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- (73) Patenthaver: **W. L. Gore & Associates GmbH, Hermann-Oberth-Strasse 22, 85640 Putzbrunn, Tyskland**
- (72) Opfinder: **Peikert, Marc, Bachstrasse 8a, 83646 Bad Toelz, Tyskland**
NABERNIK, Stane, Kurirska pot 23, 4000 Kranj, Slovenien
- (74) Fuldmægtig i Danmark: **RWS Group, Europa House, Chiltern Park, Chiltern Hill, Chalfont St Peter, Bucks SL9
9FG, Storbritannien**
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Description

The invention relates to a composite shoe sole, footwear constructed with it, as well as a method for producing such
5 footwear.

There is no longer a need to decide, as an alternative, either on a waterproof shoe-base structure that blocks sweat moisture or on one that is permeable to sweat moisture but also water-
10 permeable for as long as there have been shoe-base structures that are waterproof in spite of being permeable to water vapour, owing to the use of a perforated outsole or one provided with apertures and a waterproof, water-vapour-permeable functional layer arranged above it, for example in the form of a membrane.
15 Documents EP 0 275 644 A2, EP 0 382 904 A2, EP 1 506 723 A2, EP 0 858 270 B1, DE 100 36 100 C1, EP 959704 B1, WO 2004/028 284 A1, DE 20 2004 08539 U1, and WO 2005/065479 A1 provide examples.

Since the human foot has a strong tendency to sweat, the aim of
20 the present invention is to provide footwear that has a shoe-base structure with particularly high water vapour permeability, without seriously compromising its stability.

In footwear with an outsole with small apertures according to
25 EP 0 382 904 A2, sufficient stability of the sole structure can be achieved with normally stiff outsole material, but only with moderate water vapour permeability of the shoe base.

Sole structures according to EP 959 704 B1, WO 2004/028 284 A1
30 and WO 2005/063069, which have an outsole favouring higher water vapour permeability consisting essentially of only a peripheral frame for incorporation of water-vapour-permeable material in addition to a number of separate outsole cleats, which material is supposed to protect a membrane situated above it from
35 penetration of foreign bodies, such as small stones, but itself is not separately stable, do not provide a degree of stabilization of the sole structure, as is desired for many types of footwear. The outsole in WO 2004/028 284 A1 is formed

from the peripheral frame and a number of outsole cleats, which are distributed over the bottom of the sole within the peripheral frame.

5 The situation is similar in the sole structures according to DE 20 2004 08539 U1 and WO 2005/065479 A1, in which waterproof, water-vapour-permeable inserts are inserted into large-area openings of the outsole, which have a membrane that covers the aperture in a waterproof manner and beneath it a laminated mesh
10 serving as protection of the membrane against penetration of foreign objects. Since both the membrane and the laminated mesh consist of relatively soft material, so that they can scarcely make a contribution to stabilization of the sole structure, the stability of the sole structure is weakened at the sites of the
15 large-area openings.

Better stabilization of the shoe-base structure was achieved in an athletic shoe according to DE 100 36 100 C1, whose outsole is formed from outsole parts with large-area openings, in that
20 the outsole parts are arranged on the bottom of a support layer, consisting of compression-proof plastic, which is provided with mesh-like openings at the sites that lie above the large-area openings of the outsole parts and is therefore water-vapour-permeable, like the outsole parts. A membrane is arranged
25 between the support layer and an insole situated above it, which is provided with holes for water vapour permeability, which is intended not just to achieve waterproofing coupled with water vapour permeability, but is also supposed to prevent small stones that the mesh openings of the support layer cannot keep
30 out from penetrating into the interior of the shoe. The membrane, which is easily damaged by mechanical effects, is therefore supposed to offer protection, which it itself actually requires.

Other solutions, for example according to EP 1 506 723 A2 and
35 EP 0 858 270 B1, propose a protective layer beneath the membrane as protection against the penetration of foreign objects, such as small stones that have entered through a perforated outsole.

In embodiments of EP 1 506 723 A2, the membrane and the protective layer are joined to each other by spot gluing, i.e., by means of a glue pattern applied as a dot matrix. Only the surface part of the membrane not covered by glue is still
5 available for water-vapour transport. The membrane and the protective layer then form a glue composite that either forms a composite sole with an outsole that is attached as such to the upper base of the footwear or forms a part of the upper base, onto which an outsole still has to be attached.

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In another embodiment of EP 1 506 723 A2, the outsole is divided in two in terms of thickness, both outsole layers are provided with perforations of relatively small diameter that are flush with one another, and the protective layer is arranged between
15 the two outsole layers. The membrane in the finished footwear is situated on the top of this outsole. Since only the perforated area part of this outsole is available for water-vapour passage, only a correspondingly smaller part of the membrane surface can have an effect on water-vapour passage. It has also turned out
20 that standing air volumes inhibit water-vapour transport. Such standing air volumes are formed in the perforations of this outsole, and their elimination by air circulation through the outsole is adversely affected by the protective layer. Added to the effect that the surface parts of the membrane that lie
25 outside the perforations of the outsole and make up a significant percentage of the total membrane surface cannot have an effect on water-vapour transport is the fact that the surface parts of the membrane opposite the perforations also have only a restricted effect on water-vapour transport.

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WO 2006/010578 A1 discloses a waterproof and breathable sole for shoes and has a structure having a lower layer having at least one large passage opening. Above the lower layer is disposed a mesh arranged essentially such that it overlaps the at least one
35 large passage opening. A membrane made of a material impermeable to water and permeable to water vapour is associated with the mesh in an upper region, at least in the case of the large opening. The membrane is hermetically bonded to at least one

component of the sole at least at the circumference, in such a way that the ascent of liquid through the circumference of the large opening is prevented. A perforated upper layer is disposed above the membrane. The lower layer is shaped over the mesh and
5 partly encloses it.

It is now a common division of labour in the production of footwear that one manufacturer produces the shoe upper and another manufacturer is responsible for producing the
10 corresponding shoe sole or the corresponding composite shoe sole or moulding it onto the shoe upper. Since the manufacturers of shoe soles are ordinarily less equipped and experienced in handling waterproof, water-vapour-permeable membranes, a desirable aim is shoe-base concepts in which the composite shoe
15 sole, as such, has no membrane and the membrane forms part of the upper base on which the composite shoe sole is disposed.

It is therefore an object of the present invention to provide footwear that has a shoe-base structure with permanent
20 waterproofness and with particularly high water-vapour permeability, preferably achieving the highest possible stability of the shoe-base structure, a composite shoe sole suitable for this, as well as a method for producing footwear.

25 The invention achieves this object by providing a water-vapour-permeable composite shoe sole according to Claim 1 and footwear according to Claim 8. Modifications of these objects are mentioned in the corresponding dependent claims.

30 A first aspect of the invention provides a water-vapour-permeable composite shoe sole with a top side that has at least one aperture extending through the thickness of the composite shoe sole. A barrier unit is provided with a top side at least partially forming the top side of the composite shoe sole, and
35 with a water-vapour-permeable barrier material formed as a barrier against the penetration of foreign objects, by means of which the at least one aperture is closed in a water-vapour-permeable manner. A stabilization device is assigned to the

barrier material for mechanical stabilization of the composite shoe sole, which is constructed with at least one stabilization bar which is arranged on at least one surface of the barrier material and at least partially bridges the at least one
5 aperture.

At least one outsole part is arranged beneath the barrier unit. "Beneath the barrier unit" means that the at least one outsole part is arranged on the surface of the barrier unit facing the
10 floor or ground. A situation is therefore achieved in which only the at least one outsole part assumes the function of walking or standing of the composite sole. The at least one outsole part is arranged on the barrier unit, so that no outsole parts are found in the at least one aperture. Since the barrier unit does
15 not represent or does not significantly represent the layer in the composite shoe sole that touches the ground, it is possible to optimize it with respect to its stabilizing properties, such as stiffness and torsion stiffness. In comparison with this, the outsole can be optimized with respect to its outsole function,
20 for example, a material with limited wear and high adhesion can be chosen.

In one embodiment of the invention, the barrier material is a fibre composite with at least two fibre components that differ
25 with respect to melting point. At least one part of a first fibre component then has a first melting point and a first softening temperature range lying beneath it and at least one part of a second fibre component has a second melting point and a second softening temperature range lying beneath it. The first
30 melting point and the first softening temperature range are higher than the second melting point and the second softening temperature range. The fibre composite is thermally bonded, while maintaining water-vapour permeability in the thermally bonded area, as a result of thermal activation of the second
35 fibre component with an adhesive softening temperature lying in the second softening temperature range.

"Melting point" is understood to mean, in the field of polymer

or fibre structures, a narrow temperature range in which the crystalline areas of the polymer or fibre structure melt and the polymer converts to a liquid state. It lies above the softening temperature range and is a significant characteristic for partially crystalline polymers. "Softening temperature range" is understood to mean, in the field of synthetic fibres, a temperature range of different width occurring before the melting point is reached, in which softening, but no melting occurs.

This property is exploited in the barrier material to the extent that for both fibre components of the fibre composite, a material choice is made, so that the conditions according to the invention with respect to melting points and softening temperature ranges are satisfied for both fibre components, and a temperature is chosen for the thermal bonding that represents an adhesive softening temperature for the second fibre component, at which softening of the second fibre component occurs, in which case, its material exerts a gluing effect, so that at least part of the fibres of the second fibre component are thermally bonded to each other by gluing, so that bonding stabilization of the fibre composite occurs that is above the bonding obtained in a fibre composite with the same materials for the two fibre components by purely mechanical bonding, for example, by needle attachment of the fibre composite. The adhesive softening temperature can also be chosen in such a way that softening of the fibres of the second fibre component occurs to an extent that not only are the fibres of the second fibre component glued to each other, but additionally partial or complete enclosure of individual sites of the fibres of the first fibre composite with softened material of fibres of the second fibre composite occurs, i.e., partial or full embedding of such sites of fibres of the first fibre composite in the material of fibres of the second fibre component, so that a correspondingly increased stabilization bonding of the fibre composite occurs.

In one embodiment of the composite shoe sole according to the invention, the barrier material has a fibre composite with a

first fibre component and a second fibre component with two fibre parts, wherein the first fibre component has a first melting point and a first softening temperature range lying beneath it, and a second fibre part of the second fibre component has a second melting point and a second softening temperature range lying beneath it; the first melting point and the first softening temperature range are higher than the second melting point and the second softening temperature range, the first fibre part of the second fibre component has a higher melting point and a higher softening temperature lying beneath it than the second fibre part, and the fibre composite, as a result of thermal activation of the second fibre part of the second fibre component, is thermally bonded, while retaining water vapour permeability in the thermally bonded area, with an adhesive softening temperature lying in the second softening temperature range. A material choice is then made so that the conditions according to the invention with respect to melting points and softening temperature ranges for the two fibre components and fibre parts are satisfied and a temperature is chosen for thermal bonding that represents an adhesive softening temperature for the second fibre part of the second fibre component at which softening of this fibre part of the second fibre component occurs, in which case its material exerts an adhesive effect, so that at least part of the fibres of the second fibre component are thermally bonded to each other by gluing, so that bonding stabilization of the fibre composite occurs that is above, the bonding obtained in a fibre composite with the same materials for both fibre components by purely mechanical bonding, for example, by needle attachment of the fibre composite.

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An embodiment for the second fibre component with two fibre parts of different melting points and different softening temperature ranges has fibres with a core-shell structure in which the core has a higher melting point and a higher softening temperature range than the shell and thermal bonding of the fibre composite occurs by appropriate softening of the shell.

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Another embodiment for the second fibre component with two fibre

parts of different melting point and different softening temperature ranges has fibres with a side-to-side structure, in which the second fibre component has two fibre parts running parallel to each other in the longitudinal direction of the fibres, a first one of which has a higher melting point and a higher softening temperature range than the second fibre part, and thermal bonding of the fibre composite occurs by appropriate softening of the second fibre part.

10 In this embodiment, the adhesive softening temperature can also be chosen in such a way that softening of the second fibre part of the second fibre component occurs to such an extent that not only are the second fibre parts of the second fibre component bonded to each other, but additionally partial or full enclosure
15 of individual sites of the fibres of the first fibre component with softened material of the second fibre part of the second fibre component, i.e., partial or full embedding of those sites of fibres of the first fibre component in material of the second fibre part of the second fibre component, occurs, so that a
20 correspondingly increased stabilization bonding of the fibre composite develops. This is especially true for the case in which the second fibre component has the already mentioned side-to-side fibre structure. During adhesive softening of the second fibre part of the second fibre component to the mentioned extent,
25 partial or full enclosure, not only of individual sites of the fibres of the first fibre component, but also of the first fibre part of the second fibre component, can then occur.

By additional compression of the fibre composite during or after
30 adhesive softening of the second fibre component, an additional increase in stabilization can be achieved, in which partial or full embedding of fibre sites in softened material of fibres of the second fibre component is further intensified. The thermal bonding of the fibre composite, achieved by using the adhesive
35 softening temperature, is to be chosen, on the other hand, in such a way that sufficient water-vapour permeability of the fibre composite is produced, i.e., fibre bonding is always restricted to the individual bonding sites, so that sufficient

unbonded sites for water-vapour transport remain. The choice of adhesive softening temperature can be made according to the desired requirements of the practical embodiment, especially with respect to stability properties and water-vapour permeability.

By selecting specific materials for the two fibre components and by selecting the degree of thermal bonding of the fibre composite, a desired stabilization of the fibre composite with respect to its state before thermal bonding can be achieved while maintaining water-vapour permeability. Because of this thermal bonding, the fibre composite reaches a strength on account of which it is particularly suitable as a water-vapour-permeable barrier material that stabilizes a composite shoe sole and is therefore suitable for footwear whose shoe base is supposed to have good water vapour permeability on the one hand, and good stability on the other.

Because of its thermal bonding and the stability achieved thereby, such a barrier material is particularly suitable for a composite shoe sole that is designed to obtain high water-vapour permeability with large-area apertures, so that it requires, on the one hand, a barrier material for protection of a membrane situated above it from penetration of foreign objects, such as small stones, through such an aperture to the membrane and, on the other hand, additional stabilization, because of the large-area apertures.

Unlike a non-woven fibre composite traditionally used in the shoe-base area, which is constructed with a single fibre component that is completely melted and thermally compressed in the attempt at thermal bonding, it is possible in such a barrier material, by selecting the materials for the at least two fibre components and by the parameters chosen for thermal bonding, to utilize degrees of freedom by means of which the degree of the desired stability, as well as the degree of water-vapour permeability, can be established. By softening the fibre component with the lower melting point, not only are the fibres

of this fibre component fixed with respect to each other, but during the thermal bonding process, fixation of the fibres of the other fibre component with the higher melting point also occurs, which leads to particularly good mechanical bonding and stability of the fibre composite. By choosing the ratio between the fibres of the fibre component with higher melting point and the fibres of the fibre component with the lower melting point, as well as by choosing the adhesive softening temperature and therefore the degree of softening, properties of the barrier material, such as air permeability, water-vapour permeability, and mechanical stability of the barrier material, can be adjusted.

In one embodiment of the barrier material, its fibre composite is a textile fabric, which can be a weave, loop-formed knit, loop-drawn knit, non-woven fabric, felt, mesh, or laid scrim. In one practical embodiment, the fibre composite is a mechanically strengthened non-woven fabric, wherein mechanical bonding can be achieved by needling the fibre composite. Water-jet bonding can also be used for mechanical bonding of the fibre composite, in which, instead of true needles, water jets are used for mechanically bonding entanglement of the fibres of the fibre composite.

In one embodiment of the invention, the first fibre component is a support component and the second fibre component is a bonding component of the barrier material.

In one embodiment of the invention, in which the second fibre component has a first fibre part having a higher melting point and a second fibre part having a lower melting point, the first fibre part of the second fibre component forms an additional support component in addition to the first fibre component, the second fibre part of the second fibre component forming the bonding component of the barrier material.

The choice of materials for the fibre components is made in one embodiment in such a way that at least part of the second fibre

component and then, if the second fibre component includes at least a first fibre part and a second fibre part, at least part of the second fibre part of the second fibre component can be activated at a temperature in the range between 80°C and 230°C
5 for adhesive softening.

In one embodiment, the second softening temperature range lies between 60°C and 220°C.

10 Especially in view of the fact that footwear and especially its sole structure are often exposed to relatively high temperatures during production, for example, when an outsole is moulded on, in one embodiment of the invention, the first fibre component, and optionally the first fibre part of the second fibre
15 component, are melt-resistant at a temperature of at least 130°C, wherein, in practical embodiments, melt resistance at a temperature of at least 170°C or even at least 250°C is chosen by corresponding selection of the material for the first fibre component, and optionally for the first fibre part of the second
20 fibre component.

For the first fibre component, and optionally the first fibre part of the second fibre component, materials such as natural fibres, plastic fibres, metal fibres, glass fibres, carbon
25 fibres, and blends thereof, are appropriate. Leather fibres represent an appropriate material in the context of natural fibres.

In one embodiment of the invention, the second fibre component, and optionally the second fibre part of the second fibre
30 component, are constructed with at least one plastic fibre suitable for thermal bonding at an appropriate temperature.

In one embodiment of the invention, at least one of the two
35 fibre components, and optionally at least one of the two fibre parts of the second fibre component, are chosen from the material group including polyolefins, polyamide, copolyamide, viscose, polyurethane, polyacrylic, polybutylene terephthalate, and

blends thereof. The polyolefin here may be chosen from polyethylene and polypropylene.

5 In one embodiment of the invention, the first fibre component, and optionally the first fibre part of the second fibre component, is chosen from the material group polyesters and copolyesters.

10 In one embodiment of the invention, at least the second fibre component, and optionally at least the second fibre part of the second fibre component, are constructed with at least one thermoplastic material. The second fibre component, and optionally the second fibre part of the second fibre component, can be chosen from the material group polyamide, copolyamide, 15 polybutylene terephthalate and polyolefins, or also from the material group polyester and copolyester.

Examples of appropriate thermoplastic materials are polyethylene, polyamide (PA), polyester (PET), polyethylene 20 (PE), polypropylene (PP), and polyvinylchloride (PVC). Additional appropriate materials are rubber, thermoplastic rubber (TR), and polyurethane (PU). Thermoplastic polyurethane (TPU), whose parameters (hardness, colour, elasticity, etc.) can be adjusted very variably, is also suitable.

25 In one embodiment of the invention, both fibre parts of the second fibre component consist of polyester, the polyester of the second fibre part having a lower melting point than the polyester of the first fibre part.

30 In one embodiment of the invention, at least the second fibre component has a core-shell structure, i.e., a structure, in which a core material of the fibre component is coaxially surrounded by a shell layer. The first fibre part, having a 35 higher melting point, forms the core, and the second fibre part, having a lower melting point, forms the shell.

In another embodiment of the invention, at least the second

fibre component has a side-to-side structure, i.e., two fibre parts of different material running next to each other in the longitudinal direction of the fibre, each of which have a semicircular cross section, for example, are placed against each other, so that the two fibre components are joined to each other side by side. One side then forms the first fibre part of the barrier material, having a higher melting point, and the second side forms the second fibre part of the second fibre component of the barrier material, having a lower melting point.

In one embodiment of the invention, the second fibre component has a weight percentage, referred to the basis weight of the fibre composite in the range from 10% to 90%. In one embodiment, the weight percentage of the second fibre component lies in the range from 10% to 60%. In practical embodiments, the weight percentage of the second fibre component is 50% or 20%.

In one embodiment of the invention, the materials for the two fibre components, and optionally for the two fibre parts of the second fibre component, are chosen in such a way that their melting points differ by at least 20°C.

The barrier material can be thermally bonded over its entire thickness. Depending on the requirements to be achieved, especially with respect to air permeability, water-vapour permeability, and stability, an embodiment can be chosen in which only part of the thickness of the barrier material is thermally bonded. In one embodiment of the invention, the barrier material thermally bonded over at least part of its thickness is additionally compressed on at least one surface by means of pressure and temperature. It can be advantageous to smooth the bottom of the barrier material facing the tread of the composite shoe sole by surface compression, because dirt that reaches the bottom of the barrier material through apertures of the composite shoe sole then adheres less readily to it. At the same time, the abrasion resistance of the barrier material is increased.

In one embodiment of the invention, the barrier material is finished or treated with one or more agents from the material group water repellents, dirt repellents, oil repellents, antibacterial agents, deodorants, and/or a combination thereof.

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In another embodiment, the barrier material is treated so as to be water-repellent, dirt-repellent, oil-repellent, antibacterial and/or treated against odour.

10 In one embodiment of the invention, the barrier material has a water-vapour permeability of at least $4000 \text{ g/m}^2 \cdot 24 \text{ h}$. In practical embodiments, a water-vapour permeability of at least $7000 \text{ g/m}^2 \cdot 24 \text{ h}$ or even $10\,000 \text{ g/m}^2 \cdot 24 \text{ h}$ is chosen.

15 In one embodiment of the invention, the barrier material is designed to be water-permeable.

In embodiments of the invention, the barrier material has a thickness in the range from at least 1 mm to 5 mm, wherein
20 practical embodiments, especially in the range from 1 mm to 2.5 mm, or even in the range from 1 mm to 1.5 mm, are chosen, the specially selected thickness depending on the special application of the barrier material, and also on which surface smoothness, air permeability, water-vapour permeability, and
25 mechanical strength are to be provided.

In a practical embodiment of the invention, the barrier material has a fibre composite with at least two fibre components that differ with respect to melting point and softening temperature
30 range, a first fibre component consisting of polyester and having a first melting point and a first softening temperature range lying beneath it, and at least part of a second fibre component having a second melting point and a second softening temperature range lying beneath it, wherein the first melting
35 point and the first softening temperature range are higher than the second melting point and the second softening temperature range. The second fibre component has a core-shell structure and a first fibre part of polyester that forms the core and a second

fibre part of polyester that forms the shell, the first fibre part having a higher melting point and a higher softening temperature range than the second fibre part. The fibre composite, as a result of thermal activation of the second fibre component, is thermally bonded, while maintaining water-vapour permeability in the thermally bonded area, with an adhesive softening temperature lying in the second softening temperature range, and the fibre composite is a needled non-woven fabric that is compressed on at least one of its surfaces by means of pressure and temperature.

In one embodiment of the invention, the barrier material is obtained by surface compression of a surface of the fibre composite with a surface pressure in the range from 11.5 N/cm² to 4 N/cm² at a heating-plate temperature of 230°C for 10 s. In a practical embodiment, the surface compression of a surface of the fibre composite occurs with a surface pressure of 3.3 N/cm² at a heating-plate temperature of 230°C for 10 s.

In one embodiment of the invention, the barrier material is produced with a puncture strength in the range from 290 N to 320 N, so that it forms a good protection for a waterproof, water-vapour-permeable membrane situated above it against penetration of foreign objects, such as small stones.

Such a barrier material is therefore particularly suited in a water-vapour-permeable composite shoe sole as a water-vapour-permeable barrier layer that stabilizes the composite shoe sole and protects a membrane situated above it.

A barrier unit constructed with such a barrier material is therefore particularly suited for a composite shoe sole according to the invention.

According to the invention, at least one stabilization device for stabilizing the barrier material and therefore the composite shoe sole is assigned to the barrier material. This is advantageous especially when the barrier material itself is not

designed or not adequately designed as a stabilization material, so that the barrier material acquires stabilization or stabilization support from the stabilization device. In this case, a situation is achieved in which additional stabilization is added to the intrinsic stability that the barrier material has, because of its thermal bonding, and optionally surface compression, for example, which can be produced deliberately at certain sites of the barrier unit, especially in the area of apertures of the composite shoe sole, which are made with a large surface, in order to provide high water vapour permeability of the composite shoe sole.

The forefoot area and midfoot area of the composite shoe sole will be discussed hereinafter. In the human foot, the forefoot is the longitudinal foot area extending over the toes and ball of the foot to the beginning of the instep, and the midfoot is the longitudinal foot area between the ball of the foot and the heel. In connection with the composite shoe sole according to the invention, forefoot area and midfoot area mean the longitudinal areas of the composite shoe sole over which the forefoot or the midfoot of the wearer of the footwear extends when wearing footwear provided with such a composite shoe sole.

In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 15% of the surface of the forefoot area of the composite shoe sole is water-vapour-permeable.

In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 25% of the surface of the forefoot area of the composite shoe sole is water-vapour-permeable.

In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 40% of the surface of the forefoot area of the composite shoe sole is water-vapour-permeable.

In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 50% of the surface of the forefoot area of the composite shoe sole is water-vapour-permeable.

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In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 60% of the surface of the forefoot area of the composite shoe sole is water-vapour-permeable.

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In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 75% of the surface of the forefoot area of the composite shoe sole is water-vapour-permeable.

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In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 15% of the surface of the midfoot area of the composite shoe sole is water-vapour-permeable.

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In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 25% of the surface of the midfoot area of the composite shoe sole is water-vapour-permeable.

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In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 40% of the surface of the midfoot area of the composite shoe sole is water-vapour-permeable.

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In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 50% of the surface of the midfoot area of the composite shoe sole is water-vapour-permeable.

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In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 60% of the surface of the midfoot area of the composite shoe sole

is water-vapour-permeable.

In one embodiment of the invention, the at least one
stabilization device is designed in such a way that at least 75%
5 of the surface of the midfoot area of the composite shoe sole
is water-vapour-permeable.

The stabilization devices of the midfoot area leading to the
different percentages mentioned above can be combined with
10 individual stabilization units of the forefoot area leading to
the different percentages stated above.

In one embodiment of the invention, the at least one
stabilization device is designed in such a way that at least 15%
15 of the front-half of the longitudinal extent of the composite
shoe sole is water-vapour-permeable.

In one embodiment of the invention, the at least one
stabilization device is designed in such a way that at least 25%
20 of the front-half of the longitudinal extent of the composite
shoe sole is water-vapour-permeable.

In one embodiment of the invention, the at least one
stabilization device is designed in such a way that at least 40%
25 of the front-half of the longitudinal extent of the composite
shoe sole is water-vapour-permeable.

In one embodiment of the invention, the at least one
stabilization device is designed in such a way that at least 50%
30 of the front-half of the longitudinal extent of the composite
shoe sole is water-vapour-permeable.

In one embodiment of the invention, the at least one
stabilization device is designed in such a way that at least 60%
35 of the front-half of the longitudinal extent of the composite
shoe sole is water-vapour-permeable.

In one embodiment of the invention, the at least one

stabilization device is designed in such a way that at least 75% of the front-half of the longitudinal extent of the composite shoe sole is water-vapour-permeable.

- 5 In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 15% of the longitudinal extent of the composite shoe sole minus the heel area is water-vapour-permeable.
- 10 In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 25% of the longitudinal extent of the composite shoe sole minus the heel area is water-vapour-permeable.
- 15 In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 40% of the longitudinal extent of the composite shoe sole minus the heel area is water-vapour-permeable.
- 20 In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 50% of the longitudinal extent of the composite shoe sole minus the heel area is water-vapour-permeable.
- 25 In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 60% of the longitudinal extent of the composite shoe sole minus the heel area is water-vapour-permeable.
- 30 In one embodiment of the invention, the at least one stabilization device is designed in such a way that at least 75% of the longitudinal extent of the composite shoe sole minus the heel area is water-vapour-permeable.
- 35 The percentages just stated in conjunction with water vapour permeability refer to that part of the entire composite shoe sole that corresponds to the surface within the outside contour of the foot sole of the wearer of the footwear, i.e., essentially

the surface part of the composite shoe sole that is enclosed in the finished footwear by the inner periphery of the lower upper end on the sole side (upper contour on the sole side). A shoe sole edge that protrudes radially outward above the upper
5 contour on the sole side, i.e., protrudes above the foot sole of the wearer of the footwear, need not have water-vapour permeability, because no sweat-releasing foot area is situated there. The percentages mentioned therefore refer, with respect to the forefoot area, to the part of the surface included by the
10 upper contour on the sole side bounded on the forefoot length and, with respect to the midfoot area, to the part of the surface enclosed by the upper contour on the sole side bounded on the midfoot length.

15 If the footwear in question is a business shoe whose outsole has an outsole peripheral edge protruding relatively widely above the outside of the upper contour on the sole side, which, for example, is firmly stitched on a mounting frame that also runs around the outside of the upper contour on the sole side, water-
20 vapour permeability need not exist in the area of this outsole peripheral edge, since this area is situated outside the part of the composite shoe sole contacted by the foot, and therefore no sweat release occurs in this area. The percentages mentioned in the preceding paragraphs refer to footwear that does not have
25 the above-mentioned protruding outsole edge typical of business shoes. Since this outsole area of the business shoe can account for about 20% of the total outsole surface, about 20% can be subtracted in business shoes from the total outsole surface, and the above-mentioned percentages for water-vapour permeability
30 of the composite shoe sole pertain to the remaining approximately 80% of the total outsole surface.

The stabilization device can consist of one or more stabilization bars, which are arranged, for example, on the
35 bottom of the barrier material on the outsole side. In one embodiment, the stabilization device is provided with at least one opening, which forms at least one part of the aperture after production of the composite shoe sole and is closed with barrier

material.

In one embodiment of the invention, the above-mentioned percentage water-vapour permeabilities in the forefoot area and/or midfoot area are provided mostly or even exclusively in the area of the at least one opening of the stabilization device.

In one embodiment of the invention, at least one support element is assigned to the barrier material in the aperture or at least one of the apertures, which extends from the side of the barrier material facing the tread to the level of the tread, so that the barrier material, during walking, is supported on the floor by the support element. In this case, at least one of the stabilization bars can simultaneously be designed as a support element.

In the composite shoe sole, which, according to the invention, has the barrier unit and a one-part or multipart outsole arranged beneath it, each of which has passage openings for water-vapour permeability, the passage openings of the outsole or outsole parts and the barrier unit can have the same or different surface areas. It is important that these passage openings overlap at least partially, wherein an interface of the corresponding passage opening of the barrier unit and the corresponding passage opening of the outsole or the outsole part forms an opening through the entire composite shoe sole. When a specific dimension of the corresponding passage opening of the outsole or outsole part is stipulated, the extent of the opening is greatest when the corresponding passage opening of the barrier unit is at least equally large and extends over the entire area of the corresponding passage opening of the outsole or outsole part, or vice versa.

It is envisaged that the stabilization device, with the at least one stabilization bar, shall not be a component of the at least one outsole part. This means that the stabilization device, and especially the at least one stabilization bar, does not assume an outsole function. In particular, the stabilization device

with the at least one stabilization bar has a spacing from the floor or the ground. The composite shoe sole with outsole is provided for walking and standing on a floor or on the ground. In this case, the at least one stabilization bar in the composite shoe sole is situated above the floor or ground and a certain distance is provided between the stabilization bar and the floor. In one embodiment, the distance corresponds to the thickness of the at least one outsole part, which is arranged beneath the barrier unit.

An exception from the stipulation that the at least one stabilization bar has a spacing from the floor or the ground applies when a stabilization bar is simultaneously formed as a support element that extends to the floor or ground.

In another embodiment, the outsole part has a first material and the stabilization device has a second material that is different from the first material, the second material being harder (according to Shore) than the first material. "Hardness" is understood to mean the mechanical resistance that a substance has in order to withstand the penetration of another, harder substance.

Due to the fact that the corresponding aperture of the composite shoe sole is closed with a water-vapour-permeable barrier material, water-vapour permeability in the at least one aperture of the composite shoe sole is achieved with simultaneous protection of a membrane situated above it against the penetration of foreign objects, such as small stones. If a barrier material is used for the barrier unit that can be equipped with a much higher intrinsic stability, as a result of thermal bonding and optionally additional surface compression, than the material can offer without thermal bonding and surface bonding, such a barrier material for the barrier unit can offer additional stabilization to the composite shoe sole provided with apertures, even if the one or more apertures of the composite shoe sole are designed with a very large area in the interest of high water vapour permeability. This intrinsic

stability is further increased by the use of the already mentioned additional stabilization device and selectively in areas of the composite shoe sole that require particular stabilization.

5

If the stabilization device is provided with several openings, these can either be closed overall with a piece of the barrier material or each with a piece of barrier material.

10 The stabilization device can be designed to be sole-shaped, if it is to extend over the entire area of the composite shoe sole, or partially sole-shaped, if it is to be provided only in part of the surface of the composite shoe sole.

15 In one embodiment of the invention, the stabilization device of the barrier unit has at least one stabilization frame that stabilizes at least the composite shoe sole, so that the composite shoe sole experiences an additional stabilization apart from the stabilizing effect through the barrier material.

20 A particularly good stabilization effect is achieved if the stabilization frame is fit into the at least one aperture, or at least one of the apertures of the composite shoe sole, so that where the composite shoe sole is initially weakened in its stability by the apertures with the largest possible area, good
25 stabilization of the composite shoe sole is nevertheless ensured by means of the stabilization frame.

In one embodiment of the barrier unit according to the invention, the at least one opening of the stabilization device has an area
30 of at least 1 cm². In practical embodiments, an opening surface of the at least one opening of at least 5 cm², for example, in the range from 8 to 15 cm², or even at least 10 cm², or even at least 20 cm², or even at least 40 cm², is chosen.

35 In the barrier unit according to the invention, the stabilization device has at least one stabilization bar that is arranged on at least one surface of the barrier material and at least partially bridges the surface of the at least one opening.

If the stabilization device is provided with a stabilization frame, a stabilization bar can be arranged on the stabilization frame. Several stabilization bars can be provided that form a mesh-like structure on at least one surface of the barrier material. Such a mesh structure leads to particularly good stabilization of the composite shoe sole, on the one hand, and also prevents larger foreign objects, such as larger stones or ground elevations, from penetrating up to the barrier material and being felt by the user of the footwear equipped with such a barrier unit when stepped on.

In one embodiment, the stabilization device of the barrier unit of the composite shoe sole according to the invention is constructed with at least one thermoplastic material. Thermoplastic materials of the above-mentioned type can be used for this.

In one embodiment of the invention, the stabilization device and the barrier material are at least partially connected to each other, for example, by gluing, welding, moulding-on, insert moulding, vulcanizing-on or insert vulcanization. During moulding-on or vulcanizing-on, it is predominantly attachment between the stabilization device and the barrier material that occurs on opposite surface areas. During insert moulding and insert vulcanization, it is predominantly peripheral encasing of the barrier material with the stabilization device that occurs.

In one embodiment, the composite shoe sole is water-permeable.

According to a second aspect, the invention provides footwear with a composite shoe sole according to the invention that can be constructed, for example, according to one or more of the embodiments mentioned above in conjunction with the composite shoe sole. The footwear has an upper provided with a waterproof and water-vapour-permeable upper-base functional layer in an upper end region on the sole side, wherein the composite shoe sole is connected to the upper end region provided with the

upper-base functional layer, so that the upper-base functional layer, at least in the area of the at least one aperture of the composite shoe sole, is not joined to the barrier material.

5 The upper-base functional layer in this footwear according to the invention, in the upper end region on the sole side and the barrier material in the composite shoe sole according to the invention, leads to several advantages. On the one hand, handling of the upper-base functional layer is brought into the
10 area of upper production and kept out of the area of production of the composite shoe sole. This takes into account the practice that upper manufacturers and composite-sole manufactures are often different manufacturers or at least different manufacturing areas, and the upper manufacturer is usually
15 better set up to handle the functional layer material and its intrinsic problems than shoe-sole manufacturers or composite-shoe-sole manufacturers. On the other hand, the upper-base functional layer and the barrier material, if they are not accommodated in the composite itself, but are divided to the
20 upper-base composite and the shoe-sole composite, after attachment of the composite shoe sole to the lower upper end region, can be kept essentially unconnected to each other, since their positioning with respect to each other in the finished footwear is brought about by attachment (by gluing on or moulding
25 on) of the composite shoe sole onto the lower upper end. Keeping the upper-base functional layer and the barrier material fully or largely unbonded to each other means that there need be no gluing between them, which would lead to blocking of part of the active area of the functional layer with water-vapour
30 permeability, even during gluing with a spot-like glue.

In one embodiment of the footwear according to the invention, the upper is constructed with at least one upper material that has a waterproof upper functional layer, at least in the area
35 of the upper end region on the sole side, wherein, between the upper functional layer and the upper-base functional layer, a waterproof seal exists. Footwear is then achieved in which the foot is waterproof, both in the upper area and in the upper base

region, and at the transition sites between the two, while maintaining water-vapour permeability both in the upper region and upper base region.

5 In one embodiment of the footwear according to the invention, the upper-base functional layer is assigned to a water-vapour-permeable upper-mounting sole, wherein the upper-base functional layer can be part of a multilayer laminate. The upper-mounting sole can itself also be formed by the upper-base functional
10 layer constructed with the laminate. The upper-base functional layer, and optionally the upper functional layer, can be formed by a waterproof, water-vapour-permeable coating or by a waterproof, water-vapour-permeable membrane, wherein either a microporous membrane or a membrane having no pores can be
15 involved. In one embodiment of the invention, the membrane has expanded polytetrafluoroethylene (ePTFE).

Appropriate materials for the waterproof, water-vapour-permeable functional layer are in particular polyurethane,
20 polypropylene, and polyester, including polyether esters and laminates thereof, as described in documents US-A-4,725,418 and US-A-4,493,870. However, expanded microporous polytetrafluoroethylene (ePTFE) is particularly preferred, as described, for example, in documents US-A-3,953,566 and US-A-
25 4,187,390, and expanded polytetrafluoroethylene provided with hydrophilic impregnation agents and/or hydrophilic layers; see, for example, document US-A-4,194,041. "Microporous functional layer" is understood to mean a functional layer whose average pore size is between about 0.2 μm and about 0.3 μm . The pore
30 size can be measured with the Coulter Porometer (trade name), which is produced by Coulter Electronics Inc., Hialeah, Fla., USA.

According to a third aspect, the invention provides a method for
35 producing footwear, which, in addition to a water-vapour-permeable composite shoe sole according to the invention, for example, according to one or more of the embodiments mentioned above for the composite shoe sole, has an upper provided in an

upper end region on the sole side with a waterproof and water-vapour-permeable upper-base functional layer. In this method, the composite shoe sole and the upper are prepared first. The upper is provided in the upper end region on the sole side with
5 a waterproof and water-vapour-permeable upper-base functional layer. The composite shoe sole and the upper end region provided on the sole side with the upper-base functional layer are joined to each other, so that the upper-base functional layer remains unconnected to the barrier material, at least in the area of the
10 at least one aperture. This leads to the advantages already explained above.

In one embodiment of this method, the upper end region on the sole side is closed with the upper-base functional layer. If the
15 upper is provided with an upper functional layer, a waterproof connection is produced between the upper functional layer and the upper-base functional layer. This leads to footwear that is waterproof and water-vapour-permeable footwear overall.

20 The invention, aspects of the object of the invention, and advantages of the invention will now be further explained with reference to embodiments. Shown in the corresponding drawings is:

25 Figure 1:

a sketch of a non-woven material, mechanically bonded by needling;

30 Figure 2:

likewise a sketch of the non-woven material according to figure 1, after thermal bonding;

35 Figure 2a:

a detail, also as a sketch, at a highly enlarged scale of area IIa of the thermally bonded non-woven material of figure 2;

Figure 2b:

5 a detail, also as a sketch, with an even more enlarged scale of area IIa, shown in figure 2a, of the thermally bonded non-woven material of figure 2;

Figure 3:

10 a sketch of the thermally bonded non-woven material depicted in figure 2 after additional thermal surface compression;

Figure 4:

15 a schematic view of a composite shoe sole, still without barrier material, showing the aperture extending through the thickness of the composite shoe sole;

Figure 5:

20

a schematic view of a first example of a barrier unit with a stabilization device having a bar and a barrier material accommodated therein;

25 Figure 6:

a schematic view of another example of a barrier unit with a stabilization device having a bar and a barrier material;

30 Figure 7:

a schematic view of another example of a barrier unit with a stabilization device in the form of at least one bar;

35 Figure 8:

a schematic view of another example of a barrier unit with a stabilization device having a bar and a barrier material;

Figure 9:

5 a schematic view of the composite shoe sole depicted in Figure 4 with barrier material and a stabilization device, having a bar;

Figure 10:

10 a schematic view of stabilization bars arranged on the bottom of the barrier material;

Figure 11:

15 a schematic view of a stabilization mesh arranged on the bottom of the barrier material;

Figure 12:

20 a perspective oblique view from the bottom of a shoe provided with a composite sole according to the invention;

Figure 13a:

25 the shoe depicted in figure 12, but before a composite shoe sole according to the invention is placed on an upper base of the shoe;

Figure 13b:

30

the shoe depicted in figure 12, which is provided with another example of a composite sole according to the invention;

Figure 14:

35

the composite shoe sole depicted in figure 13a, in a perspective top view;

Figure 15:

the composite shoe sole depicted in figure 14 in an exploded
view of its individual components, in an oblique perspective
5 view from the top;

Figure 16:

the part of the composite shoe sole depicted in figure 15, in a
10 perspective oblique view from the bottom;

Figure 17:

a forefoot area and a midfoot area of the barrier unit depicted
15 in figure 16, in a perspective oblique view from the top, wherein
the stabilization device parts and the barrier material parts
are shown separately from each other;

Figure 18:

20 in a perspective oblique view from the bottom, a modification
of the midfoot area of the barrier unit depicted in figure 17,
wherein only a middle area of this barrier-unit part is occupied
with barrier material and two side parts are formed without
25 passage openings;

Figure 19:

the barrier-unit part depicted in figure 18, in a view in which
30 the corresponding stabilization device part and the
corresponding barrier material part are shown separately from
each other;

Figure 20:

35 a schematic sectional view in the forefoot area through an upper
closed on the upper-base side of a first embodiment, with a
composite shoe sole still not positioned on the upper base;

Figure 21:

5 a schematic view of another example of the barrier unit with a barrier material and a stabilization bar during selected bonding with an upper base situated above it;

Figure 22:

10 a detail view of the shoe structure depicted in figure 20, with a glued-on composite shoe sole;

Figure 23:

15 a detail view of the sole structure depicted in figure 21, with a moulded-on composite shoe sole;

Figure 24:

20 a shoe structure similar to that shown in figure 20, but with a differently constructed upper base, with a composite shoe sole still separated from the upper;

Figure 25:

25 a detail view of the shoe structure depicted in figure 24;

Figure 26:

30 a composite sole in another embodiment;

Figure 27:

a composite shoe sole in another embodiment.

35

An embodiment of a barrier material particularly suited for a composite shoe sole according to the invention will be initially explained with reference to figures 1 to 3. Explanations

concerning embodiments of a barrier unit according to the invention then follow, with reference to figures 4 to 11. Embodiments of the footwear according to the invention and composite shoe soles according to the invention will then be explained by means of figures 12 to 27.

The embodiment of the barrier material depicted in figures 1 to 3 consists of a fibre composite 1 in the form of a thermally bonded and thermally surface-bonded non-woven material. This fibre composite 1 consists of two fibre components 2, 3, which are each constructed with polyester fibres, for example. A first fibre component 2, which serves as support component of the fibre composite 1, then has a higher melting point than that of the second fibre component 3, which serves as bonding component. In order to guarantee temperature stability of the entire fibre composite 1 of at least 180°C, specifically in view of the fact that footwear can be exposed to relatively high temperatures during production, for example, during moulding-on of an outsole, in the embodiment in question, polyester fibres with a melting point above 180°C are used for both fibre components. There are different variations of polyester polymers that have different melting points and softening temperatures correspondingly below them. In the embodiment in question of the barrier material according to the invention, a polyester polymer with a melting point of about 230°C is chosen for the first component, whereas a polyester polymer with a melting point of about 200°C is chosen for at least one fibre part of the second fibre component 3. In one embodiment, in which the second fibre component has two fibre parts in the form of a core-shell fibre structure, the core 4 consists of this fibre component from polyester with a softening temperature of about 230°C and the shell of this fibre component consists of a polyester with an adhesive softening temperature of about 200°C (figure 2b). Such a fibre component with two fibre parts of different melting points is also referred to as "bico" for short. This concise term will be used subsequently.

In the embodiment in question, the fibres of the two fibre

components are both staple fibres with the above-mentioned special properties. With respect to the total basis weight of the fibre composite of about 400 g/m², the weight fraction of the first fibre component is about 50%. The weight fraction of the second fibre component is accordingly about 50% with respect to the basis weight of the fibre composite. The fineness of the first fibre component is 6.7 dtex, whereas the second fibre component, designed as a bico, has a higher fineness of 4.4 dtex.

To produce such barrier materials, the fibre components present as staple fibres are first mixed. Several individual layers of this staple fibre mixture are then placed one on top of the other in the form of several individual non-woven layers, until the basis weight sought for the fibre component is reached, in which case a non-woven package is obtained. This non-woven package has only very slight mechanical stability and must therefore pass through a strengthening process.

Initially, mechanical strengthening of the non-woven package occurs by needling by means of a needle technique in which needle bars arranged in a needle matrix penetrate the non-woven package perpendicular to the plane of extension of the non-woven package. Fibres of the non-woven package are reoriented by this from their original position in the non-woven package, so that balling of the fibres and a more stable mechanical structure of the non-woven package occur. A non-woven material mechanically strengthened by such needling is schematically shown in figure 1.

The thickness of the non-woven package with respect to the initial thickness of the unneedled non-woven package is already reduced by the needling process. However, this structure obtained by needling is still not permanently tenable, since it is a purely mechanical three-dimensional "hooking" of stable fibres, which can be "unhooked" again under stress.

In order to achieve permanent stabilization, namely a

stabilizing property for the use in footwear, the fibre composite according to the invention is further treated. Thermal energy and pressure are then used. In this process, the advantageous composition of the fibre mixture is utilized, in which a temperature is chosen for thermal bonding of the fibre mixture, so that it lies at least in the range of the adhesive softening temperature of the shell of the core-shell bico that melts at a lower melting point, in order to soften it into a viscous state, so that the fibre parts of the first fibre component, which is situated in the vicinity of the softened mass of the shell of the corresponding bico, can be partially incorporated in this viscous mass. Because of this, the two fibre components are permanently bonded to each other without changing the fundamental structure of the non-woven material. The advantageous properties of this non-woven material can also be utilized, especially its good water-vapour permeability combined with a permanent mechanical-stabilization property.

Such a thermally bonded non-woven material is shown schematically in figure 2, in which a detailed view of a detail on a highly enlarged scale is shown in figure 2a, in which the glue-bonding points between individual fibres are shown by flat black spots, and figure 2b shows an area of the detail on an even larger scale.

In addition to thermal bonding of the non-woven material, thermal surface compression can be performed on at least one surface of the non-woven material by exposing the surface of this non-woven material simultaneously to the effect of pressure and temperature, for example, by means of heating compression plates or compression rollers. The result is even stronger bonding than in the remaining volume of the non-woven material and smoothing of the thermally compressed surface.

A non-woven material initially mechanically bonded by needling, then thermally bonded, and finally thermally surface-compressed on one of its surfaces, is shown schematically in figure 3.

In an accompanying comparison table, various materials, including barrier materials according to the invention, are compared with respect to some parameters. Split sole leather, two non-woven materials only needle-bonded, a needle-bonded and thermally bonded non-woven material, and, finally, a needle-bonded, thermally bonded, and thermally surface-compressed non-woven material are then considered, wherein these materials, for simplicity of the subsequent treatment of the comparison table, are assigned the material numbers 1 to 5 in the comparison table.

The longitudinal elongation values and the transverse elongation values show the percentage by which the corresponding material expands when acted upon with a stretching force of 50 N, 100 N, or 150 N. The lower the longitudinal and transverse elongation, the more stable and better suited as a barrier material the material is. If the corresponding material is used as a barrier material to protect the membrane against penetration of foreign objects, such as small stones, puncture resistance is important. The abrasion strength, called abrasion in the comparison table, is also significant for use of the corresponding material in a composite shoe sole.

It can be seen from the comparison table that split sole leather does have high tensile strength, relatively good resistance to stretching forces, and high puncture resistance, but it only has moderate abrasion strength during wet tests, and especially quite moderate water-vapour permeability.

The only needle-bonded non-woven materials (material 2 and material 3) are relatively light and have high water-vapour permeability in comparison with leather, but they have relatively low stretching resistance in terms of stretching forces, possess only limited puncture resistance, and have only moderate abrasion strength.

The needle-bonded and thermally bonded non-woven material (material 4), at a lower thickness, has a higher basis weight than materials 2 and 3, and is therefore more compact. The water-

vapour permeability of material 4 is higher than that of material 2 and about as high as that of material 3, but almost three times as high as that of leather according to material 1. The longitudinal and transverse elongation resistances of material 4 are much higher than those of non-woven materials 2 and 3, which are only needle-bonded and the longitudinal and transverse breaking load is also much higher than that of materials 2 and 3. The puncture resistance and abrasion strength in material 4 are also much higher than in materials 2 and 3.

Material 5, i.e., the needle-bonded, thermally bonded, and non-woven material thermally compressed on one of its surfaces, has a lower thickness than material 4, because of thermal surface compression with the same basis weight, and therefore takes up less room in a composite shoe sole. The water-vapour permeability of material 5 still lies above that of material 4. With respect to elongation resistance, material 5 is also superior to material 4, since it shows no elongation when longitudinal and transverse elongation forces of 50 N to 150 N are applied. The tensile strength is higher with respect to longitudinal loading and lower with respect to transverse loading than that of material 4. The puncture resistance is somewhat below that of material 4, which is caused by the more limited thickness of material 5. A special superiority compared to all materials 1 to 4 is exhibited by material 5 with respect to abrasion strength.

The comparison table therefore shows that when high water-vapour permeability, high shape stability, and therefore a stabilization effect and a high abrasion resistance are required in the barrier material, material 4, and especially material 5, are quite particularly suited.

In the case of material 5, the needle-bonded and thermally bonded non-woven material, which already has very good stabilization, in one embodiment of the invention is then subjected to hydrophobic finishing, for example, by a dipping process in a liquid that causes hydrophobization, in order to minimize

suction effects of the non-woven material. After the hydrophobization bath, the non-woven material is dried under the influence of heat, wherein the hydrophobic property of the applied finishing is further improved. After the drying process,
5 the non-woven material passes through sizing rollers, wherein the final thickness of, say, 1.5 mm is also set.

In order to achieve a particularly smooth surface, the non-woven material is then exposed to temperature and pressure again, in
10 order to melt the fibre parts again, namely the second fibre component in the shell of the bico on the surface of the non-woven material and to press it against a very smooth surface by means of pressure applied simultaneously. This occurs either with appropriate calendering devices or by means of a heated
15 compression die, wherein a separation material layer can be introduced between the non-woven material and the heated pressure plate, which can be silicone paper or Teflon, for example.

20 Surface smoothing by thermal surface compression is performed on only one surface or both surfaces of the non-woven material, depending on the desired properties of the barrier material.

As already shown by the comparison table, the non-woven material
25 thus produced has high stability against a tearing load and possesses good puncture resistance, which is important when the material is used as a barrier material to protect a membrane.

Material 5, just described, represents a first working example
30 of the barrier material used according to the invention, in which both fibre components consist of polyester, both fibre components have a weight percentage of 50% in the total fibre composite, and the second fibre component is a polyester core-shell fibre of the bico type.

35 Additional working examples of the barrier material used according to the invention will now be considered briefly:

Working example 2

A barrier material in which both fibre components consist of polyester and have a weight percentage of 50% in the total fibre composite, and the second fibre component is a bico from polyester of the side-by-side type.

Except for the special bico structure, the barrier material according to working example 2 is produced in the same way and has the same properties as the barrier material according to working example 1 with a bico fibre of the core-shell type.

Working example 3

A barrier material in which both fibre components have a weight percentage of 50% and the first fibre component is a polyester and the second fibre component is a polypropylene.

In this working example, no bico is used, but a single-component fibre is instead used as the second fibre component. For production of this fibre composite, only two fibre components with different melting points are chosen. In this case, the polyester fibre (with a melting point of about 230°C) with a weight fraction of 50% represents the support component, whereas the polypropylene fibre, also with a weight fraction of 50%, has a lower melting point of about 130°C and therefore represents the gluable bonding component. The production process otherwise runs as in working example 1. In comparison to working example 2, the non-woven material according to working example 3 has lower heat stability, but it can also be produced using lower temperatures.

Working example 4

A barrier material with a percentage of 80% polyester as the first fibre component and a polyester core-shell bico as the second fibre component.

In this working example, production again occurs as in working example 1, the only difference being that the percentage of the second fibre component, which forms the bonding component, is changed. Its weight percentage is now only 20% compared to 80%
5 of the weight formed by the first fibre component, which has a higher melting point. Because of the proportionate reduction in the bonding component, the stabilizing effect of the barrier material obtained is reduced. This can be advantageous when a non-woven material with high mechanical lifetime combined with
10 increased flexibility is required. The temperature resistance of this non-woven material corresponds to that of the first working example.

Some working examples of a composite shoe sole and a barrier
15 unit and details of it are now considered by means of figures 4 to 11.

Figure 4 shows a partial cross section through a composite shoe sole 21 with an underlying outsole 23 and a shoe-stabilization
20 device 25 situated above it, before this composite shoe sole 21 is provided with a barrier material. The outsole 23 and the shoe-stabilization device 25 each have passage openings 27 and 29, which together form a passage 31 through the total thickness of the composite shoe sole 21. The passage 31 is therefore formed
25 by the interface of the two passage openings 27, 29. To complete this composite shoe sole 21, a barrier material 33 (not shown in figure 4) is then placed in the passage opening 29 or arranged above it.

30 Figure 5 shows an example of a barrier unit 35 with a piece of barrier material 33 held by a stabilization device 25.

In one embodiment, the stabilization device is moulded around the peripheral area of the piece of barrier material 33 or
35 moulded onto it, so that the material of the stabilization device 25 penetrates into the fibre structure of the barrier material 33 and is cured there and forms a solid composite.

As a material for the insert moulding of the stabilization device or moulding onto the stabilization device, thermoplastic polyurethane (TPU) is suitable, which leads to very good encasing of the barrier material and can be well bonded to it.

5

In another embodiment, the barrier material 33 is glued to the stabilization device 25. The stabilization device 25 preferably has a stabilization frame that stabilizes at least the composite shoe sole 21 and at least one stabilization bar 37, which is
10 arranged on a surface of the barrier material 33. The at least one stabilization bar 37 is preferably arranged on the bottom of the barrier material 33 facing the outsole.

Figure 6 shows a barrier unit 35, in which a piece of barrier
15 material 33 is enclosed by a stabilization device 25 in the sense that the edge area of the barrier material 33 is not only surrounded by the stabilization device 25, but also held on both surfaces.

Figure 7 shows a barrier unit 35, in which a piece of barrier
20 material 33 is provided with a stabilization device 25 in the form of at least one stabilization bar 37. The stabilization bar 37 is arranged on at least one surface of the barrier material 33, preferably on the surface facing downward toward the outsole
25 23.

Figure 8 shows a barrier unit 35, in which a piece of barrier
material 33 is provided with a stabilization device 25, so that the barrier material 33 is applied to at least one surface of
30 the stabilization device 25. The barrier material 33 then covers the passage opening 29. The stabilization bar 37 is situated within the passage opening 29 of the stabilization device 25.

Figure 9 shows a composite shoe sole 21 according to figure 4,
35 which has a barrier unit according to figure 5 above the outsole 23, wherein only one stabilization bar 37 is shown.

For all the embodiments according to figures 4 to 9 described

above, it is true that the bonding material during moulding on, moulding around, or gluing between the barrier material 33 and the stabilization device 25, not only adheres to the surfaces being joined, but also penetrates into the fibre structure and
5 cures there. The fibre structure is therefore additionally strengthened in its joining area.

Two embodiments of stabilization-bar patterns of stabilization bars 37 applied to a surface of the barrier material 33 are
10 shown in figures 10 and 11. Whereas, in the case of figure 10, three individual bars 37a, 37b, and 37c are arranged in a T-shaped mutual arrangement on a circular surface 43, for example, the bottom of the barrier material 33, which corresponds to an aperture of the composite shoe sole 21, for example, by gluing
15 onto the bottom of the barrier material, in the case of figure 11, a stabilization-bar device in the form of a stabilization mesh 37d is provided.

Embodiments of shoes designed according to the invention will
20 now explained with reference to figures 12 to 27, wherein their individual components will also be considered, especially in connection with the corresponding composite shoe sole.

Figure 12 shows, in a perspective oblique view from the bottom,
25 a working example of a shoe 101 according to the invention with an upper 103 and a composite shoe sole 105 according to the invention. The shoe 101 has a forefoot area 107, a midfoot area 109, a heel area 111, and a foot-insertion opening 113. The composite shoe sole 105 has a multipart outsole 117 on its
30 bottom, which has an outsole part 117a in the heel area, an outsole part 117b in the area of the ball of the foot, and an outsole part 117c in the toe area of the composite shoe sole 105. These outsole parts 117 are attached to the bottom of a stabilization device 119, which has a heel area 119a, a midfoot
35 area 119b, and a forefoot area 119c. The composite shoe sole 105 will be further explained in detail with reference to the following diagrams.

Further components of the composite shoe sole 105 can be damping sole parts 121a and 121b, which are applied in the heel area 111 and in the forefoot area 107 on the top of the stabilization device 119. The outsole 117 and the stabilization device 119 have passage openings that form apertures through the composite shoe sole. These apertures are covered by barrier materials 33a-33d in a water-vapour-permeable manner.

Figure 13a shows the shoe 101 according to figure 12 in a manufacturing stage in which the upper 103 and the composite shoe sole 105 are still separate from each other. The upper 103 is provided on its lower end area on the sole side with an upper base 221, which has a waterproof, water-vapour-permeable upper-base functional layer, which can be a waterproof, water-vapour-permeable membrane. The functional layer is preferably a component of a multilayer functional-layer laminate that has at least one protective layer, for example, a textile backing, as processing protection, in addition to the functional layer. The upper base 115 can also be provided with an upper-mounting sole. However, there is also the possibility of assigning the function of upper-mounting sole to the functional-layer laminate. The composite shoe sole also has the apertures 31 already mentioned in figure 8, which are covered with barrier material parts 33a-33d. The bars 37 are shown within the peripheral edge of the corresponding apertures. In other embodiments, three apertures, two apertures or one aperture can be provided. In another embodiment, more than four apertures are provided. The composite shoe sole 105 can be attached to the upper end on the sole side, either by moulding on or gluing, in order to produce the state according to figure 12. For a detailed explanation of the functional layer and its laminate and the connection with the mounting sole, the description and figures 20 to 25 are referred to.

Figure 13b shows the same shoe structure as in figure 13a, with the difference that the shoe in figure 13a has four apertures 31, whereas the shoe according to figure 13b, is provided with two apertures 31. It can be seen here that the bars 37 are

arranged within the peripheral edge of the corresponding aperture 31 and do not form a limitation of the aperture 31. The surface of an aperture is determined minus the total surface of the bars bridging it, since this bar surface blocks water-vapour transport.

Figure 14 shows a composite shoe sole 105 with a top lying away from the outsole 117. On the top lying away from the outsole 117, the stabilization device 119 is covered in its middle area 119b and its forefoot area 119c with several pieces 33a, 33b, 33c, and 33d of a barrier material 33, with which apertures of the composite shoe sole 105 (not visible in figure 14) are covered. In the heel area and in the forefoot area of the composite shoe sole 105, a damping sole part 121a and 121b is applied to the top of the stabilization device 119, essentially over the entire surface in the heel area and with recesses in the forefoot area wherever the barrier material parts 33b, 33c and 33d are situated.

Since the outsole parts of outsole 117, the stabilization device 119, and the damping sole parts 121a and 121b have different functions within the composite shoe sole, they are appropriately also constructed with different materials. The outsole parts, which are supposed to have good abrasion resistance, consist, for example, of a thermoplastic polyurethane (TPU) or rubber. Thermoplastic polyurethane is the term for a number of different polyurethanes that can have various properties. For an outsole, a thermoplastic polyurethane can be chosen with high stability and slip resistance. The damping sole parts 121a and 121b, which are supposed to have the effect of absorbing shock during walking movements of the user of the shoe, consist of correspondingly elastically compliant material, for example, ethylene-vinyl acetate (EVA) or polyurethane (PU). The stabilization device 119, which serves as a holder for the non-coherent outsole parts 117a, 117b, 117c and for the also non-coherent damping sole parts 121a, 121b and serves as a stabilization element for the entire composite shoe sole 105 and is supposed to have corresponding elastic rigidity, consists of at least one

thermoplastic material. Examples of appropriate thermoplastic materials are polyethylene, polyamide, polyamide (PA), polyester (PET), polyethylene (PE), polypropylene (PP), and polyvinylchloride (PVC). Other appropriate materials are rubber, thermoplastic rubber (TR), and polyurethane (PU). Thermoplastic polyurethane (TPU) is also suitable.

The composite shoe sole depicted in figure 14 is shown in an exploded view in figure 15, i.e., in a view in which the individual parts of the composite shoe sole 105 are shown separately from each other, except for the barrier material parts 33a, 33b, 33c, and 33d, which are already shown arranged on the stabilization device parts 119b and 119c. In the embodiment depicted in figure 15, the stabilization device 119 has its parts 119a, 119b, and 119c as initially separate parts, which are joined together to the stabilization device 119 during assembly of the composite shoe sole 105, which can occur by welding or gluing of the three stabilization device parts to one another. As will still be explained in connection with figure 16, openings are situated beneath the barrier material parts, which, together with openings 123a, 123b, and 123c in the outsole parts 117a, 117b, and 117c, form apertures 31 of the type already explained in connection with figure 4, and with which barrier material parts 33a-33d are covered in a water-vapour-permeable manner. A passage opening 125 in the heel part 119a of the stabilization device 119 is not closed with barrier material 33, but with the full-surface damping sole part 121a. A better damping effect of the composite shoe sole 105 in the heel area of the shoe is thereby achieved, where sweat-moisture removal, under some circumstances, can be less required, since foot sweat mostly forms in the forefoot and midfoot areas, but not in the heel area.

The damping sole part 121b is provided with passage openings 127a, 127b, and 127c, which are dimensioned so that the barrier material parts 33b, 33c, 33d can each be accommodated within an enclosing boundary edge 129a, 129b, or 129c of the stabilization device part 119c in the passage openings 127a, 127b, and 127c.

In another embodiment, no damping sole part 121 is provided. In this case, the parts of the stabilization device 119a, 119b, and 119c have a flat surface without a boundary edge 129a, 129b, 129c, so that the barrier material 33 is positioned flush with the surface of the stabilization device in its openings. The composite sole is only formed by the barrier unit, which is constructed from the barrier unit 33, the stabilization device 119, and the outsole.

The composite shoe sole parts 105 shown obliquely from above in figure 15 are shown in figure 16 likewise in an arrangement separate from one another, but in an oblique view from the bottom. It can be seen that the outsole parts 117a to 117c are provided in the usual manner with an outsole profile, in order to reduce the danger of slipping. The bottoms of the stabilization device parts 119a and 119e on their bottom also have several knob-like protrusions 131, which serve to accommodate the complementary recesses seen in figure 15 in the tops of the outsole parts 117a, 117b, and 117c for positionally correct joining of the outsole parts 117a to 117c to the corresponding stabilization device parts 119a and 119c. Openings 135a, 135b, 135c, and 135d are also visible in the stabilization device parts 119b and 119d in figure 16, which are covered with the corresponding barrier material 33a, 33b, 33c, and 33d in a water-vapour-permeable manner, so that the apertures 31 (figure 4) of the composite shoe sole 105 are closed in a water-vapour-permeable manner. In one embodiment, the barrier materials are arranged so that their smooth surface is directed toward the outsole. The openings 135a to 135d are each bridged with a stabilization mesh 137a, 137b, 137c, and 137e and form a stabilization structure in the area of the corresponding opening of the stabilization device 119. These stabilization meshes 137a-137e also act against the penetration of larger foreign objects up to the barrier material 33 or even farther, which could be perceived as unpleasant by the user of the shoe.

Connection elements 139, provided on the axial ends of the

stabilization device part 119b on the midfoot side, must also be mentioned, which, during assembly of the stabilization device 119 from the three stabilization device parts 119a to 119c, can lie overlapping on the top sides of the stabilization device parts 119a and 119c facing away from the outsole application side, in order to be attached there, for example, by welding or gluing.

Figure 17 shows, in an enlarged view compared to figure 16, the two stabilization device parts 119a and 119b before attaching to each other, wherein the openings 135b to 135d of the stabilization device part 119c on the forefoot side and the stabilization mesh structures situated in it can be seen particularly well. It is also clear that the middle stabilization device part 119b shows raised frame and mesh parts on the longitudinal sides. The barrier material piece 33a to be placed on the stabilization device part 119b, is provided on its long sides with correspondingly raised side wings 141. Through these raised parts, both of the shoe-stabilization part 119b and the barrier material piece 33a, an adjustment to the shape of the lateral midfoot sides is achieved. The remaining barrier material parts 33b to 33d are essentially flat, corresponding to the essentially flat design of the stabilization device part 119c on the forefoot side.

It should be added in general here that the at least one opening 135a-135d of the stabilization device 119b and 119c is bounded by the frame 147 of the stabilization device 119 and not by the bars 37 present in the openings 135a-135d. The boundary edges 129a-129c depicted in figure 17 represent part of the corresponding frame 147 in this embodiment.

It is also possible, instead of several barrier material parts 33b, 33c, 33d, to use a one-piece barrier material part. The mounting protrusions 150 and/or boundary edges 129a-129c must be configured accordingly.

Another modification of the barrier-unit part provided for the

midfoot area with the stabilization device part 119b and the barrier material part 33a is shown in figures 18 and 19: in figure 18 in the finished mounted state and in figure 19 while these two parts are still separate from each other. In contrast to the embodiment in figure 17, in the modification of figures 18 and 19, the stabilization device part 119b provided for the midfoot area is only provided with an opening and a stabilization mesh 137a situated in it in the middle area, whereas the two wing parts 143 on the long sides of the stabilization device part 119b are designed to be continuous, i.e., have no opening, but are only provided on their bottom with stabilization ribs 145. The barrier material piece 33a provided for this barrier-unit part is accordingly narrower than in the embodiments of figures 18 to 19, because it does not require the side wings 141 according to figure 17.

While embodiments of the composite shoe sole 105 according to the invention were explained with reference to figures 12 to 19, embodiments and details of footwear according to the invention will now be explained with reference to figures 20 to 27, the footwear being constructed with a composite shoe sole according to the invention. Figures 20, 22, and 23 show an embodiment of the footwear according to the invention in which the upper base has an upper-mounting sole and also a functional-layer laminate, while figures 24 and 25 show an embodiment of footwear according to the invention in which an upper-base functional-layer laminate 237 simultaneously assumes the function of an upper-mounting sole 233. Figure 26 shows another embodiment of the composite shoe sole 105.

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In the two embodiments depicted in figures 20 to 25, the shoe 101, in agreement with figures 12 and 13a-b, has an upper 103 that has an outer material layer 211 situated on the outside, a lining layer 213 situated on the inside, and a waterproof, water-vapour-permeable upper functional layer 215 situated in between, for example, in the form of a membrane. The upper functional layer 215 can be present in connection with the lining layer 213 as a two-ply laminate or as a three-ply laminate, wherein the

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upper functional layer 215 is embedded between the lining layer 213 and a textile backing 214. The top end of the upper 217 is closed or open with respect to the foot-insertion opening 113 (figure 12), depending on whether the sectional plane of the cross-sectional view depicted in figures 20 and 24 lies in the forefoot area or the midfoot area. On the upper end region 219 on the sole side, the upper 103 is provided with an upper base 221, with which the lower end of the upper 103 on the sole side is closed. The upper base 221 has an upper-mounting sole 233, which is connected to the upper end region 219 on the sole side, which occurs in the embodiments according to figures 20 to 25 by means of a Strobel seam 235.

In the case of the embodiment of figures 20, 22, and 23, in addition to the upper-mounting sole 233, an upper-base functional-layer laminate 237 is provided, which is arranged beneath the upper-mounting sole 233 and extends beyond the periphery of the upper-mounting sole 233 into the upper end region 219 on the sole side. The upper-base functional-layer laminate 237 can be a three-ply laminate, wherein the upper-base functional layer 248 is embedded between a textile backing and another textile layer. It is also possible to provide the upper-base functional layer 247 with the textile backing only. The outer material layer 211 in the upper end region 219 on the sole side is shorter than the upper functional layer 215, so that a protrusion of the upper functional layer 215 with respect to the outer material layer 211 is created there and exposes the outer surface of the upper functional layer 215. Mostly for mechanical tension relief of the protrusion of the upper functional layer 215, a mesh band 241 or another material that can be penetrated with sealant is arranged between the end 238 of the outer material layer 211 on the sole side and the end 239 of the upper functional layer 215 on the sole side, the long side of which, facing away from the Strobel seam 235, is joined by means of a first seam 243 to the end 238 of the outer material layer 211 on the sole side, but not to the upper functional layer 215, and whose long side, facing the Strobel seam 235, is joined by means of the Strobel seam 235 to the end 239 of the upper functional

layer 215 on the sole side and to the upper-mounting sole 233. The mesh band 241 preferably consists of a monofilament material, so that it has no water conductivity. The mesh band is preferably used for moulded-on soles. If the composite sole
5 is attached to the upper by means of glue instead of the mesh band, the end 238 of the outer material layer 211 on the sole side can be attached by means of glue 249 to the lasting-upper functional-layer laminate (figure 22). In the peripheral area 245, in which the upper-base functional-layer laminate 237
10 protrudes beyond the periphery of the upper-mounting sole 233, a sealing material 248 is arranged between the upper-base functional-layer laminate 237 and the end 239 of the upper functional layer 215 on the sole side, by means of which a waterproof connection is produced between the end 239 of the
15 upper functional layer 215 on the sole side and the peripheral area 245 of the upper-base functional-layer laminate 237, this seal acting through the mesh band 241.

The mesh-band solution depicted in figures 20, and 23 to 25
20 serves to prevent water that runs down or creeps down on the outer material layer 211, from reaching the Strobel seam 235 and advancing into the shoe interior from there. This is prevented by the fact that the end 238 of the outer material layer 211 on the sole side ends at a spacing from the end 239 of the upper
25 functional layer 215 on the sole side, which is bridged with the non-water-conducting mesh band 241, and the sealing material 247 is provided in the area of the protrusion of the upper functional layer 215. The mesh-band solution is known from document EP 0298360 B1.

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Instead of the mesh-band solution, all joining technologies used in the shoe industry for preferably waterproof joining of an upper to the upper base can be used. The depicted mesh-band solution and the lasting solution in figure 22 are working
35 examples.

The upper structure depicted in figure 24 agrees with the upper structure shown in figure 20, with the exception that no separate

upper-mounting sole is provided there, but the upper-base functional-layer laminate 237 simultaneously assumes the function of an upper-mounting sole 233. According to it, the periphery of the upper-base functional-layer laminate 237 of the embodiment depicted in figure 24 is connected by a Strobel seam 235 to the end 239 on the sole side of the upper functional layer 215 and the sealing material 248 is applied in the area of the Strobel seam 235, so that the transition between the end 239 on the sole side of the upper functional layer 215 and the peripheral area of the upper-base functional-layer laminate 237 is sealed completely, including the Strobel seam 235.

In both embodiments of figures 20 and 24, an identically constructed composite shoe sole 105 can be used, as shown in these two diagrams. Since sectional views of the shoe 101 are shown in the forefoot area in figures 20 and 24, these diagrams are a sectional view of the forefoot area of the composite shoe sole 105, i.e., a sectional view along a line of intersection running across the stabilization unit part 119c intended for the forefoot area with the barrier material piece 33c inserted in its opening 135c.

The sectional view of the composite shoe sole 105 accordingly shows the stabilization device part 119c with its opening 135c, a bar of the corresponding stabilization mesh 137c bridging this opening, the upward protruding frame 129b, the barrier material piece 33c inserted into this frame 129b, the damping sole part 121b on the top side of the stabilization device part 119c, and the outsole part 117b on the bottom of the stabilization device part 119c. To this extent, the two embodiments of figures 20 and 24 correspond.

Figure 21 shows an example of a barrier unit 35, in which a piece of barrier material 33 is provided on the bottom with at least one stabilization bar 37. On the surface area of the barrier material 33 opposite the stabilization bar 37, glue 39 is applied, with which the barrier material 33 is joined to the waterproof, water-vapour-permeable upper base 221, which is

situated above the barrier unit 35 outside the composite shoe sole. The glue 39 is applied in such a way that the upper base 221 is joined to the barrier material 33 wherever no material of the stabilization bar 37 is situated on the bottom of the barrier material 33. In this way, it is ensured that the water vapour permeability function of the upper base 115 is interfered with by glue 39 only where the barrier material 33 cannot permit any water-vapour transport in any case, because of the arrangement of the stabilization bar 37.

Whereas the corresponding composite shoe sole 105 in figures 20 and 24 is still separated from the corresponding upper 103, figures 22, 23, and 25 show, in an enlarged view and as a detail, these two embodiments with the composite shoe sole 105 applied to the upper base. In these enlarged views, the upper-base functional layer 247 of the upper-base functional-layer laminate 237, in all embodiments, is preferably a microporous functional layer, for example, made of expanded polytetrafluoroethylene (ePTFE). As already mentioned above, however, different types of functional layer materials can also be used.

In these enlarged detail views of figures 22, 23, and 25, the waterproof connection between the overlapping opposite ends of the upper functional layer 215 and the upper-base functional layer 247 created with the sealing material 248 can be seen particularly well. In addition, the involvement of a longitudinal mesh-band side in the Strobel seam 235 can also be seen more readily than in figures 20 and 24.

Figure 22 shows an embodiment in which the composite sole 105 according to the invention is attached by means of attaching glue 250 to the upper base. The upper functional-layer laminate 216 is a three-ply composite with a textile layer 214, an upper functional layer 215, and a lining layer 213. The end 238 of the outer material layer 211 on the sole side is attached with lasting glue 249 to the upper functional-layer laminate 216.

The attaching glue 250 is applied superficially to the surface

of the composite sole, except for the apertures 135 and the barrier material 33 arranged in the area of the apertures 135. When the composite sole is attached to the upper base 221, the attaching glue 250 penetrates up to and partially into the upper
5 functional-layer laminate 216 and up to and partially into the edge areas of the upper-base functional-layer laminate 237.

Figure 23 is a view of the upper structure according to figure 20 with a moulded-on composite shoe sole. The three-ply upper-
10 base functional-layer laminate 237 is then attached to the upper-mounting sole 233, so that the textile backing 246 faces the composite sole. This is advantageous, because the sole-moulding material 260 penetrates more easily into the thin textile backing and can be anchored there and a firm connection
15 to the upper-base functional-layer laminate 237 is thus created.

The barrier unit with the at least one opening 135 and the at least one piece of barrier material 33 is present as a prefabricated unit and is inserted into the injection mould
20 before the moulding process. The sole-moulding material 260 is moulded onto the upper base accordingly, advancing up to the upper functional-layer laminate 216 through the mesh band 241.

Figure 25 shows an enlarged and sectional view of figure 24. The
25 composite sole 105 shows an additional embodiment of the barrier unit 35 according to the invention. The shoe-stabilization device 119c forms a part of the composite sole 105 and does not extend here to the outer periphery of the composite sole 105. A piece of barrier material 33c is applied over the opening 135,
30 so that the material 33c lies on the peripheral continuous flat boundary edge 130 of opening 135.

The composite sole 105 can be attached to the upper base 221 with attaching glue 250 or moulded on with sole-moulding
35 material 260 (as shown).

Figure 25 also clearly shows that, in the embodiment in which the upper-base functional-layer laminate 237 assumes the

function of the upper-mounting sole 233, the laminate comes to lie directly above the opposite top of the barrier material piece 33c, which is particularly advantageous. In this case, an air cushion that might adversely affect water-vapour removal cannot form between the upper-base functional-layer laminate 237 and the barrier material piece 33c, and the barrier material piece 33c, and especially the upper-base functional-layer 247, are situated particularly tight against the foot sole of the user of such a shoe, which improves water-vapour removal, which is also determined by the existing temperature gradient between the shoe interior and the shoe exterior.

Figure 26 is a view of another embodiment of the composite sole according to the invention. The perspective view shows several openings 135 in the shoe-stabilization device 119, which are arranged from the toe area to the heel area of the composite sole. The stabilization material 33 is therefore also present in the heel area. The outsole is formed by the outsole parts 117.

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Figure 27 is a view of another embodiment of the composite sole according to the invention in a cross-sectional view. The composite sole 105 of this embodiment is quite similar to the composite sole depicted in figure 24. The composite sole 105 according to figure 27 has an outsole, in which a cross section through the ball of the foot area of the composite sole 105 and therefore a cross section through the corresponding outsole part 117b is shown in this diagram. However, the disclosure according to figure 27 also applies to the other areas of the composite sole 105, i.e., to its midfoot part and heel part. The outsole part 117b has a tread 153 that touches the floor during walking. The sectional view of the composite sole 105 of figure 27 shows the stabilization device part 119c with its opening 135c, its upward protruding boundary edge 129b, the barrier material piece 33c inserted into the boundary edge 129b, the damping sole part 121b on the top side of the stabilization device part 119c, and the outsole part 117b on the bottom of the stabilization device part 119c. A support element 151 is applied to the bottom of the

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barrier material piece 33c. This extends from the side of the barrier material 33 facing the tread to the level of the tread 153, so that the barrier material 33 is supported on the floor during walking by the support element 151. This means that a lower free end of the support element 151 in figure 27 touches the surface when the shoe provided with this composite sole stands on a surface. Through this support by the support element 151, during walking on such a surface, the barrier material piece 33c is held essentially in the position depicted in figure 27, so that it is prevented from bending under the load of the user of the shoe. Several support elements 151 can be arranged in opening 135c, in order to increase the support effect for the barrier material piece 33c and make its surface extent more uniform.

The support function can also be obtained by the fact that the stabilization bar 137c depicted in figure 24 is simultaneously formed as the support element 151 by allowing the stabilization bar 137c not to end at a spacing from the bottom of the outsole part 117b serving as the tread, but extending it to the level of this bottom. The stabilization bar 137c is then given the dual function of stabilizing and supporting the barrier material piece 33c. For example, the stabilization bars 37c depicted in figure 10 or the stabilization mesh 37d depicted in figure 11 can be formed fully or partially as support elements 151.

With the sole structure according to the invention, a high water-vapour permeability is achieved, because, on the one hand, large-area apertures in the composite shoe sole 105 are provided and these are closed with material of high water-vapour permeability, and because, at least in the area of the apertures 31, there is also no connection between the water-vapour-permeable barrier material 33 and the upper-base functional layer 247 that prevents water-vapour exchange, and such a connection is, at most, present in the areas outside the apertures 31 of the composite shoe sole 105 that do not participate actively in water-vapour exchange, such as the edge areas of the composite shoe sole 105. In the structure according

to the invention, the upper-base functional layer 247 is also arranged tightly with the foot, which leads to accelerated water-vapour removal.

5 The upper-base functional-layer laminate 237 can be a multilayer laminate with two, three, or more layers. At least one functional layer is contained with at least one textile support for the functional layer, wherein the functional layer can be formed by a waterproof, water-vapour-permeable membrane 247, which is
10 preferably microporous.

Further embodiments of the invention are disclosed in the following numbered paragraphs:

15 1. Water-vapour-permeable composite shoe sole (105) with a top side (50), having:

at least one aperture (31) extending through the thickness of the composite shoe sole;

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a barrier unit (35) with a top side forming at least partially the top side (50) of the composite shoe sole (105) and with a water-vapour-permeable barrier material (33) designed as a barrier against penetration of foreign objects, by means of
25 which the at least one aperture (31) is closed in a water-vapour-permeable manner;

a stabilization device (25) assigned to the barrier material (33), designed for mechanical stabilization of the composite
30 shoe sole (105), which is constructed with at least one stabilization bar (37), which is arranged at least on one surface of the barrier material (33) and at least partially bridges the at least one aperture (31);

35 and at least one outsole part (117) arranged beneath the barrier unit (35).

2. Composite shoe sole (105) according to paragraph 1, whose

barrier unit (35) is designed to be water-permeable.

3. Composite shoe sole (105) according to paragraph 1, which is designed to be water-permeable.

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4. Composite shoe sole (105) according to any of paragraphs 1 to 3,

whose at least one stabilization device (119) is designed so that at least 15% of the surface of the forefoot area of the composite shoe sole is water-vapour-permeable.

5. Composite shoe sole (105) according to paragraph 4, whose at least one stabilization device (119) is designed so that at least 25% of the surface of the forefoot area of the composite shoe sole is water-vapour-permeable.

6. Composite shoe sole (105) according to according to paragraph 5,

whose at least one stabilization device (119) is designed so that at least 40% of the surface of the forefoot area of the composite shoe sole is water-vapour-permeable.

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7. Composite shoe sole (105) according to according to paragraph 6,

whose at least one stabilization device (119) is designed so that at least 50% of the surface of the forefoot area of the composite shoe sole is water-vapour-permeable.

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8. Composite shoe sole (105) according to according to paragraph 7,

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whose at least one stabilization device (119) is designed so that at least 60% of the surface of the forefoot area of the composite shoe sole is water-vapour-permeable.

9. Composite shoe sole (105) according to according to paragraph 8,

5 whose at least one stabilization device (119) is designed so that at least 75% of the surface of the forefoot area of the composite shoe sole is water-vapour-permeable.

10 10. Composite shoe sole (105) according to any of paragraphs 1 to 9,

whose at least one stabilization device (119) is designed so that at least 15% of the surface of the midfoot area of the composite shoe sole is water-vapour-permeable.

15 11. Composite shoe sole (105) according to any of paragraphs 1 to 9,

20 whose at least one stabilization device (119) is designed so that at least 25% of the surface of the midfoot area of the composite shoe sole is water-vapour-permeable.

25 12. Composite shoe sole (105) according to any of paragraphs 1 to 9,

whose at least one stabilization device (119) is designed so that at least 40% of the surface of the midfoot area of the composite shoe sole is water-vapour-permeable.

30 13. Composite shoe sole (105) according to any of paragraphs 1 to 3,

35 whose at least one stabilization device (119) is designed so that at least 50% of the surface of the midfoot area of the composite shoe sole is water-vapour-permeable.

14. Composite shoe sole (105) according to any of paragraphs 1 to 3,

whose at least one stabilization device (119) is designed so that at least 60% of the surface of the midfoot area of the composite shoe sole is water-vapour-permeable.

5

15. Composite shoe sole (105) according to any of paragraphs 1 to 3,

whose at least one stabilization device (119) is designed so
10 that at least 75% of the surface of the midfoot area of the composite shoe sole is water-vapour-permeable.

16. Composite shoe sole (105) according to any of paragraphs 1 to 3, whose at least one stabilization device (119) is designed
15 so that at least 15% of the front-half of the longitudinal extent of the composite shoe sole is water-vapour-permeable.

17. Composite shoe sole (105) according to according to paragraph 16, whose at least one stabilization device (119) is
20 designed so that at least 25% of the front-half of the longitudinal extent of the composite shoe sole is water-vapour-permeable.

18. Composite shoe sole (105) according to according to paragraph 17, whose at least one stabilization device (119) is
25 designed so that at least 40% of the front-half of the longitudinal extent of the composite shoe sole is water-vapour-permeable.

19. Composite shoe sole (105) according to according to paragraph 18, whose at least one stabilization device (119) is
30 designed so that at least 50% of the front-half of the longitudinal extent of the composite shoe sole is water-vapour-permeable.

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20. Composite shoe sole (105) according to according to paragraph 19, whose at least one stabilization device (119) is designed so that at least 60% of the front-half of the

longitudinal extent of the composite shoe sole is water-vapour-permeable.

21. Composite shoe sole (105) according to any of paragraphs 1
5 to 3, whose at least one stabilization device (119) is designed
so that at least 75% of the front-half of the longitudinal extent
of the composite shoe sole is water-vapour-permeable.

22. Composite shoe sole (105) according to any of paragraphs 1
10 to 3, whose at least one stabilization device (119) is designed
so that at least 15% of the longitudinal extent of the composite
shoe sole minus the heel area is water-vapour-permeable.

23. Composite shoe sole (105) according to according to
15 paragraph 22, whose at least one stabilization device (119) is
designed so that at least 25% of the longitudinal extent of the
composite shoe sole minus the heel area is water-vapour-
permeable.

20 24. Composite shoe sole (105) according to paragraph 23, whose
at least one stabilization device (119) is designed so that at
least 40% of the longitudinal extent of the composite shoe sole
minus the heel area is water-vapour-permeable.

25 25. Composite shoe sole (105) according to according to
paragraph 24, whose at least one stabilization device (119) is
designed so that at least 50% of the longitudinal extent of the
composite shoe sole minus the heel area is water-vapour-
permeable.

30 26. Composite shoe sole (105) according to according to
paragraph 25, whose at least one stabilization device (119) is
designed so that at least 60% of the longitudinal extent of the
composite shoe sole minus the heel area is water-vapour-
35 permeable.

27. Composite shoe sole (105) according to according to
paragraph 26, whose at least one stabilization device (119) is

designed so that at least 75% of the longitudinal extent of the composite shoe sole minus the heel area is water-vapour-permeable.

5 28. Composite shoe sole (105) according to any of paragraphs 1 to 27,

with a number of apertures (31), each closed by a piece of barrier material (33).

10

29. Composite shoe sole (105) according to any of paragraphs 1 to 27,

15 with a number of apertures (31) closed overall by one piece of barrier material (33).

30. Composite shoe sole (105) according to any of paragraphs 1 to 29,

20 in which the barrier unit (35) has at least one stabilization bar (37) on the side of the barrier unit (35) facing the outsole.

31. Composite shoe sole (105) according to any of paragraphs 1 to 30,

25

in which the stabilization device (25) with the at least one stabilization bar (37) is not a component of the at least one outsole part.

30 32. Composite shoe sole (105) according to any of paragraphs 1 to 31,

in which the stabilization device with the at least one stabilization bar (37) has a spacing from the floor.

35

33. Composite shoe sole (105) according to paragraph 32,

in which the spacing corresponds to the thickness of the at

least one outsole part.

34. Composite shoe sole (105) according to any of the preceding paragraphs,

5

whose outsole part has a first material, and the stabilization device has a second material different from the first material, the second material being harder (according to Shore) than the first material.

10

35. Composite shoe sole (105) according to any of paragraphs 1 to 34,

15

in which the barrier material (33) is designed in the form of a fibre composite.

36. Composite shoe sole (105) according to any of paragraphs 1 to 35,

20

in which the stabilization device (119) is designed in one piece and carries barrier material (33) that closes all the apertures (31).

25

37. Composite shoe sole (105) according to any of paragraphs 1 to 36,

30

in which the stabilization device (119) is designed in several pieces, in which the pieces are at least assigned to at least one aperture (31) and each carry a piece of the barrier material (33) that closes the at least one aperture (31).

38. Composite shoe sole (105) according to any of paragraphs 1 to 37,

35

whose stabilization device (25) is provided with at least one opening (135), which forms at least one part of the aperture (31) and is closed with barrier material (33).

39. Composite shoe sole (105) according to paragraph 38,

whose stabilization device (25) has a number of openings (135) that are closed overall with one piece of barrier material (33).

5

40. Composite shoe sole (105) according to paragraph 38,

whose stabilization device (25) has a number of openings (135) that are each closed with a piece of barrier material (33).

10

41. Composite shoe sole (105) according to any of paragraphs 1 to 40,

whose stabilization device (25) is designed to be sole-shaped or partially sole-shaped.

15

42. Composite shoe sole (105) according to any of paragraphs 1 to 41,

whose stabilization device (25) has at least one stabilization frame (147) that stabilizes at least the composite shoe sole (105).

20

43. Composite shoe sole (105) according to paragraph 42,

25

whose stabilization frame (147) is fitted into the at least one aperture (31) or into at least one of the apertures of the composite shoe sole (105).

44. Composite shoe sole (105) according to any of paragraphs 38 to 43,

30

in which the at least one opening (135) has an area of at least 1 cm².

35

45. Composite shoe sole (105) according to paragraph 44,

in which the at least one opening (135) has an area of at least

5 cm².

46. Composite shoe sole (105) according to paragraph 45,

5 in which the at least one opening (135) has an area of at least 20 cm².

47. Composite shoe sole (105) according to paragraph 46, in which the at least one opening (135) has an area of at least 40
10 cm².

48. Composite shoe sole (105) according to any of paragraphs 42 to 47,

15 in which the stabilization frame (147) of the stabilization device (119) has at least one stabilization bar (37) that bridges the corresponding aperture (31).

49. Composite shoe sole (105) according to any of paragraphs 1
20 to 48,

whose stabilization device (119) has several stabilization bars (37) that form a grid-like structure on at least one surface of the barrier material.
25

50. Composite shoe sole (105) according to any of paragraphs 1 to 49,

whose stabilization device (119) is constructed with at least
30 one thermoplastic material.

51. Composite shoe sole (105) according to any of paragraphs 1 to 50,

35 in which the stabilization device (119) and the barrier material (33) are at least partially joined to each other.

52. Composite shoe sole (105) according to paragraph 51,

in which the stabilization device (119) and the barrier material (33) are joined to each other by means of at least one joining technique, chosen from gluing, welding, moulding-on, insert
5 moulding, vulcanizing-on, and insert vulcanization.

53. Composite shoe sole (105) according to any of paragraphs 1 to 52,

10 in which the barrier material (33) has a fibre composite with at least two fibre components that differ with respect to their melting point,

wherein at least one part of a first fibre component has a first
15 melting point and a first softening temperature range lying beneath it, and at least one part of a second fibre component has a second melting point and a second softening temperature range lying beneath it, and the first melting point and the first softening temperature range are higher than the second
20 melting point and the second softening temperature range,

and wherein the fibre composite is thermally bonded, while retaining water-vapour-permeability in the thermally bonded area, as a result of thermal activation of the second fibre
25 component with an adhesive softening temperature lying in the second softening temperature range.

54. Composite shoe sole (105) according to paragraph 53, in which at least part of the fibre components of the fibre
30 composite is thermally glued to each other by at least partial softening of the second fibre component.

55. Composite shoe sole (105) according to paragraph 53 or 54,
35 in whose fibre composite at least the second fibre component includes at least a first fibre part and a second fibre part, the first fibre part having a higher melting point and a higher softening temperature range than the second fibre part.

56. Composite shoe sole (105) according to any of paragraphs 53 to 55,

5 whose fibre composite is a textile fabric.

57. Composite shoe sole (105) according to paragraph 56,

whose fibre composite is a weave, loop-formed knit, loop-drawn
10 knit, non-woven fabric, felt, mesh, or laid scrim.

58. Composite shoe sole (105) according to paragraph 57,

whose fibre composite is a mechanically bonded non-woven
15 material.

59. Composite shoe sole (105) according to paragraph 58,

whose fibre composite is a needled non-woven material.
20

60. Composite shoe sole (105) according to any of paragraphs 53 to 59, in which at least part of the second fibre component, and optionally the second fibre part of the second fibre component, can be heat-activated at a temperature in the range
25 between 80°C and 230°C.

61. Composite shoe sole (105) according to any of paragraphs 53 to 60,

30 in which the first fibre component, and optionally the first fibre part of the second fibre component, are melt-resistant at a temperature of at least 130°C.

62. Composite shoe sole (105) according to paragraph 61,

35 in which the first fibre component, and optionally the first fibre part of the second fibre component, are melt-resistant at a temperature of at least 170°C.

63. Composite shoe sole (105) according to paragraph 62,

in which the first fibre component, and optionally the first
5 fibre part of the second fibre component, are melt-resistant at
a temperature of at least 250°C.

64. Composite shoe sole (105) according to any of paragraphs
53 to 63,

10

in which the first fibre component, and optionally the first
fibre part of the second fibre component, are chosen from the
material group including natural fibres, plastic fibres, metal
fibres, glass fibres, carbon fibres, and mixtures thereof.

15

65. Composite shoe sole (105) according to any of paragraphs
53 to 64,

in which the second fibre component, and optionally the second
20 fibre part of the second fibre component, are constructed with
at least one plastic fibre.

66. Composite shoe sole (105) according to paragraph 64 or 65,

25 in which at least one of the two fibre components, and optionally
at least one of the two fibre parts of the second fibre
component, are chosen from the material group comprising
polyolefins, polyamide, copolyamide, viscose, polyurethane,
polyacrylic, polybutylene terephthalate, and mixtures thereof.

30

67. Composite shoe sole (105) according to paragraph 63 or 65,

in which the first fibre component, and optionally the first
fibre part of the second fibre component, are chosen from the
35 material group polyester and copolyester.

68. Composite shoe sole (105) according to paragraph 64 or 65,

in which at least the second fibre component, and optionally at least the second fibre part of the second fibre component, have at least one thermoplastic material.

5 69. Composite shoe sole (105) according to paragraph 68,

in which the second fibre component, and optionally the second fibre part of the second fibre component, are chosen from the material group polyamide, copolyamide, polybutylene
10 terephthalate and polyolefin.

70. Composite shoe sole (105) according to paragraphs 65 and 68,

15 in which the polyolefin is chosen from polyethylene and polypropylene.

71. Composite shoe sole (105) according to paragraph 69,

20 in which the second fibre component, and optionally the second fibre part of the second fibre component, are chosen from the material group polyester and copolyester.

72. Composite shoe sole (105) according to paragraph 71,

25

in which both fibre parts of the second fibre component are polyesters and the polyester of the second fibre part has a lower melting point, with a softening temperature range lying beneath it, than the polyester of the first fibre part.

30

73. Composite shoe sole (105) according to paragraph 53 to 72,

in which at least the second fibre component has a core-shell structure and the second fibre part forms the shell.

35

74. Composite shoe sole (105) according to any of paragraphs 53 to 72,

in which at least the second fibre component has a side-to-side structure, one side of which is constructed with the second fibre part of the second fibre component.

5 75. Composite shoe sole (105) according to any of paragraphs 53 to 74,

in which the second fibre component has a weight percentage, with respect to the basis weight of the fibre composite, in the
10 range from 10% to 90%.

76. Composite shoe sole (105) according to paragraph 75,

in which the second fibre component has a weight percentage,
15 with respect to the basis weight of the fibre composite, in the range from 10% to 60%.

77. Composite shoe sole (105) according to paragraph 76,

20 in which the second fibre component has a weight percentage, with respect to the basis weight of the fibre composite, of 50%.

78. Composite shoe sole (105) according to paragraph 76,

25 in which the second fibre component has a weight percentage, with respect to the basis weight of the fibre composite, of 20%.

79. Composite shoe sole (105) according to any of paragraphs 53 to 78,

30

in which the two fibre components, and optionally the two fibre parts of the second fibre component, are chosen from fibre materials, whose melting points differ by at least 20°C.

35 80. Composite shoe sole (105) according to any of paragraphs 53 to 79,

whose barrier material (33) is thermally bonded over at least

part of its thickness.

81. Composite shoe sole (105) according to any of paragraphs 53 to 79,

5

whose barrier material (33) is thermally bonded over at least part of its thickness and compressed for surface smoothing on at least one surface by means of pressure and temperature.

10 82. Composite shoe sole (105) according to any of paragraphs 1 to 81,

whose barrier material is finished with one or more agents from the material group of water-repellent agents, dirt-repellent
15 agents, oil-repellent agents, antibacterial agents, deodorants and combinations thereof.

83. Composite shoe sole (105) according to any of paragraphs 1 to 82,

20

whose barrier material (33) is treated to be water-repellent, dirt-repellent, oil-repellent, antibacterial, and/or treated against odour.

25 84. Composite shoe sole (105) according to any of paragraphs 1 to 83,

whose barrier material has a water vapour permeability of at least $4000 \text{ g/m}^2 \cdot 24 \text{ h}$.

30

85. Composite shoe sole (105) according to paragraph 84,

whose barrier material (33) has a water-vapour-permeability of at least $7000 \text{ g/m}^2 \cdot 24 \text{ h}$.

35

86. Composite shoe sole (105) according to paragraph 85,

whose barrier material (33) has a water-vapour-permeability of

at least $10\,000\text{ g/m}^2 \cdot 24\text{ h}$.

87. Composite shoe sole (105) according to any of paragraphs 1 to 86,

5

whose barrier material (33) has a thickness in the range from at least 1 mm to 5 mm.

88. Composite shoe sole (105) according to paragraph 87,

10

whose barrier material (33) has a thickness in the range from at least 1 mm to 2.5 mm.

89. Composite shoe sole (105) according to paragraph 88,

15

whose barrier material (33) has a thickness in the range from at least 1 mm to 1.5 mm.

90. Composite shoe sole (105) according to any of paragraphs 1 to 89, with a tread (153),

20

in which at least one support element (151) is assigned to the barrier material (33) in the aperture or at least one of the apertures (33a, 33b, 33c), which extends from the side of the barrier material (33) facing the tread to the level of the tread (153), so that the barrier material (33) is supported on the floor during walking by the support element (151).

25

91. Composite shoe sole (105) according to paragraph 90, wherein at least one of the stabilization bars (37) is simultaneously designed as a support element (151).

30

92. Footwear with a composite shoe sole (105) according to any of paragraphs 1 to 91,

35

having an upper (103), which is provided in an upper end region (219) on the sole side with a waterproof and water-vapour-permeable upper-base functional layer (247), wherein the

composite shoe sole (105) is joined to the upper end region provided with the upper-base functional layer (247), so that the upper-base functional layer (247) is not bonded to the barrier material (33), at least in the area of the at least one aperture
5 (31).

93. Footwear according to paragraph 92, in which the upper (103) is constructed with at least one upper material, wherein the upper material has a waterproof upper functional layer (215)
10 at least in the area of the upper end region (219) on the sole side, and wherein a waterproof seal exists between the upper functional layer (215) and the upper-base functional layer (247).

15 94. Footwear according to paragraph 92 or 93,

whose upper-base functional layer (247) is assigned to a water-vapour-permeable upper-mounting sole (233).

20 95. Footwear according to any of paragraphs 92 to 94,

whose upper-base functional layer (247) is part of a multilayer laminate.

25 96. Footwear according to paragraph 95,

whose upper-mounting sole (233) is constructed with the laminate.

30 97. Footwear according to any of paragraphs 92 to 96,

whose upper-base functional layer (247), and optionally the upper functional layer (215), have a waterproof, water-vapour-permeable membrane.

35

98. Footwear according to paragraph 97,

whose membrane (247) has expanded polytetrafluoroethylene.

99. Footwear according to any of paragraphs 92 to 98, with a shoe-base structure, having the composite shoe sole (105) and the upper-base functional layer (247) situated above it, in which the shoe-base structure has a water-vapour transmission rate (MVTR) in the range from 0.4 g/h to 3 g/h.

100. Footwear according to paragraph 99, whose shoe-base structure has a water-vapour transmission rate (MVTR) in the range from 0.8 g/h to 1.5 g/h.

101. Footwear according to paragraph 100, whose shoe-base structure has a water-vapour transmission rate (MVTR) of 1 g/h.

102. Method for producing footwear with a water-vapour-permeable composite shoe sole (105) according to any of paragraphs 1 to 91 and an upper (103) that is provided in an upper end region (219) on the sole side with a waterproof and water-vapour-permeable upper-base functional layer (247) with the following process steps:

a) the composite shoe sole (105) and upper (103) are provided;

b) the upper (103) is provided in the upper end region (219) on the sole side with a waterproof and water-vapour-permeable upper-base functional layer (247);

c) the composite shoe sole (105) and the upper end region (219) on the sole side provided with the upper-base functional layer (247) are joined to each other in such a way that the upper-base functional layer (247) remains unbonded to the barrier material (33), at least in the area of the at least one aperture (31).

103. Method according to paragraph 102,

in which the upper end region (219) on the sole side is closed with the upper-base functional layer (247).

104. Method according to paragraph 102 or 103 for production of footwear, whose upper (103) is provided with an upper functional layer (215),

5

wherein a waterproof joint is produced between the upper functional layer (215) and the upper-base functional layer (247).

10 Test Methods

Thickness

The thickness of the barrier material according to the invention
15 is tested according to DIN ISO 5084 (10/1996).

Puncture Resistance

The puncture resistance of a textile fabric can be measured with
20 a measurement method used by the EMPA (Swiss Federal Laboratories for Materials Science and Technology), using a test device of the Instron tensile-testing machine (model 4465). A round textile piece 13 cm in diameter is punched out with a punch and attached to a support plate in which there are 17
25 holes. A punch, on which 17 spike-like needles (sewing needle type 110/18) are attached, is lowered at a speed of 1000 mm/min to such an extent that the needles pass through the textile piece into the holes of the support plate. The force for puncturing the textile piece is measured by means of a
30 measurement sensor (a force sensor). The result is determined from a test of three samples.

Waterproof Functional Layer/Barrier Unit

35 A functional layer is considered "waterproof", optionally including the seams provided on the functional layer, when it guarantees a water-penetration pressure of at least 1×10^4 Pa. The functional-layer material preferably guarantees a water-

penetration pressure of more than 1×10^5 Pa. The water-penetration pressure is then measured according to a test method in which distilled water, at $20 \pm 2^\circ\text{C}$, is applied to a sample of 100 cm^2 of the functional layer with increasing pressure. The pressure increase of the water is 60 ± 3 cm water per minute. The water-penetration pressure corresponds to the pressure at which water first appears on the other side of the sample. Details concerning the procedure are provided in ISO standard 0811 from 1981.

10 Waterproof Shoe

Whether a shoe is waterproof can be tested, for example, with a centrifugal arrangement of the type described in US-A-5 329 807.

15 Water-Vapour Permeability of the Barrier Material

The water-vapour permeability values of the barrier material according to the invention are tested by means of the so-called beaker method according to DIN EN ISO 15496 (09/2004).

20

Water-Vapour Permeability of the Functional Layer

A functional layer is considered "water-vapour-permeable" if it has a water-vapour permeability number, R_{et} , of less than $150 \text{ m}^2 \times \text{Pa} \times \text{W}^{-1}$. The water-vapour permeability is tested according to the Hohenstein skin model. This test method is described in DIN EN 31092 (02/94) or ISO 11092 (1993).

30 Water-Vapour Permeability of the Shoe-Base Structure According to the Invention

In one embodiment of the footwear according to the invention with a shoe-base structure that includes the composite shoe sole and the upper-base functional layer or the upper-base functional-layer laminate situated above it, the shoe-base structure has a water-vapour permeability (MVTR moisture vapour transmission rate) in the range from 0.4 g/h to 3 g/h , which can lie in the range from 0.8 g/h to 1.5 g/h and in a practical

embodiment, is 1 g/h.

The extent of water-vapour permeability of the shoe-base structure can be determined with the measurement method documented in EP 0 396 716 B1, which is conceived for measuring the water-vapour permeability of an entire shoe. To measure the water-vapour permeability of only the shoe-base structure of a shoe, the measurement method according to EP 0 396 716 B1 can also be used, in which the measurement is made with the measurement layout depicted in figure 1 of EP 0 396 716 B1 in two consecutive measurement scenarios, namely once for the shoe with a water-vapour-permeable shoe-base structure and another time for an otherwise identical shoe with a water-vapour-impermeable shoe-base structure. From the difference between the two measurements, the percentage of water-vapour permeability that is attributed to the water-vapour permeability of the water-vapour-permeable shoe-base structure can be determined.

In each measurement scenario, using the measurement method according to EP 0 396 716 B1, the following sequence of steps was used:

a) Conditioning of the shoe by leaving it in an air-conditioned room (23°C, 50% relative humidity) for at least 12 hours.

b) Removal of the insert sole (foot bed).

c) Lining the shoe with a waterproof, water-vapour-permeable lining material adapted to the shoe interior, which, in the area of the foot insertion opening of the shoe, can be sealed waterproof and water-vapour-tight with a waterproof, water-vapour-impermeable sealing plug (for example, made of Plexiglas and with an inflatable sleeve).

35

d) Filling water into the lining material and closing the foot-insertion opening of the shoe with the sealing plug.

- e) Preconditioning the water-filled shoe by leaving it for a predetermined period (3 hours), during which the temperature of the water is kept constant at 35°C. The climate of the surrounding room is also kept constant at 23°C and 50% relative humidity. A fan is used to blow against the front of the shoe during the test with a wind velocity, on average, of at least 2 m/s to 3 m/s (to destroy a resting air layer that forms around the standing shoe, which would cause a significant resistance to water-vapour passage).
- f) Reweighing the shoe filled with water and sealed with the sealing plug after preconditioning (result: weight m_2 (g)).
- g) Standing again in a test phase of 3 hours under the same conditions as in step e).
- h) Reweighing the sealed water-filled shoe (result: weight m_3 (g)) after the 3-hour test phase.
- i) Determining the water-vapour permeability of the shoe from the amount of water vapour that escapes through the shoe during the test time of 3 hours ($m_2 - m_3$) (g) according to the relation $M = (m_2 - m_3) \text{ (g)} / 3 \text{ (h)}$.
- After both measurement scenarios have been conducted, in which the water vapour permeability values are measured, on the one hand, for the entire shoe with a water-vapour-permeable shoe-base structure (value A) and, on the other hand, for the entire shoe with the water-vapour-permeable upper-base structure (value B), the water vapour permeability value for the water-vapour-permeable shoe-base structure alone can be determined from the difference A-B.

It is important during measurement of water-vapour permeability of the shoe with the water-vapour-permeable shoe-base structure to avoid a situation where the shoe or its sole stands directly on a closed substrate. This can be achieved by raising the shoe or by positioning the shoe on a mesh structure, so that it is

ensured that the ventilation air stream can flow along - or, better beneath - the outsole.

It is useful in each test layout to make repeated measurements
5 for a certain shoe and to consider the averages from them, in order to be able to estimate the measurement scatter better. At least two measurements should be made for each shoe with the measurement layout. In all measurements, a natural fluctuation of the measurement results of ± 0.2 g/h around the actual value,
10 for example, 1 g/h, should be assumed. For this example, measured values between 0.8 g/h and 1.2 g/h could therefore be determined for the identical shoe. Influencing factors for these fluctuations could be the person performing the test or the quality of sealing on the top edge of the upper, for example.
15 By determining several individual measured values for the same shoe, a more exact picture of the actual value can be obtained.

All values for water-vapour permeability of the shoe-base structure are based on a normally cut men's shoe of size 43
20 (French size), wherein the statement of the size is not standardized and shoes of different manufacturers could come out differently.

There are essentially two possibilities for the measurement
25 scenarios:

1. Measurement of shoes with a water-vapour-permeable upper, having
 - 30 1.1 a water-vapour-permeable shoe-base structure;
 - 1.2 a water-vapour-impermeable shoe-base structure;
2. Measurement of shoes with a water vapour-impermeable upper,
35 having
 - 2.1 a water-vapour-permeable shoe-base structure,

2.2 a water-vapour-impermeable shoe-base structure.

Elongation and Tensile Strength

5 An elongation and tensile-strength test was conducted according to DIN EN ISO 13934-1 of 04/1999. Instead of five samples per direction, three were used. The spacing of the clamping jaws was 100 mm in all samples.

10 Abrasion

With respect to abrasion resistance, two measurement methods were used for the abrasion measurements to obtain the abrasion values in the comparison table. In the first place, a Martindale
15 abrasion tester was used ("abrasion carbon" in the table), in which, according to Standard DIN EN ISO 124947-1; -2 (04/1999), the sample being tested is rubbed against sandpaper. Three deviations from the standard are then made: first, sandpaper with grain 180 plus standard foam is tightened in the sample
20 holder. Secondly, standard felt plus the test sample is tightened in the sample table. Thirdly, the sample is inspected every 700 passes and the sandpaper is changed. On the other hand, the abrasion resistance was tested in wet samples (in the table "abrasion wet") according to DIN EN ISO 12947-1; -2; -4;
25 with the deviation from the standard that the sample table with standard felt and standard wool were saturated with distilled water every 12,800 passes.

In the abrasion tests, friction movements according to Lissajous
30 figures were conducted. Lissajous figures represent a periodically repeating overall picture during a corresponding choice of the ratio of participating frequencies, which consists of individual figures offset relative to each other. Passage through one of these individual figures is referred to as a pass
35 in connection with the abrasion test. In all materials 1 to 5, it was measured after how many passes the first holes occurred in the corresponding material and the material had therefore been scraped through. In the comparison table, two pass values

are found for each of the materials, which were formed from the two abrasion tests with the same material.

Hardness

5

Hardness test according to Shore A and Shore D (DIN 53505, ISO 7619-1, DIN EN ISO 868)

Principle:

10

"Hardness according to Shore" is understood to mean the resistance to penetration of an object of a specific shape under defined spring force. The Shore hardness is the difference between the numerical value 100 and the penetration depth of the penetration object in mm under the influence of the test force divided by the scale value 0.025 mm.

15

During testing according to Shore A, a truncated cone with an opening angle of 35° is used as the penetration object, and in Shore D, a cone with an opening angle of 30° and a tip radius of 0.1 mm is used. The penetration objects consist of polished, tempered steel.

20

Measurement Equation:

25

$$HS = 100 - \frac{h}{0.025}$$

$$F = 550 + 75HS_A$$

$$F = 445HS_D$$

h in mm, F in mN

Area of Application:

30

Because of the different resolution of the two Shore hardness methods in different hardness ranges, materials with a Shore A hardness >80 are appropriately tested according to Shore D and materials with a Shore D hardness <30 according to Shore A.

35

Hardness scale	Application
Shore A	Soft rubber, very soft plastic
Shore D	Hard rubber, soft thermoplastic material

Definitions

5 Barrier Material:

Material that enables the shoe or parts/materials present in the shoe, such as outer material, sole, membrane, to be mechanically protected and resist deformation, and also penetration of external objects/foreign bodies, for example, through the sole, while retaining high water-vapour transport, i.e., high climate comfort in the shoe. The mechanical protection and resistance to deformation are mostly based on limited elongation of the barrier material.

15

Fibre Composite:

General term for a composite of fibres of any type. This includes leather, non-woven materials, or knits consisting of metal fibres, under some circumstances, also in a blend with textile fibres, also yarns and textiles produced from yarns (fabrics).

20

The fibre composite must have at least two fibre components. These components can be fibres (for example, staple fibres), filaments, fibre elements, yarns, strands, etc. Each fibre component consists either of a material or contains at least two different material fractions, one fibre part softening/melting at a lower temperature than the other fibre part (bico). Such bico fibres can have a core-shell structure - a core fibre part enclosed with a shell fibre part here - a side-to-side structure or an island-in-the-sea structure. Such processes and machines therefor are available from Rieter Ingolstadt, Germany and/or Schalfhorst in Mönchengladbach, Germany.

25
30

The fibres can be simply spun, multifilament, or several torn fibres with frayed ends looped to one another.

- 5 The fibre components can be distributed uniformly or non-uniformly in the fibre composite.

10 The entire fibre composite must preferably be temperature-stable at at least 180°C. A uniform and smooth surface on at least one side of the fibre composite is achieved by means of pressure and temperature. This smooth surface points "downward" to the ground/floor, so that a situation is achieved in which particles/foreign objects bounce off the smooth surface better or are repelled more simply.

15 The properties of the surface or overall structure of the fibre composite or stabilization material depend on the selected fibres, the temperature, the pressure, and the period over which the fibre composite was exposed to temperature and pressure.

20 Non-Woven Material:

Here, the fibres are laid on a conveyor belt and tangled.

25 Laid scrim:

A fishnet or sieve structure of the fibres. See EP 1 294 656 from Dupont.

30 Felt:

Wool fibres that are opened and hooked by mechanical effects.

Woven Fabric:

35 A fabric produced with warp and weft threads.

Woven and Knitted Fabric:

A fabric formed by meshes.

Melting Point:

5

The melting point is the temperature at which the fibre component or fibre part becomes liquid. Melting point is understood, in the field of polymer or fibre structures, to mean a narrow temperature range in which the crystalline areas of the polymer or fibre structure melt and the polymer converts to a liquid state. It lies above the softening temperature range and is a significant quantity for partially crystallized polymers. Molten means the change of state of aggregation of a fibre or parts of a fibre at a characteristic temperature from solid to viscous/free-flowing.

Softening Temperature Range:

The second fibre component or the second fibre part must only become soft/plastic, but not liquid. This means the softening temperature used lies below the melting point at which the component/part flows. The fibre component or parts of it are preferably softened, so that the more temperature-stable component is embedded or incorporated in the softened parts.

25

The first softening temperature range of the first fibre component lies higher than the second softening temperature range of the second fibre component or the second fibre part of the second fibre component. The lower limit of the first softening range can lie below the upper limit of the second softening temperature range.

30

Adhesive Softening Temperature:

Temperature, at which softening of the second fibre component or the second fibre part occurs, at which its material exerts a gluing effect, so that at least part of the fibres of the second fibre component are thermally bonded to one another by gluing

35

to such an extent that a bonding stabilization of the fibre component occurs, which is greater than the bonding obtained in a fibre composite with the same materials for the two fibre components by purely mechanical bonding, for example, by needle bonding of the fibre composite. The adhesive softening temperature can also be chosen in such a way that softening of the fibres of the second fibre component occurs to an extent that gluing develops not only of the fibres of the second fibre component to one another, but also partial or full enclosure of the individual sites of the fibres of the first fibre composite with softened material of the fibres of the second fibre composite occurs, i.e., partial or full embedding of those sites of the fibres of the first fibre composite in the material of the fibres of the second fibre component, so that a correspondingly increased stabilization bonding of the fibre composite is produced.

Temperature Stability:

If the stabilization device is moulded-on, the barrier material must be temperature-stable for moulding. The same applies to moulding (about 170°C-180°C) or vulcanization of the shoe sole. If the stabilization device is to be moulded-on, the barrier material must have a structure such that the stabilization device can at least penetrate into the structure of the barrier material, or optionally penetrate through it.

Functional Layer/Membrane:

The upper-base functional layer, and optionally the upper functional layer can be formed by a waterproof, water-vapour-permeable coating or a waterproof, water-vapour-permeable membrane, which can either be a microporous membrane or a membrane having no pores. In one embodiment of the invention, the membrane is expanded polytetrafluoroethylene (ePTFE).

Appropriate materials for a waterproof, water-vapour-permeable functional layer include in particular: polyurethane,

polypropylene, polyester, including polyether-ester, and laminates thereof, as described in documents US-A-4,725,418 and US-A-4,493,870. However, expanded microporous polytetrafluoroethylene (ePTFE) is particularly preferred, as
5 described, for example, in documents US-A-3,953,566 and US-A-4,187,390, and expanded polytetrafluoroethylene provided with hydrophilic impregnation agents and/or hydrophilic layers; see, for example, document US-A-4,194,041. A "microporous functional layer" is understood to mean a functional layer whose average
10 pore size lies between about 0.2 μm and about 0.3 μm .

The pore size can be measured with a Coulter Porometer (trade name), which is produced by Coulter Electronics, Inc., Hialeah, Fla., USA.

15

Barrier Unit:

The barrier unit is formed by the barrier material, and optionally by the stabilization device in the form of at least
20 one bar and/or frame. The barrier unit can be present in the form of a prefabricated component.

Composite Shoe Sole:

25 The composite shoe sole consists of barrier material and at least one stabilization device and at least one outsole, as well as optionally additional sole layers, wherein the barrier material closes the at least one aperture extending through the thickness of the composite shoe sole.

30

Aperture:

An aperture is an area of the composite shoe sole, through which water-vapour transport is possible. The outsole and the
35 stabilization devices each have passage openings that overall form an aperture through the entire thickness of the composite shoe sole. The aperture is therefore formed by the interface of the two passage openings. Any bars present are arranged within

the peripheral edge of the corresponding aperture and do not form a limitation of the aperture. The area of an aperture is determined by subtracting the area of all bridging bars, since these bar surfaces block water-vapour transport and therefore do not represent aperture surfaces.

Stabilization Device:

The stabilization device acts as additional stabilization of the barrier material and is formed and applied to the barrier material in such a way that the water-vapour permeability of the barrier material is only slightly influenced, if at all. This is achieved by the fact that only a small area of the barrier material is covered by the stabilization device. The stabilization device is preferably directed downward toward the floor. The stabilization device is primarily assigned not a protective function, but a stabilization function.

Opening of the Stabilization Device:

The at least one opening of the stabilization device is bounded by its at least one frame. The area of an opening is determined by subtracting the area of all bridging bars.

Shoe:

A foot covering consisting of a composite shoe sole and a closed upper part (upper).

Shoe Base:

The shoe base includes all layers beneath the foot.

Thermal Activation:

Thermal activation occurs by exposing the fibre composite to energy, which leads to an increase in temperature of the material to the softening temperature range.

Water-Permeable Composite Shoe Sole:

A composite shoe sole is tested according to the centrifuge
5 arrangement of the type described in US-A-5,329,807. Before
testing, it must be ensured that any upper-base functional layer
present is made water-permeable. A water-permeable composite
shoe sole is assumed if this test is not passed. If necessary,
the test is conducted with a coloured liquid, in order to show
10 the path of the liquid through the composite shoe sole.

Laminate:

Laminate is a composite consisting of a waterproof, water-
15 vapour-permeable functional layer with at least one textile
layer. The at least one textile layer, also called a backing,
primarily serves to protect the functional layer during
processing thereof. We speak here of a two-ply laminate. A three-
ply laminate consists of a waterproof, water-vapour-permeable
20 functional layer embedded between two textile layers, spot-
gluing being able to be applied between these layers.

Waterproof Functional-Layer/Barrier Unit:

25 A functional layer is considered "waterproof", optionally
including seams provided on the functional layer, if it
guarantees a water-penetration pressure of at least 1×10^4 Pa.

Top of the Composite Shoe Sole:

30

The "top" of the composite shoe sole is understood to mean the
surface of the composite shoe sole that lies opposite the upper
base.

35 Outsole:

"Outsole" is understood to mean the part of the composite shoe
sole that touches the floor/ground or produces the main contact

with the floor/ground.

List of reference numerals

	1	Fibre composite
	2	First fibre component
5	3	Second fibre component
	4	Core
	5	Shell
	6	Connection
	21	Composite shoe sole
10	23	Outsole
	25	Shoe-stabilization device
	27	Outsole opening
	29	Shoe-stabilization device opening
	31	Aperture
15	33	Barrier material
	33a	Barrier material
	33b	Barrier material
	33c	Barrier material
	33d	Barrier material
20	35	Barrier unit
	37	Stabilization bar
	37a	Individual bar
	37b	Individual bar
	37c	Individual bar
25	37d	Stabilization mesh
	39	Glue
	43	Circular surface
	101	Shoe
	103	Upper
30	105	Composite shoe sole
	107	Forefoot area
	109	Midfoot area
	111	Heel area
	113	Foot-insertion opening
35	115	Upper base
	117	Multipart outsole
	117a	Multipart outsole heel area
	117b	Multipart outsole ball of foot area

- 117c Multipart outsole toe area
- 119 Stabilization device
- 119a Heel area
- 119b Midfoot area
- 5 119c Forefoot area
- 121 Damping sole part
- 121a Damping sole part heel area
- 121b Damping sole part midfoot area
- Outsole openings
- 10 123a Heel area
- 123b Midfoot area
- 123c Forefoot area
- 125 Passage opening in the heel area 119a of the stabilization device
- 15 Openings in the damping sole part
- 127a Heel area
- 127b Midfoot area
- 127c Forefoot area
- Boundary edge of the shoe-stabilization device
- 20 129a Midfoot area
- 129b Forefoot area
- 129c Forefoot area
- 131 Protrusions
- 133 Recesses
- 25 Stabilization-device openings
- 135a Midfoot area
- 135b Forefoot area
- 135c Forefoot area
- 135d Forefoot area
- 30 Stabilization mesh
- 137a Midfoot area
- 137b Forefoot area
- 137c Forefoot area
- 137d Forefoot area
- 35 139 Connection element
- 141 Side wings
- 143 Wing parts of the stabilization device
- 145 Stabilization rib

	147	Frame of the stabilization device
	150	Support protrusion
	151	Support element
	153	Tread
5	211	Outer material layer
	213	Lining layer
	214	Textile layer
	215	Upper functional layer
	216	Upper functional-layer laminate
10	217	Top end of the upper
	219	Upper-end area on the sole side
	221	Upper base
	233	Upper-mounting sole
	235	Strobel seam
15	237	Upper-base functional-layer laminate
	238	End of the outer material layer on the sole side
	239	End of the upper functional layer on the sole side
	241	Seam band
	243	First seam
20	244	Textile layer
	245	Peripheral area
	246	Textile backing
	247	Membrane
	248	Sealing material
25	249	Lasting glue
	250	Attaching glue
	260	Sole-moulding material

COMPARISON TABLE

Material type	Split sole leather	Non-woven material, needle-bonded only	Non-woven material, needle-bonded only	Non-woven material, needle-bonded and thermally consolidated	Non-woven material, needle-bonded, thermally consolidated; thermal surface pressing at 3.3 N/cm²/230°C/10 s
Material number	Material 1	Material 2	Material 3	Material 4	Material 5
Material	100% leather	100% PES	100% PES	PES + bico total 100% PES	PES + bico total 100% PES
Basis weight [g/m²]	2383	206	125	398	397
Thickness [mm]	3.36	2.96	2.35	1.71	1.46
MVTR [g/m² 24 h] (1)	3323	8086	9568	9459	9881
Longitudinal elongation at 50 N [%]	1	34	55	0	0
Longitudinal elongation at 100 N [%]	2	48	79	1	0
Longitudinal	2	59	104	1	0

elongation at 150 N [%]						
Longitudinal tear strength [N]	3106	324	152	641		821
Longitudinal elongation at break [%]	40	94	107	26		27
Transverse elongation at 50 N [%]	0	32	46	0		0
Transverse elongation at 100 N [%]	1	43	63	1		0
Transverse elongation at 150 N [%]	1	52	75	1		0
Transverse tear strength [N]	4841	410	252	884		742
Transverse elongation at break [%]	43	92	99	35		32
Puncture resistance [N]	857	5	6	317		291
Abrasion wet	25 600/30	20 600/20 600	20 700/16 500	70 200/70 200		614 000/704 000

[passes] (2)	100				
Abrasion carbon	about 35 000	1570/1600	452/452	7700/7700	14 000/15 400
[passes] (2)					

(1) DIN EN ISO 15496 (09/2004)

(2) DIN EN ISO 12947-1; -2 (04/1999)

5

Men's shoe size 42/43 (French)

Test time: 3 hours

- 93 -
 10 All uppers constructed identically, i.e., scatter only through natural scatter of the materials (leather, textile, etc.)

Upper can be designed to be waterproof

15 Constant amount of water in all shoes

Insert soles removed for the test

Shoe-base structures in numbers 2 and 3 comparable; in number 1 only the outsole is closed, i.e.,
 20 it has no openings

			Air flow over the upper and beneath the sole	Test weight before start of test	Test weight after end of test	Overall shoe water vapour permeability MVTR = (m ² ·m ³)/test duration	Average repeat measurements per shoe base MVTR structure	Water vapour permeability of the shoe-
Shoe No.	Repeat measurements	Sole vapour permeable? YES/NO	Test weight before start of test	Test weight after end of test	Test weight after end of test	Test weight after end of test	Test weight after end of test	Test weight after end of test
1	1	No	Yes	1106.66	1097.55	3.0		
1	2	No	Yes	1103.58	1095.03	2.8		
1	3	No	Yes	1102.98	1094.63	2.8		
1	4	No	Yes	1112.44	1102.54	3.3		
1	5	No	Yes	1143.9	1133.75	3.4	3.1	0
1	6	No	Yes	1108.56	1098.42	3.4		
1	7	No	Yes	1102.62	1094.15	2.8		
1	8	No	Yes	1101.78	1093.16	2.9		
1	9	No	Yes	1117.55	1107.86	3.2		
2	1	Yes	Yes	1179.2	1167.06	4.0		
2	2	Yes	Yes	1156.7	1144.65	4.0		
2	3	Yes	Yes	1144.65	1132.97	3.9		
2	4	Yes	Yes	1159.46	1148.3	3.7	4.0	4.0 - 3.1 = 0.9
2	5	Yes	Yes	1153.56	1142.5	3.7		
2	6	Yes	Yes	1175.88	1163.36	4.2		
2	7	Yes	Yes	1173.78	1160.84	4.3		
2	8	Yes	Yes	1165.54	1153.05	4.2		

3	1	Yes	Yes	1153	1140	4.3	4.3	4.3 - 3.1 = 1.2
3	2	Yes	Yes	1168.42	1156.17	4.1		
3	3	Yes	Yes	1160.6	1146.98	4.5		
3	4	Yes	Yes	1183.8	1170.5	4.4		

Patentkrav

1. Vanddampgennemtrængelig kompositskosål (105) med en
overside (50), hvilken kompositskosål har:
- 5 i det mindste en gennembrydning (31), der strækker sig igennem
kompositskosålen tykkelse;
en barriereenhed (35) med en overside, der i det mindste delvist
danner kompositskosålen (105) overside (50), og med et som
barriere mod en gennemtrykning af fremmedlegemer udformet
- 10 vanddampgennemtrængeligt barrieremateriale (33), ved hjælp af
hvilket den i det mindste ene gennembrydning (31) på
vanddampgennemtrængelig måde er lukket;
en til barrierematerialet (33) tilordnet
stabiliseringsindretning (25, 119), der er udformet til en
- 15 mekanisk stabilisering af kompositskosålen (105), og som er
opbygget med i det mindste en stabiliseringsribbe (37), der er
anbragt i det mindste på en overflade af barrierematerialet
(33), og som i det mindste delvist krydser den i det mindste ene
gennembrydning (31); og
- 20 i det mindste en ydersåldel (117), der er anbragt under
barriereenheden (35),
hvor stabiliseringsindretningen (25, 119) har flere
stabiliseringsribber (37), som danner en gitterformet struktur
på i det mindste en overflade af barrierematerialet,
- 25 kendetegnet ved, at
kompositskosålen har en gåflade (153), hvor der til
barrierematerialet (33) i gennembrydningen henholdsvis i det
mindste en af gennembrydningerne (33a, 33b, 33c) er tilordnet i
det mindste et støtteelement (151), der strækker sig ud fra den
- 30 mod gåfladen vendte side af barrierematerialet (33) frem til
gåfladens (153) niveau sådan, at barrierematerialet (33) ved
gang via støtteelementet (151) er støttet på den betrædte jord,
hvor i det mindste en af stabiliseringsribberne (37) samtidig
er udformet som støtteelement (151).
- 35
2. Kompositskosål (105) ifølge krav 1, hvis
stabiliseringsindretning (25, 119) har en flerhed af første
stabiliseringsribber (37), der forløber i det væsentlige i en

første retning, og i det mindste en anden stabiliseringsribbe (37), der forløber i det væsentlige i en anden retning, og som krydser de første stabiliseringsribber (37), hvor de første stabiliseringsribber (37) krydser den i det mindste ene anden stabiliseringsribbe (37) i det væsentlige ortogonalt, og
5 hvor de første stabiliseringsribber (37) forløber i det væsentlige i fodens tværretning, og den i det mindste ene anden stabiliseringsribbe (37) forløber i det væsentlige i fodens længderetning.

10

3. Kompositskosål (105) ifølge krav 1 eller 2, hvor stabiliseringsgitteret (137) er udformet helt eller delvist som støtteelement.

15 4. Kompositskosål (105) ifølge et af de foregående krav, hvis stabiliseringsindretning (25, 119) er forsynet med i det mindste en åbning (135), som danner i det mindste en del af gennembrydningen (31) og er lukket med barrieremateriale (33).

20 5. Kompositskosål (105) ifølge et af de foregående krav, hvis stabiliseringsindretning (25, 119) har i det mindste en stabiliseringsramme (147), der i det mindste stabiliserer kompositskosålen (105).

25 6. Kompositskosål (105) ifølge krav 5, hvor stabiliseringsrammen (147) begrænser den i det mindste ene åbning (135), og stabiliseringsgitteret (137) forløber inde i åbningen.

30 7. Kompositskosål (105) ifølge et af de foregående krav, hvis i det mindste ene stabiliseringsindretning (25, 119) er udformet sådan, at i det mindste 15 % af arealet af kompositskosålen forfodsområde er vanddampgennemtrængelig, og/eller hvis i det mindste ene stabiliseringsindretning (25, 119) er udformet
35 sådan, at i det mindste 15 % af arealet af kompositskosålen mellemfodsområde er vanddampgennemtrængelig.

8. Fodtøj med en kompositskosål (105) ifølge et af kravene 1

til 7, hvilket fodtøj har et skaft (103), som på et endeområde af skaftet (219) på sålsiden er forsynet med et vandtæt og vanddampgennemtrængeligt funktionslag (247) af skaftbunden, hvor kompositkosålen (105) er forbundet sådan med det 5 endeområde af skaftet, der er forsynet med skaftbundens funktionslag (247), at skaftbundens funktionslag (247) i området ved den mindste i det mindste ene gennembrydning (31) ikke er forbundet med barrierematerialet (33).

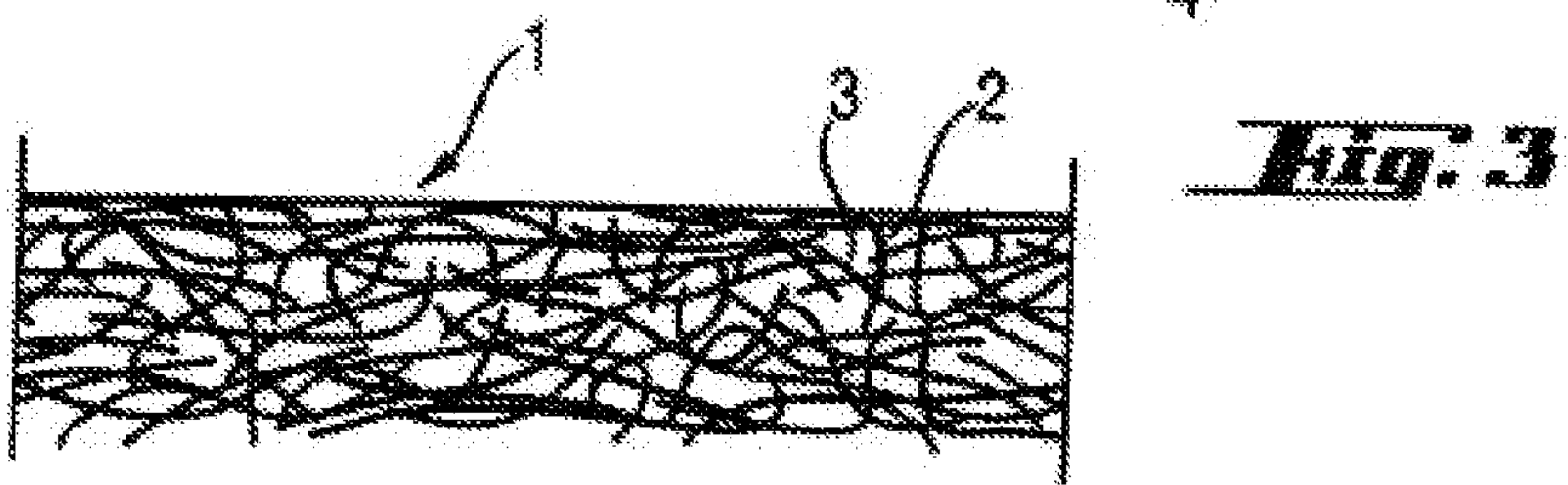
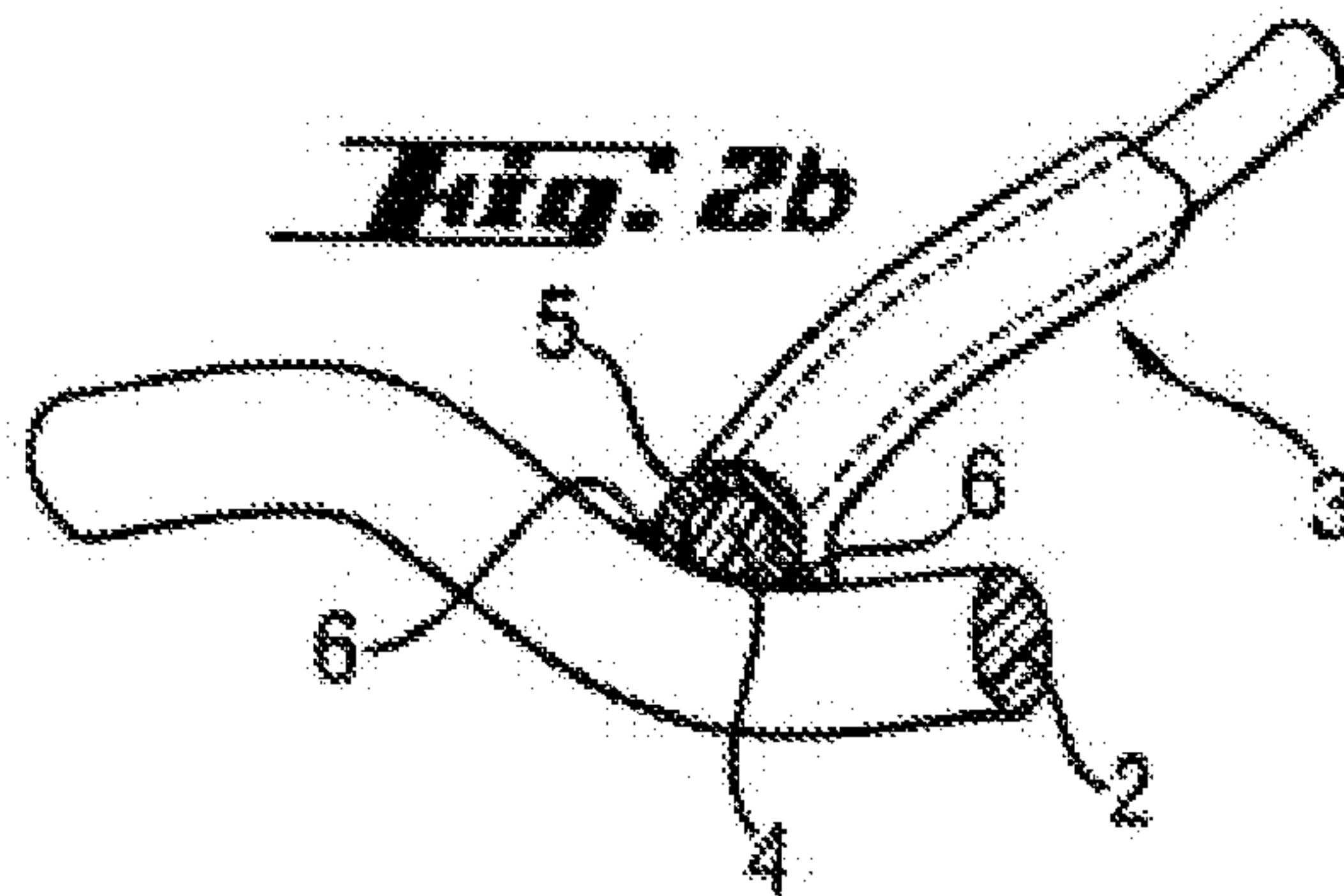
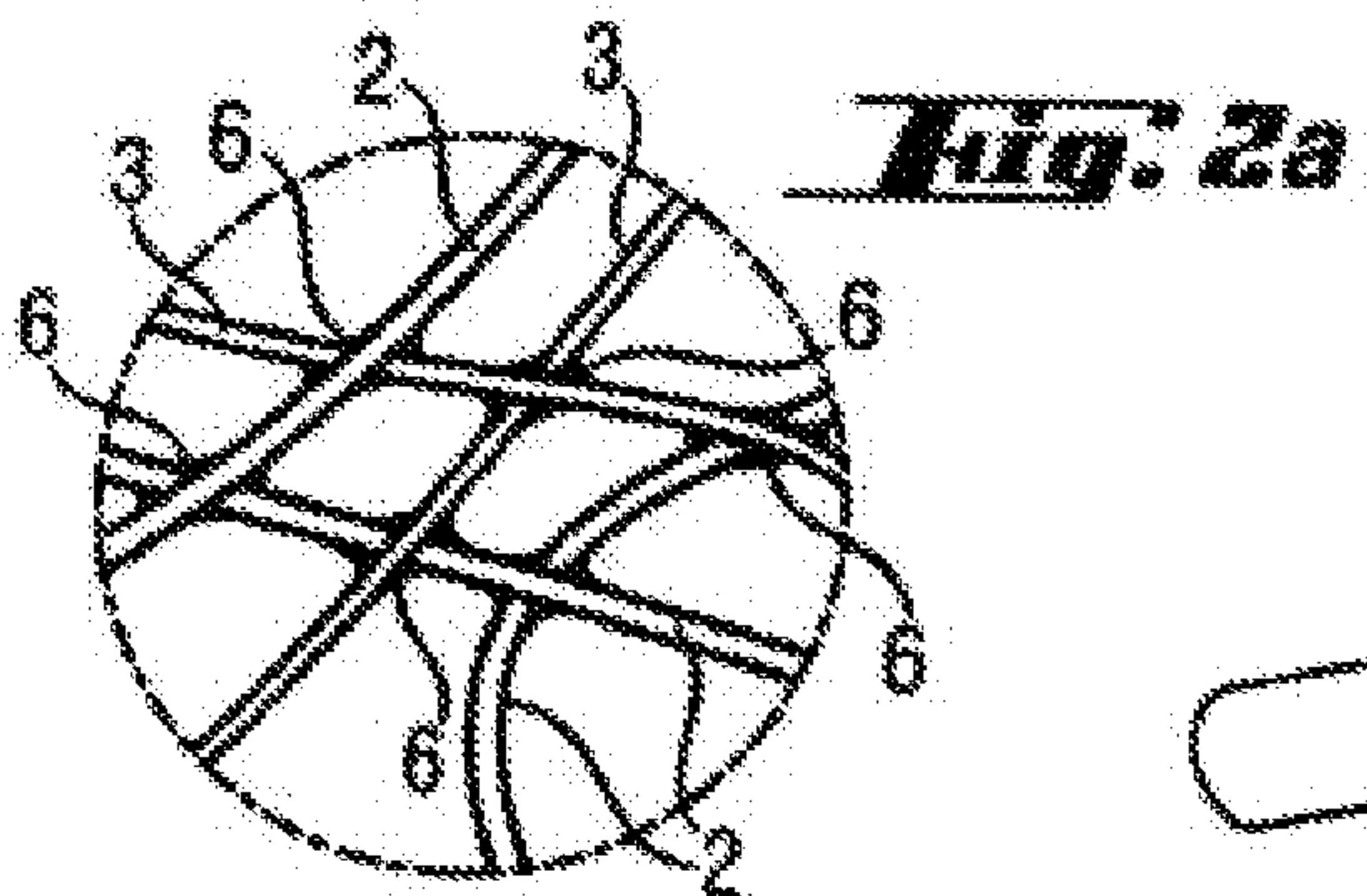
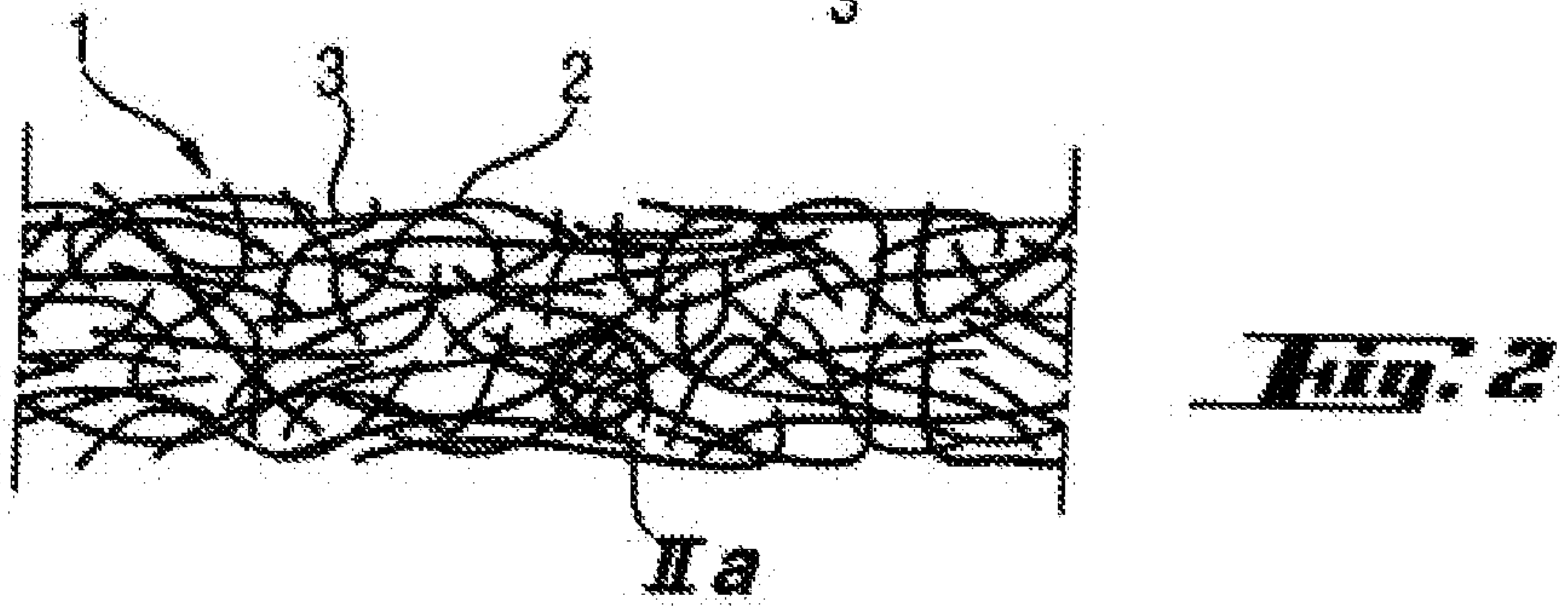
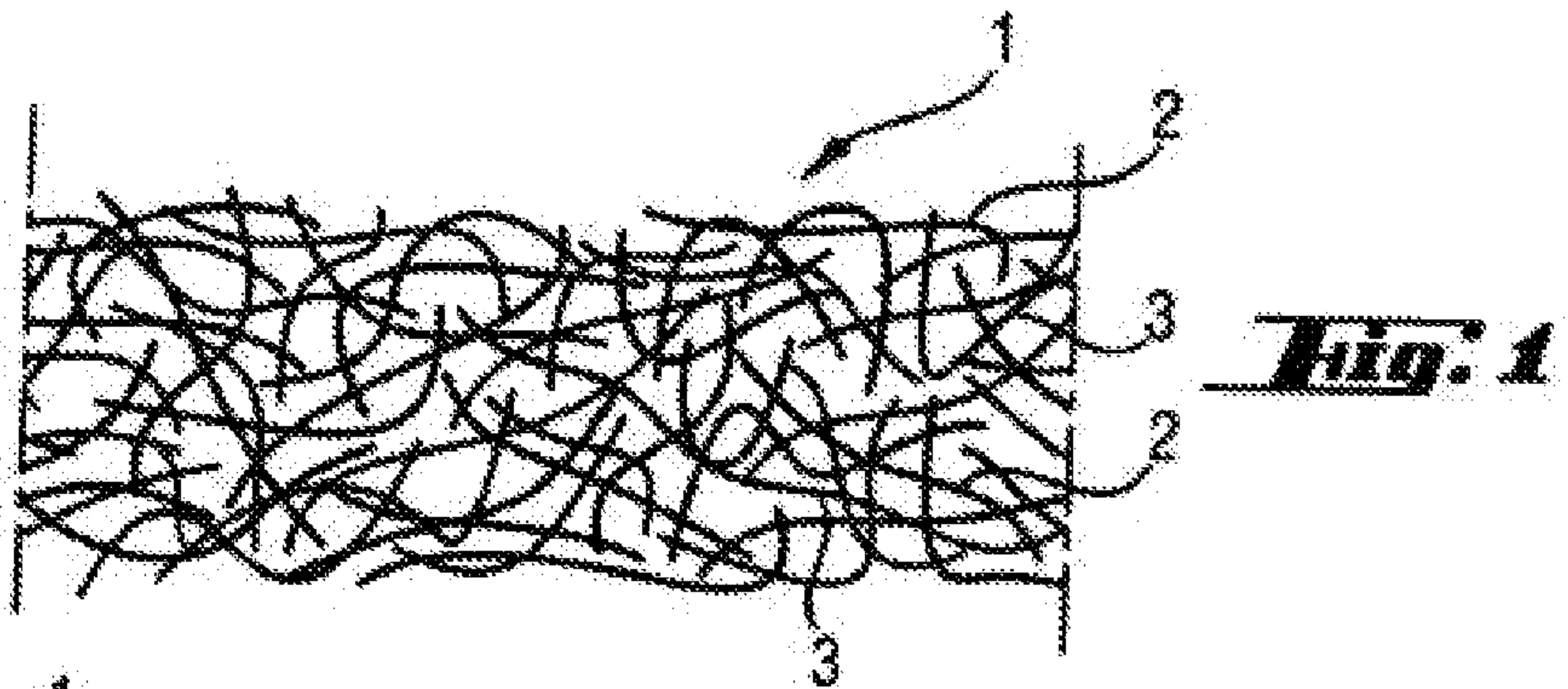


Fig. 4

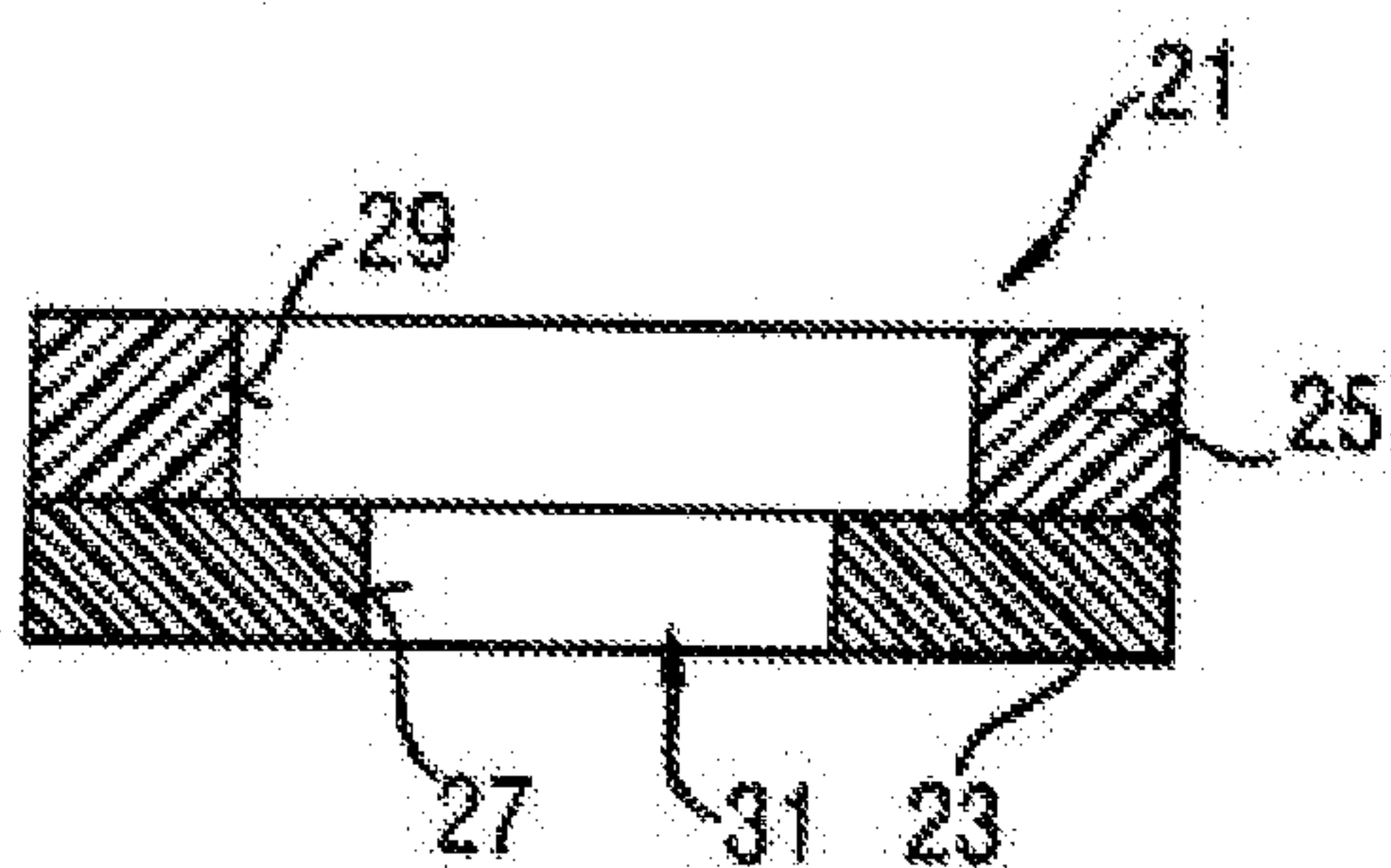


Fig. 6

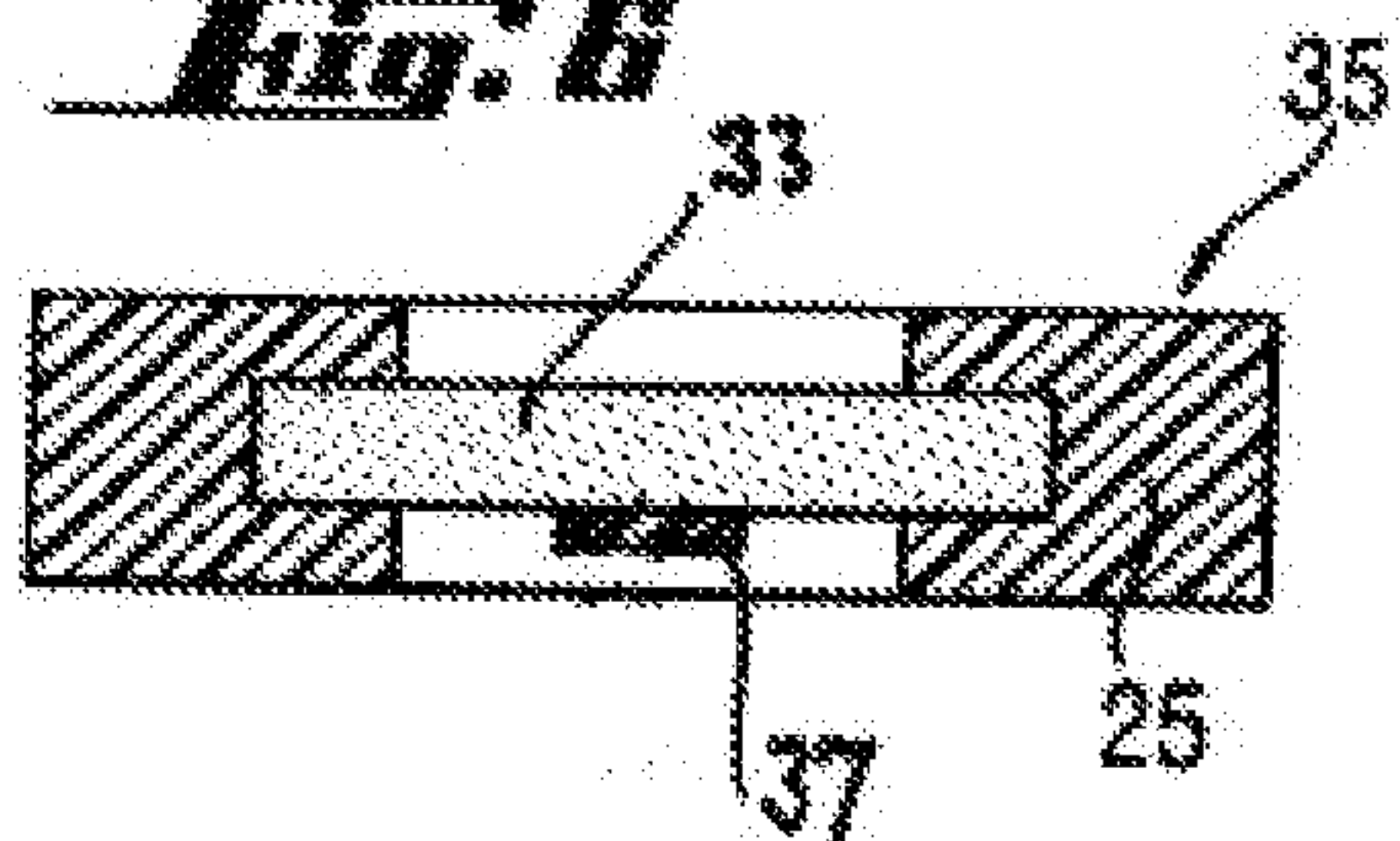


Fig. 5

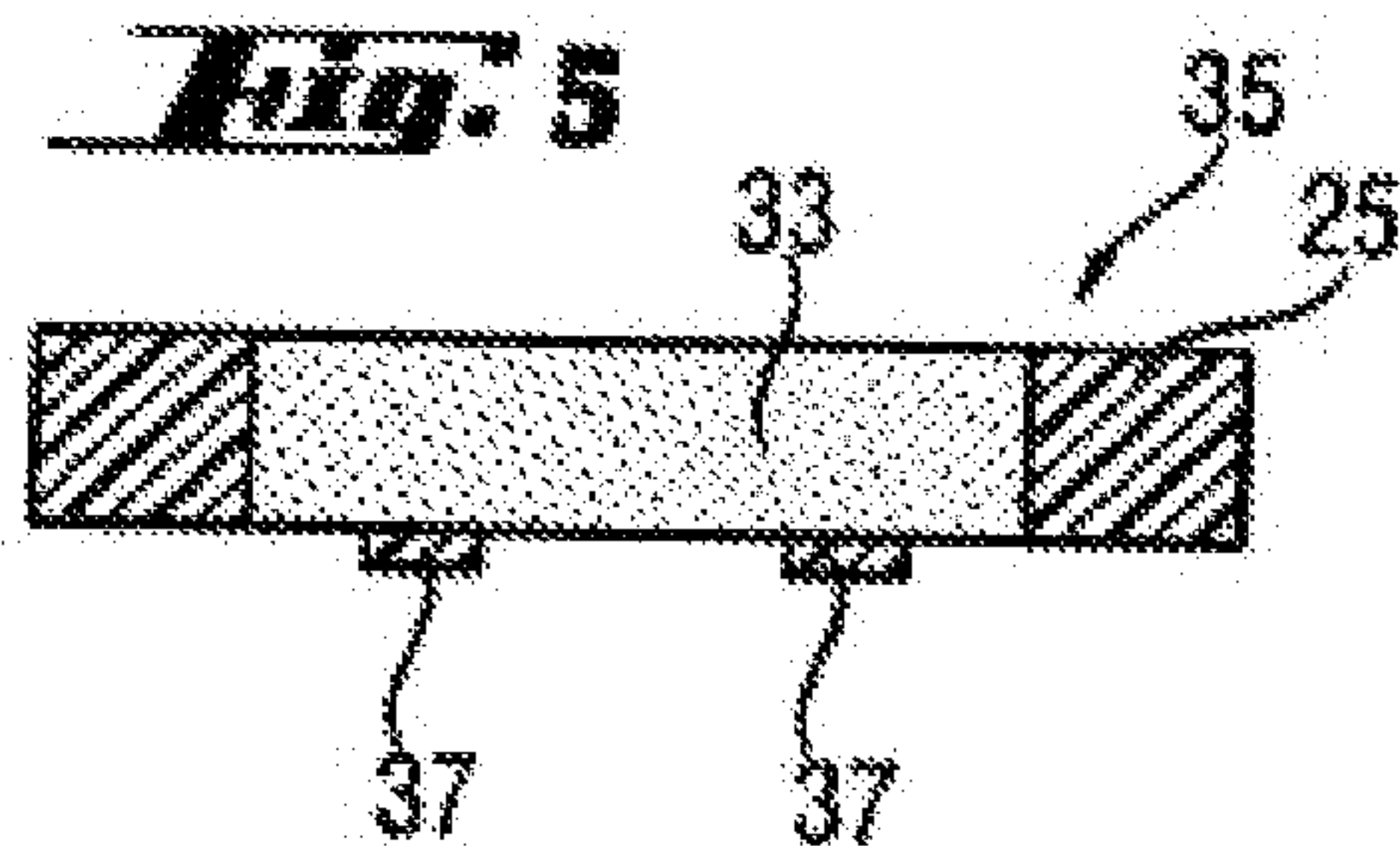


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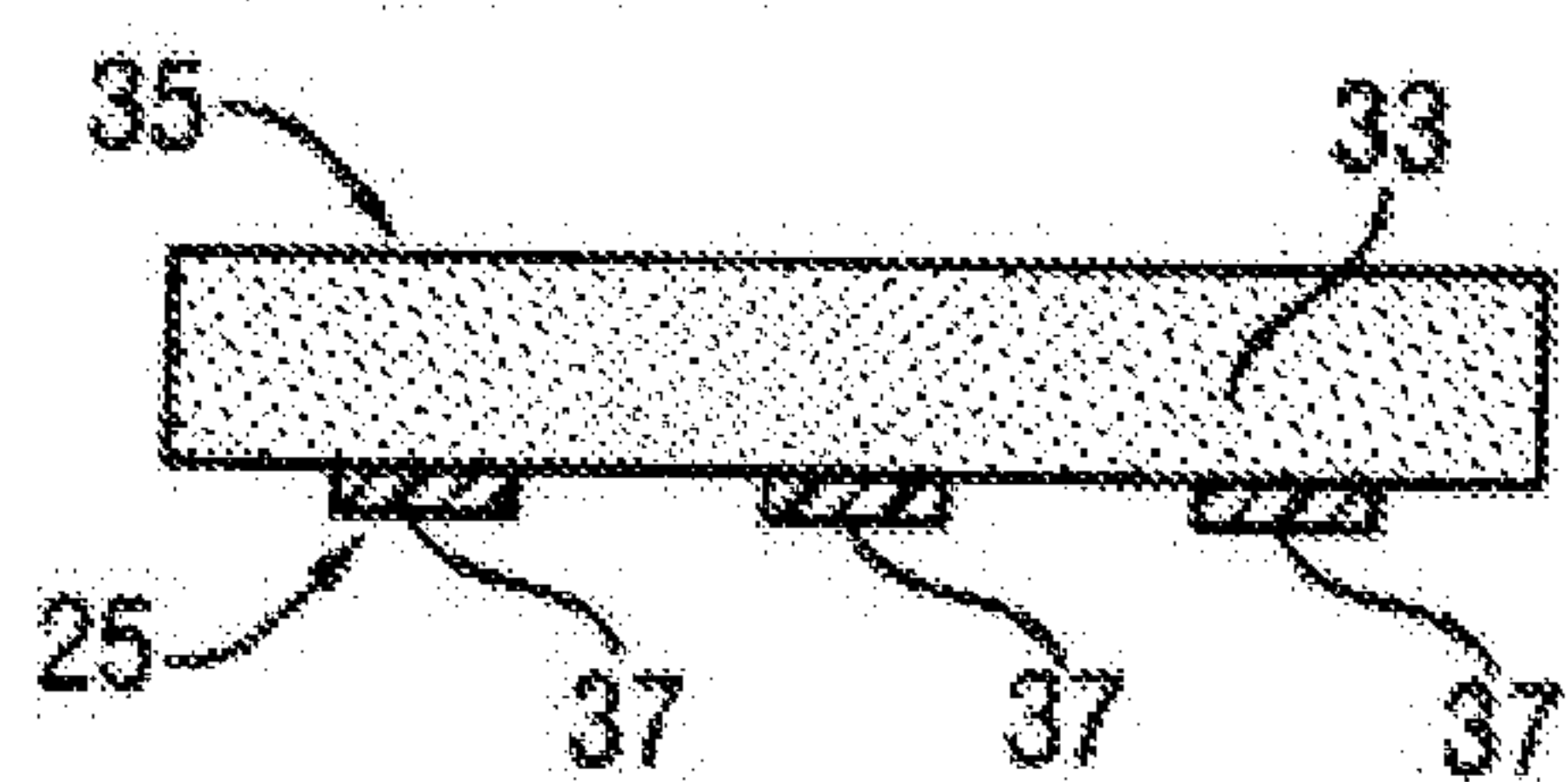


Fig. 8

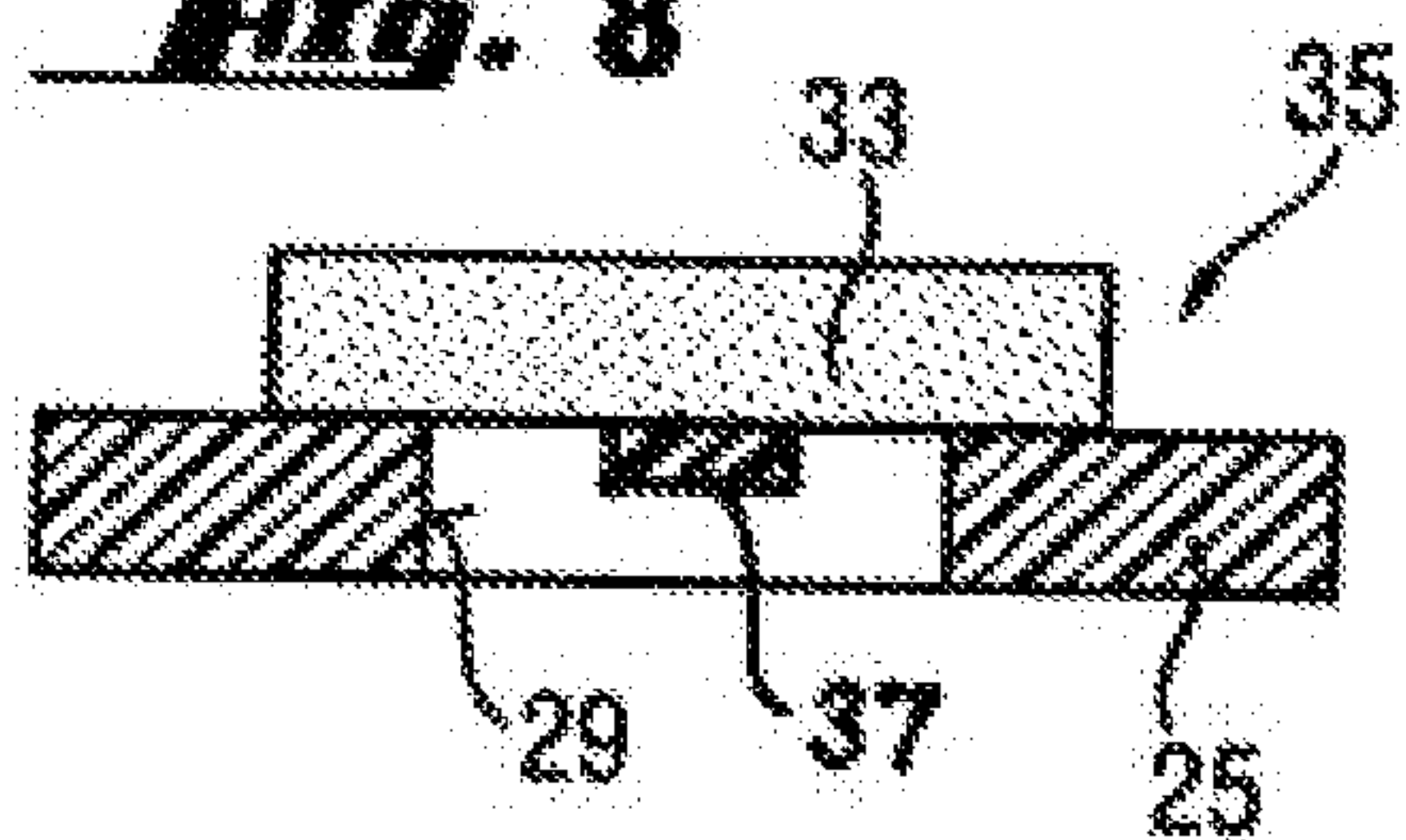


Fig. 9

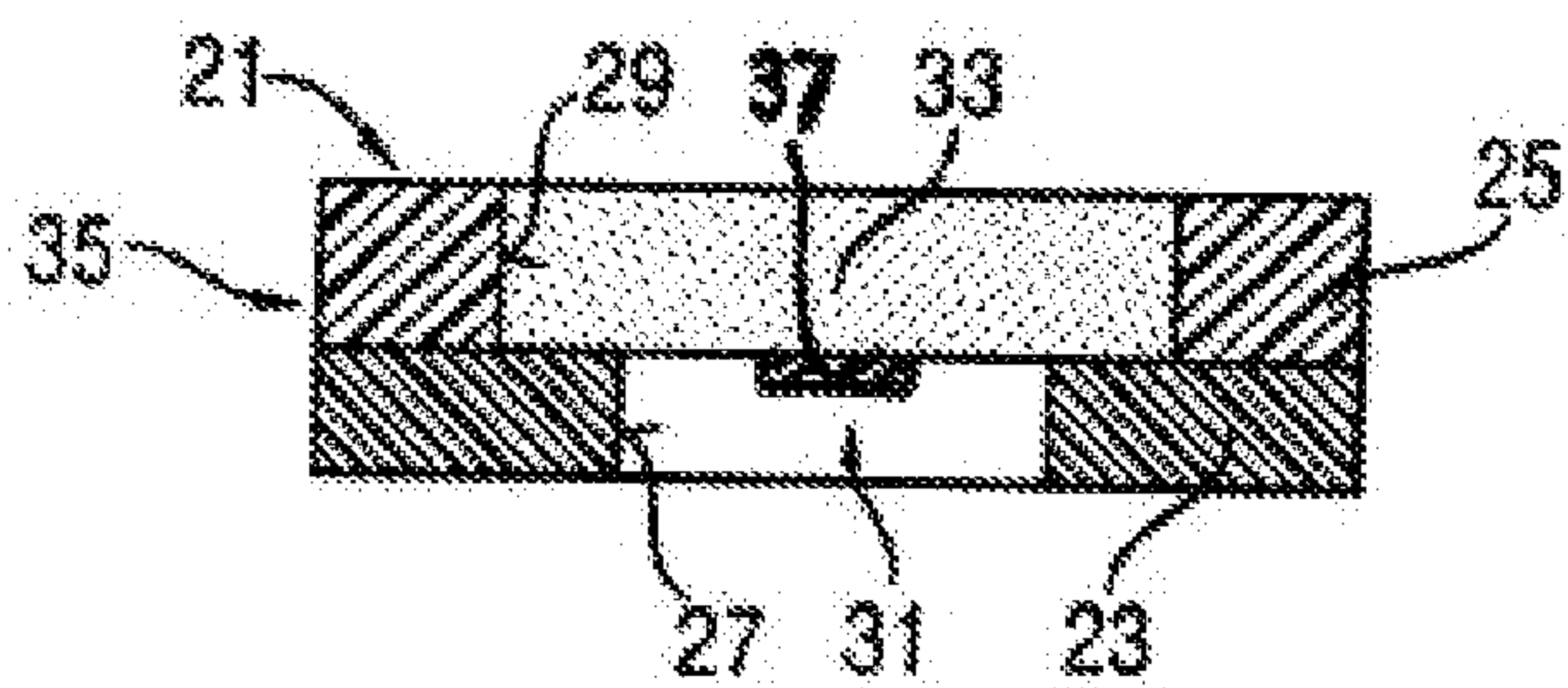
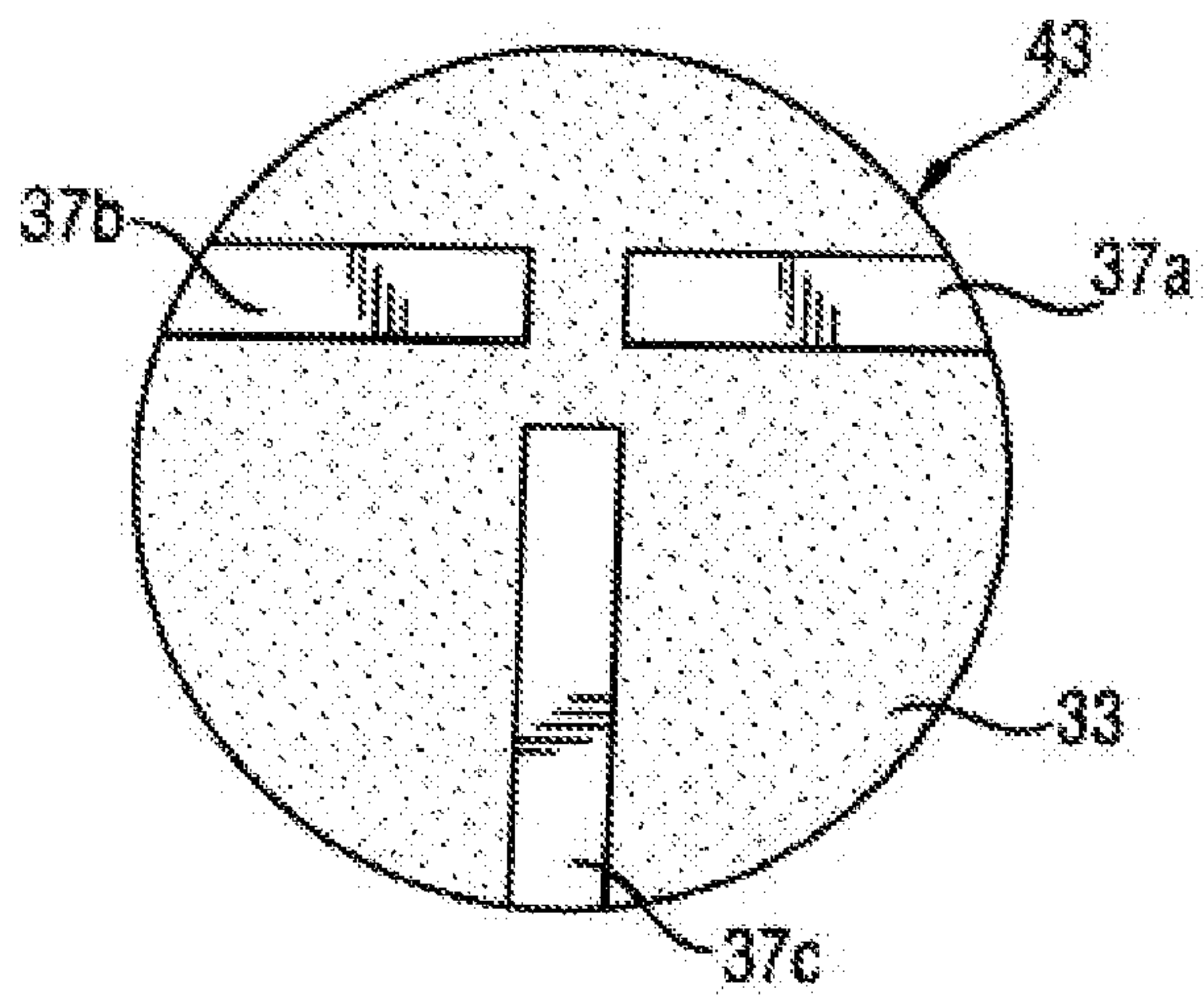
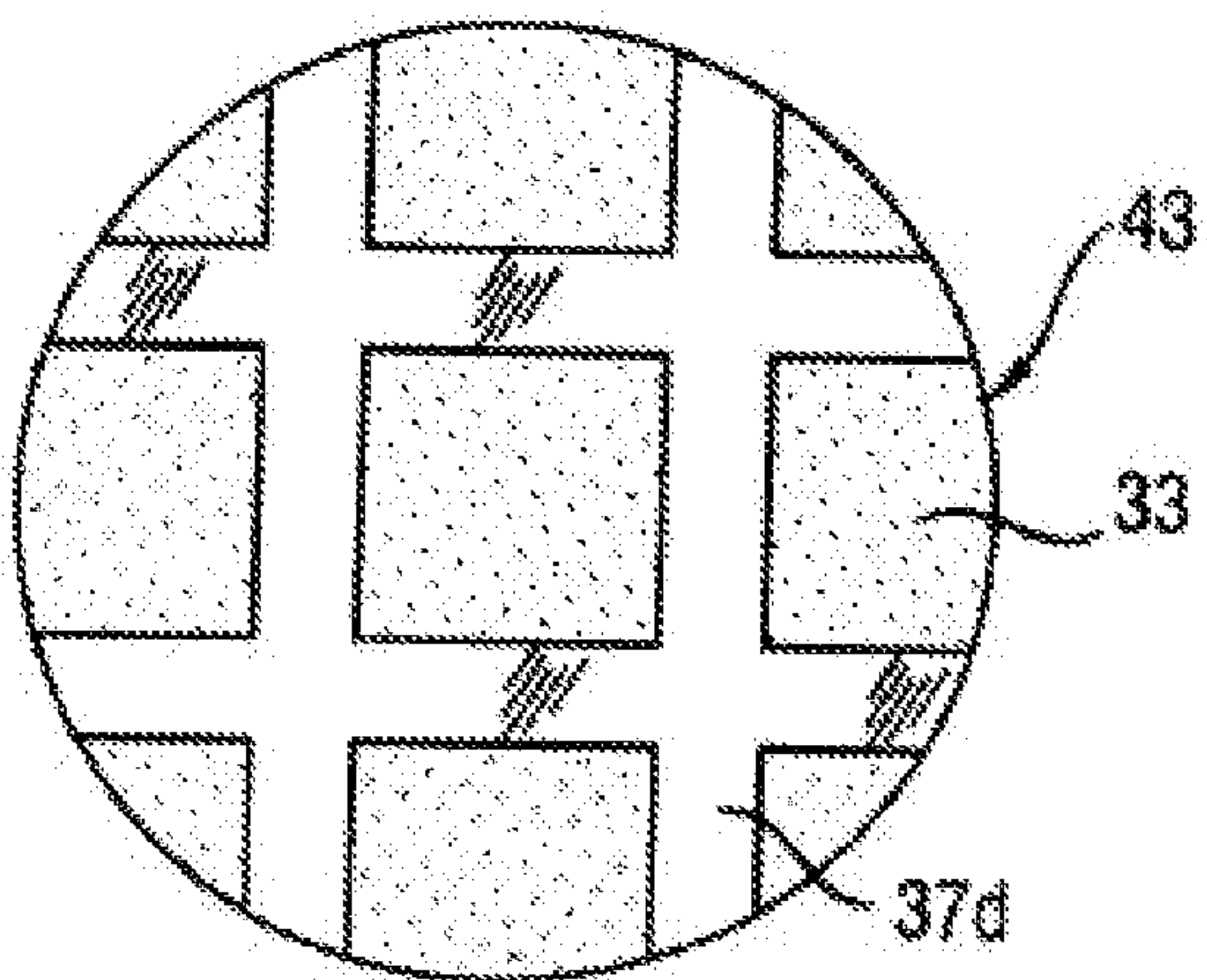


Fig. 10***Fig. 11***

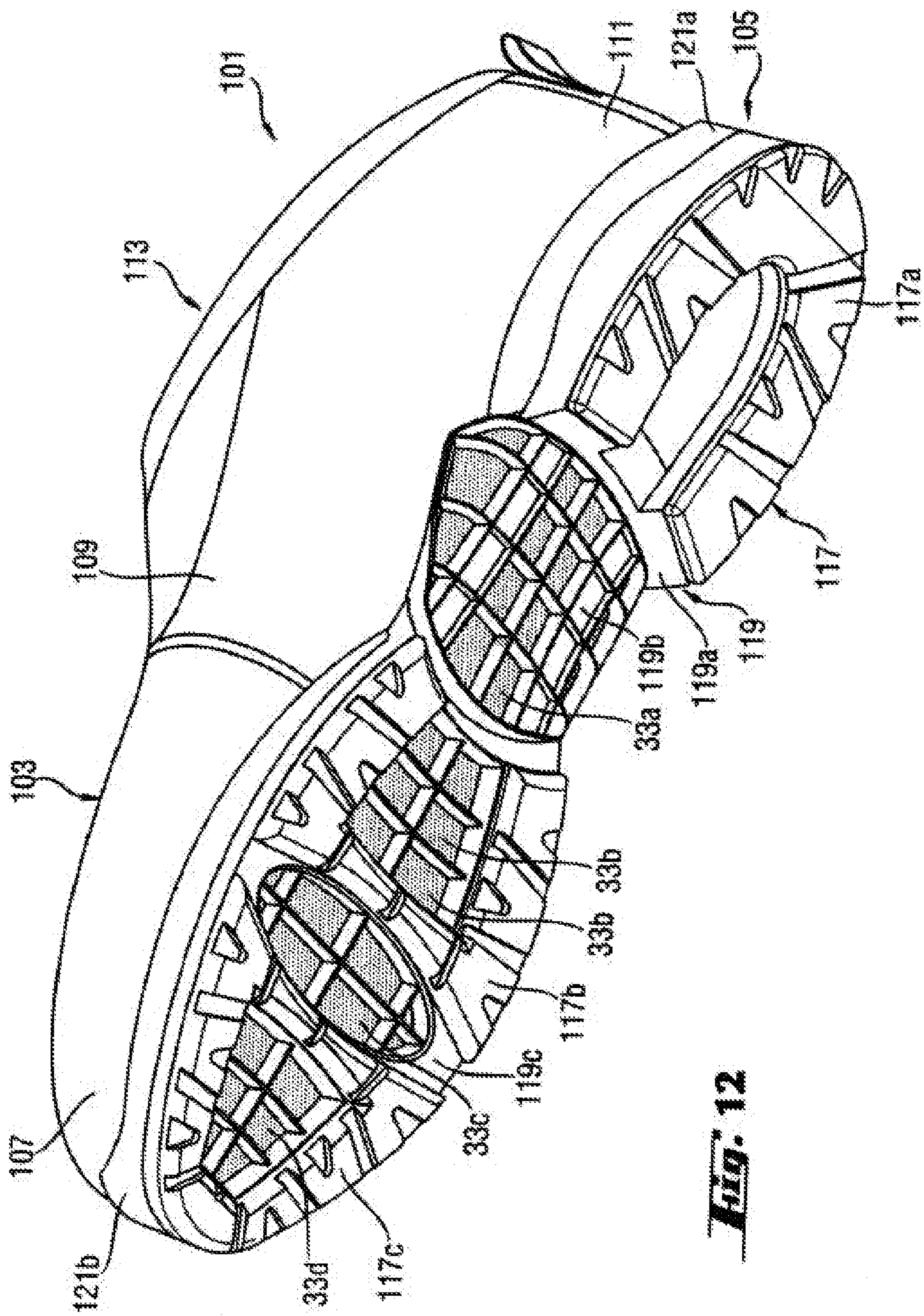


Fig. 12

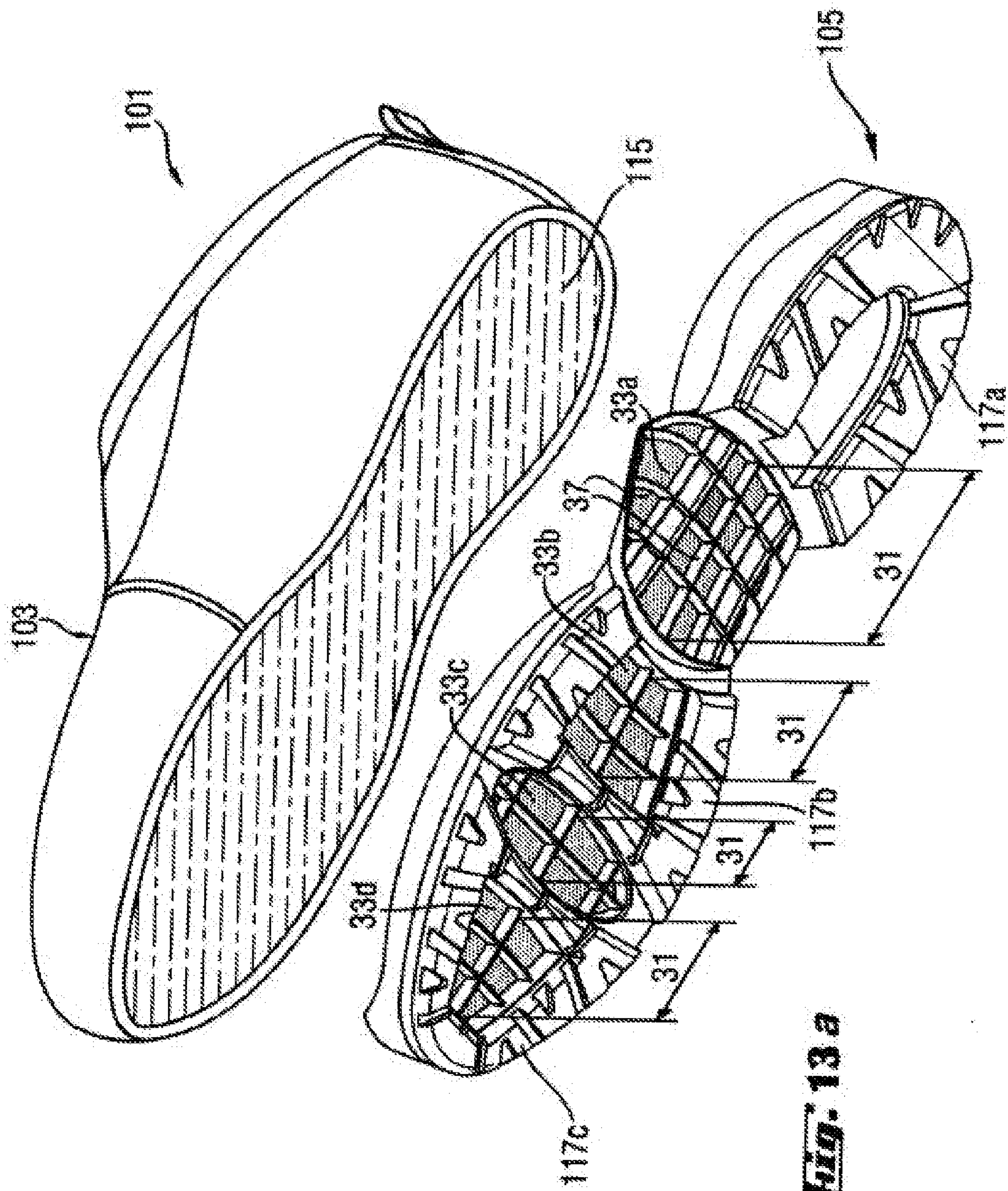


Fig. 13 a

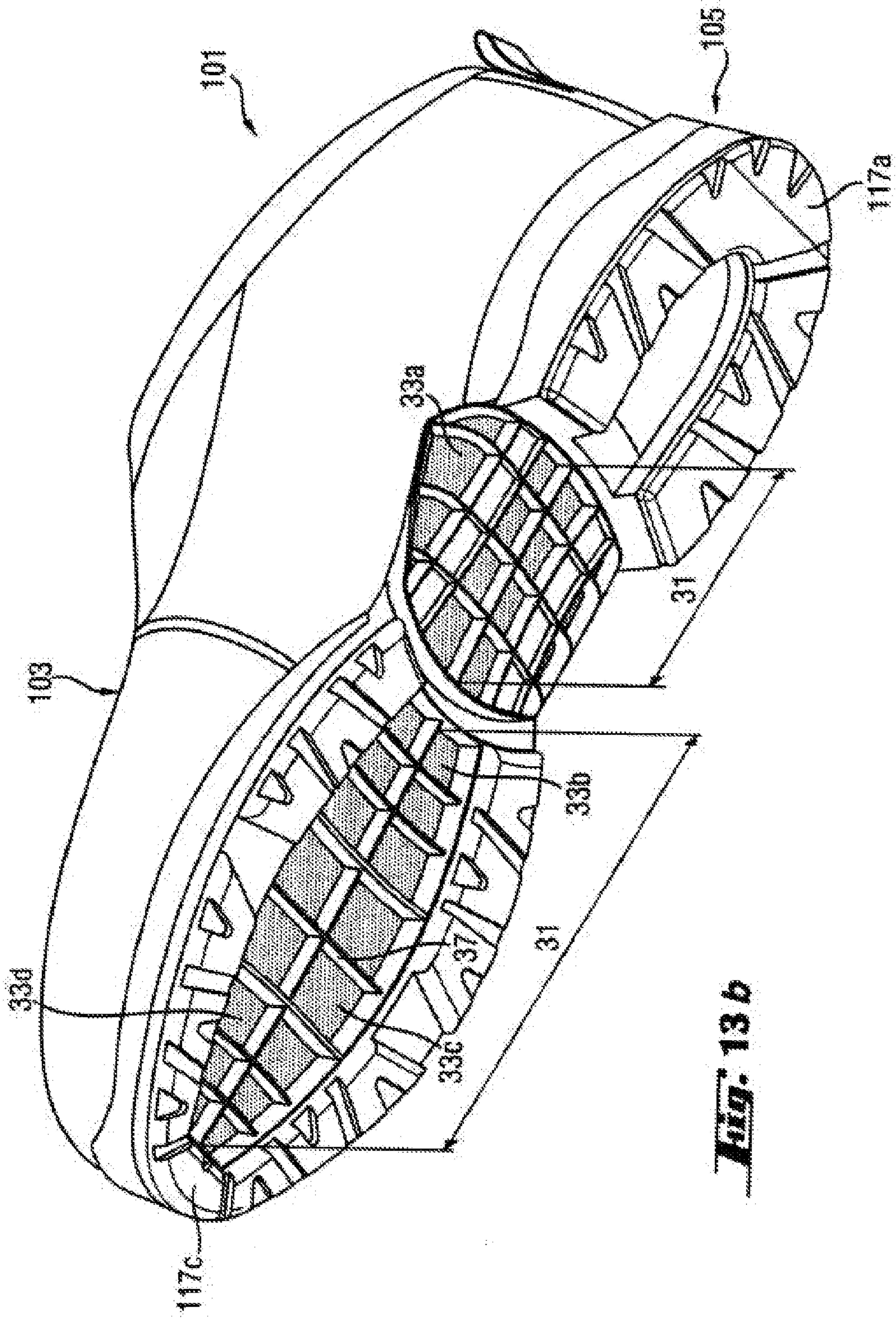


Fig. 13 b

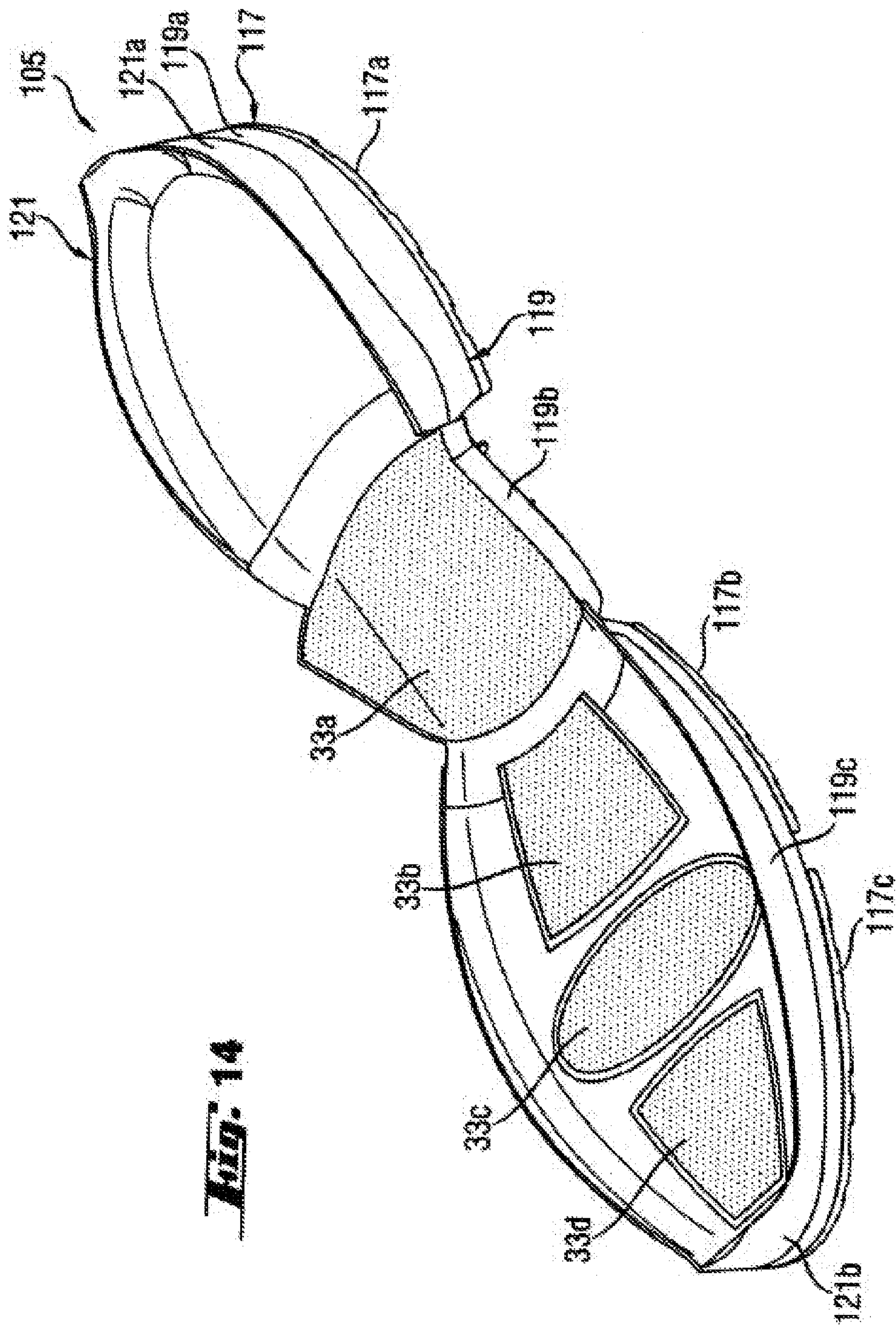
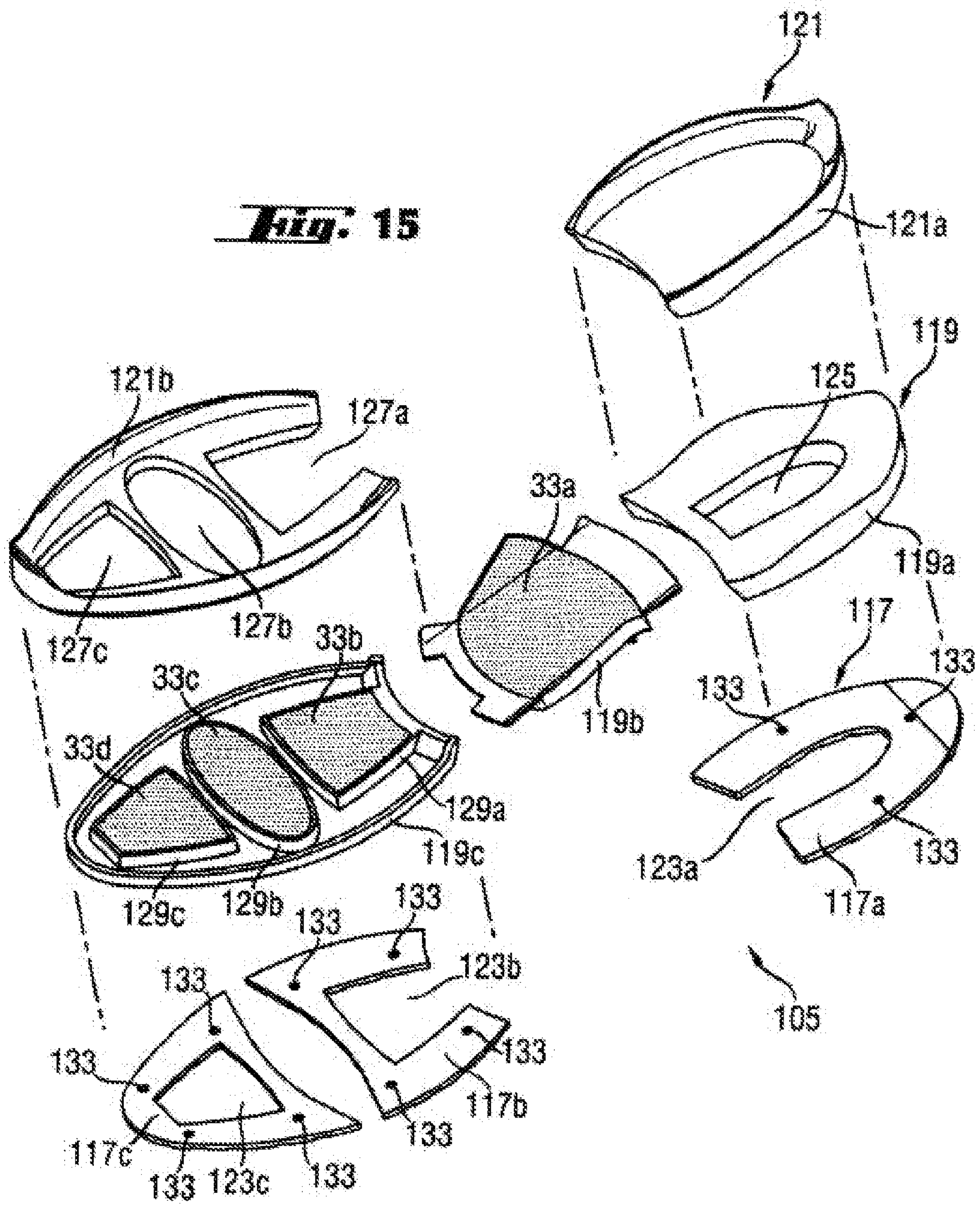


Fig. 14

Fig. 15



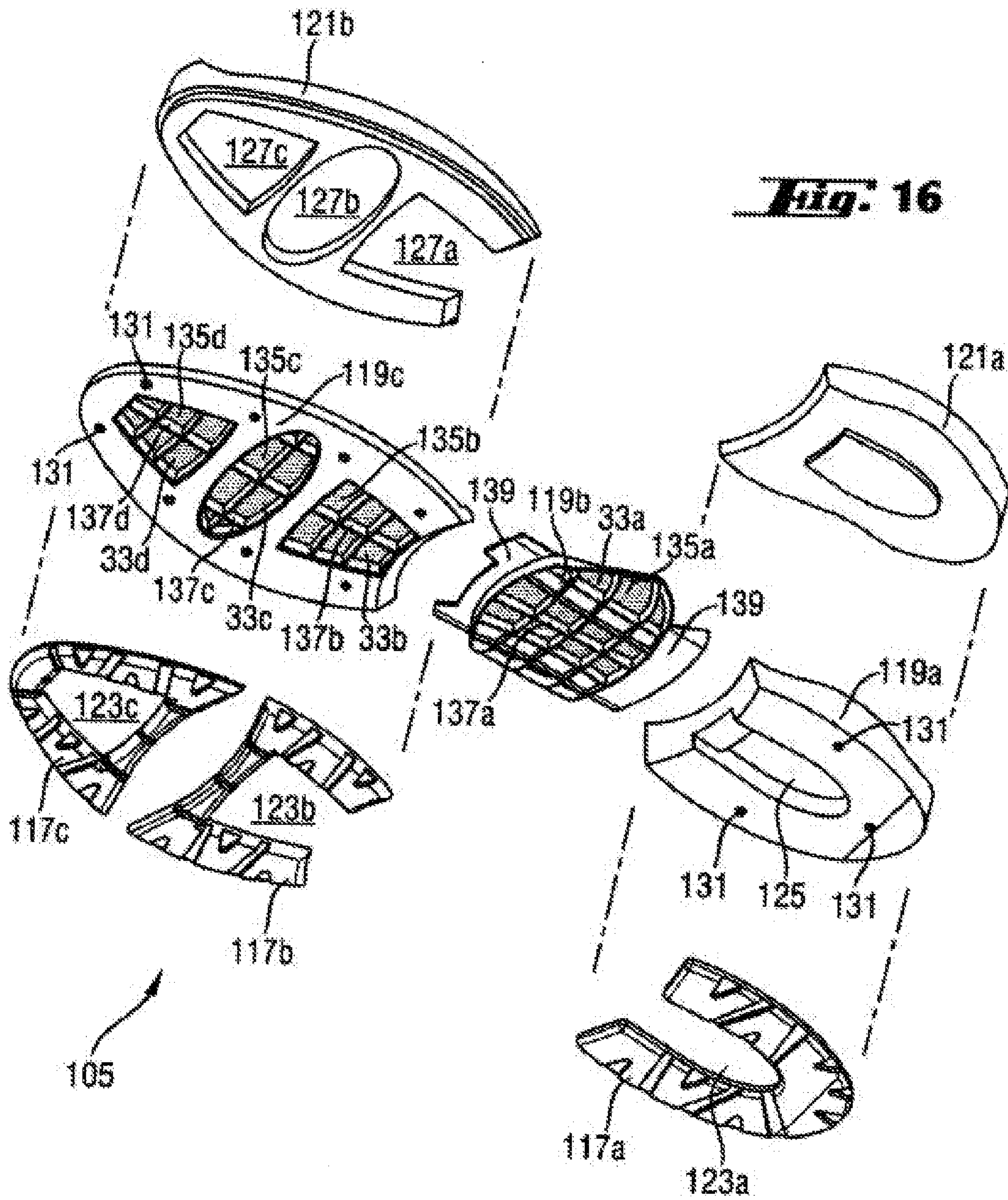


Fig. 17

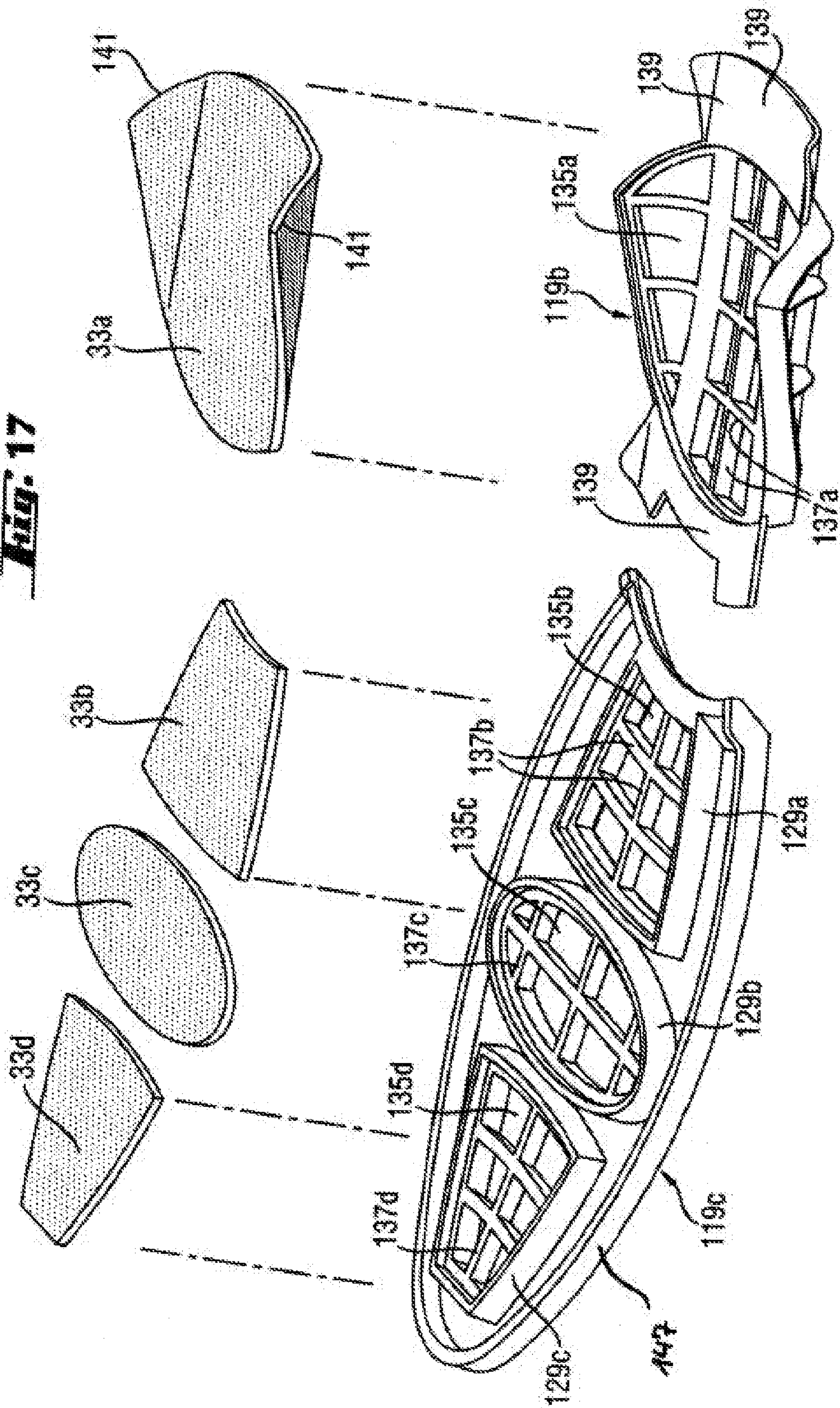


Fig. 18

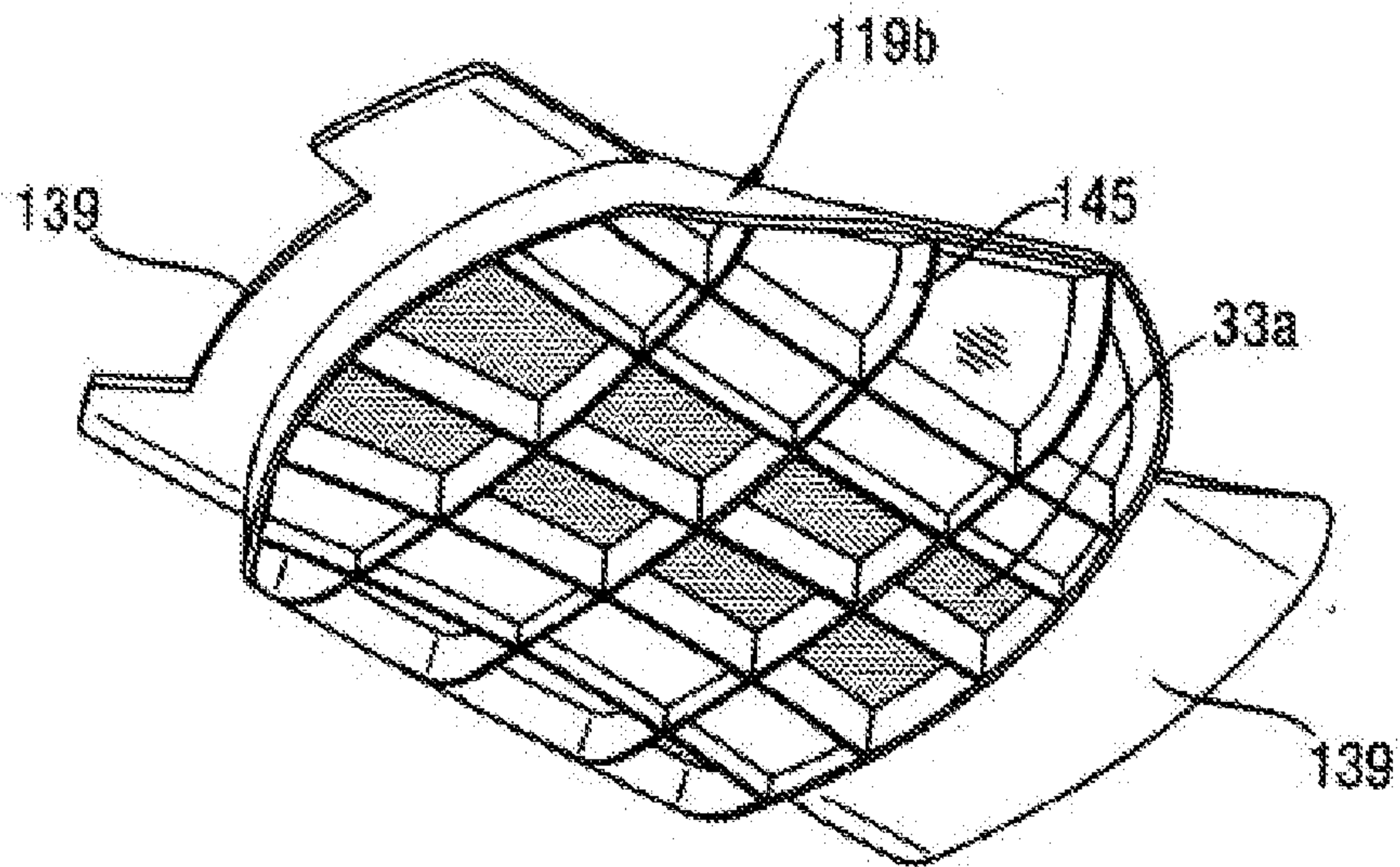
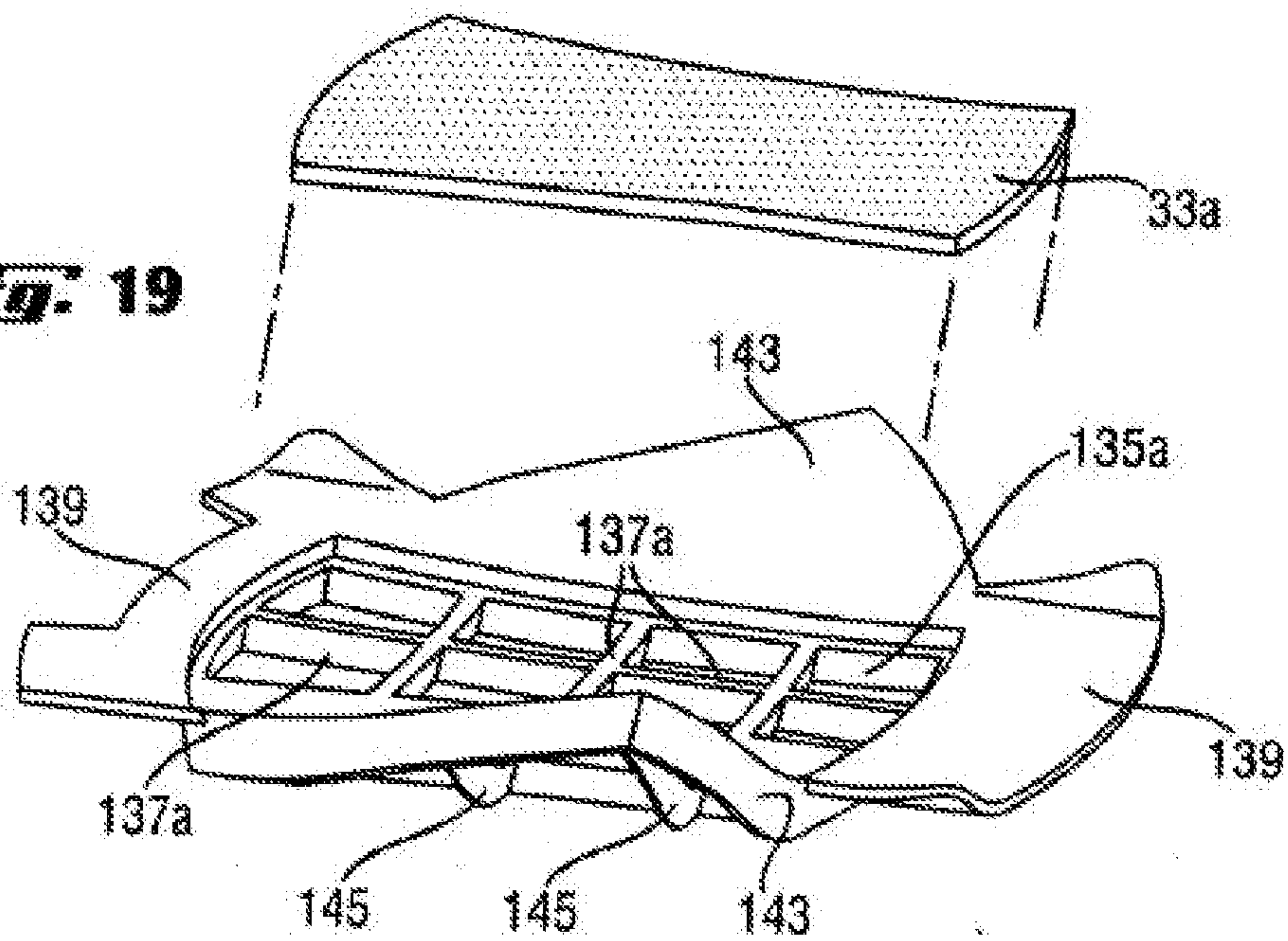


Fig. 19



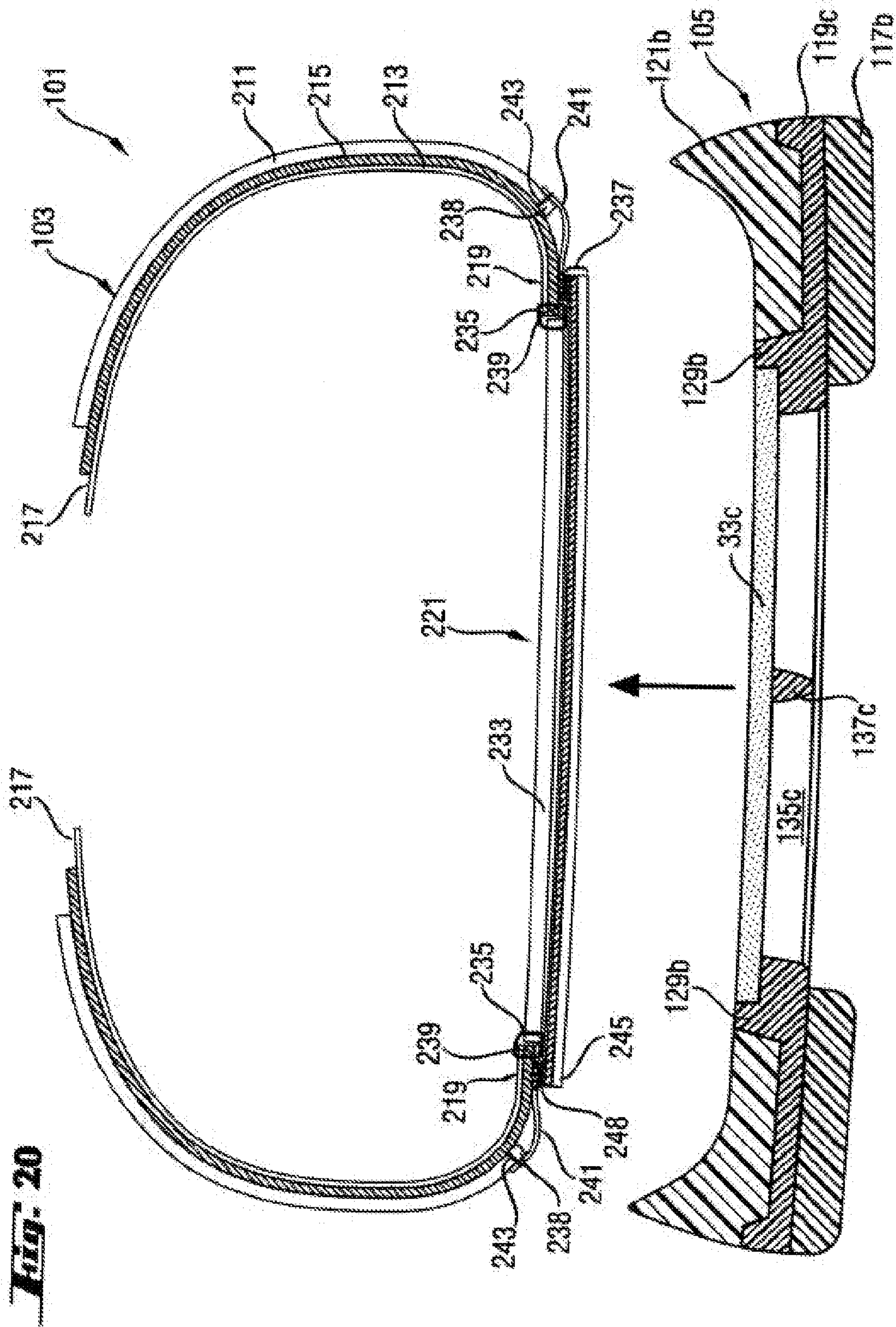
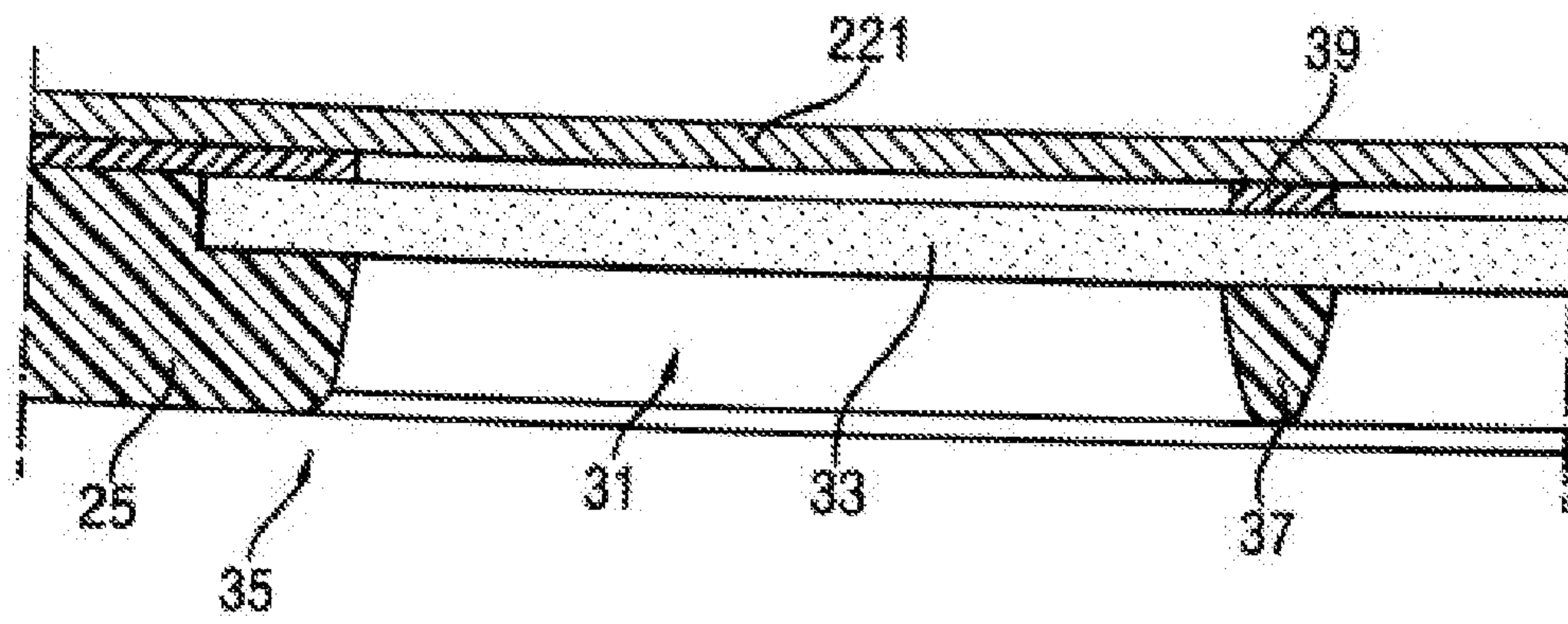
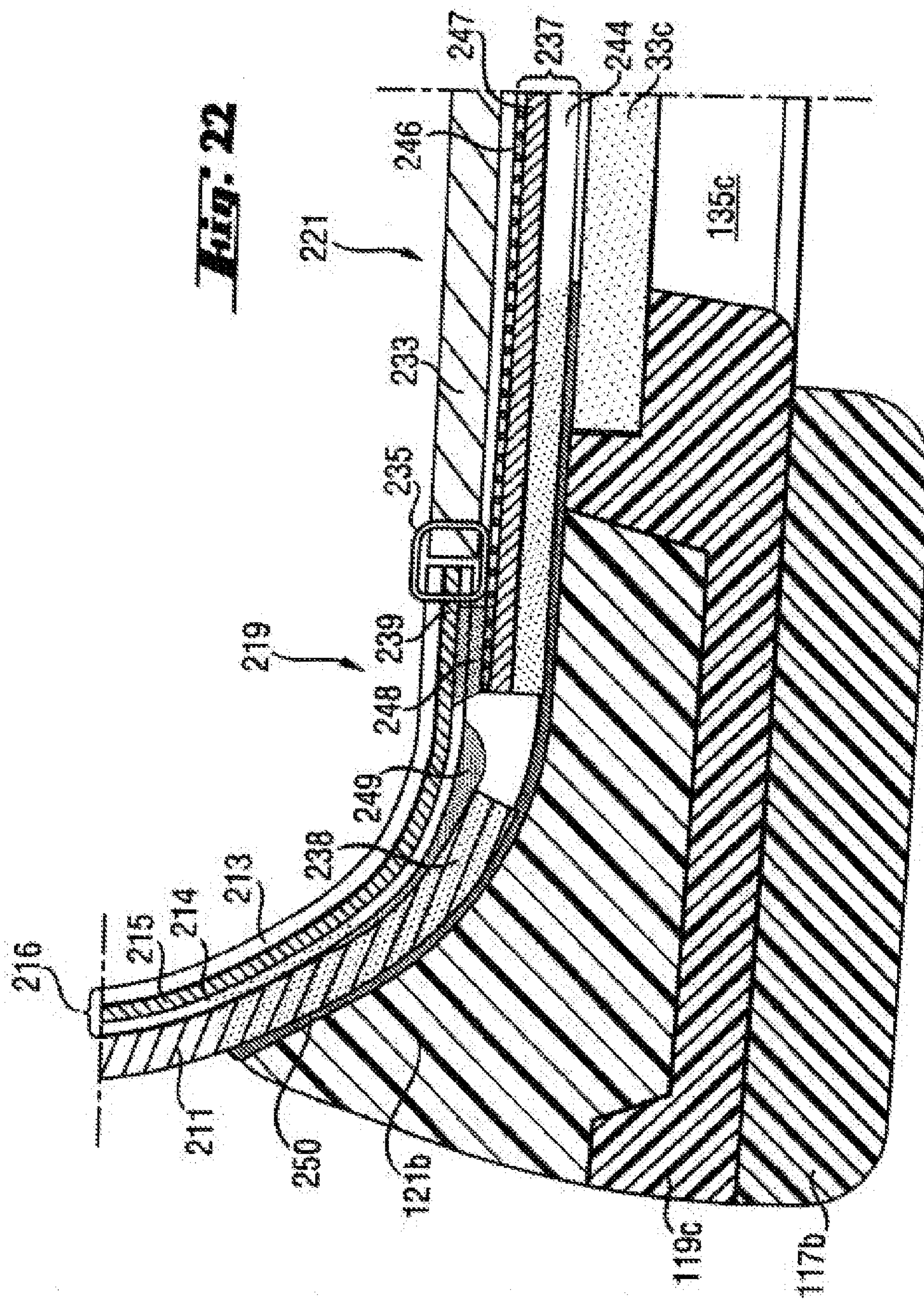
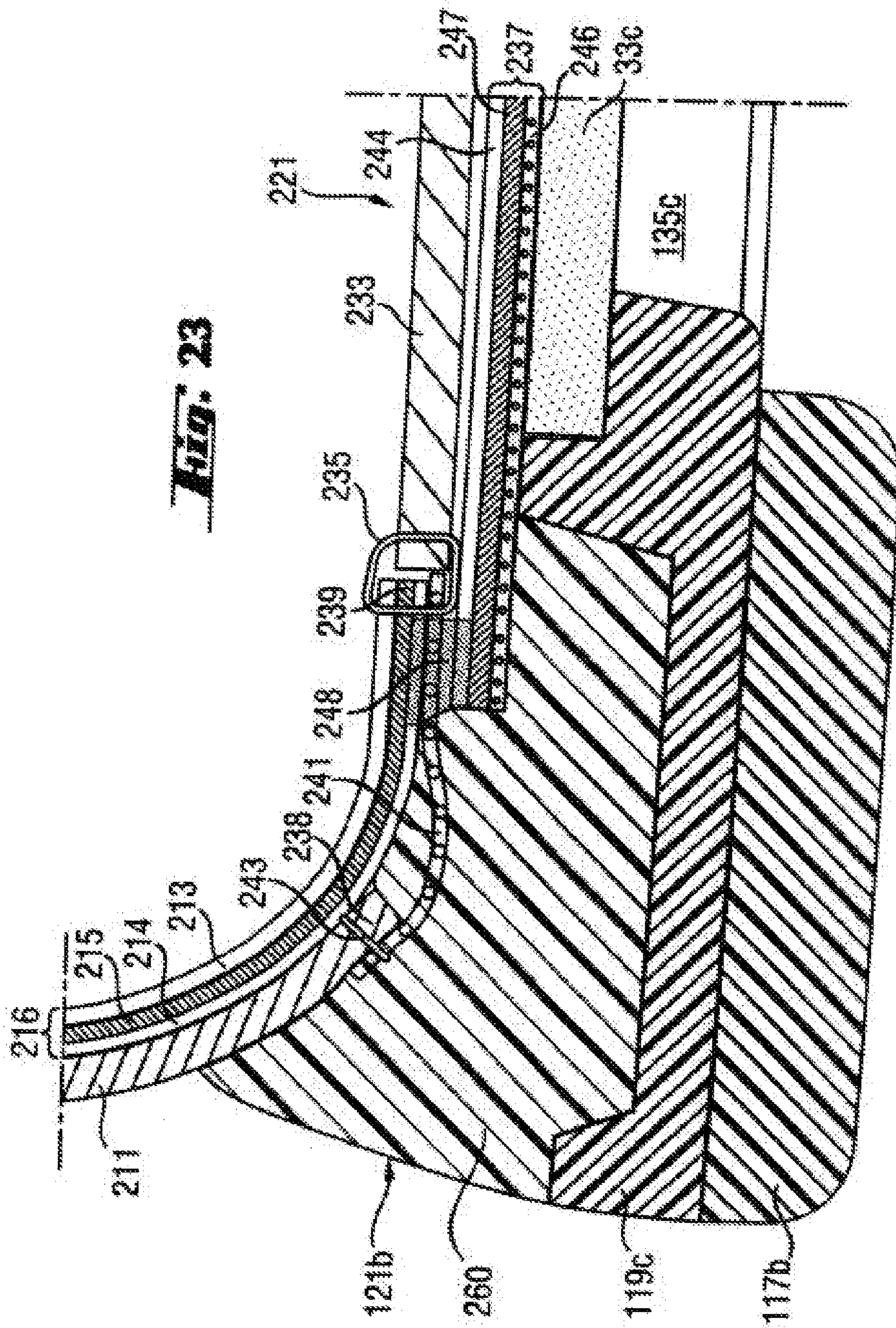
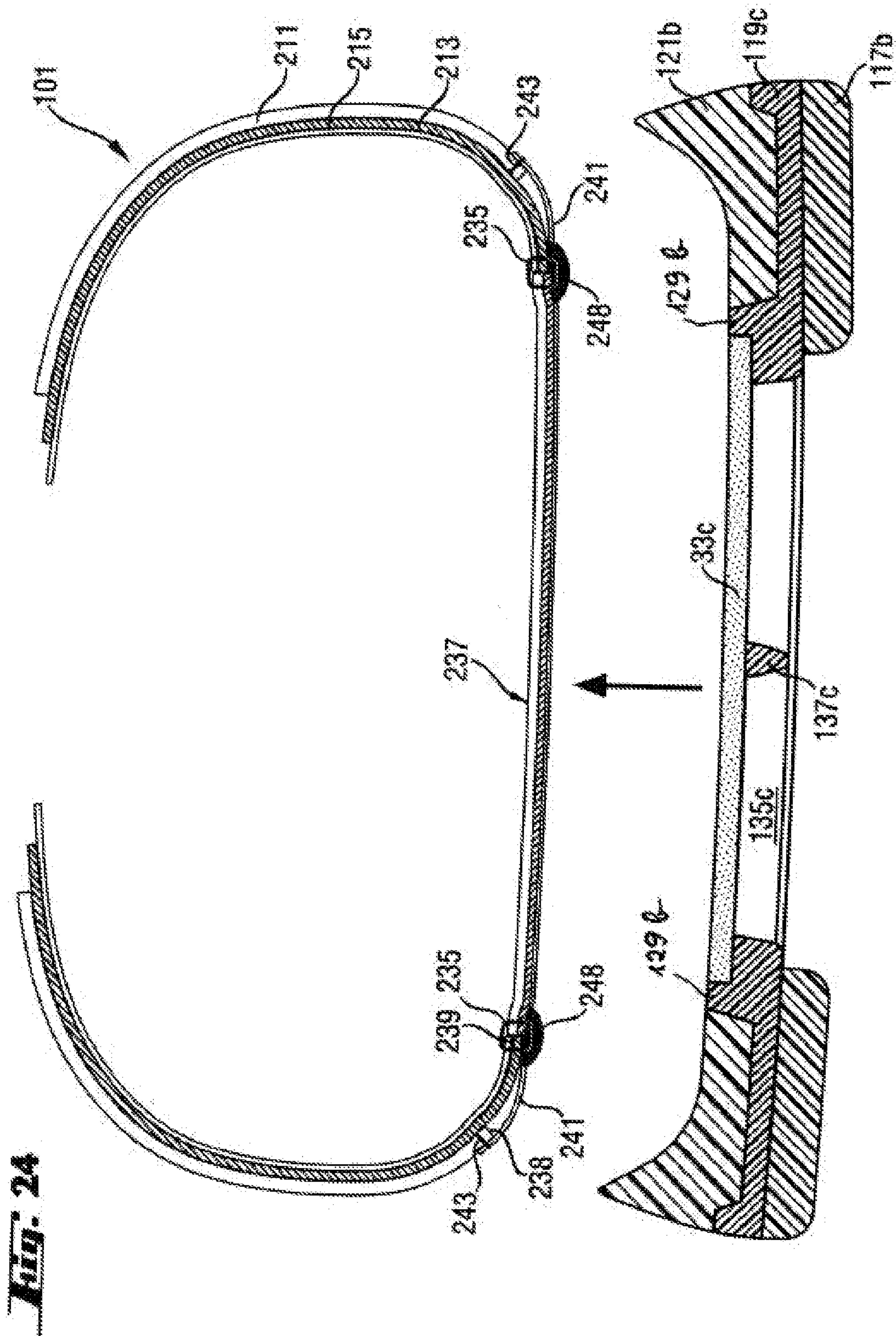


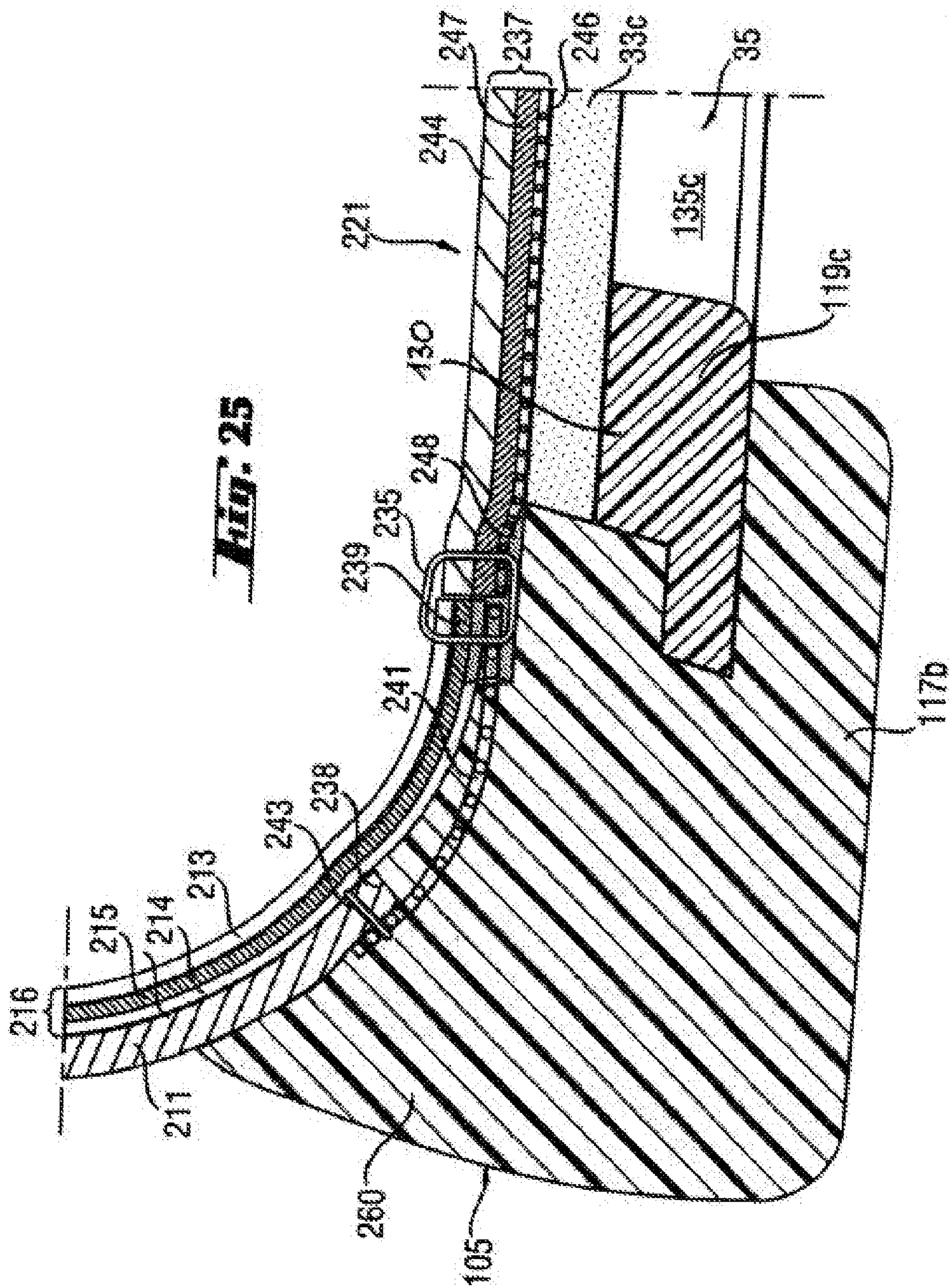
Fig. 21

44-22









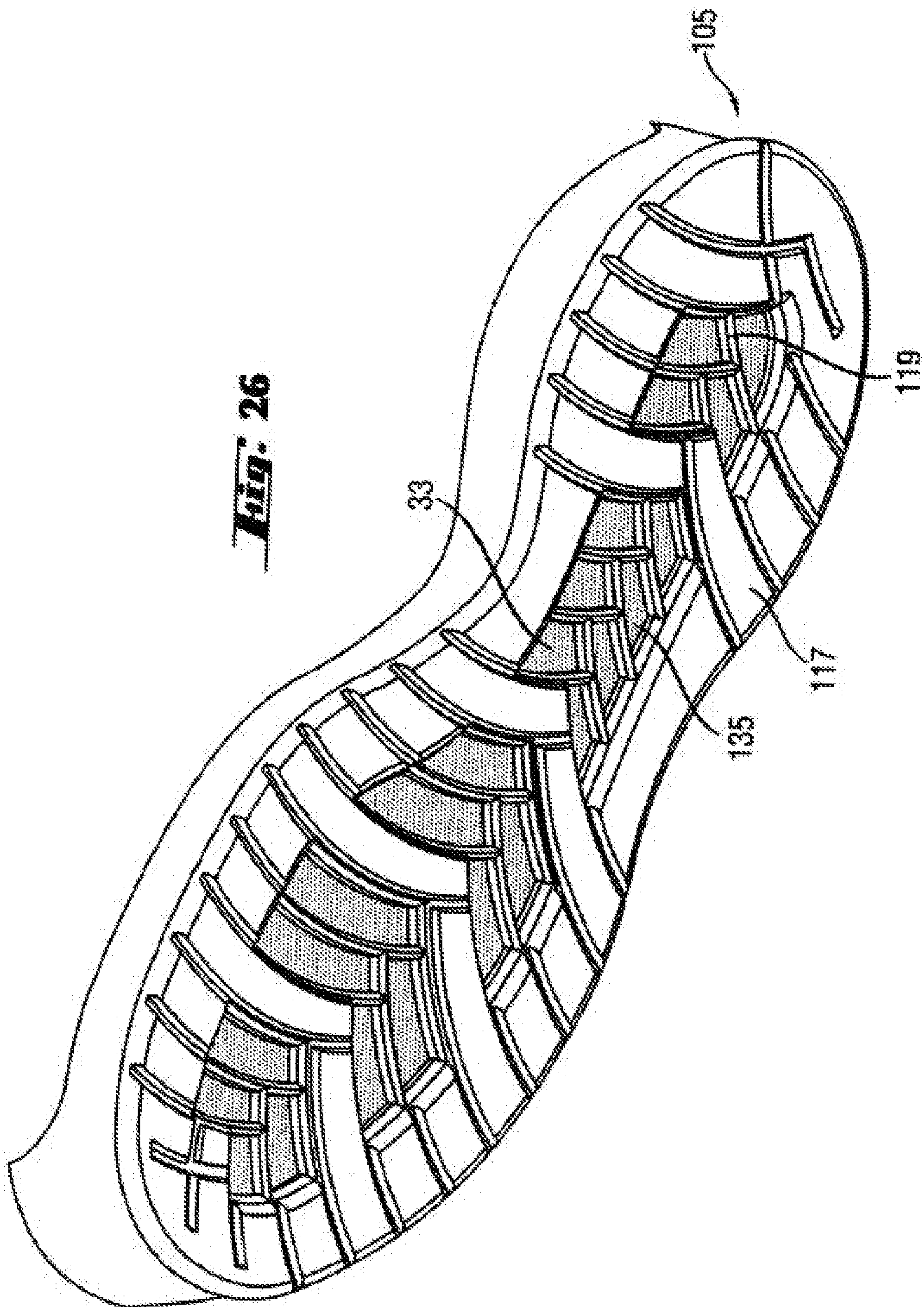


Fig. 27