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(54) SHOE, IN PARTICULAR A SPORTS SHOE

(57) Shoe (100), in particular a sports shoe, comprising a sole (110), in particular a midsole, and a heel counter (120), wherein the heel counter (120) is not attached to a top surface (112) of the sole (110).

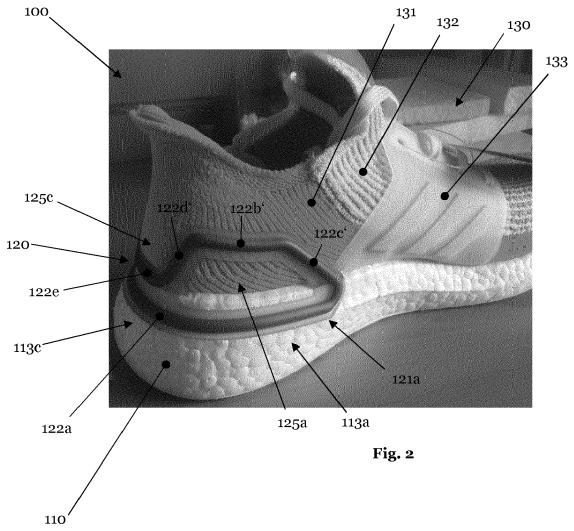


Fig. 2

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Description

1. Technical field:

[0001] The present invention relates to shoes, in particular, sports shoes.

2. Description of the prior art:

[0002] Shoes generally comprise an upper and a sole. To increase support and stability shoes can further comprise a heel counter.

[0003] A sole of a shoe can perform many functions, for example, protecting the wearer's sole and providing a stable base upon which the wearer's foot can rest. In particular, in sports shoes, soles may further provide cushioning. When used for sports energy return of the sole may be maximised to help the wearer reduce their energy exertion. Soles may also support or partly guide the posture and movements of the wearer during movements, for example, the movement of a gait cycle.

[0004] Numerous designs of shoe soles are known which aim to fulfil some or all of the above functions. A particularly well-suited sole, especially for sports shoes, may be provided by the technology known from, e.g., EP 2 649 896 B1, EP 2 786 670 A1, EP 2 767 183 B1, EP 2 767 181 A1 and EP 2 845 504 B1. This technology provides particle foam materials that exhibit characteristics markedly advantageous and desirable for soles, especially soles for sports shoes. Such materials distinguish themselves by very good cushioning properties and a good elasticity and high energy return. They may at the same time be lightweight and their properties remain essentially independent of temperature over an expected use range.

[0005] The basic function of a heel counter is to provide better positioning and stability to the foot within the shoe. In particular, a heel counter may prevent the foot from slipping off the sole, for example, during lateral movements. In order to correctly maintain the wearer's heel position on the sole, in particular, on the sole of a sports shoe, the heel counter requires a strong attachment to the sole. To achieve this aim, one common solution is to attach the heel counter to the sole via a rigid flange portion on the heel counter that is attached to a top surface of the sole in the region under the heel of the wearer.

[0006] US 2018/0199665 A1 relates to a sole structure for an article of footwear.

[0007] US 2018/0110292 A1 relates to a device that is configured to surround a portion of a foot-receiving cavity at a heel region of an article of footwear.

[0008] US 2006/0010718 A1 discloses an article of footwear that includes a sole assembly, an upper secured to the sole assembly, a heel counter secured to the upper, and a heel pad removably attached to an inner surface of the heel counter.

[0009] However, in known shoes the locating and supporting of the wearer's heel and the wearing comfort of the shoe are not optimal.

[0010] It is therefore desirable to provide a shoe, and in particular, a sports shoe, that effectively locates and supports the wearer's heel on the sole of the shoe while ensuring optimal comfort.

3. Summary of the invention:

[0011] The above need is at least partly met by a shoe according to independent claim 1.

[0012] In an example, a shoe, in particular, a sports shoe, comprises a sole, in particular, a midsole, and a heel counter, wherein the heel counter is not attached to a top surface of the sole.

[0013] Thus, a shoe may be provided which stabilizes the heel, but in which no portion of the heel counter is arranged on the top surface of the sole (i.e., a projection of the wearer's foot onto the sole that is essentially perpendicular to the ground). Thus, the top surface of the sole may remain free from the heel counter, such that the heel counter does not interfere with the interaction between the wearer's foot, in particular the wearer's heel (comprising amongst other features, the calcaneus), and the sole of the foot. The inventors have realized that the location of the heel counter between the heel of the wearer and the sole, as usual in the prior art, prevents the foot of the wearer from lying on a uniform substrate, which reduces the comfort and the overall cushioning provided by the sole material, in particular, when the sole material is a particle foam material. In contrast, a shoe according to the invention may allow the wearer to fully feel the sole and, in particular, its cushioning and energy return, even in the region under his or her heel. This is highly desirable since the region under the heel may experience the largest forces, especially when doing sports where the impact forces are high. Thus, the shoe may decrease fatigue and limit peak loads experienced throughout the body, while increasing the wearer's agility and speed, such that overall performance and comfort may be improved. Therefore, it would benefit wearers of shoes and, in particular, those shoes that are worn during high impact activities, for example, running. It is noted that the sole may furthermore remain free from the heel counter altogether below the foot of the wearer (for example, in a portion of the sole defined by projecting the wearer's foot through the sole onto the ground).

[0014] The heel counter may be (essentially rigidly) attached to the side surface of the sole. Additionally or alternatively, the heel counter may be attached directly to the side surface of the sole.

[0015] The heel counter not being attached to the top surface or attached to the side surface may allow for improving the manufacturing process through attaching the heel counter during a later stage of the manufacturing process which leads to increased efficiency and improved quality (it is understood that the heel counter and sole may be fabricated separately and subsequently joined).

[0016] Furthermore, bonding the sole and the upper at an earlier stage in the manufacturing process, when compared to the prior art method of attaching the heel counter before bonding the sole and upper, may provide the opportunity to customise the heel counter selection on the shoe. The heel counter may be attached after joining the shoe and upper so that it is possible to pre-assemble the main body of the shoes and then later attach a selectable heel counter. This provides the opportunity to produce a base range of main body shoes and then alter the final performance of the product by attaching heel counters with different properties, for example, fit, stability, weight etc under one manufacturing process. Furthermore, it is also possible that a shoe produced according to the aforementioned manufacturing process is customisable by selecting the heel counter according to individual properties, for example, the desired degree of stability and/or intended use or sports activity.

[0017] Providing such a shoe may allow joining of the sole and the heel counter at a later point in the manufacturing process. For example, the heel counter may be joined to the sole after the sole and the upper of the shoe have been joined, as opposed to the state of the art in which the two generally need to be joined together early in the production process. For example, the heel counter may be joined to one or more side surfaces of the sole after the other parts of the shoe have been fully assembled. This in turn may enable a high degree of individualization of the heel counter and hence of the shoe. The heel counter may be adjusted or even (modularly) produced according to the wearer's preferences, especially with a view to its fit. For example, form and/or position of each portion of the heel counter may be adjusted to the shape of the wearer's foot. Thus, a custom-fit heel counter may be joined to the shoe. The heel counter may furthermore be adjusted with a view to the requirements of the activity the shoe is supposed to be used in.

[0018] It is noted that, in the following, aspects of the invention are mainly described with reference to a sole without further identifying different components of the sole. However, in examples in which the sole comprises a midsole, the properties ascribed to a sole as described herein may also apply to the midsole itself.

[0019] The sole may comprise a particle foam material. As described above, soles or other cushioning elements made of such material exhibit particularly advantageous properties. These properties are especially desirable in sport soles. To fully exploit the extraordinary cushioning properties as well as the remarkable elasticity and energy return of such soles, it is desirable to have their properties fully perceived by the wearer, without being affected by any heel counter. The present invention enables just that, allowing the sole to be governed by the properties of the particle foam material across the entire foot, in particular, if the sole is a midsole.

[0020] The particle foam material may comprise particles of at least one of expanded thermoplastic polyurethane (eTPU); expanded polyamide (ePA); expanded polyether-block-amide (ePEBA); expanded polylactide (ePLA); expanded polyethylene terephthalate (ePET); expanded polybutylene terephthalate (ePBT); expanded thermoplastic polyester ether elastomer (eTPEE). These materials have been found to be particularly well-suited for particle foam materials.

[0021] A medial, a lateral and/or a rear side surface of the sole may comprise an upper wall having a height with respect to a central point of the top surface of the sole located under the calcaneus corresponding to the average diameter of at least two or more particles of the particle foam material. Such an upper wall may provide additional stability to the foot and thereby enhance the overall fit and performance of the shoe.

[0022] The height of the upper wall may be different in different side surfaces of the sole. For example, the upper wall may be higher where a more stable fit is required and lower where a less stable fit is required. The height of the upper wall may also depend on the configuration of the heel counter. Where the heel counter already provides a particularly high degree of stability, the upper wall may need to provide less stability and vice versa. Furthermore, the height of the upper wall may be chosen dependent on the activity that the shoe is supposed to be used for. Whilst some sports, such as basketball or tennis, may require a particularly high degree of stability with respect to lateral movements, other sports, such as running, may require higher levels of stability with respect to longitudinal (relative to the front of the shoe) movements. Accordingly, the upper wall may, for example, be higher in a lateral side surface than in a rear surface in basketball and tennis shoes, but it may be lower in medial and lateral side surfaces than in a rear surface in running shoes.

[0023] The sole may comprise an outer shape and the heel counter may comprise at least one protrusion and/or at least a first recess corresponding to the outer shape of the sole. This may benefit the positioning on and the attachment of the heel counter to the sole and may also enhance the fit of the heel counter to the wearer's foot, thereby improving overall fit and performance of the shoe.

[0024] The top surface of the sole may be contoured to follow the anatomy of the heel of the wearer in a region under the heel. This may allow the top surface of the sole to better conform to the heel and, in particular, the calcaneus of the wearer which improves the fit, stability, comfort and performance of the shoe.

[0025] The heel counter may be attached to at least one side surface of the sole. Hence, the heel counter may be firmly attached to the sole without sitting between the wearer's heel and the sole. This may allow the heel counter not to interfere with the interaction between the wearer's foot, and, in particular, the wearer's heel (comprising amongst others features, the calcaneus) and the sole which improves the fit, stability, comfort and performance of the shoe

[0026] The heel counter may be attached to an upper

half of the sole. For example, a lower half of the sole may remain free from the heel counter, whereas the heel counter may be firmly attached to the upper half of the sole, for example, to one or more side surfaces thereof. Hence, the lower half of the sole may be compressed freely, for example, through contact with the ground, without affecting the heel counter. This also reduces the risk of the heel counter bottoming out since any deformation of the lower half of the sole does not affect the heel counter. Hence, wear and tear of the heel counter and the portion of the sole to which it is attached may be reduced and overall performance and comfort of the shoe increased. It is understood throughout this specification that a reference to a first element (e.g., heel counter) being attached to a portion of a second element (e.g., sole) includes the possibility that the remaining portion(s) of the second element remain(s) free from the first element, even if not expressly mentioned.

[0027] The heel counter may be attached to an upper third of the sole. For example, the heel counter may be attached to one or more side surfaces of the upper third of the sole. In turn, the lower two thirds of the sole may remain free from the heel counter. This has been found to be a particularly well-suited compromise between the aforementioned advantages regarding sole compressibility and firm attachment.

[0028] At least one side surface of the sole may comprise a second recess to receive, at least in part, the heel counter. This may enable a particularly accurate positioning and firm attachment of the heel counter to the sole and hence increase stability. In some examples, the second recess may ensure that any adhesive used for attaching the heel counter to the respective side surface is placed correctly and is not visible once the heel counter is attached.

[0029] The heel counter may be attached to the sole using techniques, such as, for example, at least one of cementing, in-mold assembly and/or welding by radiation. Cementing may comprise using a glue, optionally a water-based glue, to attach the heel counter to the sole. In other examples, the heel counter may be placed in a mold along with one or more materials from which the sole, or portions thereof, respectively, is to be formed before the one or more materials are processed. By such processing, the heel counter may then for example be attached to the sole, for example, the heel counter may be firmly enclosed by the one or more materials. In some examples, one or more materials from which the sole, or portions thereof, respectively, is to be formed may comprise foam particles, and processing the foam particles may comprise bonding them together. In some examples, the heel counter may be welded to the sole using welding techniques, for example, ultrasonic welding, high frequency welding, and/or joined using electromagnetic radiation, for example, infrared radiation, microwave radiation or radio frequency radiation, for example, in techniques such as RF welding. Furthermore, the heel counter may be welded to the sole using a combination of two or more techniques. All of these techniques have been shown to provide a particularly firm attachment. Additionally, or alternatively, the use of other techniques known in the state of the art is also possible.

[0030] The heel counter may comprise at least one opening. This feature may reduce the weight of the heel counter and hence the overall weight of the shoe. Key fit points of the heel counter may remain unaffected by the opening(s), such that wearing comfort and stability are maintained. Also, the openings may allow tissue, in particular fat tissue, of the wearer's foot to expand through the openings, e.g., when his or her foot hits the ground. All of this may in turn improve overall performance and comfort of the shoe. Moreover, this may reduce the environmental impact of the shoe since the amount of required material is minimized.

[0031] The heel counter may be provided as a skeleton frame. This feature may reduce the weight even further while still maintaining key fit points. Also, forces acting upon the heel counter may be distributed throughout the heel counter more evenly, in turn improving its stability and reducing its wear and tear.

[0032] The skeleton frame may comprise a plurality of segments. Providing the heel counter in the form of a skeleton frame comprising a plurality of segments (e.g., with a wire shape, wherein the segments are at least partly connected) enables increased design flexibility. For example, this may allow for modular construction of the heel counter and hence for - possibly individual - adjustment of the heel counter's characteristics and fit.

[0033] At least one of the segments may comprise a first portion and a second portion. The first portion and the second portion may perform different functions. For example, the first portion may facilitate attachment of the heel counter to the shoe and may therefore face the sole and/or the shoe upper, while the second portion may increase stability. In this example, stability and attachment of the segments to the sole and/or upper of the shoe may thus be improved independently, in turn increasing the overall performance of the shoe.

[0034] The first portion and the second portion may differ in at least one of their properties. This may allow them to better perform their respective functions, in turn increasing the performance of the heel counter. For example, they may differ with respect to their density, weight, bulk modulus, compressive strength, ductility, durability, elasticity, fatigue limit, flexibility/stiffness, hardness, plasticity, shear strength, specific weight, surface roughness, tensile strength, viscosity, molecular weight and/or any other known chemical / mechanical properties In some examples, differences in such properties may be brought about by shaping or processing the first portion and the second portion differently, although they may comprise (or essentially consist of) the same material. For example, the first portion may be thinner than the second portion, such that it is more flexible and/or compressible.

[0035] In some examples, the heel counter or one or

more segments thereof may essentially consist of a single material. Nevertheless, different properties may be provided in first and second portions, for example, by shaping or processing the first and second portions differently, as explained above. In some examples, the heel counter and/or one or more segments of the heel counter may comprise (or essentially consist of) rubber. For example, the thickness of the rubber may be varied to form first and second portions of a segment that differ in at least one of their properties.

[0036] It is also possible that the heel counter, or at least one segment of the heel counter, comprises a textile. Furthermore, it is possible that the textile is reinforced is certain regions as described earlier. The reinforcement can be achieved by placing a yarn on a textile layer and affixing the yarn to the textile layer by stitching.

[0037] In other examples, the first portion may comprise a first material and the second portion may comprise a second material that differs from the first material. This may provide an alternative or additional way to adapt the first portion and the second portion to their respective functions, thereby further increasing the performance of the heel counter. For example, the first material may be chosen to be particularly suited for attachment to the upper and/or the sole, while the second material may be chosen to be particularly stable.

[0038] The first and second materials may be injection moulded, in particular they may be co-injection moulded, and/or they may be manufactured by 2D compression moulding, additive manufacturing, joining 2D films, welding.

[0039] The first material may comprise a first TPU and the second material may comprise a second TPU. TPU has been found to be particularly well-suited for segments of heel counters that are provided as skeleton frames according to the present invention. For example, the first material may comprise TPU A85 (Shore hardness), having a tensile modulus stiffness of approximately 25MPa whereas the second material may comprise TPU 64D (Shore hardness) which has a tensile modulus of approximately 300MPa. Other possible materials that could be used include PA, PEBA, co-polyesters, TPO, POM and any other known plastics that can be formulated to provide such contrast in their stiffnesses. Additionally, or alternatively to TPU, the first and/or second material may comprise a different material, for example, a rubber and/or a TPU.

[0040] The heel counter may comprise a medial portion and a lateral portion which differ. This may improve the heel counter's fit to the wearer's heel since the heel counter may be adapted to the different needs in these portions. Hence, overall performance as well as comfort may be increased.

4. Brief description of the Figures:

[0041] Possible examples of the present invention will be described in more detail in the subsequent detailed description with reference to the following figures:

Fig. 1:	Schematic cross section of an example of a sole according to the present invention;
Fig. 2:	Medial view of an example of a shoe according to the present invention;
Fig. 3:	Lateral view of an example of a shoe according to the present invention;
Fig. 4:	Rear view of an example of a shoe according to the present invention;
Fig. 5:	Top view of an example of a shoe according to the present invention;
Figs. 6A, 6B:	Example of a sole and heel portion thereof according to the present invention;
Figs. 7A, 7B:	Lateral and front view of an example of a heel counter according to the present invention.

5. Detailed description of possible examples:

[0042] For the sake of brevity only a few examples will be described in the following. The skilled person will recognize that the specific features described with reference to these examples may be modified and combined differently and that individual features may also be omitted if they are not essential. The general explanations in the sections above will also be valid for the following more detailed explanations.

[0043] It should be noted that, within this specification, references to a "heel counter" are references to a heel counter configured to interact with both the sole and the upper.

[0044] Fig. 1 shows a schematic cross section of an example of a sole 110 according to the present invention. The nomenclature defined with respect to Fig. 1 will be adhered to throughout the specification. Sole 110 comprises a medial side surface 113a and a lateral side surface 113b. Medial side surface 113a comprises a lower portion 114a and an upper portion 115a. The upper portion 115a is the side surface of the upper wall 117a which furthermore comprises a non-zero thickness and, therefore, a rim 116a. Similarly, lateral side surface 113b comprises a lower portion 114b and an upper portion 115b. Upper portion 115b is comprised in upper wall 117b, which furthermore comprises a non-zero thickness and, therefore, a rim 116b. Lower portion 114a has a height *hi.* Upper wall 117a has a height h_u with respect to a lowest point on a top surface 112 of sole 110, while its non-zero thickness is defined by a width r of rim 116a. Heights and width(s) of lower portion 114b and upper

wall 117b may be defined similarly, although they may each differ from those of lower portion 114a and upper wall 117a. Further side surfaces such as side surfaces 113a and/or 113b of sole 110 may be defined similarly, e.g., a rear side surface 113c of sole 110 may comprise a lower portion 114c such as lower portions 114a and/or 114b, an upper wall 117c such as upper walls 117a and/or 117b comprising an upper portion 115c such as upper portion 115a and/or 115b as well as a rim 116c such as rims 116a and/or 116b (cf. Figs. 6A, 6B). Note that side surfaces may furthermore be similarly defined with respect to portions of the sole, e.g., a heel portion thereof.

[0045] Top surface 112 may be defined as a projection of the wearer's foot onto the sole that is essentially perpendicular to the ground, which does not include rims such as rims 116a and/or 116b. It is noted, that in some examples, which do provide rims such as rims 116a and/or 116b, the heel counter may also be arranged at or attached to one or more of these rims. However, it is also conceivable, that the heel counter is also not arranged at or attached to one or more of these rims.

[0046] Top surface 112 may also comprise a region under the heel of the wearer 111, i.e., a projection of the wearer's heel onto the sole that is essentially perpendicular to the ground.

[0047] Fig. 2 shows an example of a shoe 100 according to the present invention. Shoe 100 comprises sole 110 and a heel counter 120. Furthermore, shoe 100 comprises an upper 130. In the example, upper 130 comprises a sock-like portion, which furthermore comprises a first region 131 and a second region 132. First region 131 is arranged in a heel region of shoe 100 and surrounds the heel of the wearer's foot. Moreover, first region 131 is also arranged at least in part on the lower lateral and medial sides of the shoe 100.

[0048] Region 132 is arranged in a forefoot and midfoot region of shoe 100 and covers the instep and upper forefoot regions of the wearer's foot. Region 132 may comprise, incorporate or replace a shoe tongue. The sock-like portion, in particular, first and second regions 131 and 132, may comprise a textile that may be woven or knit or that may comprise any other suitable structure. The first and second regions 131 and 132 may comprise different materials, for example, the second region 132 contains a more elastic material when compared to the material of the first region 131. This may be useful for improved adaptation to the shape of the wearer's foot. Additionally or alternatively, the second region 132 may be stiffer than the first region 131 to provide increased stability of the foot within the shoe. The materials may also differ with respect to other properties, for example, the material comprised in second region 132 may have a more open structure to improve breathability and/or the material may have improved wetting characteristics to improve permeability to water (i.e. be more waterproof).

[0049] In other examples, the sock-like portion may comprise a single region, or it may comprise more than one or more than two regions. It is possible that these regions further comprise different functionality and/or different materials as outlined earlier. However, in further examples, it is possible that the upper may not comprise a sock-like portion at all. Materials such as textiles, plastic, leather and/or suede may be used for upper 130 and/or the sock-like portion and/or for different regions of the sock-like portion such as first and second regions 131 and 132, respectively.

[0050] In addition, the upper 130 of Fig. 2 comprises a reinforcing element 133. Reinforcing element 133 may be arranged in a midfoot region of upper 130, for example, in a lateral and/or a medial midfoot region and/or an instep region of upper 130. For example, reinforcing element 133 may comprise a plastic material. In other examples, the reinforcing element 133 may comprise a different material such as a textile, leather and/or suede. In particular, the reinforcing element 133 may be made of a textile, such as a knit textile, comprising fusible yarns, that is fused and shaped to reach the desired final shape. Reinforcing element 133 may generally be provided to increase stability of the foot within upper 130. Reinforcing element 133 may particularly be arranged at an outer side of the sock-like portion such as to selectively increase its strength in the instep region. In other examples, one or more reinforcing elements 133 may be provided in other positions. Reinforcing element 133 may further comprise holes for attaching laces. Additionally, or alternatively, shoe 100 may be fastened by different means such as hook and loop fasteners. In other examples, shoe 100 may not comprise any external means for fastening. In yet other examples upper 130 may not comprise any reinforcing element 133 at all, for example, upper 130 may be provided as a sock-like upper only.

[0051] In the example of Fig. 2, the sole 110 comprises particles of expanded material. The particles may be randomly arranged. The particles may comprise, for example, expanded thermoplastic polyurethane (eTPU), expanded polyamide (ePA), expanded polyether-block-amide (ePEBA) expanded polylactide (ePLA); expanded polyethylene terephthalate (ePET); expanded polybutylene terephthalate (ePBT); expanded thermoplastic polyester ether elastomer (eTPEE).

[0052] Components, for example, shoe soles, in particular, midsoles for shoes, may comprise at least one of the above-mentioned expanded particles. The components are produced by joining together the individual expanded particles by bonding the expanded particles at their outer surfaces to form a component, a so-called pellet or particle foam component. In some embodiments, it is possible that the component comprises at least two of the afore mentioned expanded particles.

[0053] In some examples, sole 110 may consist of a single component, for example, an integrated outsole and midsole. In other examples sole 110 may comprise multiple components, for example, a separate midsole and outsole. In examples, in which the top surface of the midsole forms the top surface of the sole 110, the heel

counter 120 may not be attached to the top surface of the midsole. As previously mentioned, in some examples, the midsole may comprise a particle foam material as described above. The midsole may be the only component of sole 110 comprising particle foam material.

[0054] In other examples, sole 110 may not comprise particle foam material at all. Sole 110 may consist of a single block of (non-expanded) material or comprise multiple blocks of (optionally different) materials that may be joined together or integrally formed. Specifically, sole 110 may also comprise a midsole formed from one or more such blocks. Materials typically used for such soles may comprise ethylene-vinyl acetate (EVA), polyurethane, thermoplastic polyurethane, carbon rubber and/or blown rubber. Soles, in particular, midsoles, may also comprise alternative cushioning elements such as gel and/or encapsulated air.

[0055] As shown in Fig. 2, heel counter 120 is not attached to the top surface 112 of sole 110, but, in this particular example, to parts of the lateral (not visible) and medial side surfaces 113b, 113a of a heel portion of sole 110 and rear side surface 113c of sole 110. Alternatively, heel counter 120 may be attached only to the lateral and medial side surfaces 113b, 113a of the sole 110 (or of its heel portion, respectively) or only to any one side surface of sole 110 (or of its heel portion, respectively). The heel counter 120 may be attached to lateral and rear side surfaces 113b, 113c of sole 110 (or of its heel portion, respectively) or to medial and rear side surfaces 113a, 113c of sole 110 (or of its heel portion, respectively) only. The respective other side surfaces of sole 110 may, in each case, remain free from heel counter 120. Heel counter 120 may also be attached to any other portion of sole 110 except for top surface 112.

[0056] In the example of Fig. 2, heel counter 120 is attached to an upper third of sole 110. More specifically, heel counter 120 is attached to an upper third of the heel portion of sole 110. The lower two thirds of the heel portion of sole 110 as well as the midfoot and forefoot portions of sole 110 may remain unattached to the heel counter 120. In other examples, heel counter 120 may be attached to sole 110 (e.g., its heel portion) in a higher position, i.e., for example in an upper quarter or an upper fifth of sole 110. In yet other examples heel counter 120 may be attached to an upper half, but not an upper third of sole 110, i.e., in a lower position. In yet further examples, heel counter 120 may be attached to sole 110 in an even lower position.

[0057] Heel counter 120 may be attached to sole 110 using cementing. Cementing may comprise using a glue, optionally a water-based glue, to attach the heel counter to the sole. In other examples, other suitable adhesives known in the art may be used. In yet other examples, the heel counter may be placed in a mold and then the mold further filled with expanded foam particles. The particles may then be bonded together to form a component, in this example, a midsole, or at least one or more portions thereof, such that the heel counter is firmly enclosed by the foam particles and thereby attached to the sole after the expanded foam particles have been bonded. In some examples, the heel counter may be welded to the sole using welding techniques, for example, ultrasonic welding, high frequency welding, and/or joined using electromagnetic radiation, for example, infrared radiation, microwave radiation or radio frequency radiation, for example, in techniques such as RF welding. Furthermore, the heel counter may be welded to the sole using a combination of two or more techniques. Additionally, or alternatively, the use of other techniques known in the state of the art is also possible.

[0058] Heel counter 120 of the example of Fig. 2 comprises an opening 125a in a medial portion 121a of heel counter 120 and an opening 125c in a rear portion of heel counter 120, in between the medial and lateral sides of the heel counter in a region corresponding to the location of the Achilles tendon of the wearer's. A further opening 125b may be provided in lateral portion 121b of heel counter 120 (cf. Fig. 3). These openings have been found to be particularly suitable for providing a good compromise between wearing comfort and stability provided by the heel counter. However, in other examples, heel counter 120 may also comprise more than one opening in each portion of heel counter 120 such as lateral portion 121b, medial portion 121a and/or the rear portion. In other examples, heel counter 120 may additionally or alternatively comprise one or more openings in other positions.

[0059] As exemplified by opening 125a, openings may be completely circumscribed by heel counter 120, i.e., they may represent "holes" within heel counter 120. Alternatively, and as exemplified by opening 125c, openings may as well only be partly circumscribed (for example, at three of four sides) by heel counter 120, i.e., they may represent a "notch" or "indentation" of an outer contour of heel counter 120. Size and position of any opening may be chosen such that the opening overlaps with both sole 110 and upper 130 of shoe 100 as it is the case for opening 125a in the example of Fig. 2, i.e., sole 110 is visible through opening 125a. Alternatively or additionally, the size and position of an opening may be chosen such that the opening overlaps with sole 110 or upper 130 only, the latter being the case for opening 125c. For different openings different sizes and positions may be chosen.

[0060] Heel counter 120 may be provided as a skeleton frame. Corresponding aspects will be described with reference to the lateral view of shoe 100 shown in Fig. 3 as well as the rear view of shoe 100 shown in Fig. 4.

[0061] According to Fig. 3, the skeleton frame comprises segments 122a, 122b, 122c and 122d. Further segments of the skeleton frame are shown in Fig. 4, namely segments 122b', 122c', 122d', 122e. First segment 122a is located on sole 110 and extends essentially parallel to an upper edge of sole 110 and/or essentially parallel to the ground. First segment 122a extends from medial portion 121a across the rear portion to lateral portion 121b of heel counter 120, i.e., first segment 122a circum-

scribes the heel portion of sole 110 as can be understood when combining Figs. 1, 2 and 3. First segment 122a may be located within a second recess (a first recess will be defined below with respect to heel counter 120, cf. Figs. 7A, 7B and below) in one side surface, for example, rear side surface 113c, of sole 110 such that it sits flush with sole 110 and hence provides a high degree of stability (cf. Fig. 6B and below for details).

[0062] Second segment 122b is located on upper 130, between the ankle of the wearer and top surface 112 of sole 110 and extends essentially parallel to the upper edge of sole 110 and/or essentially parallel to the ground. However, it may be provided shorter than first segment 122a and hence not extend as far to the front of shoe 100 as first segment 122a. In the example of Fig. 3, it also does not extend as far to the rear of shoe 100 as first segment 122a, such that it sits on the lateral side of the heel region of upper 130 of shoe 100 only, i.e., it only forms part of lateral portion 121b of heel counter 120 but does not extend to medial portion 121a of heel counter 120. As shown in Fig. 2, shoe 100 or heel counter 120, respectively, also provides a similar segment 122b' on the medial side of the heel region of shoe 100, i.e., segment 122b' only forms part of medial portion 121a of heel counter 120 but does not extend to lateral portion 121b of heel counter 120. Segments 122b and 122b' may improve the posture of the heel in the shoe and for example provide particular stability with respect to lateral movements.

[0063] The heel counter 120 comprises third segment 122c. Third segment 122c connects first segment 122a and second segment 122b and is slanted towards the rear of shoe 100. In the example of Fig. 3, third segment 122c partly overlaps with reinforcing element 133 of upper 130. Hence, additional stability may be provided. Again, as shown in Fig. 2, shoe 100 or heel counter 120, respectively, also provides a similar segment 122c' on the medial side of the heel region of shoe 100 which connects segments 122a and 122b'. The connection between third segment 122c and first segment 122a is advantageously rounded in order to prevent damaging the sole material.

[0064] The heel counter 120 also comprises fourth segment 122d. Fourth segment 122d is connected to second segment 122b and extends to the rear of shoe 100 which is shown in Fig. 4. Again, as shown in Fig. 2 and/or 3, shoe 100 or heel counter 120, respectively, also provides a similar segment 122d' on the medial side of the heel region of shoe 100 which is connected to segment 122b'. In the example of Fig. 4, a shorter fifth segment 122e extends essentially parallel to the upper edge of sole 110 and/or essentially parallel to the ground, as well, but is located on the rear of upper 130 only. Fifth segment 122e may not be arranged at the height of segments 122b and 122b' (between the ankle of the wearer and top surface 112 of sole 110), but may be arranged in a lower position, e.g., it may extend along a lower rim of upper 130 or along an upper rim of sole 110 or it may extend along an edge between sole 110 and upper 130. First segment 122a and fifth segment 122e are joined together via a shared first portion 123e (cf. below). Moreover, fifth segment 122e connects segments 122d and 122d'.

[0065] In the example of shoe 100, the connections between the segments cannot be released. However. in other examples, one or more of the segments may be connected releasably. More generally, a heel counter may consist of a single component or comprise multiple components that may or may not be connected releasably, irrespective of whether these are provided in the form of a skeleton frame and/or segments. The length of segments such as segments 122a, 122b, 122b', 122c, 122c', 122d, 122d' and/or 122e may vary. Also, the position and curvature of segments such as segments 122a, 122b, 122b', 122c, 122c', 122d, 122d' and/or i22e may vary, just as their width or thickness. Specifically, the dimensions of the segments may be adapted to the particular anatomy or needs of the individual wearer. Again, irrespective of whether the heel counter is provided in the form of a skeleton frame and/or segments, it may comprise components of varying position, length, curvature and/or width or thickness.

[0066] Accordingly, and as it is the case for shoe 100, medial portion 121a and lateral portion 121b of heel counter 120 may differ. In the example of heel counter 120, the contour of lateral portion 121b reaches higher than the contour of medial portion 121a, i.e., segment 122b is arranged at a higher position than segment 122b'. In some examples, only the medial or lateral portion may comprise an opening such as opening 125a in medial portion 121a of heel counter 120 shown in Fig. 4. Optionally, medial portion 121a and lateral portion 121b may be sized and positioned in such a way that they form an opening in between them, such as opening 125c shown in Fig. 4, which is furthermore located above first segment 122a and fifth segment 122e.

[0067] In the example of shoe 100, all segments 122a, 122b, 122b', 122c, 122c', 122d, 122d', 122e comprise a first portion, such as first portions 123a, 123b and/or 123e of segments 122a, 122b and 122e, and a second portion, such as second portions 124a and/or 124b of segments 122a and 122b. First portions and second portions may perform different functions. In the present example, first portions such as first portions 123a, 123b and/or 123e are adapted for attachment to sole 110 and upper 130 of shoe 100, whereas second portions such as second portions 124a and/or 124b are adapted to provide stability to heel counter 120 and thereby to shoe 100. In particular, first portions face the shoe 100, i.e., the sole 110 and the upper 130, and are formed such that the contact area between heel counter 120 and sole 110 as well as upper 130 of shoe 100 is increased, whereas second portions face away from shoe 100, i.e., away from sole 110 and upper 130. Second portions may comprise an elongated shape, for example, a wire-like shape, with a width of approximately 5 mm. In some examples, other

widths may be used, for example, in the range of 1 mm to 15 mm or 3 mm to 10 mm. First portions may comprise a wider width, for example, they may be approximately 2 to 4 times or 3 times wider than the second portions. Second portions may be arranged on an outer side of first portions, i.e., a side facing away from shoe 100, i.e., sole 110 and upper 130. In other examples, both first portions and second portions may face shoe 100, i.e., sole 110 and upper 130, for example, first portions may be arranged adjacent to second portions. Additionally, or alternatively, one or more first portions may be structured as to facilitate attachment and/or adhesion enhancement of the heel counter 120 to sole 110 and/or to upper 130, for example, by providing barbs, holes or any other suitable structures. For further adhesion enhancement, some or all surfaces of one or more first portions may be roughened to increase adhesion between heel counter 120 and sole 110 and/or upper 130. Irrespective of whether the heel counter 120 is provided in the form of a skeleton frame and/or segments, it may comprise first portions and/or second portions and may optionally be fully, only partly, or not at all attached to upper 130.

[0068] More generally, first portions such as first portions 123a, 123b and/or 123e and second portions such as second portions 124a and/or 124b may differ in their shape and/or in at least one of their properties since this may allow them to better perform their respective functions. For example, they may differ with respect to their density, weight, bulk modulus, compressive strength, ductility, durability, elasticity, fatigue limit, flexibility/stiffness, hardness, plasticity, shear strength, specific weight, surface roughness, tensile strength, viscosity, molecular weight and/or any other known chemical / mechanical properties

[0069] In some examples, differences in such mechanical properties may be brought about by shaping or processing first portions such as first portions 123a, 123b and/or 123e and second portions such as second portions 124a and/or 124b differently, although they may comprise the same material. For example, first portions may be thinner than respective second portions, such that they are more elastic and/or compressible. In some examples, segments such as segments 122a, 122b, 122b', 122c, 122c', 122d, 122d' and/or 122e may comprise (or essentially consist of) rubber. The shape, for example, the thickness, of the rubber, may be adapted to form one or more first portions such as first portions 123a, 123b and/or 123e and/or one or more second portions such as second portions 124a and/or 124b. Different portions of the rubber corresponding to such first and second portions may also be finished differently, for example, by vulcanization, to bring about differences in mechanical properties between such portions.

[0070] Additionally, or alternatively, first portions such as first portions 123a, 123b and/or 123e and second portions such as second portions 124a and/or 124b may also comprise different materials to bring about desired differences in the mechanical properties of first portions and second portions. For example, the first material may be chosen to be particularly suited for attachment to the upper and/or the sole and to give increased comfort whilst engaging with the foot of the wearer, while the second material may be chosen to be particularly stable. For example, the first material may comprise TPU A85 (Shore hardness), having a tensile modulus stiffness of approximately 25MPa whereas the second material may comprise TPU 64D (Shore hardness) which has a tensile modulus of approximately 300MPa. Other possible materials that could be used include PA, PEBA, co-polyesters, TPO, POM and any other known plastics that can be formulated to provide such contrast in their tensile modulus'.

[0071] The first and second materials may be injection moulded, in particular they may be co-injection moulded, manufactured by 2D compression moulding, additive manufacturing, joining 2D films, welding.

[0072] Fig. 5 shows a top view of shoe 100. Shoe 100 may optionally comprise s sockliner 101. Heel counter 120 is neither attached to a top surface of insole 101 nor of sole 110. Rather, heel counter 120 is attached to side surfaces of sole 110 as explained above with reference to Figs. 1-3. In Fig. 5 sockliner 101 is pulled upwards out of shoe 100 such that only parts of its bottom are visible. Upper 130 of shoe 100 is reinforced in the heel region by padding 135 in the material of upper 130 on both medial and lateral sides. Padding 135 may be located above the second segment 122b and its counterpart on the medial side of shoe 100, segment 122b', respectively. For example, padding 135 may be located approximately between the height of the wearer's ankle and top surface 112 of sole 110. Additionally, or alternatively, upper 130 may be reinforced by other means. Such reinforcements of upper 130 may improve stability and hence enhance the overall performance and comfort of shoe 100. For example, upper 130 may be reinforced by a lining or chemical sheet in the region of the heel that may provide a predetermined shape to upper 130, in particular, if upper 130 is knitted. The lining or chemical sheet may be 3D molded.

[0073] Figs. 6A, 6B show sole 110. In the example of Figs. 6A, 6B, sole 110 comprises an outsole 119. Furthermore, Figs. 6A, 6B show lateral side surface 113b and rear side surface 113c of sole 110, each comprising a lower portion 114b, 114c, upper portion 115b, 115c and rims 116b, 116c. Each upper portion 115b, 115c is comprised in upper wall 117b and 117c, respectively. Upper walls 117b, 117c have a height with respect to the lowest point on top surface 112 of the sole (which is provided by a central point of the top surface (112) of the sole (110) located under the calcaneus) corresponding to the average diameter of at least two or more particles of the particle foam material comprised in sole 110. Upper walls 117b, 117c as well as top surface 112 of sole 110 are adapted to provide a firm and comfortable fit to the heel of the wearer in region under his or her heel 111. In some examples, the height of upper walls such as upper walls

117b and/or 117c may differ. For example, upper walls may be higher where a more stable fit is required and lower where a less stable fit is required. As a result, the height of upper walls such as upper walls 117b and/or 117c may also depend on the configuration the heel counter 120 (not shown in Figs. 6A, 6B). Where the heel counter already provides a particularly high degree of stability, upper walls such as upper walls 117b and/or 117c may need to provide less stability and vice versa. The height of upper walls may furthermore be chosen dependent on the activity shoe 100 is supposed to be used in. Whilst some sports, such as basketball or tennis, may require a particularly high degree of stability with respect to lateral movements, other sports, such as running, may require higher levels of stability with respect to longitudinal (relative to the front of the shoe) movements. Accordingly, upper wall 117b may, for example, be higher than upper wall 117c in basketball and tennis shoes, but upper walls 117a (not indicated in Figs. 6A, 6B) and 117b may be lower than upper wall 117c in running shoes. Similarly, width r of rims such as rims 116b and/or 116c may be varied with a view to the preferences of the wearer and/or the use requirements of the shoe 100.

[0074] As shown in Fig. 6B, sole 110 comprises a second recess 118 in its rear side surface 113c as well as in parts of medial side surface 113a (not shown in Figs. 6A, 6B) and parts of lateral side surface 113b to receive, at least in part, heel counter 120. In some examples, sole 110 may comprise a second recess such as second recess 118 in more than one of its side surfaces. Optionally, sole 110 may comprise multiple second recesses such as second recess 118 in one or more of its side surfaces. The one or more second recesses such as second recess 118 may follow the contours of the portions of heel counter 120 they are to receive completely or at least partly. In some examples, the one or more second recesses may be shaped such that heel counter 120 or at least portions thereof are flush with sole 110. Alternatively, or additionally, sole 110 may comprise multiple, optionally further, second recesses and/or holes adapted to receive one or more protrusions extending from heel counter 120 (cf. Figs 7A, 7B and below). Optionally, sole 110 may comprise protrusions, wherein parts of heel counter 120 may be arranged or held in between the protrusions. It is also possible that heel counter 120 may be clipped into protrusions and/or second recesses such as second recess 118 of sole 110. In yet other examples, sole 110 may not provide any recess or protrusion at all.

[0075] Figs. 7A, 7B show heel counter 120 with segments 122a, 122b, 122b', 122c, 122c', 122d, 122d', 122e circumscribing openings 125a, 125b and 125c. Furthermore, heel counter 120 comprises a medial protrusion 128a, a lateral protrusion 128b and a rear protrusion 128c. Protrusions 128a, 128b and 128c are adapted to protrude over corresponding upper walls, e.g., upper walls 117a, 117b and 117c, or their rims, e.g., rims 116a, 116b and 116c such that the sit flush with them. In other examples, heel counter 120 may comprise only one or two protrusions. In other examples, it may comprise more than three protrusions.

[0076] Heel counter 120 may generally be adapted such that, when arranged on corresponding sole 110, its contour facing the wearer's foot extends upwards from the sole in an essentially perpendicular manner (for example, as shown in Fig. 7B, -portion of heel counter 120 extending above protrusion 128b) or at most in a manner inclined towards the wearer's foot. This may particularly ensure that the heel counter does not interfere with the interaction between the wearer's foot and the sole. More generally, heel counter 120 may be shaped such that its contour (facing the wearer's foot) extends closer towards the inside of the shoe or at most remains at the same distance as it extends upwards. In other words, the contour (facing the wearer's foot) may not comprise any inclination away from the inside of the shoe as the contour extends upwards.

[0077] In some examples, protrusions such as protrusions 128a, 128b and/or 128c may not be adapted to protrude over upper walls such as upper walls 117a, 117b and/or 117c (or such protrusions may not be provided at all) such that heel counter 120 is not arranged on upper walls 117a, 117b, 117c. For example, they may rather be adapted to be received by one or more second recesses and/or holes in one or more side surfaces of sole 110, cf. above. Vice versa, heel counter 120 may comprise one or more first recesses adapted to receive portions, possibly protrusions, of sole 110, or side surfaces thereof, respectively. More generally, heel counter 120, for example one or more protrusions and/or first recesses of heel counter 120, may be shaped to follow an outer shape of sole 110 and portions thereof, such as side surfaces 113a, 113b and/or 113c, respectively. Furthermore, heel counter 120 may not comprise any sharp corners and/or edges as to avoid damaging sole 110, as previously mentioned.

[0078] In the following, further embodiments are described to facilitate the understanding of the invention:

1. Shoe (100), in particular a sports shoe, comprising:

    a. a sole (110), in particular a midsole;
    b. a heel counter (120);
    c. wherein the heel counter (120) is not attached to a top surface (112) of the sole (110).

2. Shoe (100) according to embodiment 1, wherein the sole (110) comprises a particle foam material.

3. Shoe (100) according to embodiment 2, wherein the particle foam material comprises particles of at least one of the following materials:

    a. expanded thermoplastic polyurethane, eTPU;
    b. expanded polyamide, ePA;

c. expanded polyether-block-amide, ePEBA;
d. expanded co-polyester.

4. Shoe (100) according to embodiment 2 or 3, wherein a medial (113a), a lateral (113b) and/or a rear side surface (113c) of the sole (110) comprises an upper wall (117a, 117b, 117c) having a height with respect to a central point of the top surface (112) of the sole (110) located under the calcaneus corresponding to the average diameter of at least two or more particles of the particle foam material.

5. Shoe (100) according to embodiment 4, wherein the height of the upper wall (117a, 117b, 117c) is different in different side surfaces (113a, 113b, 113c) of the sole (110).

6. Shoe (100) according to any of the preceding embodiments, wherein the sole (110) comprises an outer shape and wherein the heel counter (120) comprises at least one protrusion and/or at least a first recess corresponding to the outer shape of the sole (100).

7. Shoe (100) according to any of the preceding embodiments, wherein the top surface (112) of the sole (110) is contoured to follow the anatomy of the heel of the wearer in a region under the heel (111).

8. Shoe (100) according to any of the preceding embodiments, wherein the heel counter (120) is attached to at least one side surface (113a, 113b, 113c) of the sole (110).

9. Shoe (100) according to any of the preceding embodiments, wherein the heel counter (120) is attached to an upper half of the sole (110).

10. Shoe (100) according to any of the preceding embodiments, wherein the heel counter (120) is attached to an upper third of the sole (110).

11. Shoe (100) according to any of the preceding embodiments, wherein at least one side surface (113a, 113b, 113c) of the sole (110) comprises a second recess to receive, at least in part, the heel counter (120).

12. Shoe (100) according to any of the embodiments 8-11, wherein the heel counter (120) is attached to the sole (110) using at least one of: cementing, in-mold assembly, welding by radiation.

13. Shoe (100) according to any of the preceding embodiments, wherein the heel counter (120) comprises at least one opening (125a, 125b, 125c).

14. Shoe (100) according to any of the preceding embodiments, wherein the heel counter (120) is provided as a skeleton frame.

15. Shoe (100) according to embodiment 14, wherein the skeleton frame comprises a plurality of segments (122a, 122b, 122b', 122c, 122c', 122d, 122d', 122e).

16. Shoe (100) according to embodiment 15, wherein at least one of the segments comprises a first portion (123a, 123b, 123e) and a second portion (124a, 124b).

17. Shoe (100) according to embodiment 16, wherein the first portion and the second portion differ in at least one of their properties.

18. Shoe (100) according to embodiment 16 or 17, wherein the first portion comprises a first material and the second portion comprises a second material that differs from the first material.

19. Shoe (100) according to embodiment 18, wherein the first material comprises a first TPU and wherein the second material comprises a second TPU.

20. Shoe (100) according to any of the preceding embodiments, wherein the heel counter (120) comprises a medial portion (121a) and a lateral portion (121b) which differ.

Claims

1. Shoe (100), in particular a sports shoe, comprising:

a. a sole (110), in particular a midsole;
b. a heel counter (120);
c. wherein the heel counter (120) is not attached to a top surface (112) of the sole (110).

2. Shoe (100) according to claim 1, wherein the sole (110) comprises a particle foam material.

3. Shoe (100) according to claim 2, wherein the particle foam material comprises particles of at least one of the following materials:

a. expanded thermoplastic polyurethane, eTPU;
b. expanded polyamide, ePA;
c. expanded polyether-block-amide, ePEBA;
d. expanded co-polyester.

4. Shoe (100) according to claim 2 or 3, wherein a medial (113a), a lateral (113b) and/or a rear side surface (113c) of the sole (110) comprises an upper wall (117a, 117b, 117c) having a height with respect to a central point of the top surface (112) of the sole

(110) located under the calcaneus corresponding to the average diameter of at least two or more particles of the particle foam material.

5. Shoe (100) according to claim 4, wherein the height of the upper wall (117a, 117b, 117c) is different in different side surfaces (113a, 113b, 113c) of the sole (110).

6. Shoe (100) according to any of the preceding claims, wherein the sole (110) comprises an outer shape and wherein the heel counter (120) comprises at least one protrusion and/or at least a first recess corresponding to the outer shape of the sole (100).

7. Shoe (100) according to any of the preceding claims, wherein the heel counter (120) is attached to at least one side surface (113a, 113b, 113c) of the sole (110).

8. Shoe (100) according to any of the preceding claims, wherein at least one side surface (113a, 113b, 113c) of the sole (110) comprises a second recess to receive, at least in part, the heel counter (120).

9. Shoe (100) according to any of the claims 7 or 8, wherein the heel counter (120) is attached to the sole (110) using at least one of: cementing, in-mold assembly, welding by radiation.

10. Shoe (100) according to any of the preceding claims, wherein the heel counter (120) is provided as a skeleton frame.

11. Shoe (100) according to claim 10, wherein the skeleton frame comprises a plurality of segments (122a, 122b, 122b', 122c, 122c', 122d, 122d', 122e).

12. Shoe (100) according to claim 11, wherein at least one of the segments comprises a first portion (123a, 123b, 123e) and a second portion (124a, 124b).

13. Shoe (100) according to claim 12, wherein the first portion and the second portion differ in at least one of their properties.

14. Shoe (100) according to claim 12 or 13, wherein the first portion comprises a first material and the second portion comprises a second material that differs from the first material.

15. Shoe (100) according to any of the preceding claims, wherein the heel counter (120) comprises a medial portion (121a) and a lateral portion (121b) which differ.

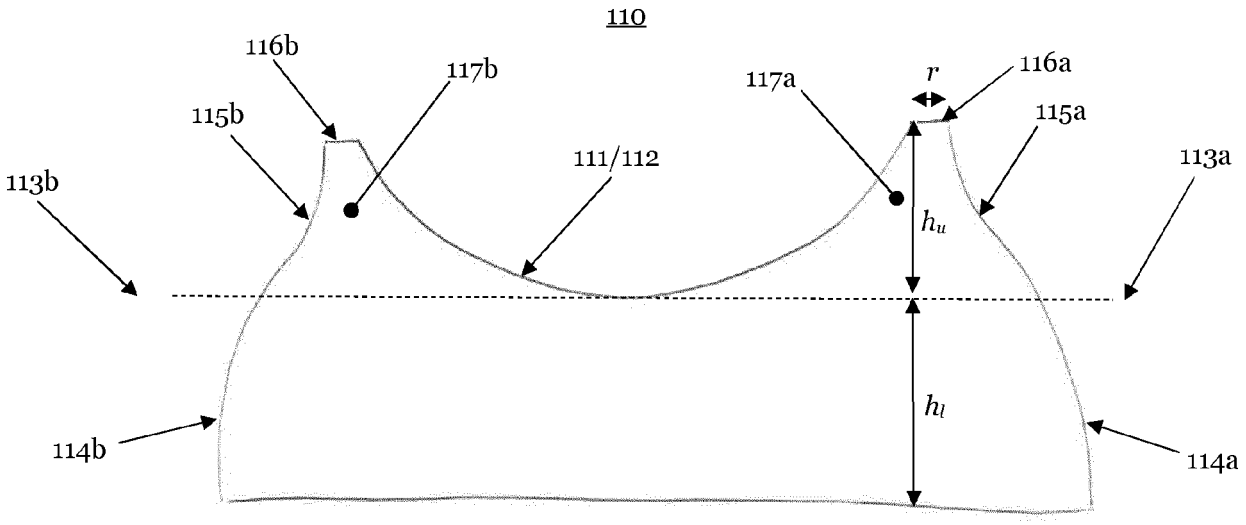

110
116b
117b
115b
111/112
113b
117a
r
116a
115a
113a
h_u
h_l
114b
114a

Fig. 1

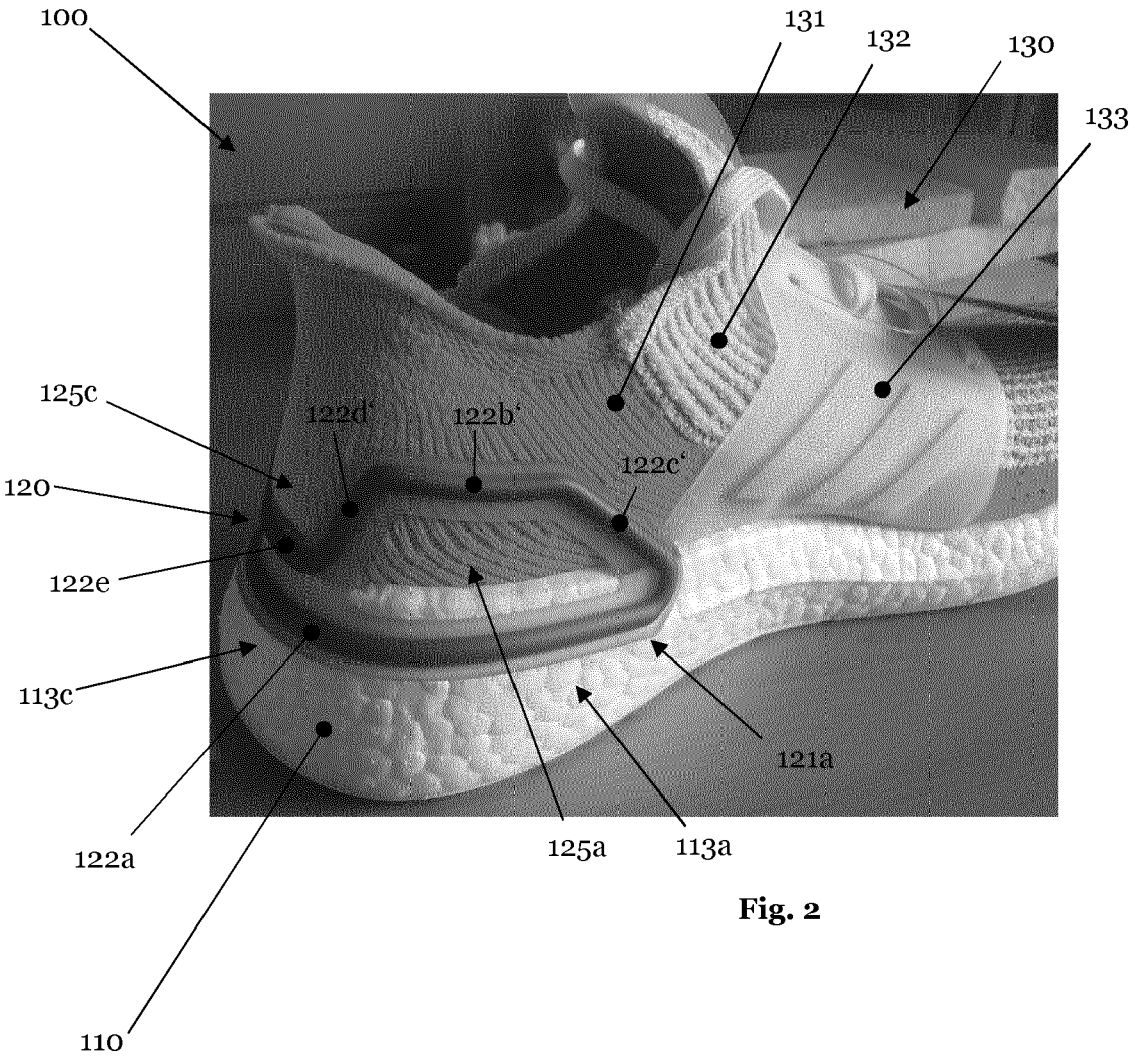

100
131
132
130
133
125c
122d'
122b'
122c'
120
122e
113c
121a
122a
125a
113a
110

Fig. 2

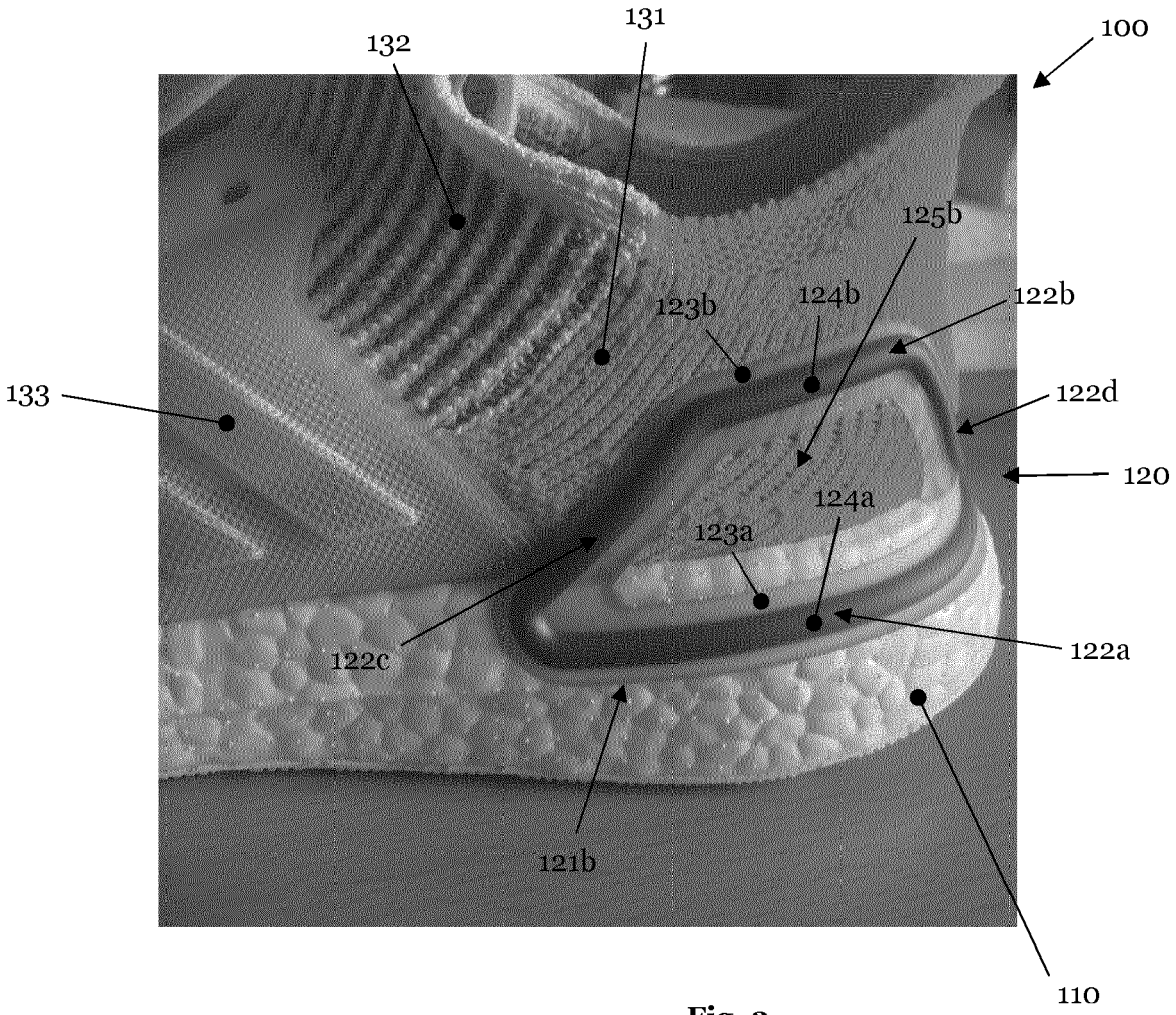

131
100
132
125b
123b
124b
122b
133
122d
120
124a
123a
122c
122a
121b
110

Fig. 3

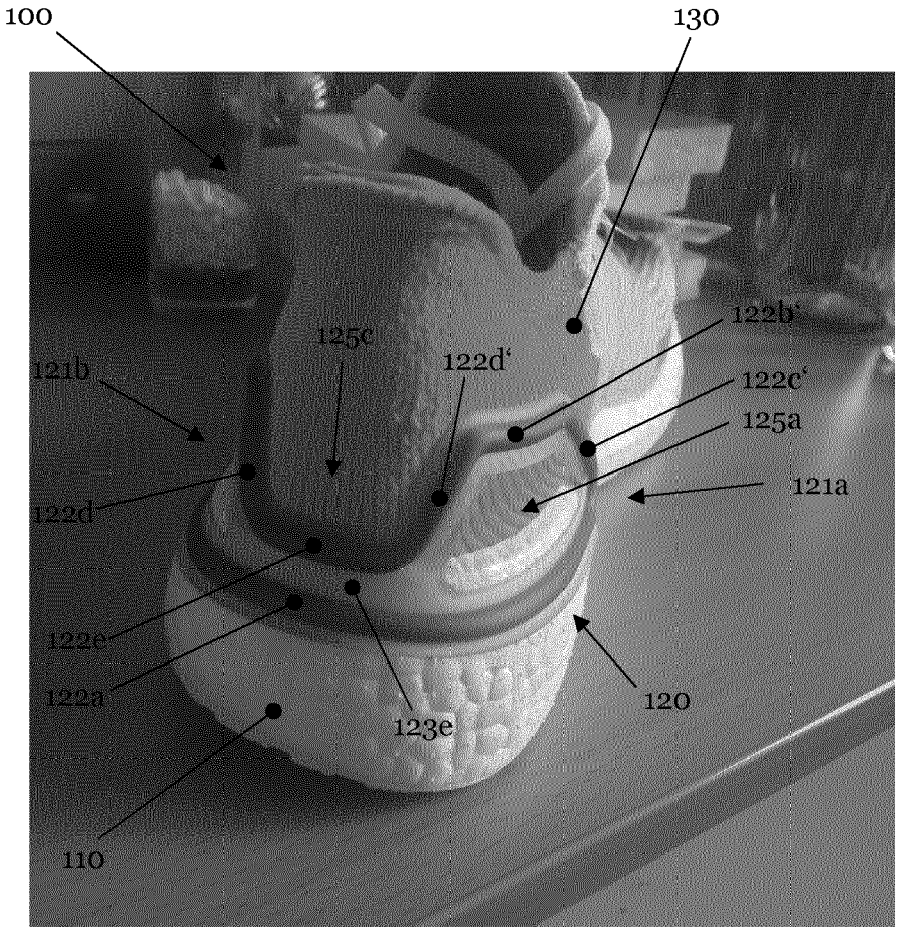

100
130
122b'
125c
122d'
121b
122c'
125a
121a
122d
122e
122a
120
123e
110

Fig. 4

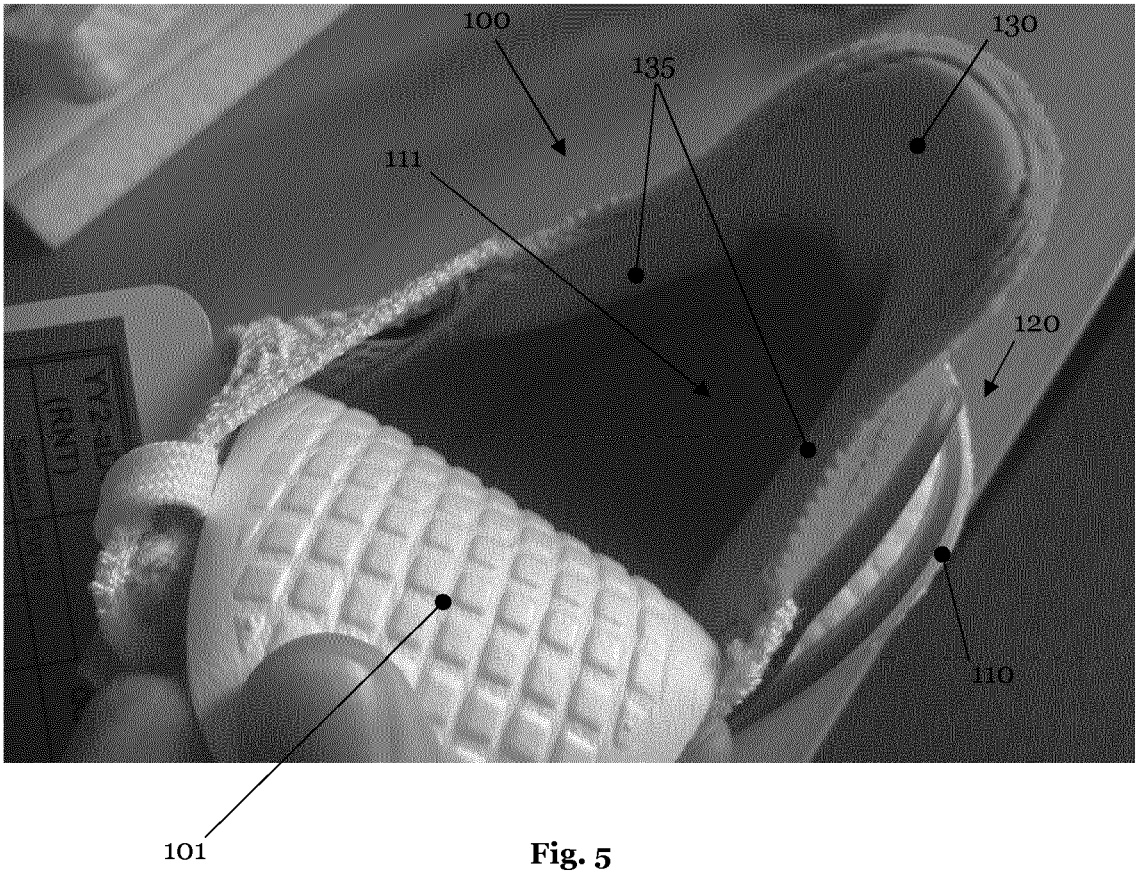


Fig. 5

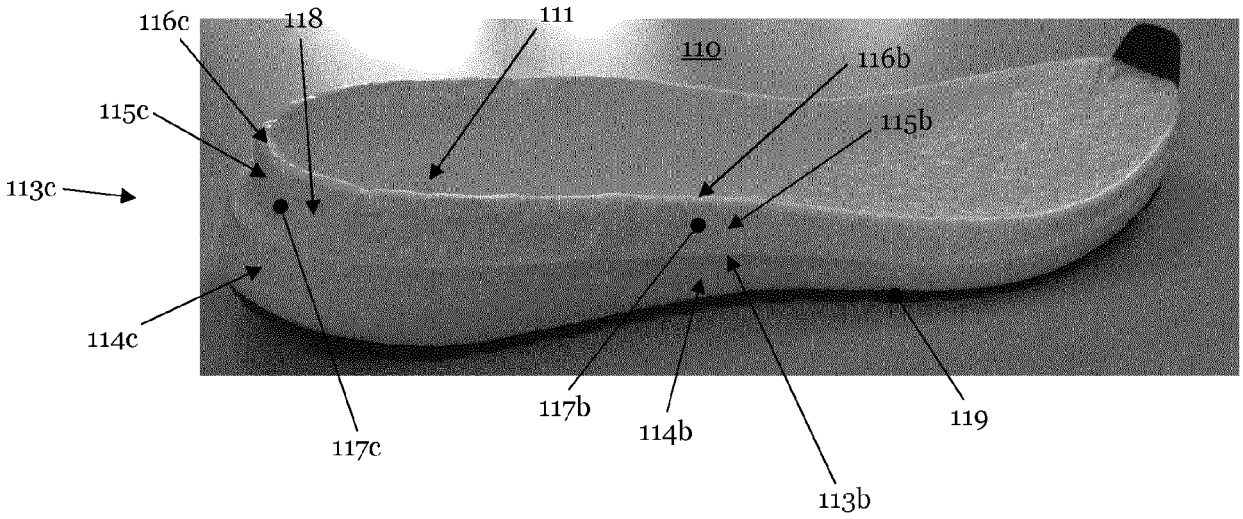

116c
118
111
110
116b
115c
115b
113c
114c
117b
114b
119
117c
113b

Fig. 6A

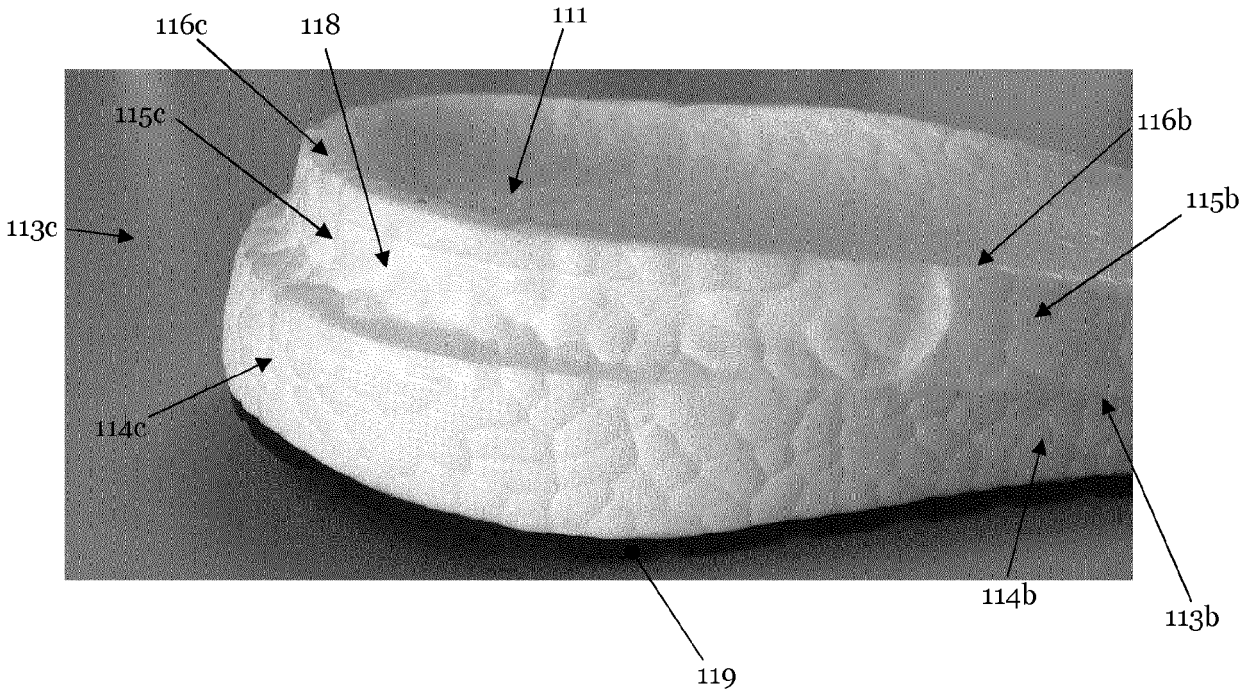


Fig. 6B

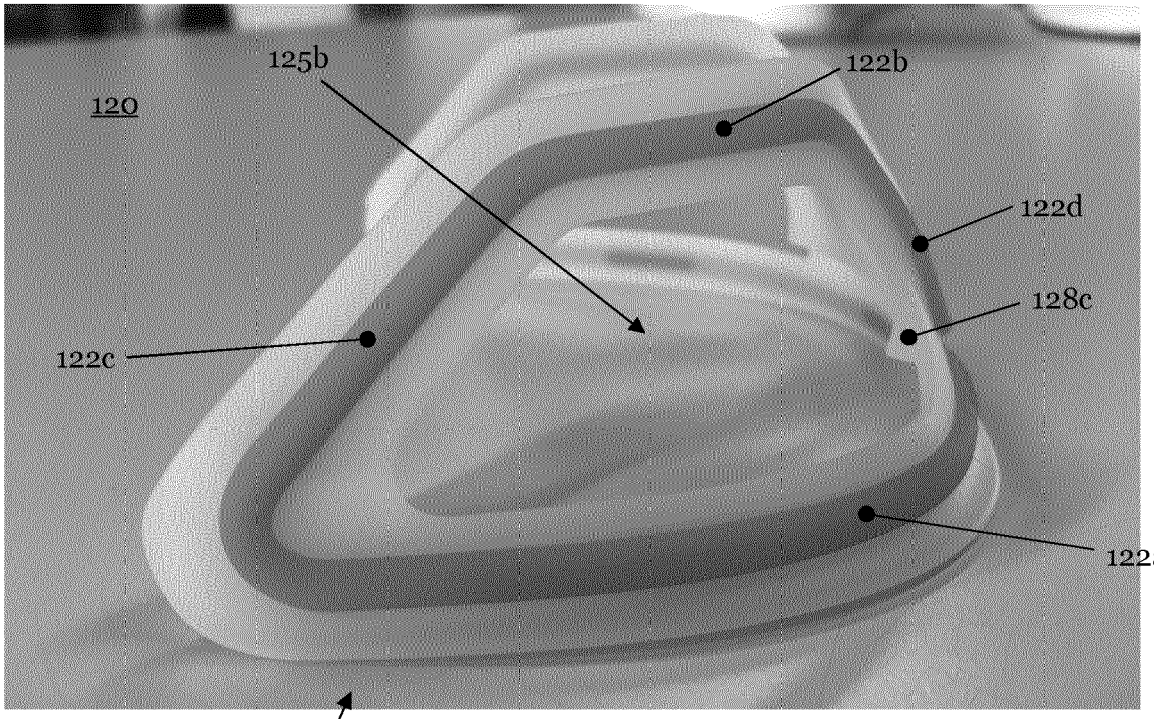


Fig. 7A

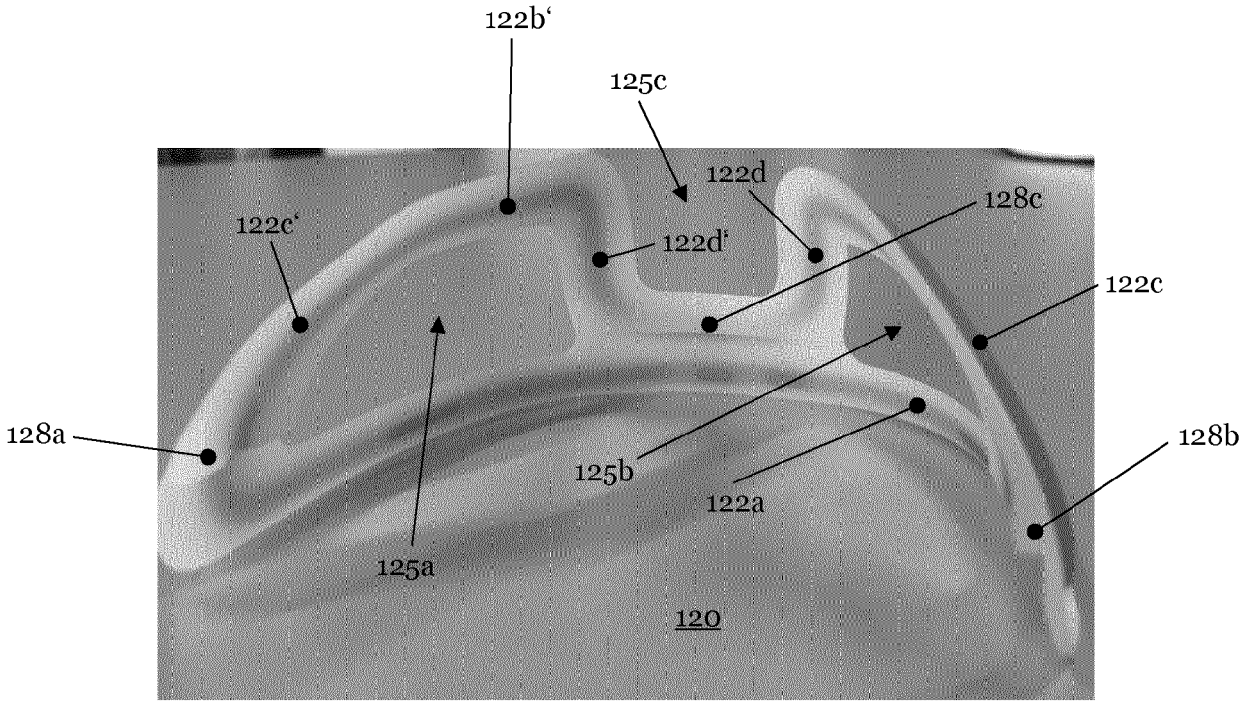

122b'
125c
122d
128c
122c'
122d'
122c
128a
125b
128b
122a
125a
120

Fig. 7B

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EUROPEAN SEARCH REPORT

Application Number
EP 19 20 8110

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 March 2020	Gkionaki, Angeliki

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 20 8110

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