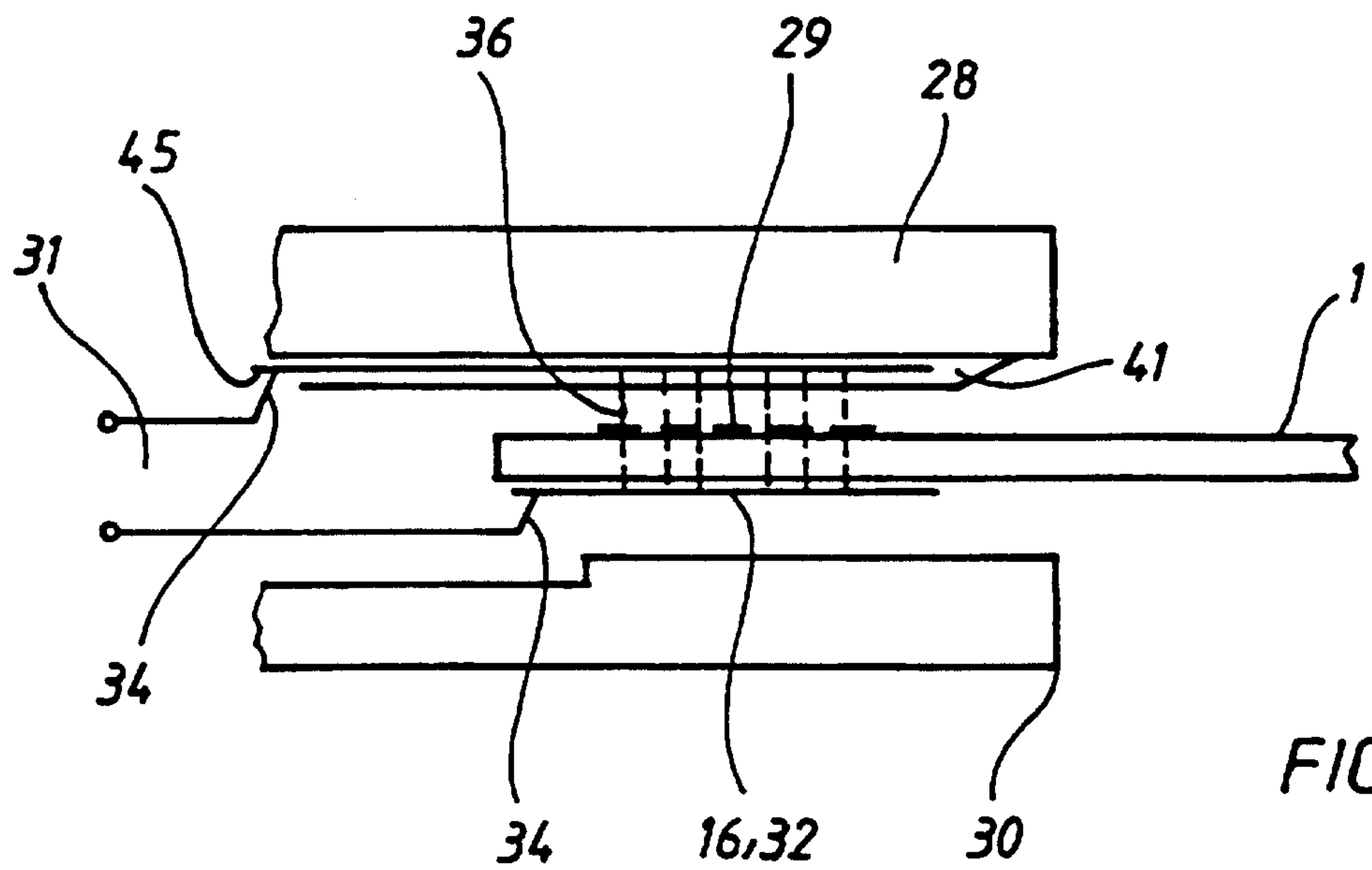
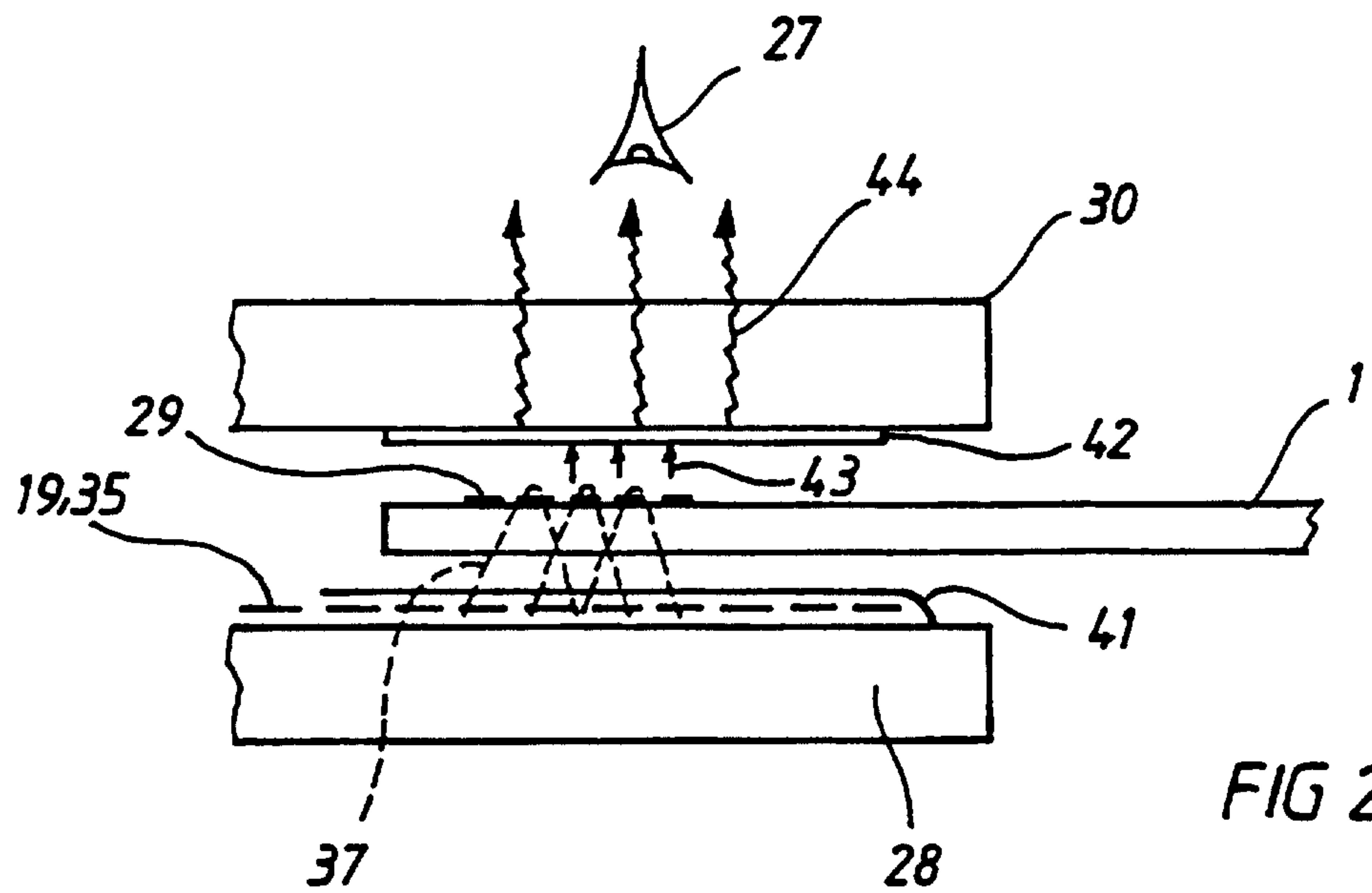
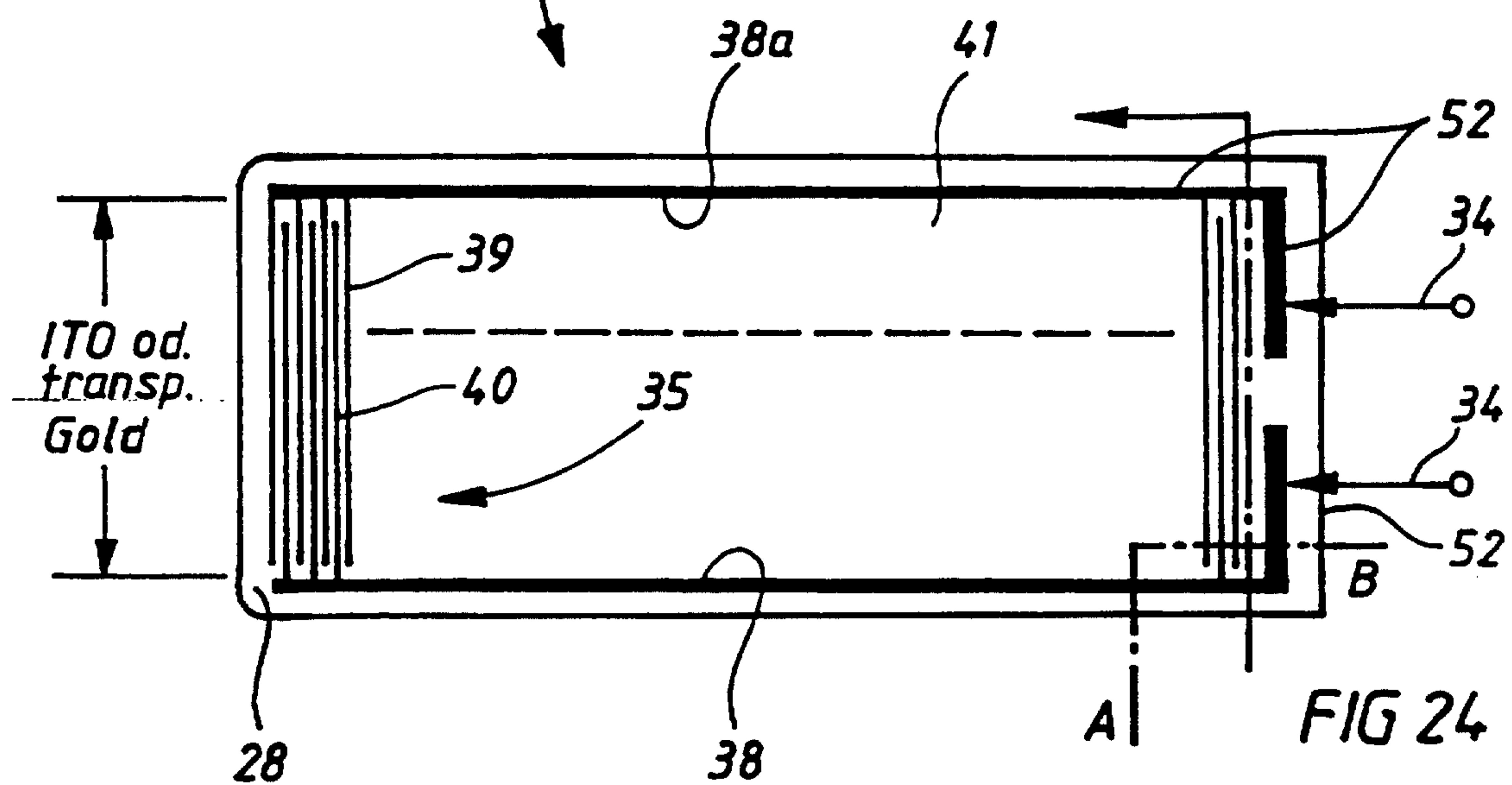
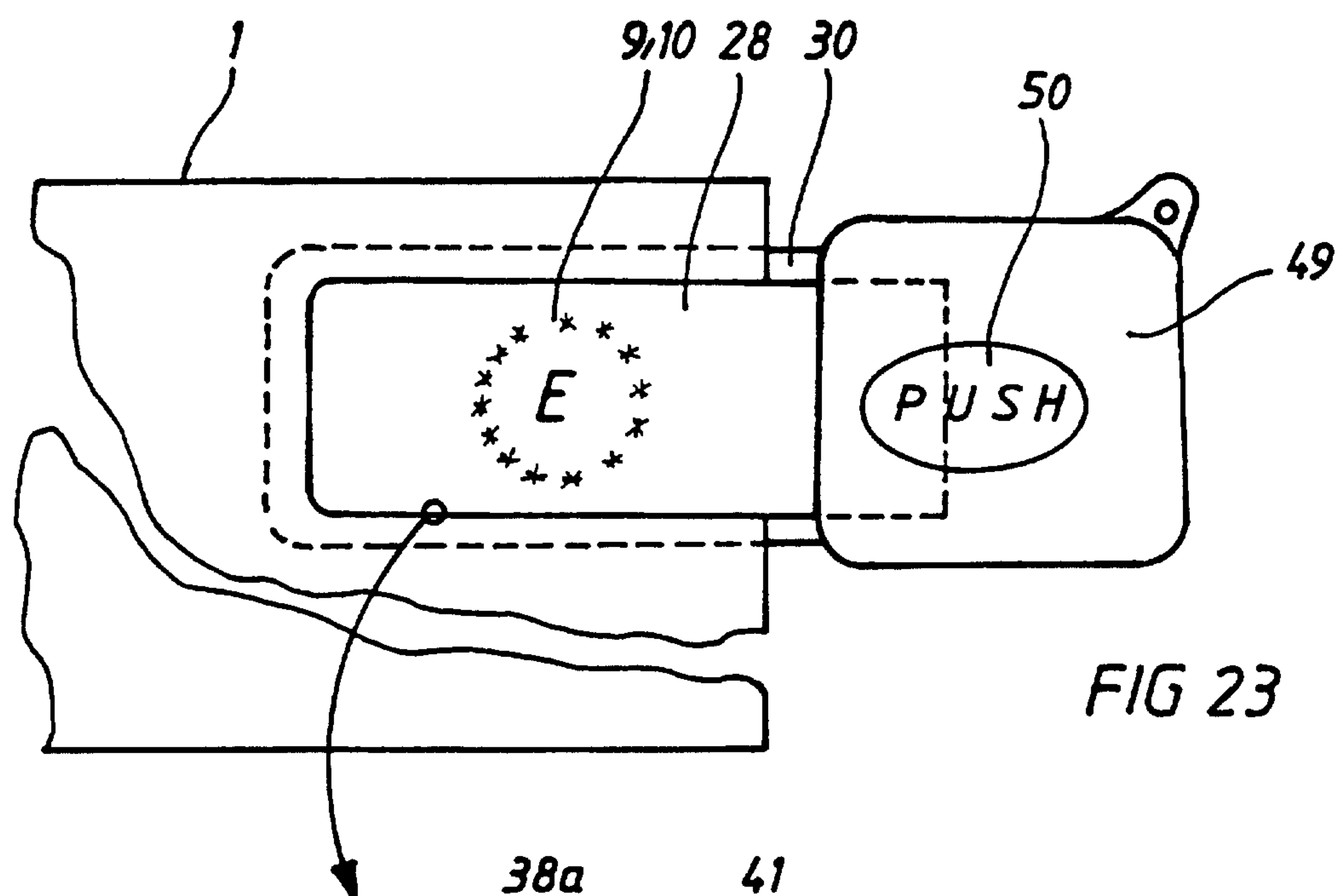
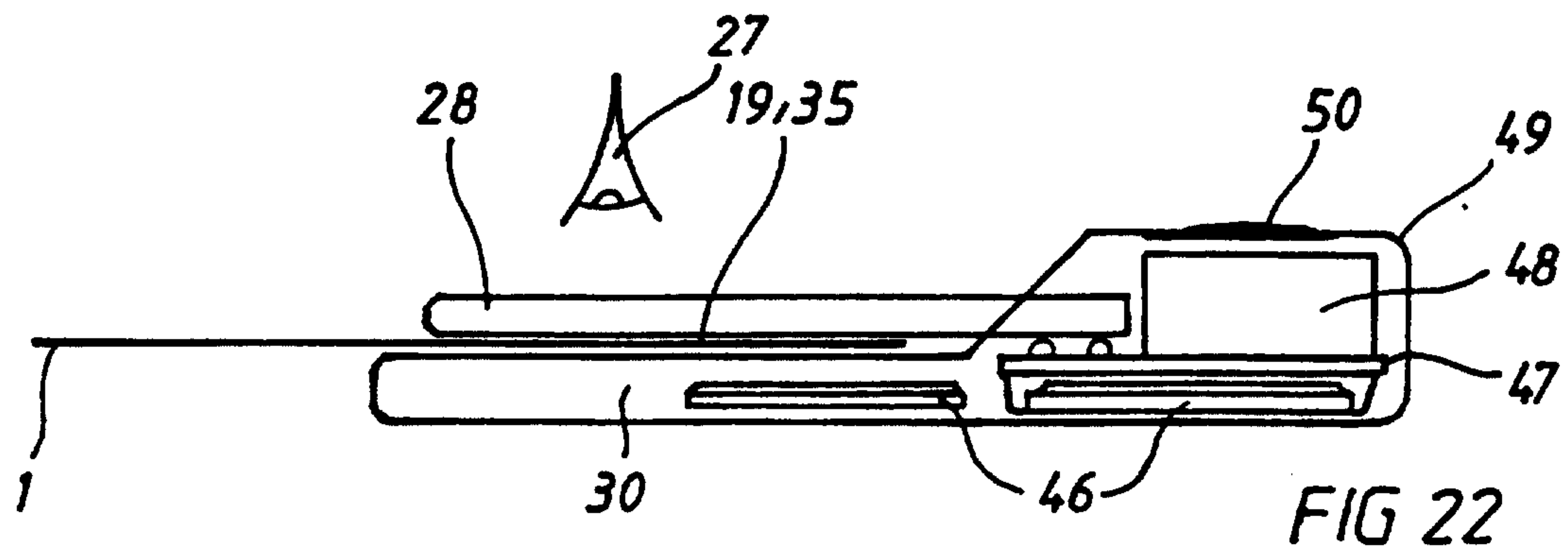


FIG 19

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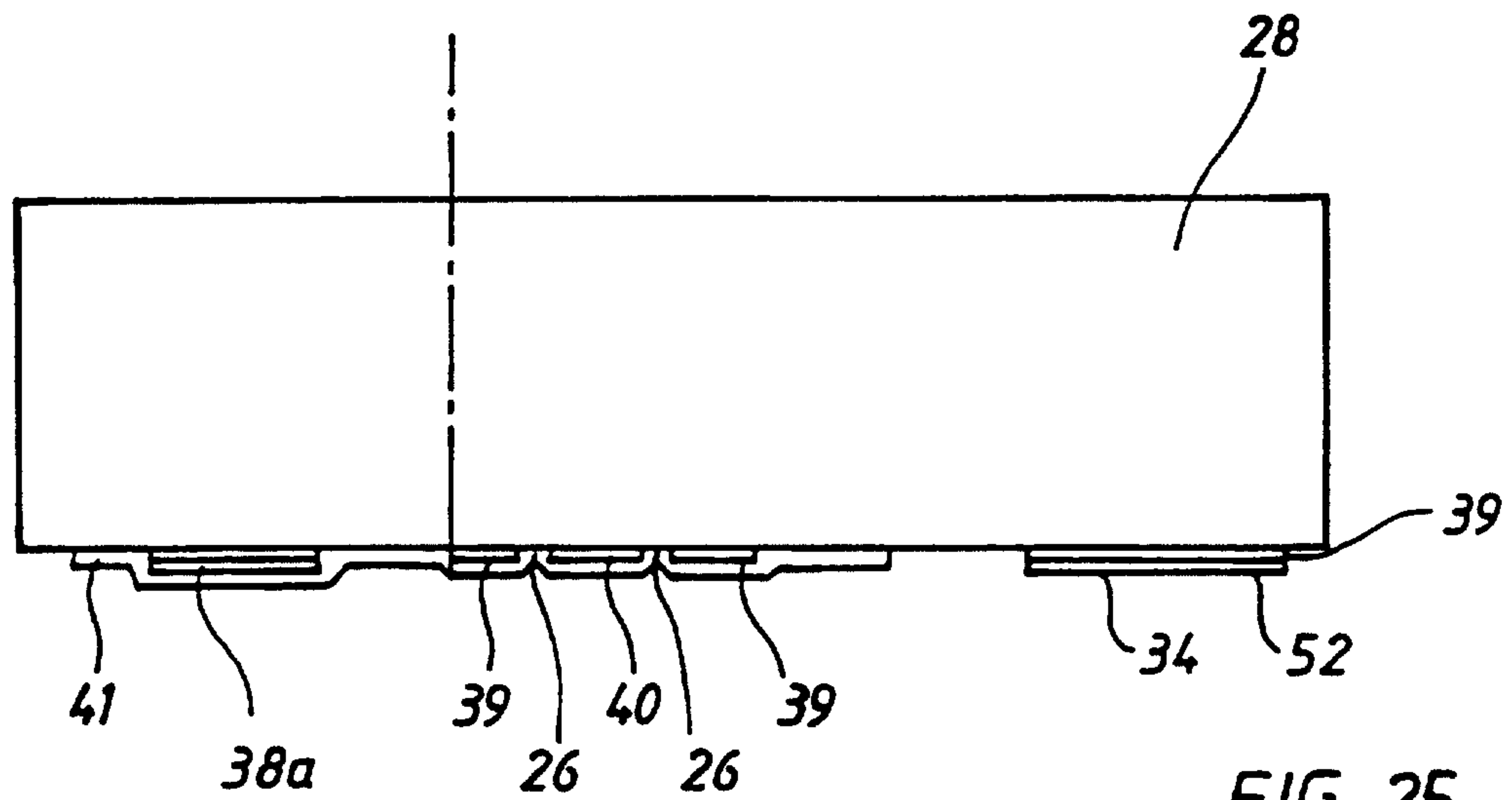


FIG 25

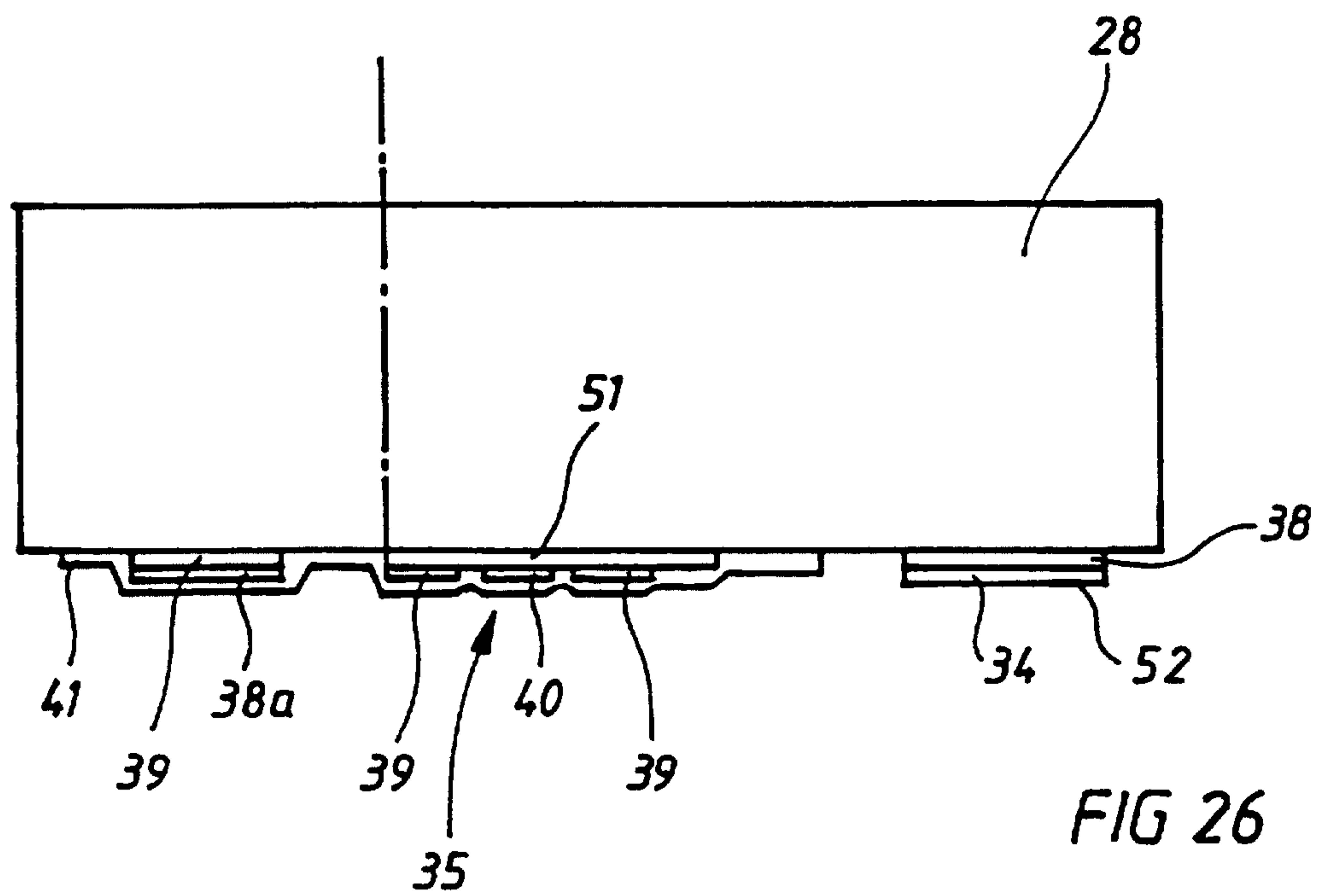


FIG 26

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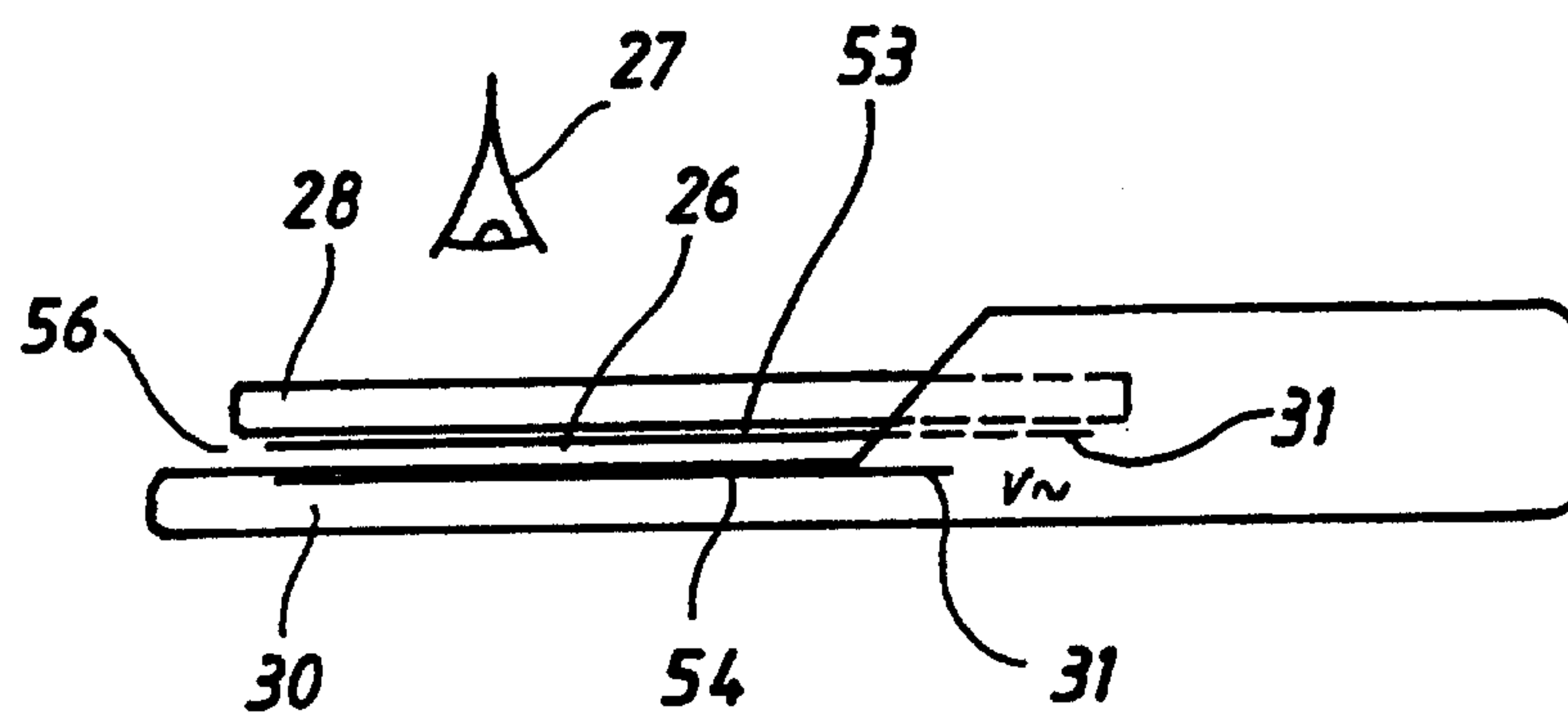


FIG 27

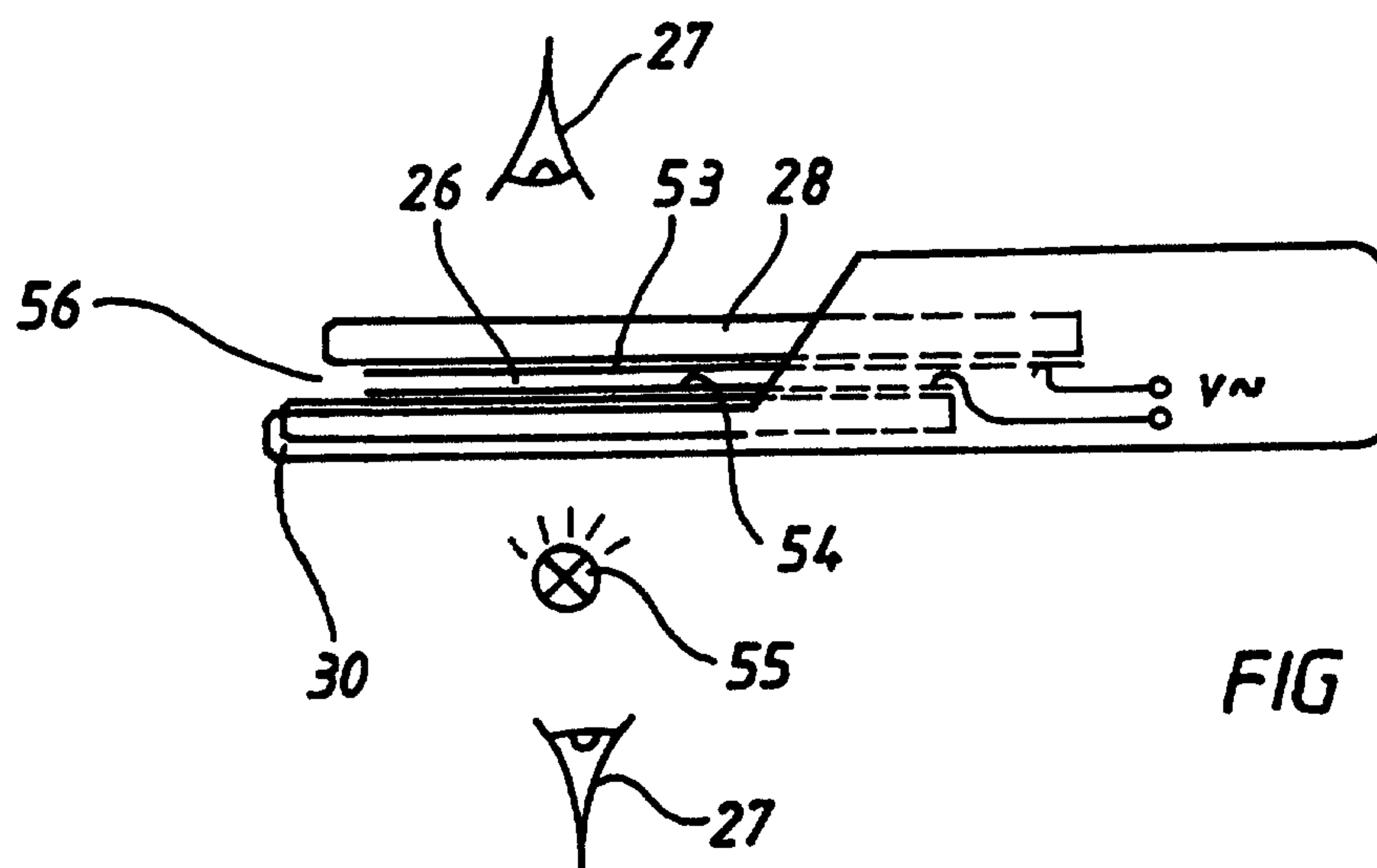


FIG 28

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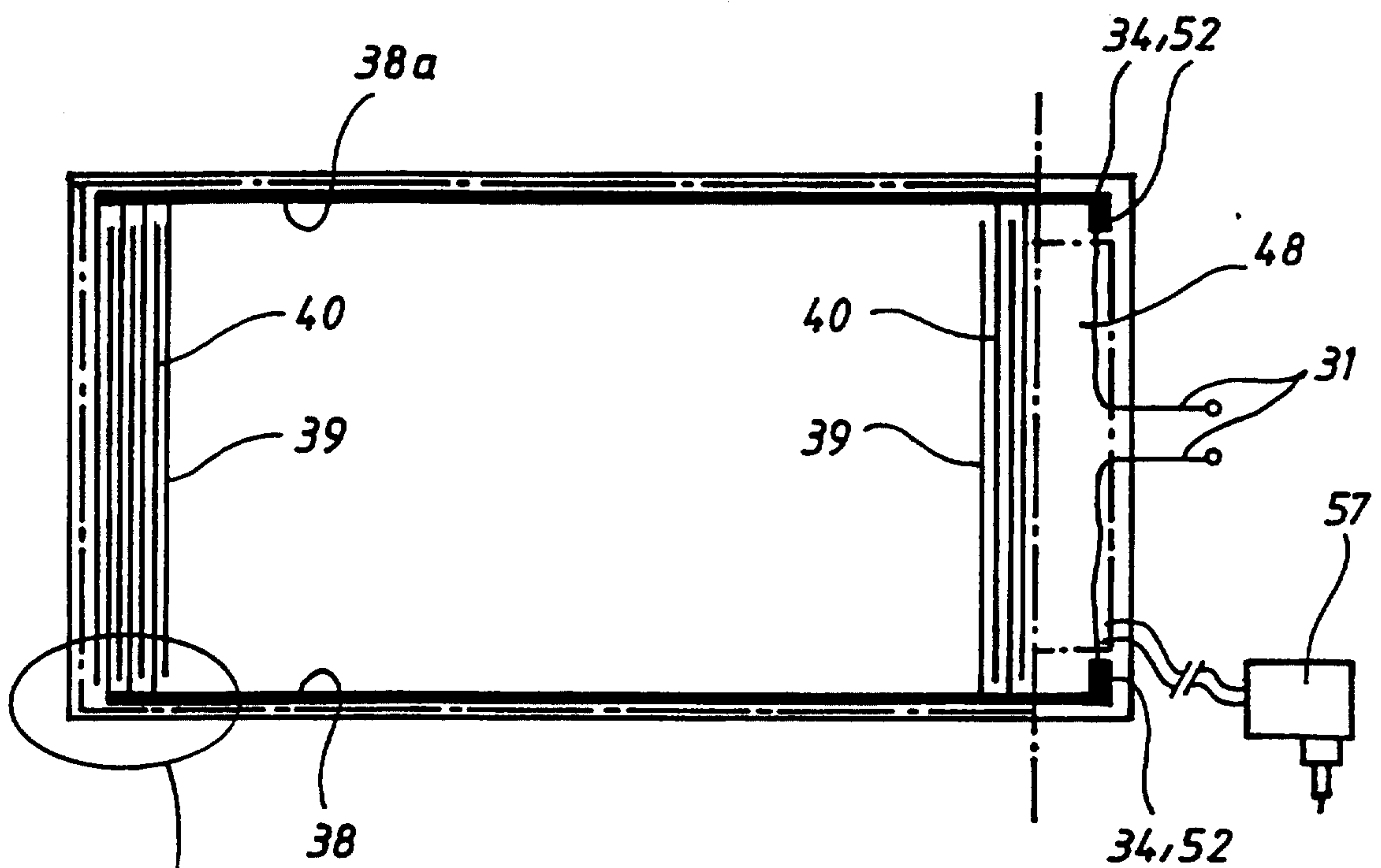


FIG 30

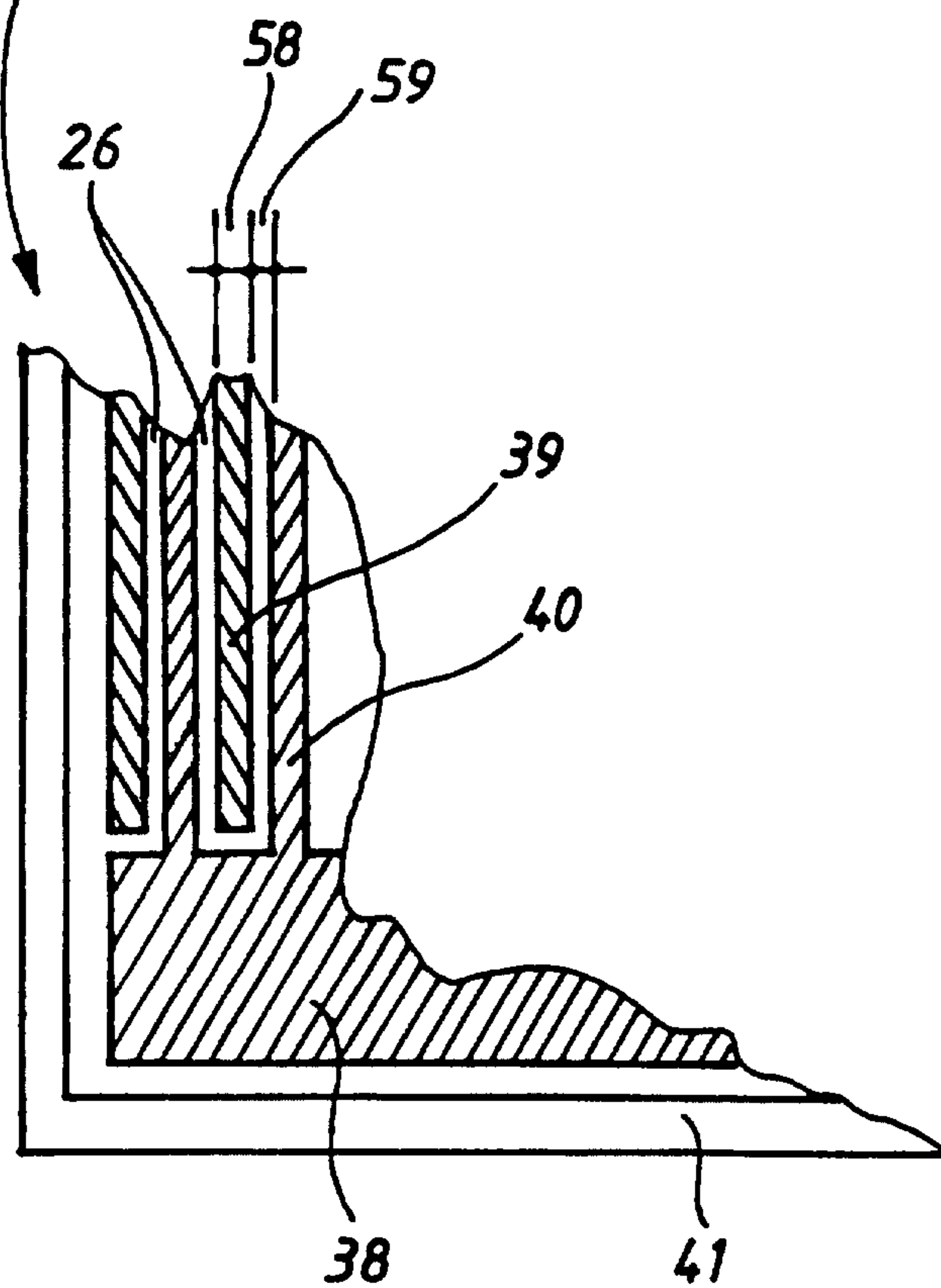


FIG 31