

(19)



(11)

EP 4 740 775 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

13.05.2026 Bulletin 2026/20

(51) International Patent Classification (IPC):

A43B 1/04 (2022.01) **A43B 23/02** (2006.01)

A43B 23/04 (2006.01) **A43B 23/08** (2006.01)

(21) Application number: **25213968.8**

(52) Cooperative Patent Classification (CPC):

A43B 1/04; A43B 23/0245; A43B 23/0265;

A43B 23/028; A43B 23/04; A43B 23/088

(22) Date of filing: **06.11.2025**

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL
NO PL PT RO RS SE SI SK SM TR**

Designated Extension States:

BA

Designated Validation States:

GE KH LA MA MD TN

(72) Inventors:

• **FILIPESCU, Florin**
91074 Herzogenaurach (DE)

• **POPESCU, Claudiu-Ionut**
91074 Herzogenaurach (DE)

• **TAMM, Stefan**
91074 Herzogenaurach (DE)

• **KLAAS, Annika**
91074 Herzogenaurach (DE)

(30) Priority: **06.11.2024 DE 102024132397**

(71) Applicant: **adidas AG**

91074 Herzogenaurach (DE)

(74) Representative: **Bardehle Pagenberg**

Partnerschaft mbB

Patentanwälte Rechtsanwälte

Prinzregentenplatz 7

81675 München (DE)

(54) **KNITTED UPPER WITH INTEGRALLY KNITTED ELEMENT**

(57) The present invention relates to an upper (1) for a shoe, comprising a knitted main part (2), wherein the main part (2) is adapted to form at least a part of a void for receiving a foot of a wearer of the shoe; a knitted flap (3); and a knitted transition part (4) connecting the flap (3) to the main part (2), wherein the main part (2), the flap (3)

and the transition part (4) form a unitary knit construction, and wherein the transition part (4) comprises a different knit structure and/or a different yarn and/or yarn combination and/or yarn placement compared to the main part (2) and/or to the flap (3).

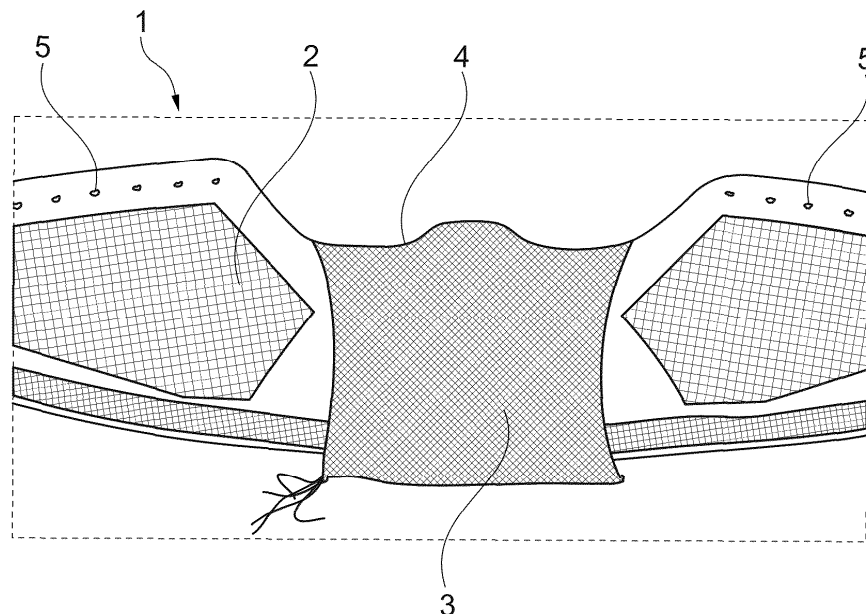


Fig. 1A

EP 4 740 775 A1

Description

Field of the invention

[0001] The present invention relates to a knitted upper for a shoe comprising an integrally knitted element and a corresponding manufacturing method.

Technical background

[0002] At present, footwear uppers are often equipped with additional functions such as cushioning, reinforcement or support by applying additional components to the upper like foams, reinforcement sheets, toe caps, heel counters, eyestay reinforcements etc. Thus, additional manufacturing steps like cutting, stitching, cementing or other labor-intensive work are necessary.

[0003] US 2,623,374 A relates to a sock comprising a sole portion, a toe portion and a heel portion having substantially the same height as the heel portions of the shoes with which the socks are to be worn and a heel tab which projects upwardly from the back of the heel portion of the sock with a fold line provided between the tab and the heel portion for folding the tab down over the outside of the heel portion of the shoe.

[0004] US 2,721,463 A relates to a knit sock which is adapted to be worn with low shoes such as golf shoes and is concealed thereby when in use with the exception of a heel supporting flap.

[0005] Therefore, the object of the present invention is to provide an upper for a shoe having additional functions, in particular cushioning and reinforcement, which is cost effective in its manufacturing.

Summary of the invention

[0006] This object is met at least in part by an upper as defined in claim 1 and a method for manufacturing such upper as defined in claim 19.

[0007] Thus, the upper for a shoe according to the invention comprises: a knitted main part, wherein the main part is adapted to form at least a part of a void for receiving a foot of a wearer of the shoe; a knitted flap; a knitted transition part connecting the flap to the main part, wherein the main part, the flap and the transition part form a unitary knit construction and, wherein the transition part comprises a different knit structure and/or a different yarn and/or yarn combination and/or yarn placement compared to the main part and/or to the flap.

[0008] The invention allows to knit the main part, the transition part and the flap in a single knitting process as a unitary knit construction which saves time and reduces manufacturing costs because additional steps of securing the flap to the rest of the upper can be avoided. The flap is an additional functional element of the upper. For example, as will be described in more detail below, the flap can function as a reinforcement or cushioning element. If needed, those functions can be achieved in

cooperation with additional elements such as paddings or reinforcement sheets. In the context of the present invention, a flap is understood as a piece of knitted material connected along one edge to the main part through the transition part. The flap may comprise a straight edge or a curved edge.

[0009] As the transition part comprises a different knit structure and/or a different yarn and/or yarn combination and/or yarn placement compared to the main part and to the flap, it can function as a natural fold line, i.e. the transition part can be configured such that the flap naturally folds at the transition part which again might save time and costs. In contrast, a traditional stitch and turn line is not adjustable in regard of stretch and other properties and may be detrimental to the visual appearance. The knitted transition part in contrast offers the freedom to be adjusted in terms of stretch and strength. The transition part as formed according to the present invention also provides a better fit and a better comfort for the wearer, since the flap tends to stay in the designated place. For example, it does not tend to unfold.

[0010] Other advantages of the present invention include saving yarn and textile material because the different parts of the upper are knitted together in a unitary knit construction directly on the knitting machine in the right shape. The process of manufacturing the upper according to the invention can be highly automated involving less human intervention and associated costs. As more parts are knitted together directly on the knitting machine manual labor can be reduced. Generally, the present invention results in less cutting, preparation and stitching work to be done. The product creation process is accelerated because of predefined knitted components. Although most parts are produced together on a knitting machine, there is still a high design freedom because the main knitting techniques that are used for creating visual and functional effects can be used independently on the flap and on the main part. Other common post process treatments can be used in addition, in order to improve the appearance or the functionality of the upper, and in particular of the main part and of the flap, such as screen printing, high frequency welding, gluing etc. Moreover, the yarns can be selected and engineered on the main part and on the flap to meet the specific needs. For instance, in those embodiments where the flap is folded inwardly, toward the void aimed to receive a foot of a wearer, the yarns used for the flap that will touch the foot can be engineered to offer comfort.

[0011] Knitting in the context of the present invention relates to both weft knitting and warp knitting.

[0012] The knit structure of the transition part may comprise a first layer and a second layer overlapping the first layer and, wherein the first layer comprises a different number of rows compared to the second layer. In this way, a pre-tensioning or pre-folding of the flap can be achieved, i.e. the flap would naturally fold in the direction of the layer having less rows.

[0013] The transition part may comprise at least one

row comprising a plurality of loops the majority of which are frontside loops and at least one another row comprising a plurality of loops the majority of which are backside loops. Thus, folding of the flap at the transition part is facilitated by having at least one row with essentially just frontside loops and another row with essentially just backside loops. A majority of loops on the front- or backside may mean more than 50%, preferably more than 75%, more preferably more than 90%, most preferably more than 95%.

[0014] The knit structure of the transition part may be a single layer structure, like for instance a single jersey. Compared to other knit structures, a single layer structure is more pliable. Moreover, it allows to achieve a thinner folded edge compared to a double layer structure. Thus, the main part and/or the flap can comprise a knit structure other than single layer structure, e.g. a double layer structure which is stiffer and adds to the stability of the upper, whereas the single jersey knit structure of the transition part facilitates folding of the flap. Other exemplary knit structures for the transition part include so called ottoman and links-links structures.

[0015] The transition part may comprise a first yarn, wherein the first yarn is different from a second yarn of the main part and/or the flap. This allows to equip the main part and/or the flap with different functions compared to the transition part. In particular, the yarn in the transition part may facilitate folding of the flap. In another example, the yarn in the transition part may have a different color than the yarn in the main part and/or the flap to visually emphasize the transition part and to delineate the folded edge in the finished product.

[0016] The first yarn may be more elastic than the second yarn. In this way the main part and the flap are dragged one toward the other by the first yarn of the transition part and the folding of the flap is facilitated. Moreover, the main part and/or the flap may be stiffer than the transition part.

[0017] The first yarn may comprise a different color than the second yarn. As outlined above, this allows to visually emphasize the transition part and delineate the folded edge in the finished product. This may also serve as an indication during the manufacturing process in order to indicate the correct fold line when folding the flap.

[0018] The transition part may comprise a frontside layer and a backside layer, wherein the frontside layer may comprise a more elastic yarn than the backside layer or the backside layer may comprise a more elastic yarn than the frontside layer. Again, such an arrangement of yarns causes the flap to fold almost automatically simply by different tensions created by the more and less elastic yarns in the backside and frontside layers. The frontside layer may be knitted on a first needle bed and the backside layer may be knitted on a second needle bed of a flat knitting machine. Alternatively, the frontside and the backside layer may be knitted on the cylinder and dial of a circular knitting machine.

[0019] The flap may be arranged at a tongue portion of

the upper such that it is adapted to cover at least a portion of the tongue or, the flap may be arranged at a heel portion of the upper. When arranged at the tongue, the flap may cover the laces or a part thereof. In this manner the flap can be used for instance to cover the lacing and the free ends of the laces and to prevent them from unfastening. When arranged at the heel, the flap may be folded to the inside of the upper to serve as a cushioning (with additional paddings if needed).

[0020] The flap may be arranged in a lace or eyelets area of the upper such that it is adapted to reinforce the lace or eyelets area. In this way, the upper can be provided with an integral reinforcement at the lace or eyelets area without the need of attaching additional components.

[0021] In addition, or alternatively, the flap may be arranged in a sole area of the upper such that it is adapted to provide a better cushioning of the sole part of the upper. In particular, the upper may comprise a sole portion, adapted to at least partially (or entirely) cover a sole of a user. For example, the upper may comprise a sock-like shape. The flap may be arranged to partially or entirely overlap the sole portion of the upper.

[0022] In some embodiments, the sole portion of the upper may be knitted as two parts, e.g., a first sole part and a second sole part of the sole portion at least partially overlapping the first sole part. Generally, the first sole part and the second sole part may be knitted. For example, the first sole part may comprise a knitted main part, e.g., may correspond to the knitted main part, and the second sole part may comprise a flap, e.g., may correspond to the knitted flap. Specifically, the first sole part may comprise a double layer knitted material and/or the second sole part may comprise a double layer knitted material.

[0023] In addition, or alternatively, the first sole part and the second sole part may be at least partially connected through the transition part. For example, the first sole part and the second sole part may be connected by means of the transition part in a heel area, e.g., in a region adapted to receive a heel.

[0024] The flap may be folded such that the flap and a portion of the main part of the upper form a void. The void may be filled with additional elements providing additional functions to the upper as will be outlined below. Generally, in the context of the present invention, components that may be inserted into the void include a heel counter, a toe cap, a cushioning foam, a reinforcement sheet etc. The position and/or shape of the flap may vary depending on the particular type of application.

[0025] A padding and/or reinforcement may be arranged in the void. Thus, the padding and/or reinforcement can be attached to the upper simply by placing it in the void formed by the integral flap and the main part of the upper. The padding and/or reinforcement can be kept in place by securing the free edges of the flap to the main part of the upper, for instance by stitching. In another embodiment the padding/reinforcement may be glued or heat bonded to the flap or to the main part to keep it in

place.

[0026] When the flap is arranged in a sole area of the upper as described above, for instance, a padding may be arranged between the first sole part and the second sole part. For example, the padding may be arranged between the first sole part and the second sole part before connecting the first sole part to the second sole part, e.g., via stitching. In some embodiments, a midsole may be at least partially attached to the sole portion of the upper. For example, the midsole may be at least partially attached to an outer and/or external surface of the sole portion. Specifically, the midsole may be at least partially attached to an outer and/or external surface of the first sole part and/or the second sole part of the sole portion. In addition, or alternatively, at least a part of the midsole may be at least partially embedded within the sole portion of the upper, e.g., embedded in the knitted textile. For example, the at least a part of the sole portion may be arranged and/or placed between the first sole part and the second sole part. Specifically, the at least a part of the sole portion may be arranged and/or placed between the first sole part and the second sole part before connecting the first sole part and the second sole part, e.g., by stitching.

[0027] The flap may comprise a Jacquard knit structure. The Jacquard knit structure may be a single layer or a double layer knit structure. Generally, the flap may comprise a single layer or a double layer knit structure. A Jacquard structure provides the possibility to create a colored pattern or writings, so it offers color options. Double layer Jacquard has more substance compared to single layer. Single layer Jacquard is flimsy and it can be used if not too much thickness should be added. On a Jacquard structure, besides the colors, also the properties of the material could be adjusted by varying structures and using different types of yarn, in a different way than could be done on a simple double layer structure.

[0028] The flap may comprise a stretch yarn. In this way, the flap can be provided with stretch which may be advantageous in certain areas of the upper. Another advantage of having a stretch yarn is that the flap can better adapt to the shape of the upper in case it is placed on a curved area, without creating creases. For instance, it is advantageous to use a stretchable yarn, like spandex or an elastic yarn, when the flap is placed on the interior of the heel area, so that it can stretch to cover the desired area without creating creases that would be uncomfortable for the wearer.

[0029] The transition part may comprise at least one yarn that is also present in the main part, wherein the number of plies of this yarn in the transition part is lower than the number of plies in the main part. Using less plies allows to obtain a thinner material, so that the transition part and/or the flap can be thinner than the rest of the upper. If it is in the transition area this allows to get a finer bending line and to more easily bend over the flap. If it is on the flap, this allows to obtain a thinner flap and thus reducing material and weight where it is not needed and

also, in case the flap is folded toward the inside of the shoe, like on the heel area, this allows improving the wearing comfort as the thickness of the material inside the shoe is lower. Instead of using a different number of plies another option could be using yarns having different deniers, e.g. 75 den and 150 den.

[0030] The main part, the transition part and the flap may have been knitted in a single knitting process forming a one-piece construction. This allows to save time and costs as the assembly of separate components is avoided. In addition, the number of seams is reduced to a minimum which adds to the visual appearance of the upper and a better wearing comfort.

[0031] The flap may have been formed by partial knitting. Partial knitting is a technique which allows to use only a specific needle area of a series of needles for stitch formation. Certain needles are not knitting but their loops are still hanging and restart the knitting after a certain amount of rows. Thus, no knitting process takes place over the entire series of needles. Partial knitting allows to obtain an upper having an edge with almost arbitrary shapes. This allows to knit the flap together with the main part and the transition part in just a single knitting process. The partial knitting on the flap may mirror the shape of the partial knitting on the main part. Thus, both the correspondent main part that will be overlapped by the flap and the flap are formed by using partial knitting. Partial knitting also allows to obtain curved and three-dimensional shapes.

[0032] Another aspect of the present invention relates to a shoe comprising an upper as described herein and a sole structure attached to the upper. The particular embodiments of the upper as described herein and their advantages are applicable to the shoe comprising such an upper as well.

[0033] A further aspect of the present invention relates to a method for manufacturing an upper for a shoe comprising the steps:

- a.) knitting a main part, wherein the main part is adapted to form at least a part of a void for receiving a foot of a wearer of the shoe;
- b.) knitting a flap;
- c.) knitting a transition part connecting the flap to the main part,

wherein steps a.), b.) and c.) are performed in a single knitting process, and wherein the transition part comprises a different knit structure and/or a different yarn and/or yarn combination and/or yarn placement compared to the main part and to the flap.

[0034] What is described herein with respect to the upper according to the invention is applicable to the method of manufacturing such an upper as well.

[0035] Generally, the steps a.), b.) and c.) of the method may be performed in an arbitrary order to allow for

maximum flexibility when manufacturing the upper.

[0036] An embodiment of the method may further be characterized in that the knit structure of the transition part comprises a first layer and a second layer overlapping the first layer and, wherein step c.) comprises knitting the transition part such that the first layer comprises a different number of rows compared to the second layer.

[0037] Step c.) of the method may comprise knitting the transition part such that at least one row comprises a plurality of loops the majority of which are frontside loops and at least one another row comprises a plurality of loopy the majority of which are backside loops.

[0038] Step c.) of the method may comprise knitting the transition part as a single layer structure.

[0039] The transition part may comprise a first yarn, wherein the first yarn is different from a second yarn of the main part and/or the flap. The first yarn may be more elastic than the second yarn. The first yarn comprises a different color than the second yarn. The flap may be arranged at a heel portion or at a tongue portion of the upper such that it is adapted to cover at least a portion of the tongue. The flap may be arranged in a lace area of the upper such that it is adapted to reinforce the lace area. Regarding the yarn and the position of the flap, reference is made to the advantages already mentioned.

[0040] The method may further comprise the step of folding the flap such that the flap and a portion of the main part of the upper form a void. The method may further comprise the step of arranging a padding and/or reinforcement in the void. Again, reference is made to the advantages mentioned with respect to the void formed by the flap and the main part.

[0041] The method may further comprise the step of securing a free end of the flap to the main part after arranging the padding and or/ reinforcement in the void. In this way, the padding or reinforcement can firmly be held in place in the void. For example, the free end of the flap may be stitched or glued to the main part. Alternatively, a melting yarn in the knit (either in the flap, the main part or both) could be used or a tape could be applied. The melt yarn could also attach to the padding/reinforcement. Additionally, the padding/reinforcement may comprise an adhesive surface to contribute keeping it in place.

[0042] Step b.) of the method according to the invention may comprise knitting the flap as a Jacquard knit structure. The flap may comprise a stretch yarn. Step b.) of the method according to the invention may comprise knitting the flap using partial knitting. Reference is made to the advantages mentioned in the context of the upper.

[0043] In step b.) of the method according to the invention a tighter stitch tension may be used than in steps a.) and/or c.). Thus, the flap may generally obtain a tighter structure which adds to the stiffness and stability of the flap. This could be done for instance if there are less plies in order to adapt the stitch length to the number of plies that are used. It can also be done to reduce the stretch or increase the support.

Short description of the figures

[0044] In the following, exemplary embodiments of the invention are described with reference to the figures. The figures show:

Figs. 1A and 1B: an exemplary embodiment of the present invention, namely a knitted upper comprising a main part, flap and transition part;

Figs. 1C and 1D: the embodiment of Figs. 1A and 1B with the flap folded open;

Fig. 2: an exemplary knit program that can be used in the context of the present invention, particularly for the embodiment shown in Figs. 4A-B;

Figs. 3A and 3B: exemplary embodiments of shoes according to the present invention;

Figs. 4A-D: another exemplary embodiment of a portion of a knitted upper according to the invention; and

Fig. 5: an exemplary method of manufacturing an upper according to the present invention.

Detailed description of preferred embodiments

[0045] In the following, only some possible embodiments of the invention are described in detail. However, the invention is not limited to those embodiments. It is to be understood that these exemplary embodiments can be modified in a number of ways and combined with each other whenever compatible and that certain features may be omitted in so far as they appear dispensable.

[0046] Figures 1A and 1B show an exemplary embodiment of the present invention, namely a detail of a knitted upper 1 for a shoe. Fig. 1A shows the inside of the upper 1, i.e. the side facing a foot of a wearer of the shoe. Fig. 1B shows the outside of the upper 1, i.e. the upper 1 of Fig. 1A flipped horizontally. It is to be noted that the idea of the present invention is to be applicable to apparel as well. Thus, the example of Figures 1A and 1B as well as the subsequent examples and embodiments are equally applicable to an apparel instead of an upper.

[0047] The upper 1 is shown in a flat configuration, i.e. before it is shaped and connected to a sole structure in order to form a complete shoe. Thus, the upper 1 can be shaped and connected to other elements (e.g. a tongue, toe box, etc.) if needed and is adapted to form at least a part of a void for receiving a foot of a wearer of the shoe. The upper 1 comprises at least three parts which are of importance in the context of the present invention.

[0048] The knitted main part 2 in this embodiment

forms the majority of the upper 1 and would form most of the void for inserting a foot once the upper 1 is shaped and connected to a sole structure. In this embodiment, the main part 2 comprises lace holes, two of which are exemplarily denoted by reference numeral 5. In other embodiments, the upper would not comprise lace holes but other means for securing the shoe to the foot like hook-and-loop fasteners or straps. In other examples, the upper 1 would not comprise any fastening means at all and the knitwear of the upper 1 would be adapted to secure the shoe to the foot like a sock.

[0049] The upper 1 also comprises a knitted flap 3 which is connected to the main part 2 via a transition portion 4. The flap 3 in this example is arranged in the heel portion of the upper. In other examples, the flap could be arranged at other locations of the upper, e.g. at a lace portion or a tongue portion. The flap 4 in the example of Figures 1A and 1B is arranged at the inside of the main part 2 of the upper 1 and covers a portion of the inside of the main part 2. In other examples, the flap could cover other portions of the main part 2 and could cover for example an outside of the main part 2.

[0050] The flap 3 is connected to the main part 2 of the upper 1 by the knitted transition part 4. The main part 2, the flap 3 and the transition part 4 form a unitary knit construction. Thus, the main part 2, the flap 3 and the transition part 4 can be manufactured in a single knitting process on a flat or circular knitting machine. Assembling of separate parts is not necessary according to the present invention. The knitted transition part 4 in the example of Figures 1A and 1B comprises a different yarn compared to the main part 2 and to the flap 3 which was threaded on a different feeder. The yarn differs in color, i.e. the colors of the yarns of the main part 2 and the flap 3 are different from the color of the yarn of the transition part 4.

[0051] In other examples, the transition part 4 would comprise a different knit structure and/or yarn combination and/or yarn placement compared to the main part 2 and to the flap 3. A different placement of a yarn relates to the placement of the yarn in the knitting machine and, consequently, in the knit structure. For example, a yarn placed on the front or back needle bed in the knitting machine ends up on the front or back layer on the knit structure. Thus, a different yarn placement comprises for example cases where for instance the same yarns are used on the transition part and on the flap and/or the main part, but they are placed differently. For instance, on the flap and/or the main part there could be elastic and polyester yarns placed both on the front and back layer and on the transition part polyester yarn could be placed only on the front or back layer and elastic on the other layer.

[0052] In another example, the main part 2 and the flap 3 could comprise a Jacquard knit structure, whereas the transition part could comprise a single jersey knit structure. In another example, the transition part 4 could comprise a different combination of yarns compared to

the main part 2 and the flap 3. For example, the transition part 4 could comprise an elastic yarn and a less elastic yarn, whereas the main part 2 and the flap 3 could comprise just an inelastic yarn.

[0053] Figures 1C and 1D show the upper 1 of Figures 1A and 1B with the flap 3 open, i.e. folded away from the main part 2. Thus, Fig. 1C corresponds to Fig. 1A and shows the inside of the upper 1, whereas Fig. 1D corresponds to Fig. 1B and shows the outside of the upper 1.

[0054] Generally, the different parts of the upper 1 such as the main part 2, the flap 3 and the transition part 4 may comprise different knit structures.

[0055] Fig. 2 illustrates an exemplary knit program that can be used to program a knitting machine in order to manufacture for example an upper 1 as described with respect to Figures 1A-1D.

[0056] Specifically, the program shows the embodiments of Figs. 4A and 4B. The program comprises an area for the main part 2, an area for the flap 3 and an area for the transition part 4 of the upper 1. As explained, the main part 2, flap 3 and transition part 4 are manufactured in a single knitting process as is also clear from the knitting program of Fig. 2. In the areas denoted by reference numeral 6, partial knitting is used to shape the edge of the main part 2 and of the flap 4. The partial knitting on the flap 3 mirrors the shape of the partial knitting on the main part 2. Thus, both the correspondent main part 2 that will be overlapped by the flap 3 and the flap 3 are formed by using partial knitting. The flap 3 is connected to the main part 2 by the transition part 4 which in this example comprises two knitting rows, namely a back stitch row near the flap 3 and a front stitch row near the main part 2. The flap 3 comprises a Jacquard structure for decoration purposes, namely a logo 7. Additionally or alternatively, the flap could include a different yarn compared to the main part 2 and/or the transition part 4, for example a moisture wicking yarn.

[0057] Fig. 3A shows a shoe 30 comprising the upper 1 of Figures 1A-1D. Therefore, what has been explained with respect to the exemplary upper 1 of Figures 1A-1D is applicable to the shoe 10 of

[0058] Fig. 3 as well. In Fig. 3, the upper 1 has been brought in a three-dimensional shape to form a void into which a user can insert a foot to put on the shoe 30. The flap 3 is folded to the inside of the upper 1 and a padding (not shown in Fig. 3A) has been arranged in the void formed between the flap 3 and the main part 2. Thus, the padding forms a cushioning for the user's heel.

[0059] The flap 3 is also fixed to the main part 2 at the lower edge of the flap 3 by a seam 7 which is made by stitching. Other examples include gluing or welding the flap 3 to the main part 2. The upper 1 comprises laces 8. The upper 1 is attached to a sole structure 9 (e.g. a midsole or strobil board) which can be made by sewing, welding or gluing for example. In this specific embodiment, the upper 1 is made in two separate pieces. The first piece is similar to the one shown in Figs. 1A-D and 2 defining the heel and quarter areas (lateral-medial) and

the second piece (only partially visible in Fig. 3A) is the one defining the toe and tongue.

[0060] Fig. 3B shows another example of a shoe 30 comprising an upper 1 according to the present invention. In this embodiment, only the tongue and the front/throat part are knitted. In this example, the upper 1 comprises a flap 3 which is arranged at the upper end of a tongue portion 10 of the upper 1. The flap 3 is folded such that it covers a portion of the tongue 10 and of the laces 8 of the upper 1. Just like in the example of Figures 1A-1D, the flap 3 is connected to the main part 2 of the upper 2 via a transition portion (not visible in Fig. 3B) and the three parts are made as a unitary knit construction in a single knitting process.

[0061] Figures 4A-4D show another example of a portion of a knitted upper 1 having a main part 2, a flap 3 and a transition part 4 which is similar to the embodiment of Figures 1A-1D, wherein

[0062] Fig. 4A shows the front side and Fig. 4B shows the back side. In the example of Figures 4A-4D, a heel foam 11 and a reinforcement sheet 12 (shown in Fig. 4D) are inserted in the void formed between the flap 3 and the main part 2. The reinforcement sheet 12 is heat activated for three-dimensional shaping. Thus, a cushioning and a stiffening at the heel portion of the upper 1 is achieved. Generally, in the context of the present invention, other components may be inserted into a void formed between the flap 3 and the main part 2 of the upper 1, namely a heel counter, a toe cap, an eyestays reinforcement etc. The position and/or shape of the flap 3 may vary depending on the particular type of application.

[0063] Fig. 5 illustrates a method 100 of manufacturing an upper 1 as described herein. The method 100 generally comprises a step 110 which is knitting of the main part 2 of the upper 1, a step 120 of knitting the transition part 4 of the upper 1 and a step 130 of knitting the flap 3 of the upper 1. It is to be noted, that the steps can generally be performed in an arbitrary order as long as the process is a single knitting process to obtain an upper 1 with a unitary knit construction and as long as the step 120 (knitting the transition part) is not the first or last step.

[0064] The process can be performed on a flat or circular knitting machine.

[0065] Optionally, in the manufacturing method 100, after knitting the main part 2, transition part 4 and flap 3, the upper 1 can be subject to steam. Further optionally, a foam, reinforcement or other component can be placed in a void formed between the flap 3 and main part 2. The inserted components can be free floating, bonded or stitched to the knit. To avoid the wrinkling of the flap 3 during the manufacturing process (too much fabric in the flap), stretch yarns can be used for knitting the flap 3. Stretch yarns may not be present in the main part 2 or the transition part 4. Alternatively, to avoid wrinkling of the flap 3, a tighter stitch tension can be used when knitting the flap 3 compared to knitting the main part 2 and/or the transition part 4. The idea underlying the present invention is also applicable to apparel such as sport apparel.

Thus, what has been described above with respect to an upper is valid for apparel as well. In this case, the upper 1 described above is to be replaced by an apparel such as for example a shirt, trousers, a sock, a hoodie, a jersey, a coat, a bra etc. Thus, the upper 1 serves as an exemplary embodiment for an apparel. Embodiments of such an apparel include:

Apparel (1), comprising:

- a. a knitted main part (2);
- b. a knitted flap (3);
- c. a knitted transition part (4) connecting the flap (3) to the main part (2),
- d. wherein the main part (2), the flap (3) and the transition part (4) form a unitary knit construction, and
- e. wherein the transition part (4) comprises a different knit structure and/or a different yarn and/or yarn combination and/or yarn placement compared to the main part (2) and/or to the flap (3).

2. Apparel (1) according to embodiment 1, wherein the knit structure of the transition part (4) comprises a first layer and a second layer overlapping the first layer and, wherein the first layer comprises a different number of rows compared to the second layer.

3. Apparel (1) according to one of embodiments 1 or 2, wherein the transition part (4) comprises at least one row comprising a plurality of loops the majority of which are frontside loops and at least one another row comprising a plurality of loops the majority of which are backside loops.

4. Apparel (1) according to one of embodiments 1-3, wherein the knit structure of the transition part (4) is a single layer structure.

5. Apparel (1) according to one of embodiments 1-4, wherein the transition part (4) comprises a first yarn, wherein the first yarn is different from a second yarn of the main part (2) and/or the flap (3).

6. Apparel (1) according to embodiment 5, wherein the first yarn is more elastic than the second yarn.

7. Apparel (1) according to one of embodiments 5 or 6, wherein the first yarn comprises a different color than the second yarn.

8. Apparel (1) according to one of embodiments 1-7, wherein the transition part (4) comprises a frontside layer and a backside layer and, wherein the frontside layer comprises a more elastic yarn than the backside layer, or the backside layer comprises a more elastic yarn than the frontside layer.

9. Apparel (1) according to one of embodiments 1-8, wherein the flap (3) is arranged at a tongue portion of the apparel (1) such that it is adapted to cover at least a portion of the tongue or, wherein the flap (3) is arranged at a heel portion of the apparel (1). 5
10. Apparel (1) according to one of embodiments 1-9, wherein the flap (3) is folded such that the flap (3) and a portion of the main part (2) of the apparel (1) form a void. 10
11. Apparel (1) according to embodiment 10, wherein a padding and/or reinforcement is arranged in the void. 15
12. Apparel (1) according to one of embodiments 1-11, wherein the flap (3) comprises a Jacquard knit structure. 20
13. Apparel (1) according to one of embodiments 1-12, wherein the flap (3) comprises a stretch yarn. 25
14. Apparel (1) according to one of embodiments 1-13, wherein the transition part (4) comprises at least one yarn that is also present in the main part (2), wherein the number of plies of this yarn in the transition part (4) is lower than the number of plies in the main part (2). 30
15. Apparel (1) according to one of embodiments 1-14, wherein the main part (2), the transition part (4) and the flap (3) have been knitted in a single knitting process forming a one-piece construction. 35
16. Apparel (1) according to one of embodiments 1-15, wherein the flap (3) has been formed by partial knitting. 40
17. Method (100) for manufacturing an apparel comprising the steps: 45
- a. knitting (110) a main part;
 - b. knitting (120) a flap;
 - c. knitting (130) a transition part connecting the flap to the main part, wherein steps a., b. and c. are performed in a single knitting process, and wherein the transition part comprises a different knit structure and/or a different yarn and/or yarn combination and/or yarn placement compared to the main part and/or to the flap. 50
18. Method (100) according to embodiment 17, wherein the knit structure of the transition part comprises a first layer and a second layer overlapping the first layer and, wherein step c. (130) comprises knitting the transition part such that the first layer comprises a different number of rows compared to the second layer. 55

19. Method (100) according to one of embodiments 17 or 18, wherein step c. (130) comprises knitting the transition part such that at least one row comprises a plurality of loops the majority of which are frontside loops and at least one another row comprises a plurality of loopy the majority of which are backside loops.
20. Method (100) according to one of embodiments 17-19, wherein step c. (130) comprises knitting the transition part as a single layer structure.
21. Method (100) according to one of embodiments 17-20, wherein the transition part comprises a first yarn, wherein the first yarn is different from a second yarn of the main part and/or the flap.
22. Method (100) according to embodiment 21, wherein the first yarn is more elastic than the second yarn.
23. Method (100) according to one of embodiments 21 or 22, wherein the first yarn comprises a different color than the second yarn.
24. Method (100) according to one of embodiments 17-23, further comprising the step of folding the flap such that the flap and a portion of the main part of the apparel form a void.
25. Method (100) according to embodiment 24, further comprising the step of arranging a padding and/or reinforcement in the void.
26. Method (100) according to embodiment 25, further comprising the step of securing a free end of the flap to the main part after arranging the padding and or/ reinforcement in the void.
27. Method (100) according to one of embodiments 17-26, wherein step b. (120) comprises knitting the flap as a Jacquard knit structure.
28. Method (100) according to one of embodiments 17-27, wherein the flap comprises a stretch yarn.
29. Method (100) according to one of embodiments 17-28, wherein step b. (120) comprises knitting the flap using partial knitting.
30. Method (100) according to one of embodiments 17-29, wherein in step b. (120) a tighter stitch tension is used than in steps a. (110) and/or c. (130).

[0066] Further embodiments of an upper include:

- 1. Upper (1) for a shoe, comprising:

- a. a knitted main part (2), wherein the main part (2) is adapted to form at least a part of a void for receiving a foot of a wearer of the shoe;
 b. a knitted flap (3); and
 c. a knitted transition part (4) connecting the flap (3) to the main part (2),
 d. wherein the main part (2), the flap (3) and the transition part (4) form a unitary knit construction, and
 e. wherein the transition part (4) comprises a different knit structure and/or a different yarn and/or yarn combination and/or yarn placement compared to the main part (2) and/or to the flap (3).
2. Upper (1) according to embodiment 1, wherein the knit structure of the transition part (4) comprises a first layer and a second layer overlapping the first layer and, wherein the first layer comprises a different number of rows compared to the second layer.
3. Upper (1) according to one of embodiments 1 or 2, wherein the transition part (4) comprises at least one row comprising a plurality of loops the majority of which are frontside loops and at least one another row comprising a plurality of loops the majority of which are backside loops.
4. Upper (1) according to one of embodiments 1-3, wherein the knit structure of the transition part (4) is a single layer structure.
5. Upper (1) according to one of embodiments 1-4, wherein the transition part (4) comprises a first yarn, wherein the first yarn is different from a second yarn of the main part (2) and/or the flap (3).
6. Upper (1) according to embodiment 5, wherein the first yarn is more elastic than the second yarn.
7. Upper (1) according to one of embodiments 5 or 6, wherein the first yarn comprises a different color than the second yarn.
8. Upper (1) according to one of embodiments 1-7, wherein the transition part (4) comprises a frontside layer and a backside layer and, wherein the frontside layer comprises a more elastic yarn than the backside layer, or the backside layer comprises a more elastic yarn than the frontside layer.
9. Upper (1) according to one of embodiments 1-8, wherein the flap (3) is arranged at a tongue portion of the upper (1) such that it is adapted to cover at least a portion of the tongue or, wherein the flap (3) is arranged at a heel portion of the upper (1).
10. Upper (1) according to one of embodiments 1-8,
- wherein the flap (3) is arranged in a lace area of the upper (1) such that it is adapted to reinforce the lace area.
11. Upper (1) according to one of embodiments 1-10, wherein the flap (3) is folded such that the flap (3) and a portion of the main part (2) of the upper (1) form a void.
12. Upper (1) according to embodiment 11, wherein a padding and/or reinforcement is arranged in the void.
13. Upper (1) according to one of embodiments 1-12, wherein the flap (3) comprises a Jacquard knit structure.
14. Upper (1) according to one of embodiments 1-13, wherein the flap (3) comprises a stretch yarn.
15. Upper (1) according to one of embodiments 1-14, wherein the transition part (4) comprises at least one yarn that is also present in the main part (2), wherein the number of plies of this yarn in the transition part (4) is lower than the number of plies in the main part (2).
16. Upper (1) according to one of embodiments 1-15, wherein the main part (2), the transition part (4) and the flap (3) have been knitted in a single knitting process forming a one-piece construction.
17. Upper (1) according to one of embodiments 1-16, wherein the flap (3) has been formed by partial knitting.
18. Shoe comprising:
- a. an upper (1) according to one of embodiments 1-17; and
 b. a sole structure attached to the upper (1).
19. Method (100) for manufacturing an upper for a shoe comprising the steps:
- a. knitting (110) a main part, wherein the main part is adapted to form at least a part of a void for receiving a foot of a wearer of the shoe;
 b. knitting (120) a flap;
 c. knitting (130) a transition part connecting the flap to the main part, wherein steps a., b. and c. are performed in a single knitting process, and
 wherein the transition part comprises a different knit structure and/or a different yarn and/or yarn combination and/or yarn placement compared to the main part and/or to the flap.
20. Method (100) according to embodiment 19,

wherein the knit structure of the transition part comprises a first layer and a second layer overlapping the first layer and, wherein step c. (130) comprises knitting the transition part such that the first layer comprises a different number of rows compared to the second layer.

21. Method (100) according to one of embodiments 19 or 20, wherein step c. (130) comprises knitting the transition part such that at least one row comprises a plurality of loops the majority of which are frontside loops and at least one another row comprises a plurality of loopy the majority of which are backside loops.

22. Method (100) according to one of embodiments 19-21, wherein step c. (130) comprises knitting the transition part as a single layer structure.

23. Method (100) according to one of embodiments 19-22, wherein the transition part comprises a first yarn, wherein the first yarn is different from a second yarn of the main part and/or the flap.

24. Method (100) according to embodiment 23, wherein the first yarn is more elastic than the second yarn.

25. Method (100) according to one of embodiments 23 or 24, wherein the first yarn comprises a different color than the second yarn.

26. Method (100) according to one of embodiments 19-25, wherein the flap is arranged at a heel portion or at a tongue portion of the upper such that it is adapted to cover at least a portion of the tongue.

27. Method (100) according to one of embodiments 19-25, wherein the flap is arranged in a lace area of the upper such that it is adapted to reinforce the lace area.

28. Method (100) according to one of embodiments 19-27, further comprising the step of folding the flap such that the flap and a portion of the main part of the upper form a void.

29. Method (100) according to embodiment 28, further comprising the step of arranging a padding and/or reinforcement in the void.

30. Method (100) according to embodiment 29, further comprising the step of securing a free end of the flap to the main part after arranging the padding and or/ reinforcement in the void.

31. Method (100) according to one of embodiments 19-30, wherein step b. (120) comprises knitting the

flap as a Jacquard knit structure.

32. Method (100) according to one of embodiments 19-31, wherein the flap comprises a stretch yarn.

33. Method (100) according to one of embodiments 19-32, wherein step b. (120) comprises knitting the flap using partial knitting.

34. Method (100) according to one of embodiments 19-33, wherein in step b. (120) a tighter stitch tension is used than in steps a. (110) and/or c. (130).

List of reference numerals

[0067]

1	Upper
2	Main part
3	Flap
4	Transition part
5	Lace holes
6	Partial knitting areas
7	Seam
8	Laces
9	Sole structure
10	Shoe
11	Foam
12	Reinforcement sheet
100	Manufacturing method
110	Step a. of knitting main part
120	Step b. of knitting flap
130	Step c. of knitting transition part

Claims

1. Upper (1) for a shoe, comprising:

- a knitted main part (2), wherein the main part (2) is adapted to form at least a part of a void for receiving a foot of a wearer of the shoe;
- a knitted flap (3); and
- a knitted transition part (4) connecting the flap (3) to the main part (2),
- wherein the main part (2), the flap (3) and the transition part (4) form a unitary knit construction, and
- wherein the transition part (4) comprises a different knit structure and/or a different yarn and/or yarn combination and/or yarn placement compared to the main part (2) and/or to the flap (3).

2. Upper (1) according to claim 1, wherein:

the knit structure of the transition part (4) comprises a first layer and a second layer overlapping the first layer and, wherein the first layer

- comprises a different number of rows compared to the second layer; and/or
the transition part (4) comprises at least one row comprising a plurality of loops the majority of which are frontside loops and at least one another row comprising a plurality of loops the majority of which are backside loops; and/or the knit structure of the transition part (4) is a single layer structure.
3. Upper (1) according to claim 1 or 2, wherein the transition part (4) comprises a first yarn, wherein the first yarn is different from a second yarn of the main part (2) and/or the flap (3); preferably wherein:
- the first yarn is more elastic than the second yarn; and/or
the first yarn comprises a different color than the second yarn.
4. Upper (1) according to one of claims 1-3, wherein the transition part (4) comprises a frontside layer and a backside layer and, wherein the frontside layer comprises a more elastic yarn than the backside layer, or the backside layer comprises a more elastic yarn than the frontside layer.
5. Upper (1) according to one of claims 1-4, wherein:
- the flap (3) is arranged at a tongue portion of the upper (1) such that it is adapted to cover at least a portion of the tongue or, wherein the flap (3) is arranged at a heel portion of the upper (1); or
the flap (3) is arranged in a lace area of the upper (1) such that it is adapted to reinforce the lace area.
6. Upper (1) according to one of claims 1-5, wherein the flap (3) is folded such that the flap (3) and a portion of the main part (2) of the upper (1) form a void; preferably wherein a padding and/or reinforcement is arranged in the void.
7. Upper (1) according to one of claims 1-6, wherein:
- the flap (3) comprises a Jacquard knit structure; and/or
the flap (3) comprises a stretch yarn; and/or
the transition part (4) comprises at least one yarn that is also present in the main part (2), wherein the number of plies of this yarn in the transition part (4) is lower than the number of plies in the main part (2); and/or
the main part (2), the transition part (4) and the flap (3) have been knitted in a single knitting process forming a one-piece construction; and/or
the flap (3) has been formed by partial knitting.
8. Shoe comprising:
- a. an upper (1) according to one of claims 1-7; and
b. a sole structure attached to the upper (1).
9. Method (100) for manufacturing an upper for a shoe comprising the steps:
- a. knitting (110) a main part, wherein the main part is adapted to form at least a part of a void for receiving a foot of a wearer of the shoe;
b. knitting (120) a flap;
c. knitting (130) a transition part connecting the flap to the main part, wherein steps a., b. and c. are performed in a single knitting process, and wherein the transition part comprises a different knit structure and/or a
- different yarn and/or yarn combination and/or yarn placement compared to the main part and/or to the flap.
10. Method (100) according to claim 9, wherein:
- the knit structure of the transition part comprises a first layer and a second layer overlapping the first layer and, wherein step c. (130) comprises knitting the transition part such that the first layer comprises a different number of rows compared to the second layer; and/or
step c. (130) comprises knitting the transition part such that at least one row comprises a plurality of loops the majority of which are frontside loops and at least one another row comprises a plurality of loops the majority of which are backside loops; and/or
step c. (130) comprises knitting the transition part as a single layer structure.
11. Method (100) according to claim 9 or 10, wherein the transition part comprises a first yarn, wherein the first yarn is different from a second yarn of the main part and/or the flap; preferably wherein the first yarn is more elastic than the second yarn.
12. Method (100) according to claim 11, wherein the first yarn comprises a different color than the second yarn.
13. Method (100) according to one of claims 9-12, wherein:
- the flap is arranged at a heel portion or at a tongue portion of the upper such that it is adapted to cover at least a portion of the tongue; or
the flap is arranged in a lace area of the upper

such that it is adapted to reinforce the lace area.

14. Method (100) according to one of claims 9-13, further comprising the step of folding the flap such that the flap and a portion of the main part of the upper form a void; preferably further comprising the step of arranging a padding and/or reinforcement in the void; most preferably further comprising the step of securing a free end of the flap to the main part after arranging the padding and or/ reinforcement in the void.

15. Method (100) according to one of claims 9-14, wherein:

step b. (120) comprises knitting the flap as a Jacquard knit structure; and/or the flap comprises a stretch yarn; and/or

step b. (120) comprises knitting the flap using partial knitting; and/or in step b. (120) a tighter stitch tension is used than in steps a. (110) and/or c. (130).

5

10

15

20

25

30

35

40

45

50

55

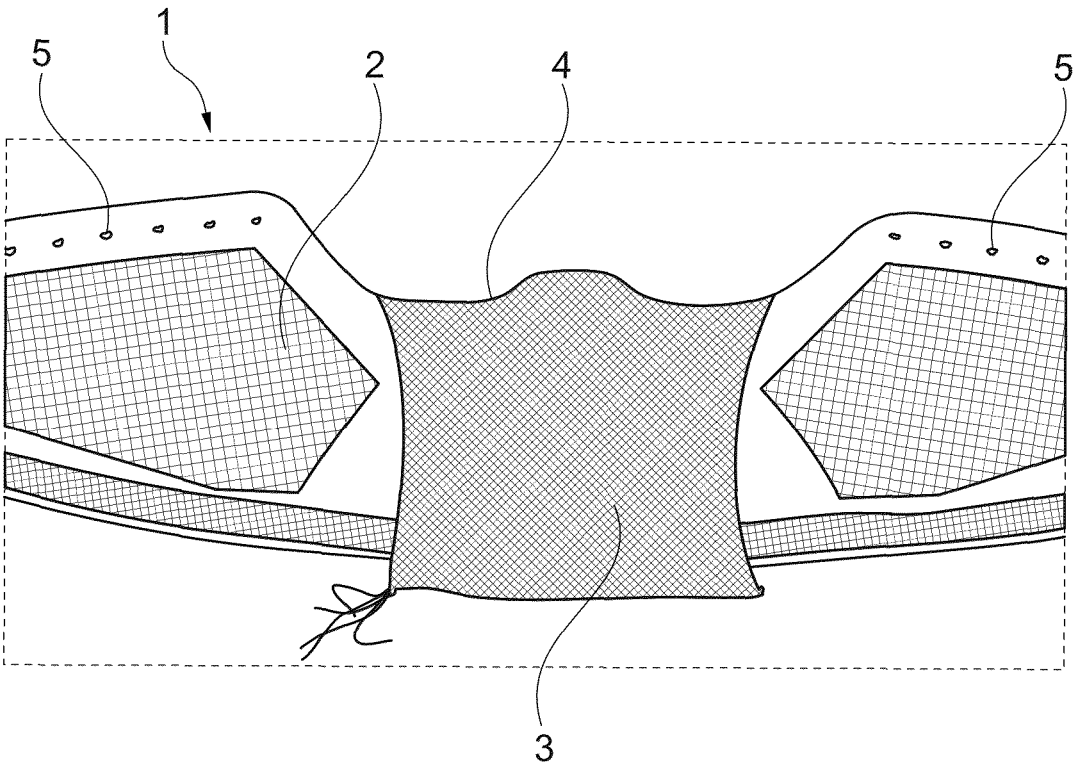


Fig. 1A

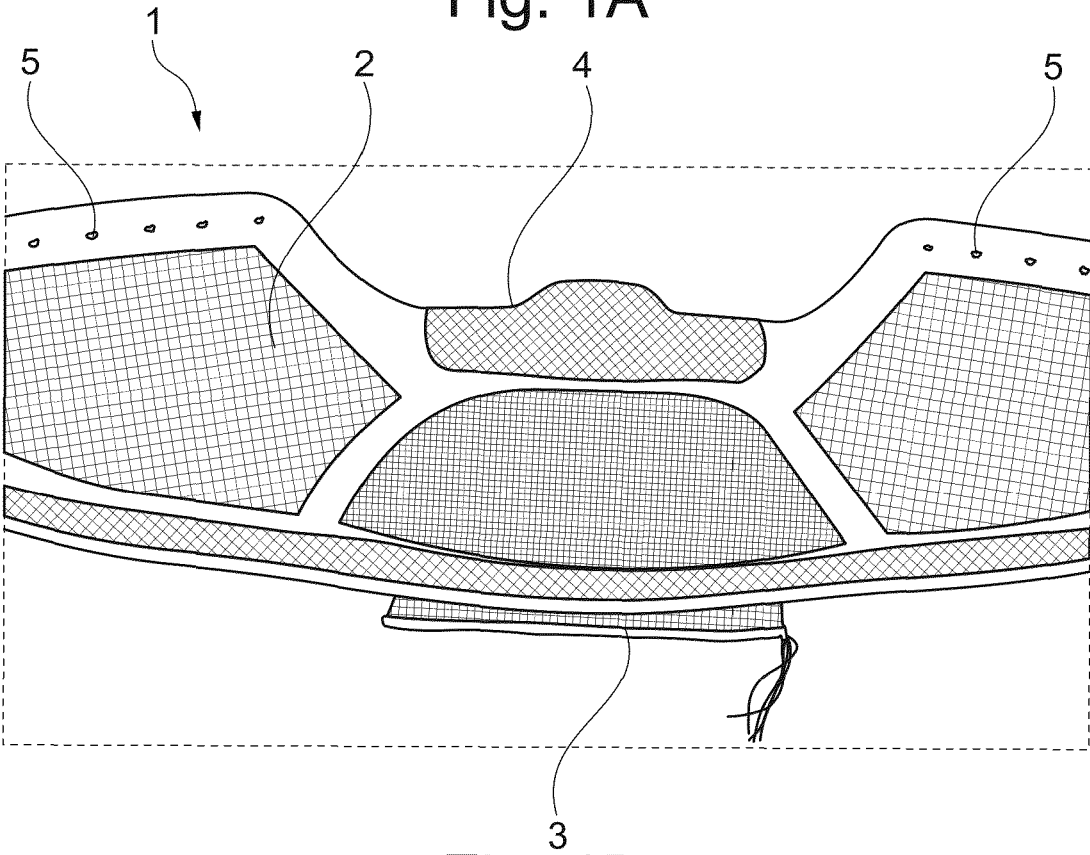


Fig. 1B

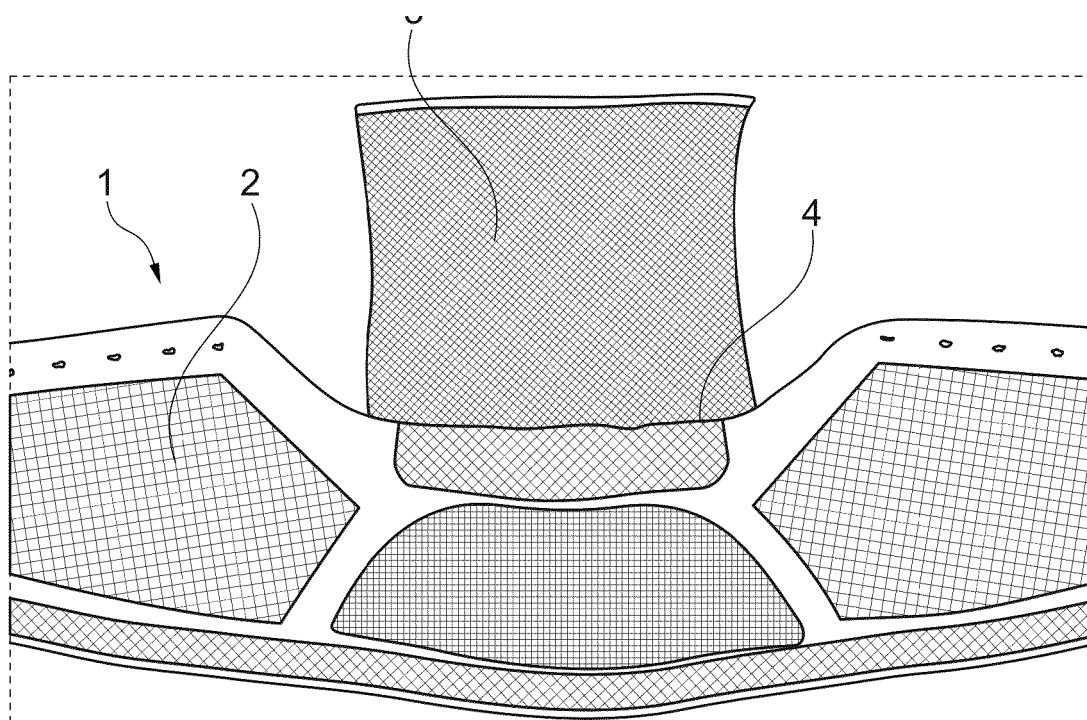


Fig. 1C

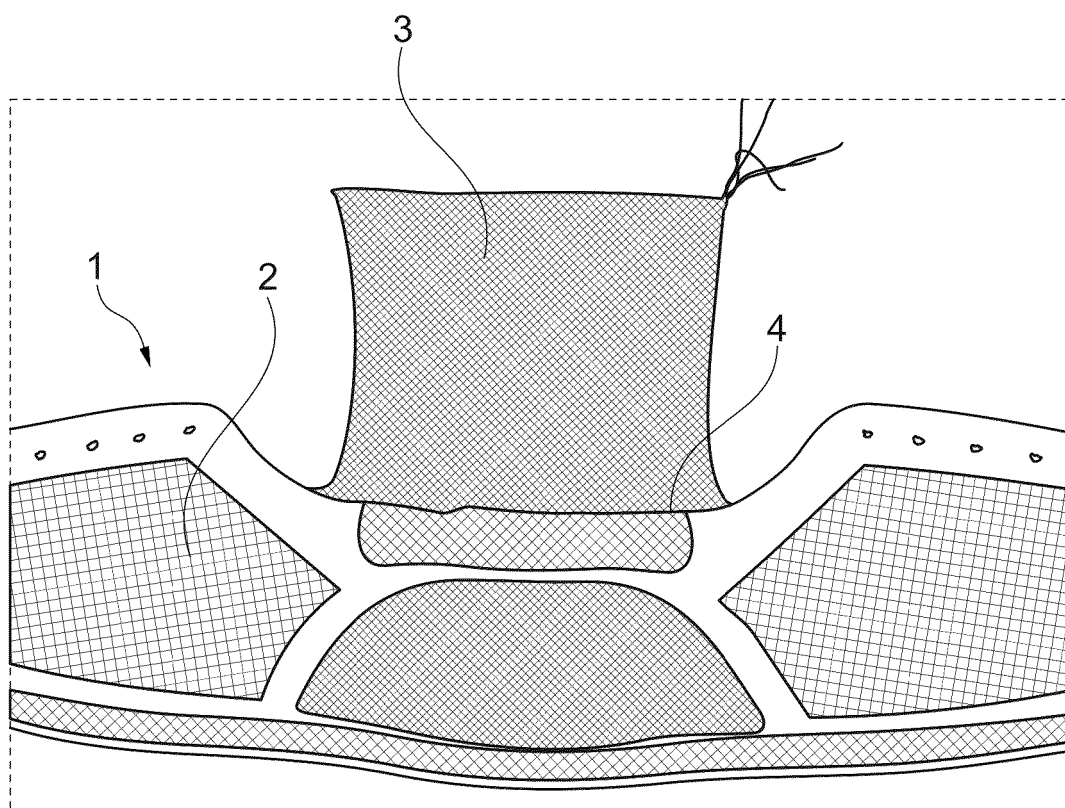


Fig. 1D

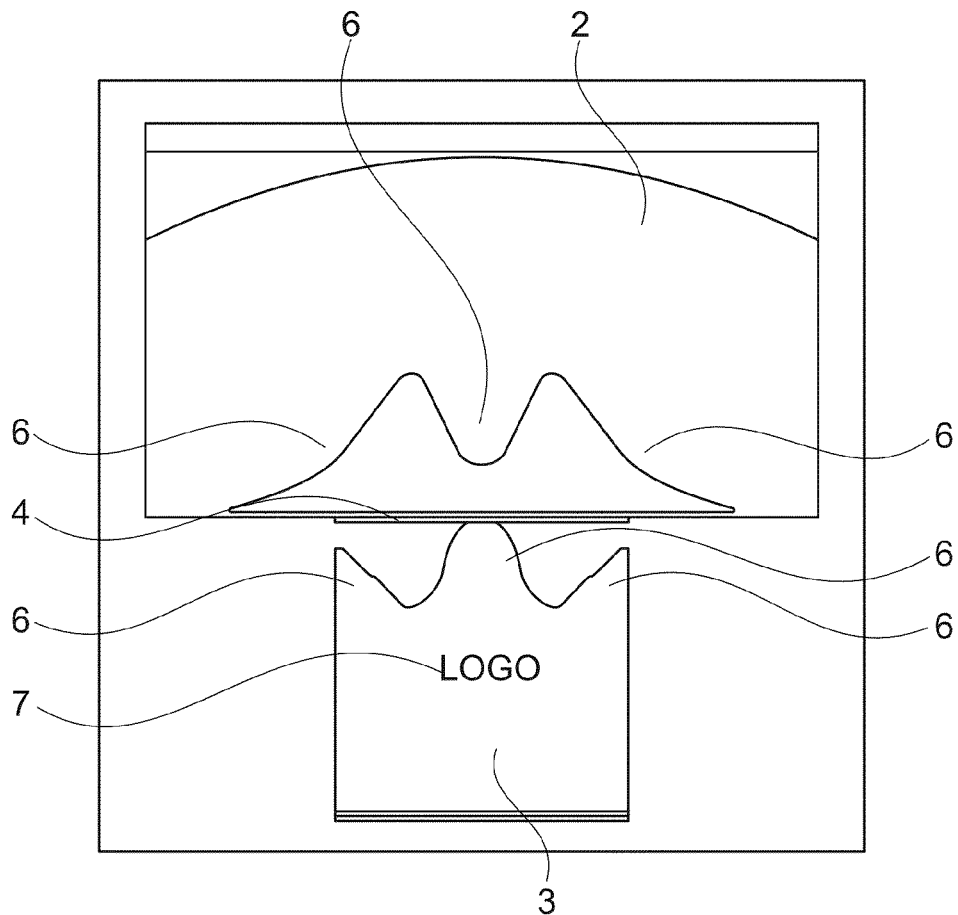


Fig. 2

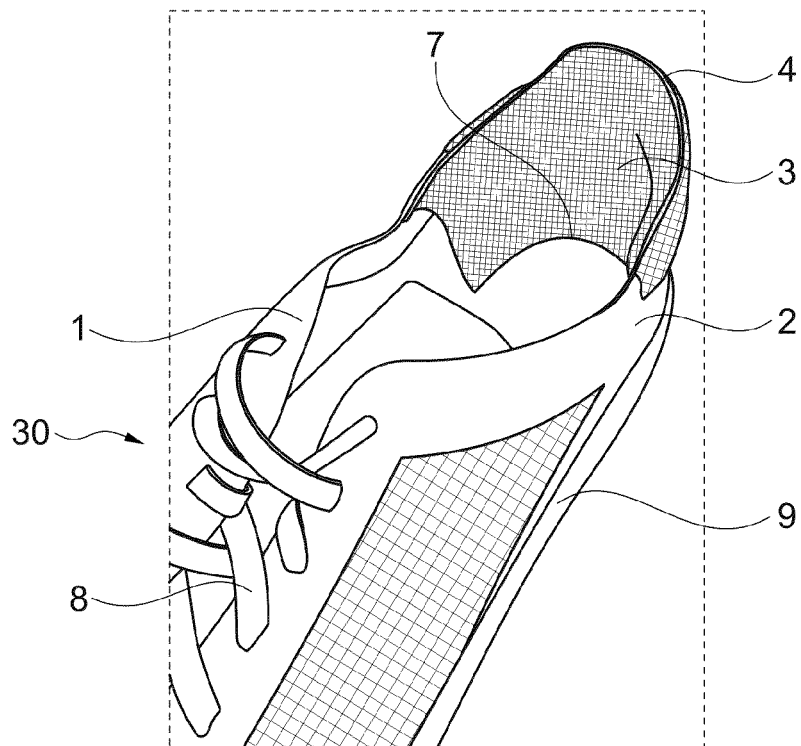


Fig. 3A

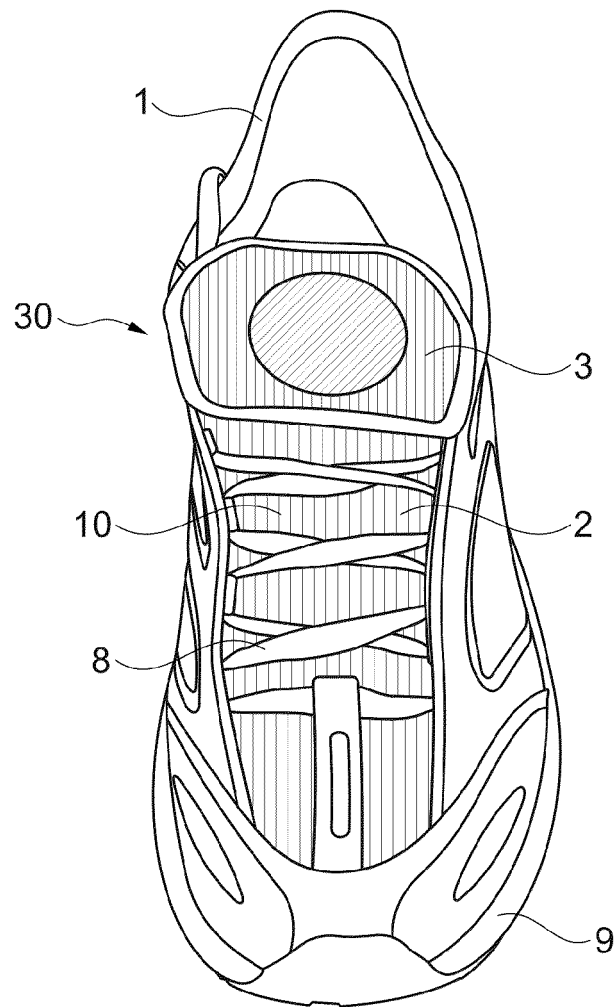


Fig. 3B

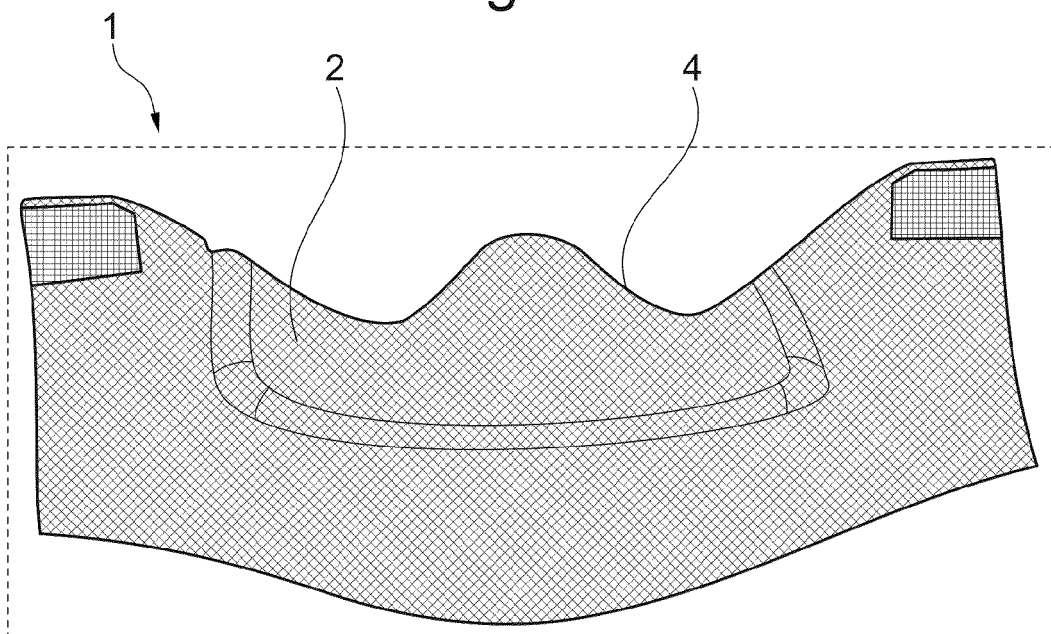


Fig. 4A

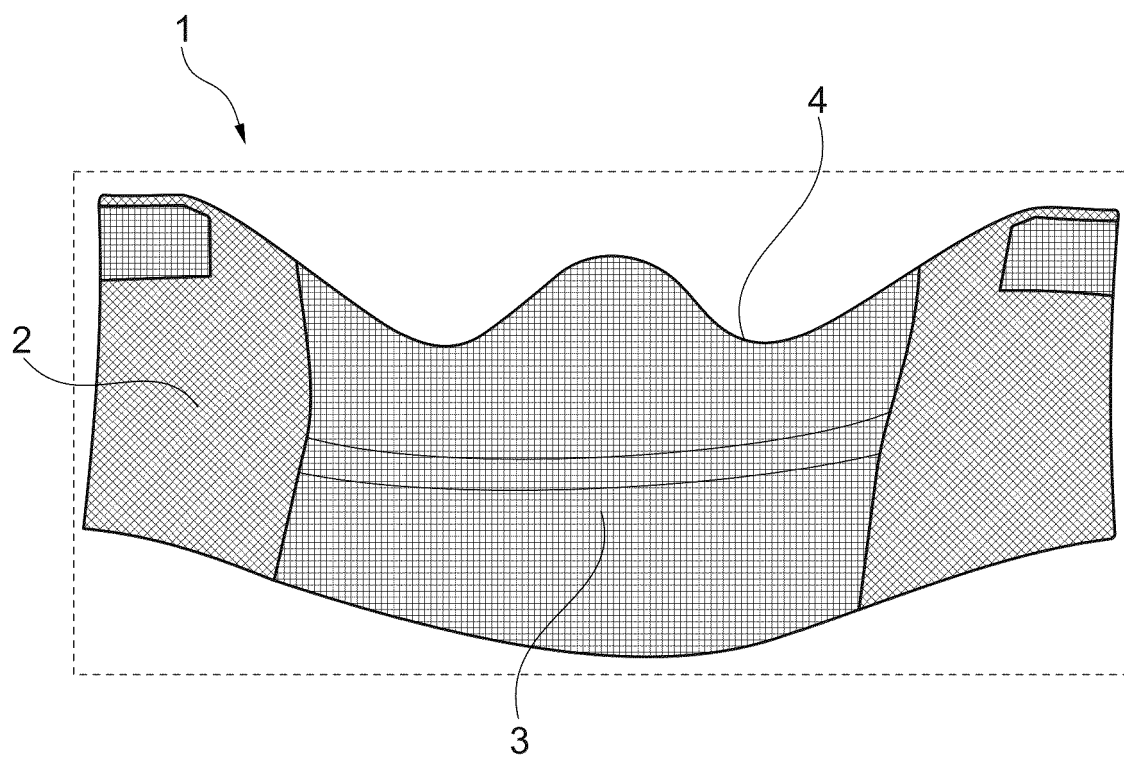


Fig. 4B

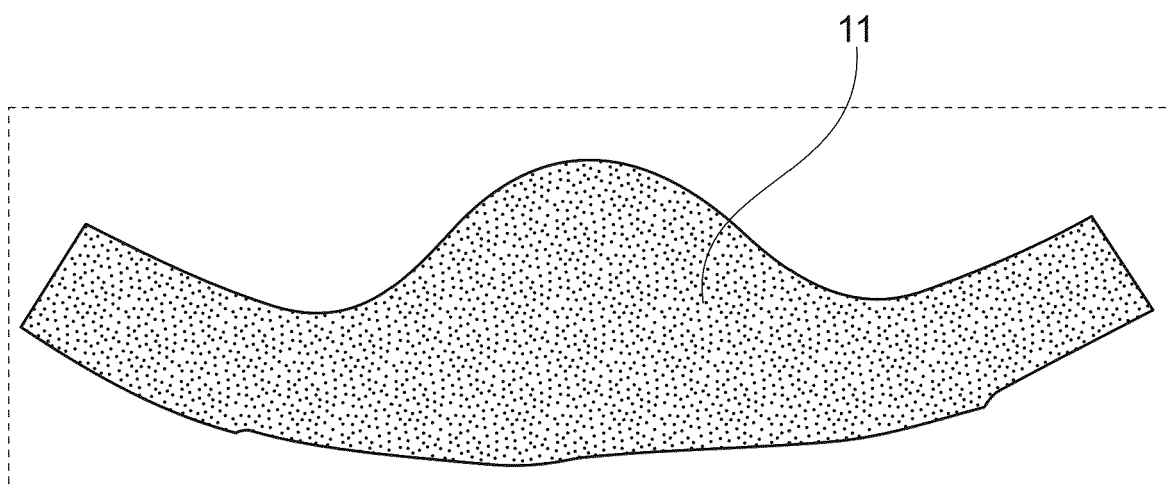


Fig. 4C

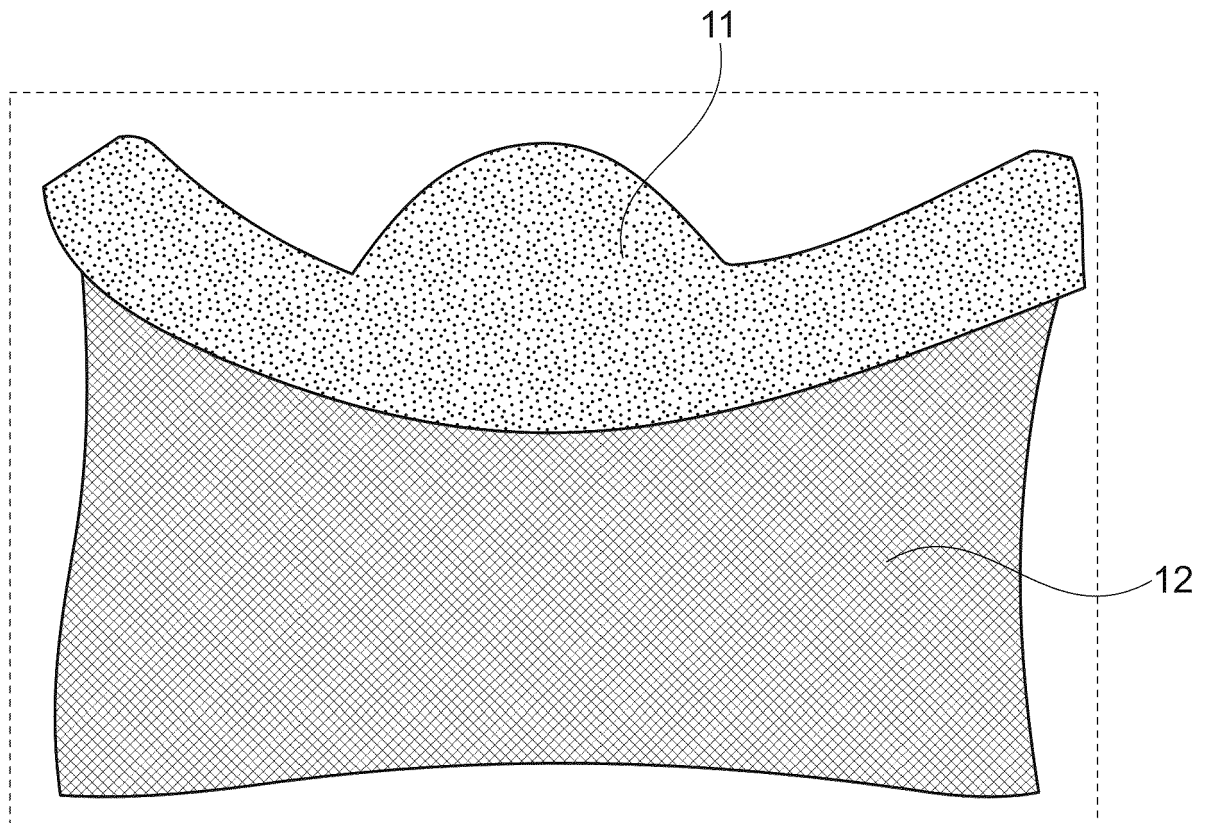


Fig. 4D

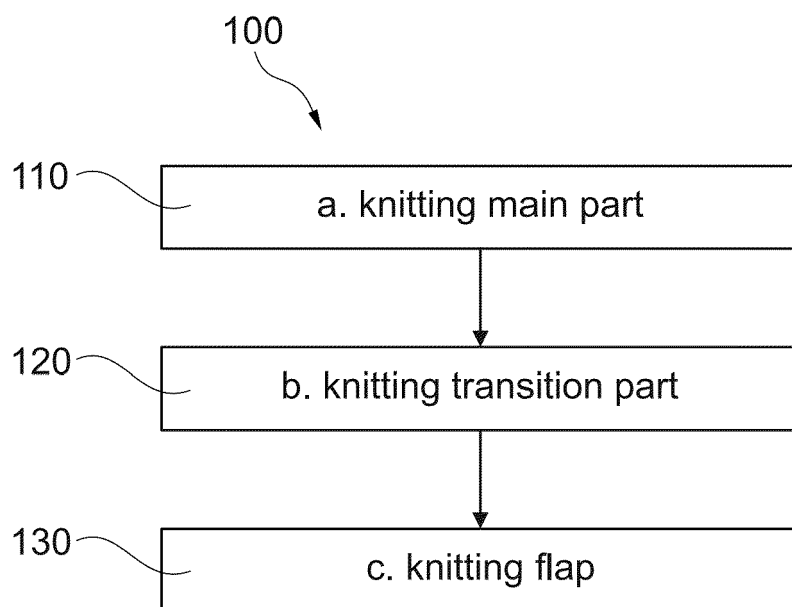


Fig. 5



EUROPEAN SEARCH REPORT

Application Number

EP 25 21 3968

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2015/076893 A1 (NIKE INNOVATE CV [US]; LONG BRADLEY S [US] ET AL.) 28 May 2015 (2015-05-28)	1-3,5, 7-13,15	INV. A43B1/04 A43B23/02
A	* abstract * * paragraphs [0001] - [0099] * * figures 1-19 * * claims 1-25 *	4,6,14	A43B23/04 A43B23/08
X	WO 2013/126313 A2 (NIKE INTERNATIONAL LTD; TATLER DAREN P [US]; PODHAJNY DANIEL A [US]) 29 August 2013 (2013-08-29)	1-3, 7-12,15	
A	* abstract * * paragraphs [0001] - [0164] * * figures 1-39C * * claims 1-11 *	4-6,13, 14	
			TECHNICAL FIELDS SEARCHED (IPC)
			A43B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		23 March 2026	Espeel, Els
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 O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P34C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 25 21 3968

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

23-03-2026

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2015076893 A1	28-05-2015	AR 098511 A1	01-06-2016
		CN 105792694 A	20-07-2016
		EP 3071063 A1	28-09-2016
		KR 20160089447 A	27-07-2016
		MX 375098 B	06-03-2025
		TW 201528981 A	01-08-2015
		US 2015143716 A1	28-05-2015
		WO 2015076893 A1	28-05-2015

WO 2013126313 A2	29-08-2013	AR 094973 A1	09-09-2015
		BR 112014020456 A2	20-06-2017
		BR 112015020813 A2	18-07-2017
		CN 104246040 A	24-12-2014
		CN 105264133 A	20-01-2016
		CN 105768363 A	20-07-2016
		DE 202013012921 U1	04-02-2022
		DE 202013012922 U1	09-02-2022
		DE 202013012924 U1	14-02-2022
		DE 202013012927 U1	16-02-2022
		DE 202013012929 U1	22-02-2022
		DE 202013012930 U1	22-02-2022
		DE 202013012939 U1	18-07-2022
		EP 2817442 A2	31-12-2014
		EP 2961873 A1	06-01-2016
		EP 3031966 A1	15-06-2016
		EP 3666102 A1	17-06-2020
		EP 4112793 A1	04-01-2023
		EP 4487726 A2	08-01-2025
		EP 4545694 A1	30-04-2025
		HK 1200507 A1	07-08-2015
		HK 1215458 A1	26-08-2016
		JP 6122878 B2	26-04-2017
		JP 6443993 B2	26-12-2018
		JP 6527545 B2	05-06-2019
		JP 7005544 B2	21-01-2022
		JP 7301177 B2	30-06-2023
		JP 7571204 B2	22-10-2024
		JP 2015513414 A	14-05-2015
		JP 2016516454 A	09-06-2016
		JP 2017124228 A	20-07-2017
		JP 2019115700 A	18-07-2019
		JP 2022044628 A	17-03-2022
		JP 2023118770 A	25-08-2023
		KR 20140123598 A	22-10-2014
		KR 20150121175 A	28-10-2015
		KR 20160064254 A	07-06-2016

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 25 21 3968

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

23-03-2026

10

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		TW 201402030 A	16-01-2014
		TW 201439392 A	16-10-2014
		TW 201514354 A	16-04-2015
		TW 201519813 A	01-06-2015
		TW 201818846 A	01-06-2018
		US 8448474 B1	28-05-2013
		US 2013212907 A1	22-08-2013
		US 2013239625 A1	19-09-2013
		US 2014144190 A1	29-05-2014
		US 2014150296 A1	05-06-2014
		US 2014245545 A1	04-09-2014
		US 2015216257 A1	06-08-2015
		US 2017000216 A1	05-01-2017
		US 2019269195 A1	05-09-2019
		US 2022042219 A1	10-02-2022
		US 2023124221 A1	20-04-2023
		US 20260071359 A1	12-03-2026
		WO 2013126313 A2	29-08-2013
		WO 2014134247 A1	04-09-2014

15

20

25

30

35

40

45

50

55

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 2623374 A [0003]
- US 2721463 A [0004]