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(54) **METHOD FOR PERMANENTLY WATERPROOFING FOOTWEAR**

(57) A method for waterproofing footwear (2), the footwear (2) including an upper assembly (4) having an outer construction (6) and a sole (8), includes providing a waterproof, breathable bootie (10) having a waterproof, breathable laminate construction, the waterproof, breathable laminate construction comprising a functional layer (54) and at least one textile layer (56, 58); inserting the

waterproof, breathable bootie (10) into an inner space (12) of the outer construction (6) and the sole (8), when the outer construction (6) and the sole (8) are in an assembled state; and fixing the waterproof, breathable bootie (10) in position in the inner space (12) of the outer construction (6) and the sole (8).

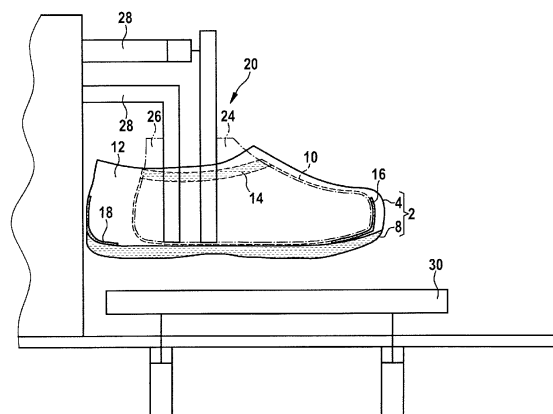


Fig. 2B

Description

[0001] The present invention is in the field of producing footwear. In particular, the present invention is in the field of producing waterproof footwear.

[0002] In recent years, there has been a trend towards waterproof shoes. Waterproof and breathable shoes have been developed that provide for an all-around waterproof structure around the wearer's foot, but at the same time provide breathability, such that moisture and sweat from the wearer's foot can escape from the interior of the shoe. While such waterproof and breathable shoes provide a very convenient feel for the user in a wide range of usage scenarios, the percentage of waterproof footwear among all shoes is still relatively low.

[0003] Accordingly, it would be beneficial to provide a method that allows for facilitating a wider range of waterproof and breathable shoes. It would further be beneficial to provide footwear produced in accordance with such a method.

[0004] Exemplary embodiments of the invention include a method for permanently waterproofing footwear, comprising providing a waterproof, breathable bootie having a waterproof, breathable laminate construction, the waterproof, breathable laminate construction comprising a functional layer and at least one textile layer; inserting the waterproof, breathable bootie through a collar of the footwear into an inner space of the footwear, after the inner space of the footwear has been closed; and permanently fixing the waterproof, breathable bootie in position in the inner space of the footwear by attaching the waterproof, breathable bootie to the footwear in a donning region of the footwear and attaching the waterproof, breathable bootie to the footwear in at least one further attachment region of the footwear.

[0005] Exemplary embodiments of the invention allow for equipping footwear with a waterproof, breathable bootie, when the footwear is otherwise already completely assembled or close to being completely assembled. In particular, when the footwear has been designed and assembled in accordance with a conventional non-waterproof design and is ready to be worn or close to being ready to be worn, it can still be equipped with a waterproof, breathable bootie. In the case of footwear that is ready to be worn, it may also be said that readily assembled non-waterproof footwear may be retrofitted with a waterproof, breathable bootie and may, thus, be made waterproof.

[0006] According to exemplary embodiments of the invention, the waterproof, breathable bootie is inserted through the collar of the footwear into the inner space of the footwear, after the inner space of the footwear has been closed. As compared to previous approaches where a waterproof, breathable laminate was attached to other components of the upper assembly, before any of the components were put on a last and before the other components of the upper assembly were brought into their final shape together with the waterproof, breathable

laminate, exemplary embodiments of the invention allow for inserting the waterproof, breathable bootie into a closed bag-like structure, which surrounds the wearer's foot during use of the footwear. As compared to previous approaches where the waterproof, breathable laminate was embedded between other components of the footwear and where the attachment of the waterproof, breathable laminate to other footwear components took place between other manufacturing steps at a comparably early stage of the production process, exemplary embodiments of the invention allow for inserting the waterproof, breathable bootie into the inner space of the footwear at a late stage of the production process. In this way, waterproofing may be applied to a wide range of footwear. In particular, waterproofing may be applied to non-waterproof footwear with no or only small alterations of the previous manufacturing steps. It is possible to produce both non-waterproof and waterproof versions of the same shoe model with the same general manufacturing process. The waterproof version may be reached, towards the end of the manufacturing process, by carrying out the method steps of the method for permanently waterproofing footwear according to exemplary embodiments of the invention. In this way, manufacturing efficiency may be greatly increased. It is also possible to locally decouple the waterproofing from the previous manufacturing steps. For example, the method of permanently waterproofing footwear, as described herein, may be carried out in a second facility, while the previous manufacturing steps are carried out in a first facility. A well-defined intermediate product, which may be a fully assembled non-waterproof footwear, may be handed from the first facility to the second facility, which in turn may help in the quality control in the first facility.

[0007] The waterproof, breathable bootie is inserted into the inner space of the footwear, after the inner space of the footwear has been closed. In other words, the waterproof, breathable bootie is inserted into the bag-like structure that forms a bag around the wearer's foot in use. In yet other words, the waterproof, breathable bootie is inserted into the foot surrounding structure, when it already exists as a foot surrounding structure, i.e. when a closed inner space already exists. In particular, the waterproof, breathable bootie may be inserted into the inner space, after the foot surrounding structure has been created around a last and after the last has been taken out of the foot surrounding structure. It is understood that the bag-like structure of the footwear, into which the waterproof, breathable bootie is inserted, has a foot insertion opening at the collar of the footwear.

[0008] The expression of permanently fixing the waterproof, breathable bootie in position in the inner space of the footwear means that the waterproof, breathable bootie cannot be detached from the footwear in a non-invasive manner. In other words, after being permanently fixed to the footwear, the waterproof, breathable bootie cannot be disassociated from the footwear without damaging the footwear and/or the waterproof, breathable

bootie and/or the fixation between the waterproof, breathable bootie and the footwear. In particular, the waterproof, breathable bootie is not releasably inserted into the footwear. The means of attachment are not releasable fasteners, such as velcro, push buttons, zippers, etc..

[0009] Permanently fixing the waterproof, breathable bootie in position in the inner space of the footwear includes attaching the waterproof, breathable bootie to the footwear in a donning region of the footwear and attaching the waterproof, breathable bootie to the footwear in at least one further attachment region of the footwear. In use, the wearer needs to don (to put on) and to doff (to take off) the footwear. The term donning region relates to that part of the footwear that the wearer's toes, midfoot, and heel pass during donning of the footwear. In general, the donning region is downwards of the collar of the footwear and adjacent thereto. Its extension may depend on the type of footwear, e.g. a boot may have a more extensive donning region than a low shoe.

[0010] The expression of providing a waterproof, breathable bootie does not necessarily relate to producing the waterproof, breathable bootie. While the terminology does not exclude a production of the waterproof, breathable bootie, before it is inserted into the inner space of the footwear, the expression of providing the waterproof, breathable bootie also encompasses a mere introduction of a pre-manufactured waterproof, breathable bootie into the production process. In other words, the term of providing the waterproof, breathable bootie may refer to using a waterproof, breathable bootie for waterproofing the footwear. In other words, the method for permanently waterproofing the footwear according to exemplary embodiments of the invention may be referred to as waterproofing the footwear with the help of a waterproof, breathable bootie.

[0011] The waterproof, breathable bootie has a waterproof, breathable laminate construction. The term waterproof, breathable laminate construction refers to the presence of both a functional layer and at least one textile layer around substantially the entire extension of the waterproof, breathable laminate. The waterproof, breathable laminate construction may be made from a single laminate or from a plurality of laminate pieces, as laid out below. Further, the single laminate or the plurality of laminate pieces may each be provided with one textile layer or with two textile layers, arranged on both sides of the functional layer / functional layer pieces of the single laminate / the plurality of laminate pieces. Also, the at least one textile layer may comprise a plurality of textile layer pieces, which may overlap in adjacent areas. Further, when a plurality of laminate pieces with a plurality of functional layer pieces are provided, they may overlap. A sealing between the plurality of functional layer pieces may be provided.

[0012] The term bootie refers to a sock-like structure that encases the foot of the wearer, when inserted into the footwear. The bootie is arranged in the inner space of the footwear. The bootie may also extend out of the

inner space of the footwear at the collar thereof. In other words, the bootie may extend upwards from an outer construction of the upper assembly of the footwear. The bootie has a waterproof, breathable laminate construction. In this way, the bootie provides a waterproof and breathable sock-like structure all around the wearer's foot. This waterproof and breathable bootie construction allows for the discharge of water vapor from the wearer's foot through the bootie and to the outside of the footwear via the upper assembly and/or the sole.

[0013] The functional layer may include or may be at least one breathable and waterproof membrane. The membrane may be selected from polyurethane, polyester, polyether, polyamide, polyacrylate, copolyether ester and copolyether amides, as well as other suitable thermoplastic and elastomeric films. In a particular embodiment, the waterproof, breathable membrane may be made of a fluoropolymer, particularly made of microporous expanded polytetrafluoroethylene (ePTFE). The microporous polytetrafluoroethylene membrane is a membrane of expanded polytetrafluoroethylene as taught in U.S. Pat. Nos. 3,953,566 and 4,187,390, to Gore. Such membranes of expanded polytetrafluoroethylene are present in commercially available laminates from W. L. Gore and Associates, Inc., Elkton, Md., under the trade-name GORE-TEX® fabric. The breathable and waterproof functional layer may be composed of a polyurethane coated microporous expanded polytetrafluoroethylene membrane made substantially according to the teachings of U.S. Pat. No. 4,194,041 and U.S. Pat. No. 4,942,214, assigned to W.L. Gore and Associates, Inc, in Elkton, Md.

[0014] According to a further embodiment, the inserting of the waterproof, breathable bootie takes place, after the inner space has been formed by an upper assembly of the footwear. In other words, the waterproof, breathable bootie is inserted into a foot surrounding structure provided by the upper assembly. After being inserted, the waterproof, breathable bootie is entirely surrounded by the upper assembly, potentially with the exception of an upper portion of the bootie extending upwards out of the upper assembly. In yet other words, the inner space of the footwear is provided within the upper assembly. The waterproof, breathable bootie is attached to the upper assembly, in particular to a donning region thereof and to at least one further attachment region thereof. The waterproof, breathable bootie is fitted into the upper assembly of the footwear, when the upper assembly is in an assembled state, i.e. when the upper assembly is already a closed foot surrounding structure. In this way, the waterproof, breathable bootie can be introduced into the footwear production at a point where the upper assembly provides a well-defined structure for the waterproofing operation.

[0015] When inserted into the inner space formed by the upper assembly, the bootie is arranged underneath and towards the inside of an outer construction of the upper assembly and upwards of a sole-side portion of

the upper assembly. The term outer construction generally refers to that part of the footwear that is seen from the outside of the footwear on top of the sole, when the footwear is in a finished state. It also includes the non-visible extensions of these materials, e.g. a lasted upper material. The outer construction further includes additional structures above and to the sides of the foot, even if they are not visible from the outside, e.g. a hidden tongue. The term sole-side portion of the upper assembly refers to that portion of the upper assembly that is arranged between the wearer's foot and the sole of the footwear.

[0016] According to a further embodiment, the inserting of the waterproof, breathable bootie into the upper assembly takes place, after a sole of the footwear has been applied to the upper assembly. In other words, the inserting of the waterproof, breathable bootie into the upper assembly takes place, when the upper assembly and the sole are in an assembled state. With the exception of the waterproof, breathable bootie, the footwear may be in a completely assembled state, before the method for waterproofing footwear in accordance with exemplary embodiments of the invention takes place. Inserting the waterproof, breathable bootie into the upper assembly, after the sole of the footwear has been applied to the upper assembly, allows for carrying out the step of waterproofing towards or at the very end of the manufacturing process. The same kind of footwear may be produced in a waterproof version and in a non-waterproof version, with only minimal changes in the production process. In particular, the producing of the waterproof footwear may only differ from the producing of the non-waterproof footwear in carrying out the method of permanently waterproofing footwear, as described herein, at the end of the production process. No prior steps of the manufacturing process need to be adapted.

[0017] According to an alternative embodiment, the inserting of the waterproof, breathable bootie takes place, before a sole of the footwear is applied to the upper assembly. As compared to the previously described embodiment, the step of applying the sole may be postponed after the waterproof, breathable bootie has been inserted into the readily assembled upper assembly. While the waterproofing is not carried out at the end of the production process, the waterproofing still takes place at a very well defined point of the production process. Both the manufacturing of the upper assembly before the insertion of the waterproof, breathable bootie and the application of the sole after the insertion of the waterproof, breathable bootie can be carried out independently from the method of waterproofing the footwear, as described herein. Again, one kind of footwear may be produced in a waterproof version and a non-waterproof version without adapting the production steps regarding the manufacturing of the upper assembly and the application of the sole.

[0018] The expression of the sole being applied to the upper assembly is intended to encompass any suitable kind of attachment between the upper assembly and the

sole, such as sewing the sole to the upper assembly, gluing the sole to the upper assembly, molding, in particular injection-molding, the sole onto the upper assembly, etc..

[0019] According to a further embodiment, the inserting of the waterproof, breathable bootie takes place, after the inner space has been jointly formed by an upper assembly of the footwear and a sole of the footwear. In other words, the inner space of the footwear is bounded in part by the upper assembly and in part by the sole of the footwear. In yet other words, for at least part of the extension of the wearer's sole, there is no part of the upper assembly between the wearer's foot and the sole. Also for such footwear constructions, waterproofing of the footwear may be achieved towards or at the end of the manufacturing process via the method in accordance with exemplary embodiments of the invention.

[0020] The terms upper assembly and sole generally indicate structures that are manufactured separately or subsequently in accordance with traditional shoe manufacturing. However, with advances in shoe manufacturing, it is also possible that the upper assembly and the sole are formed as an integrated structure. For example, the combination of the upper assembly and the sole may be manufactured as a 3D knit or in accordance with another 3D manufacturing process. Such integrated structures comprising both the upper assembly and the sole are also encompassed by the footwear as referred to herein.

[0021] According to a further embodiment, the waterproof, breathable bootie consists of the waterproof, breathable laminate construction. In particular, the waterproof, breathable bootie may be free of a support structure that would make the bootie an inherently stable structure able to stand upright. The bootie consisting of the waterproof, breathable laminate is not an inner shoe that is suitable for being worn without the surrounding footwear. Further, the waterproof, breathable bootie may be free of further layers in addition to the functional layer and the at least one textile layer. In particular, the waterproof, breathable bootie may be free of coatings, such as anti-slip coatings. In this way, the waterproof, breathable bootie may have a design of lower complexity than inner shoes of previous approaches and may thus be integrated into the footwear more quickly and more flexibly during the manufacture of the footwear.

[0022] According to a further embodiment, the attaching of the waterproof, breathable bootie to the footwear in the donning region of the footwear comprises adhering an adhesive tape of the waterproof, breathable bootie, arranged in a collar region of the waterproof, breathable bootie, to the donning region of the footwear. In this way, the waterproof, breathable bootie may be attached to the surrounding upper assembly at or close to a foot insertion portion in a particularly reliable manner. This will in turn allow the foot to glide into the bootie through a well-defined opening. A convenient stepping into the footwear is facilitated, while a reliable attachment between the

bootie and the upper assembly may be provided. The adhesive tape may be any of an originally separate, discrete adhesive tape structure, attached to the bootie, an adhesive layer applied / transferred to the bootie, and an adhesive material integrated into the bootie structure along the collar region of the bootie, such as activatable adhesive yarns knitted into the textile layer of the laminate construction.

[0023] According to a further embodiment, the adhesive tape runs around the entire circumference of the bootie. In this way, the attachment between the bootie and the upper assembly is provided all around the foot insertion portion. The stepping into the footwear is particularly convenient for the user.

[0024] According to a further embodiment, the adhesive tape has a width of between 0.5 cm and 5 cm, in particular of between 0.5 cm and 2 cm, further in particular of between 0.5 cm and 1 cm.

[0025] According to a further embodiment, the width of the adhesive tape may be up to 50% of the height from the sole portion of the inner space to the collar of the footwear, in particular between 5% and 50%, further in particular between 10% and 20%, of the height from the sole portion of the inner space to the collar of the footwear.

[0026] According to a further embodiment, the adhesive tape is at least one of sewn, glued, welded, sprayed, and printed to the waterproof, breathable bootie. The adhesive tape may be an originally separate structure that is attached to the bootie, in particular to the waterproof, breathable laminate construction. The adhesive tape may also be integrated into the waterproof, breathable laminate construction, such as via integrating an activatable, adhesive material therein. Providing the waterproof, breathable bootie may refer to providing a waterproof, breathable bootie that already has the adhesive tape attached thereto or integrated therein. It is also possible that the step of providing the waterproof, breathable bootie comprises the step of sewing and/or gluing and/or welding and/or spraying and/or printing the adhesive tape to the waterproof, breathable bootie. It is further possible that the step of providing the waterproof, breathable bootie comprises the step of cutting the bootie to a desired length and, afterwards, sewing and/or gluing and/or welding and/or spraying and/or printing the adhesive tape to the waterproof, breathable bootie. In this way, the same type of bootie may be used as the starting point for waterproofing various footwear models. In particular, the ankle portion of the bootie may be cut to a desired length.

[0027] According to a further embodiment, the adhesive tape comprises heat activated adhesive and the step of adhering the adhesive tape to the donning region of the footwear comprises heating the adhesive tape. In this way, the attaching of the bootie to the upper assembly may be related to well-defined heating conditions, allowing for reproducible, high-quality attachments throughout a production lot. The term heat activated adhesive refers to the inherent capacity of being activated by heat. It does

not mean that the adhesive is in a state of being activated. The heat activated adhesive is brought into an activated state by heating the adhesive tape. The heat activated adhesive may be thermoplastic glue, such as thermoplastic polyurethane. Any other suitable heat activated adhesive is possible as well.

[0028] According to a further embodiment, heating the adhesive tape is carried out after inserting the waterproof, breathable bootie into the inner space or before and after inserting the waterproof, breathable bootie into the inner space. For example, it is possible that the waterproof, breathable bootie and the adhesive tape are substantially at room temperature, when inserted into the inner space, and are heated thereafter. It is also possible that the adhesive tape is pre-heated before insertion, such that the activation of the adhesive tape is carried out particularly quickly after insertion.

[0029] According to a further embodiment, the adhesive tape comprises at least one of heat activated adhesive, pressure activated adhesive, pressure induced adhesive, moisture curable adhesive, and solvent curable adhesive and the step of adhering the adhesive tape to the donning region of the footwear comprises activating the adhesive tape.

[0030] According to a further embodiment, the attaching of the waterproof, breathable bootie to the footwear in the donning region of the footwear comprises sewing the waterproof, breathable bootie in a collar region thereof to the donning region of the footwear. In particular, the bootie may be sewn to the donning region of the footwear around the entire circumference of the bootie. By sewing the bootie to the upper assembly, a strong, flexible and reliable attachment may be achieved.

[0031] According to a further embodiment, the attaching of the waterproof, breathable bootie to the footwear in the donning region of the footwear comprises attaching the waterproof, breathable bootie to the footwear at a distance of at least 2 cm from a sole portion of the inner space. In this way, the waterproof, breathable bootie extends upwards from the sole portion of the inner space by at least 2 cm and gives the user a particularly waterproof feel. It is recognized that the leg of the user, when wearing the footwear, extends out of the footwear and that the waterproof nature of the footwear does by definition not apply to the foot insertion portion. Spacing the attachment between the bootie and the donning region of the footwear by at least 2 cm from the sole portion of the inner space ensures that the waterproofness extends upwards from the sole portion by a significant amount. This significant amount has been found to prevent most or all water from entering the footwear in most use scenarios and to provide a dry and convenient feel to the user. The spacing by at least 2 cm from the sole portion of the inner space ensures that waterproofness is provided close to, up to or even beyond the ankle of the user, thus achieving a high level of waterproofness.

[0032] According to a further embodiment, the attaching of the waterproof, breathable bootie to the footwear

in at least one further attachment region of the footwear comprises attaching the waterproof, breathable bootie to the footwear in at least one of a toe region of the footwear and a heel region of the footwear. In particular, the attaching of the waterproof, breathable bootie to the footwear in at least one further attachment region of the footwear may comprise attaching the waterproof, breathable bootie to the footwear in a toe region of the footwear and a heel region of the footwear.

[0033] According to a further embodiment, the attaching of the waterproof, breathable bootie to the footwear in at least one further attachment region of the footwear comprises adhering the waterproof, breathable bootie to the footwear in at least one of a toe region of the footwear and a heel region of the footwear. In particular, the attaching of the waterproof, breathable bootie to the footwear in at least one further attachment region of the footwear may comprise adhering the waterproof, breathable bootie to the footwear in a toe region of the footwear and a heel region of the footwear.

[0034] According to a further embodiment, the attaching of the waterproof, breathable bootie to the footwear in at least one further attachment region of the footwear comprises attaching, in particular adhering, the waterproof, breathable bootie to the footwear in at least one of a toe region of the footwear, a heel region of the footwear, and a sole region of the footwear. In particular, the attaching of the waterproof, breathable bootie to the footwear in at least one further attachment region of the footwear may comprise attaching, in particular adhering, the waterproof, breathable bootie to the footwear in one of the toe region of the footwear, the heel region of the footwear, and the sole region of the footwear or in any two of the toe region of the footwear, the heel region of the footwear, and the sole region of the footwear or in all of the toe region of the footwear, the heel region of the footwear, and the sole region of the footwear.

[0035] According to a further embodiment, the waterproof, breathable bootie comprises at least one of a bootie-side adhesive patch in a toe region of the waterproof, breathable bootie and a bootie-side adhesive patch in a heel region of the waterproof, breathable bootie and the step of adhering the waterproof, breathable bootie to the footwear in at least one further attachment region comprises adhering the at least one of the bootie-side adhesive patch in the toe region and the bootie-side adhesive patch in the heel region to the footwear. In this way, the bootie may achieve a firm connection to the remainder of the footwear in one or both of the toe and heel regions. With these regions being critical for the firm stance of the user due to their positions at the front and the end of the footwear, the attachment in these regions may allow for high comfort and stability to the user. Also, attaching the bootie both in the toe region and the heel region may keep the bootie in a spread out position within the inner space, making the entering of the user's foot particularly easy and convenient. The bootie-side adhesive patch in the toe region and the bootie-side adhesive patch in the

heel region may be discrete sheet portions of adhesive, applied to the bootie. It is also possible that an adhesive, such as a low viscosity adhesive or flowable adhesive, is applied to the bootie in the desired patches, e.g. applied via a brush. The adhesive patch(es) may have any of the adhesives described above with respect to the adhesive tape in the collar region of the bootie.

[0036] According to a further embodiment, the step of permanently fixing the waterproof, breathable bootie in position in the inner space of the footwear comprises leaving the waterproof, breathable bootie un-attached in a mid-foot portion of the footwear. This mid-foot portion may extend along at least 50%, in particular along at least 60%, of the extension from the tip of the waterproof, breathable bootie to the rear of the waterproof, breathable bootie. Further, the mid-foot portion is between the toe portion and the heel portion of the waterproof, breathable bootie. Leaving the waterproof, breathable bootie un-attached to the surrounding structure in the mid-foot portion of the footwear provides a particularly high amount of flexibility for the user's foot and a high level of wearing comfort. The waterproof, breathable bootie may be un-attached on the upper assembly side of the mid-foot portion of the bootie or both on the upper assembly side and the sole side of the bootie.

[0037] According to a further embodiment, the at least one of the bootie-side adhesive patch in the toe region and the bootie-side adhesive patch in the heel region comprises heat activated adhesive and the step of adhering the waterproof, breathable bootie to the footwear in at least one further attachment region comprises heating the at least one of the bootie-side adhesive patch in the toe region and the bootie-side adhesive patch in the heel region. Analogous considerations, as described above with respect to the adhesive tape in the collar region comprising heat activated adhesive, apply to the bootie-side adhesive patch in the toe region and/or the bootie-side adhesive patch in the heel region comprising heat activated adhesive. As stated above, the adhesive patch(es) may also have any of the other adhesives mentioned above with respect to the adhesive tape in the collar region of the bootie.

[0038] According to a further embodiment, the waterproof, breathable bootie comprises at least one further bootie-side adhesive patch outside of the toe region and the heel region of the waterproof, breathable bootie. By providing one or more additional bootie-side adhesive patch(es), a desired level of fixation of the bootie along the footwear may be achieved. In particular, a desired trade-off between stability, flexibility, and comfort for the user may be achieved.

[0039] According to a further embodiment, the step of permanently fixing the waterproof, breathable bootie in the inner space of the footwear comprises adhering the waterproof, breathable bootie to the footwear substantially all around its outer surface. The waterproof, breathable bootie may comprise adhesive substantially all around its outer surface. In this way, a very strong inte-

gration of the waterproof, breathable bootie into the footwear may be achieved. The waterproof, breathable bootie may become a highly inherent part of the footwear, and the strength and durability of the attachment between the waterproof, breathable bootie and the upper assembly / sole may be very high. In order to keep the footwear highly breathable, the adhesive may be applied in an adhesive pattern, such as a grid pattern or dot pattern. It is also possible that the adhesive is an inherently breathable adhesive.

[0040] According to a further embodiment, the step of adhering the waterproof, breathable bootie to the footwear in at least one further attachment region comprises applying at least one of a footwear-side adhesive patch in a toe region of the inner space and a footwear-side adhesive patch in a heel region of the inner space; and adhering the waterproof, breathable bootie to the footwear via the at least one of the footwear-side adhesive patch in the toe region of the inner space and the footwear-side adhesive patch in the heel region of the inner space. Applying at least one of a footwear-side adhesive patch in the toe region of the inner space and a footwear-side adhesive patch in the heel region of the inner space is an alternative to the bootie-side adhesive patch(es) described above. Depending on the adhesive used, the materials of the bootie, sole and upper assembly, and the accessibility of the toe and heel regions, providing adhesive on the bootie or on the footwear may be preferable. In particular, depending on the particulars of the footwear in question, one of the alternatives may provide for better attachment between the bootie and the remainder of the footwear. It is pointed out that it is also possible to combine one or more bootie-side adhesive patches with one or more footwear-side adhesive patches.

[0041] According to a further embodiment, the at least one of the footwear-side adhesive patch in the toe region and the footwear-side adhesive patch in the heel region comprises heat activated adhesive and the step of adhering the waterproof, breathable bootie to the footwear in at least one further attachment region comprises heating the at least one of the bootie-side adhesive patch in the toe region and the bootie-side adhesive patch in the heel region. Analogous considerations, as described above with respect to the adhesive tape in the collar region comprising heat activated adhesive, apply to the footwear-side adhesive patch in the toe region and/or the footwear-side adhesive patch in the heel region comprising heat activated adhesive. Again, the adhesive patch(es) may also have any of the other adhesives mentioned above with respect to the adhesive tape in the collar region of the bootie.

[0042] It is further possible that at least one further footwear-side adhesive patch outside of the toe region and the heel region of the inner space is provided. Also, a provision of adhesive substantially all around the entire inner space is possible. Analogous considerations, as described above with respect to providing adhesive on the waterproof, breathable bootie, apply to providing ad-

ditional adhesive on the footwear-side.

[0043] According to a further embodiment, the step of inserting the waterproof, breathable bootie into the inner space comprises arranging the waterproof, breathable bootie on a last and inserting the last together with the waterproof, breathable bootie into the inner space. Using a last for inserting the waterproof, breathable bootie into the inner space is an effective means for a highly accurate positioning of the bootie. The bootie may be brought into a shape on the last that corresponds well to the inner space of the footwear. Also, the last may set the footwear under some tension, thus allowing for the bootie to lay against the footwear with no or only a small amount of wrinkles. This may in turn allow for achieving a particularly good attachment between the bootie and the footwear. The term last may refer to any suitable tool that partially or completely contours the inner surface of a shoe. The last may be a traditional wooden last or may be any suitable foot-shaped or partially foot-shaped 3D structure of any suitable material. The last may also be a balloon / bladder.

[0044] According to a further embodiment, the last is expandable and the step of permanently fixing the waterproof, breathable bootie in position in the inner space comprises expanding the last within the inner space. In this way, an easy insertion of the last, when having a smaller space envelope in its un-expanded state, may be combined with an effective means of putting pressure onto the bootie and the footwear via the expansion. Also, in case adhesive is used that already has some tack when applied to the bootie or the footwear around the inner space, the expandable last helps in manoeuvring the bootie along the inner space with a low risk of the adhesive getting stuck in the wrong positions.

[0045] According to a further embodiment, the last comprises at least two last portions and the step of expanding the last within the inner space comprises spacing the at least two last portions. The term spacing may refer both to creating a space between the at least two last portions and to increasing an existing space between the at least two last portions. In particular, spacing the at least two last portions may allow for expanding the last with comparably little complexity, while still ensuring the exertion of pressure at the desired positions, e.g. in the toe portion and the heel portion.

[0046] According to a further embodiment, the last is heatable and the step of permanently fixing the waterproof, breathable bootie in position in the inner space comprises heating the last, when inserted into the inner space. In this way, the last may perform multiple functions, namely aiding in the insertion of the bootie, exerting pressure onto the bootie against the footwear, and activating heat activated adhesive. In this way, the last may act as a multi-function tool, helping to quickly and reliably carry out the method steps of the method in accordance with exemplary embodiments of the invention.

[0047] It is further possible that two or more different lasts are used subsequently. For example, the bootie

may be arranged on a first last for insertion into the inner space and for fixing the bootie in position at one or more first positions. The first last may be retracted and a second last may be inserted for fixing the bootie in position at one or more second positions. Each of the first and second lasts may have any of the properties of the last, as described above. Also, each of the first and second last may be used with one or more of the counter-pressure devices described herein below.

[0048] According to a further embodiment, the step of permanently fixing the waterproof, breathable bootie in position in the inner space comprises applying pressure to the last from outside of an upper assembly of the footwear and/or from outside of a sole of the footwear. In this way, counter-pressure towards the last may be exerted from the outside and the footwear and the bootie may be placed in a kind of press. In this way, an even better attachment between the bootie and the footwear may be achieved than in the case, where the footwear absorbs the pressure from the last. Also, less strain may be put on the footwear construction in this way.

[0049] According to a further embodiment, the step of applying pressure to the last from outside of the upper assembly and/or from outside of the sole comprises at least one of applying pressure to an instep portion of the upper assembly via an instep pressuring device; applying pressure around a heel portion of the upper assembly via a forked heel pressuring device; applying pressure to the sole via a sole pressure plate; applying pressure around substantially the entire upper assembly and the sole via a bag around the footwear and the last. In the latter case, the bag may be pressurized with air from the outside or may be evacuated for exerting pressure onto the footwear. The instep pressuring device, the forked heel pressuring device, and the sole pressure plate may allow for localized pressure against the last, thus providing fixation between the bootie and the footwear in a particularly targeted manner. In this way, a particularly high fixation accuracy may be achieved. Pressurizing or evacuating a bag that is arranged around the footwear allows for the outside air pressure and the bag applying a well-distributed pressure on all sides of the footwear. The simultaneous application of pressure onto the different portions of the footwear may allow for a particularly quick and even fixing of the bootie in the inner space of the footwear.

[0050] According to a further embodiment, the waterproof, breathable bootie is at least partly elastic. Providing an at least partly elastic waterproof, breathable bootie may help in positioning the bootie with respect to the footwear in a particularly accurate manner. For example, the last may be easily inserted into the bootie due to the elasticity thereof. Also, the elasticity may be beneficial for the user's comfort, because the bootie may adapt to the user's foot's shape.

[0051] According to a further embodiment, the waterproof, breathable bootie is elastic at least in a mid-foot portion thereof. In a particular embodiment, the water-

proof, breathable bootie is elastic at least in a mid-foot portion that extends along at least 50% of the length from the tip of the waterproof, breathable bootie to the rear of the waterproof, breathable bootie. The terms tip and rear of the waterproof, breathable bootie refer to the most forward and most rearward points of the bootie, when fixed in position in the footwear. The elasticity in the mid-foot portion allows for particularly good stability and comfort to the user in the mid-foot portion. The user's foot has the freedom to move in the mid-foot portion of the footwear, while the feeling of compression towards the foot conveys stability.

[0052] According to a further embodiment, the waterproof, breathable bootie is elastic at least in a top portion thereof, in particular at least in a top portion that extends along at least 40%, in particular along at least 50%, of the circumference of the waterproof, breathable bootie. The elasticity in the top portion, in particular in the instep portion of the foot, may enhance the comfort for the user to an even higher degree.

[0053] According to a further embodiment, the waterproof, breathable bootie has elasticity in a circumferential direction and/or in a longitudinal direction of the waterproof, breathable bootie. The waterproof, breathable bootie may have elasticity both in the circumferential direction and the longitudinal direction of the waterproof, breathable bootie. This set-up may also be referred to as biaxial stability.

[0054] As stated above, the waterproof, breathable bootie may have elasticity in a circumferential direction. In other words, when the wearer inserts a foot into the footwear, the bootie may be able to stretch and to expand elastically in order to make room for the foot of the wearer. In this process, the bootie conforms to the foot of the wearer, it is therefore also referred to as a conformable bootie. The bootie being elastic means that it exerts a force against the wearer's foot upon insertion thereof. In other words, the elasticity builds up a force that forces the bootie towards its shape before insertion of the wearer's foot. This force provides for a recovery of the bootie towards its previous shape after exertion of the wearer's foot. The elastic nature of the bootie may be achieved in any suitable way. Particular examples of producing elastic laminates are given in WO 95/32093 A1, the contents of which is incorporated herein by reference in its entirety.

[0055] The expression of the bootie having elasticity in a circumferential direction does not require the bootie to be elastic in the circumferential direction along its entire length. The bootie may be elastic along a substantial part of its length. In particular, the bootie may be elastic in the circumferential direction in the mid-foot portion. It is, however, also possible that the bootie is elastic in the circumferential direction along its entire length.

[0056] According to a further embodiment, the waterproof, breathable bootie has a circumferential elasticity of at most 15 N/cm, in particular of at most 5 N/cm, at 30% elongation in the circumferential direction of the bootie. The elongation in the circumferential direction is de-

fined in terms of a bootie sample, e.g. of the bootie material when the bootie is cut open. In other words, the elongation value is not defined for the bootie, as inserted into the footwear described herein, because an extension thereof in the circumferential direction would require stretching two layers of the bootie at the same time. The given elasticity values have been found to provide a very comfortable compromise between circumferential pressure on the foot, conveying stability and a comfortable fit, while keeping the elastic pressure at values that are not perceived as disturbing. In particular, the bootie may have a circumferential elasticity of at least 0.5 N/cm at 30% elongation in the circumferential direction of the bootie. In this way, a comfortable minimum back pressure onto the wearer's foot may be achieved. The elasticity of the bootie may for example be regulated by using textiles for the at least one textile layer that have the desired retractive force.

[0057] As stated above, the waterproof, breathable bootie may have elasticity in a longitudinal direction. According to a particular embodiment, the bootie has a longitudinal elasticity of at most 15 N/cm, in particular of at most 5 N/cm, at 10% elongation in the longitudinal direction of the bootie. The elasticity is measured as the force that is required to keep the sample at 10% elongation, with the cm value referring to the width of the test sample of the bootie. The elasticity is measured in accordance with DIN EN 14704-1, in the version of July 2005. The given values have been found to provide a bootie with a particularly comfortable fit, applying some force onto the foot for a stable and comfortable fit, while avoiding a constrained feeling of the foot due to too much pressure. In a particular embodiment, the bootie has a longitudinal elasticity of at least 0.5 N/cm at 10% elongation in the longitudinal direction of the bootie. In this way, a minimum amount of pressure for stability and a conformable fit may be achieved. The elasticity of the bootie may for example be regulated by using textiles for the at least one textile layer that have the desired retractive force.

[0058] According to a further embodiment, the waterproof, breathable laminate construction comprises a one-piece functional layer and at least one textile layer. The one-piece functional layer and the at least one textile layer may be substantially co-extensive. The term at least one textile layer intends to state that the one-piece functional layer may be provided with a textile layer on one side thereof or with a textile layer on each side thereof, i.e. with two textile layers. It is also possible that more than one textile layer is provided on one side or on both sides. In addition, each textile layer may be made up of multiple textile pieces. For example, the waterproof, breathable laminate construction may comprise a one-piece functional layer and one textile layer on one side of the functional layer, with the one textile layer being made up of multiple textile pieces that are sewn together. In other words, the one-piece functional layer may be provided with one or more textile layers that are made up from originally separate textile pieces.

[0059] As stated above, the functional layer may be a one-piece structure. The waterproof, breathable laminate construction is then also considered a one-piece structure. This is irrespective of whether the textile layer is made of originally separate textile pieces or not. In case the textile layer is made of originally separate textile pieces, a one-piece laminate structure is present, at least at the point where the laminate is formed from the one-piece functional layer and the multiple textile pieces. Hence, the bootie is made from one continuous waterproof, breathable laminate and is also considered a one-piece structure. In particular, the bootie is made from a continuous waterproof, breathable laminate, which may be shaped to inherently have the form of a bootie or which may be cut, folded and sewn or glued together to form a bootie.

[0060] An exemplary construction method for a bootie in accordance with the former case is as follows. A textile layer may be formed from a plurality of textile pieces. The plurality of textile pieces may be sized and sewn together in such a way that a sock-like textile layer is formed. The sock-like textile layer may be placed on a last, and a functional layer may be stretched over the last and brought into contact with the sock-like textile layer. The functional layer is adhered to the textile layer and the waterproof, breathable laminate construction is thus formed. This waterproof, breathable laminate construction has the inherent shape of a bootie. Both the waterproof, breathable laminate construction and the bootie are considered seamless. The seams between the originally separate textile pieces, if present, are considered to be seams of a precursor product and are not considered seams of the laminate of the bootie. It is also possible that one or more of the at least one textile layer are seamless as well.

[0061] In the alternative of the cut, folded and sewn/glued laminate construction forming the bootie, a substantially flat waterproof, breathable laminate is provided, for example having a one-piece functional layer and a textile layer on one side, potentially made from originally separate textile pieces. The laminate is cut in such a shape that, upon folding the laminate, a sock-like shape is formed. The edges of the laminate are then sewn or glued together, such that the sock-like shape is retained.

[0062] The waterproof, breathable laminate construction may be made with a two-layer laminate consisting of the functional layer and a textile layer. The waterproof, breathable laminate construction may also be made with a three-layer laminate, with the functional layer being sandwiched between a first textile layer and a second textile layer on opposite sides of the functional layer. The waterproof, breathable laminate construction may also comprise one or more further layers, such as an additional water-stopping layer, keeping water off the functional layer and thus ensuring breathability thereof. The term functional layer is a commonly used term in the art of footwear and refers to a layer combining waterproof

and breathable characteristics. Alternatively, a functional layer is also often referred to as a waterproof, breathable membrane.

[0063] According to a further embodiment, the one-piece functional layer is a seamless, one-piece functional layer. As described above, with the functional layer being a seamless, one-piece functional layer, the bootie is also considered a seamless, one-piece bootie, irrespective of the number of textile pieces used for making the waterproof, breathable laminate construction. In particular, the functional layer may be inherently shaped in the form of a bootie, e.g. by expanding the same over a last and a textile layer, thus having no seams. In other words, the functional layer / laminate construction may be manufactured to have the shape of a bootie, i.e. to have a sock-like shape, without the need for attaching different parts of the functional layer / laminate to each other. In particular, there is no need for sewing or glueing edges of the functional layer / laminate together in this case. Such bootie-shaped waterproof and breathable functional layer constructions are per se known, e.g. from WO 2015/123482 A1, the contents of which is incorporated herein in its entirety. In particular, it is known how the functional layer can be transformed from a plane layer into a bootie-shaped structure. For the details of said manufacturing process, reference is made to WO 2015/123482 A1. The provision of the seamless one-piece functional layer, and thus of the seamless, one-piece bootie, provides for a particularly high level of comfort to the wearer, because no seams interfere with the all-around feeling of stability, conformity and freedom to move.

[0064] According to an alternative embodiment, the waterproof, breathable laminate construction comprises multiple waterproof, breathable laminate pieces, with each of the multiple waterproof, breathable laminate pieces comprising a functional layer piece and at least one textile layer piece. The multiple waterproof, breathable laminate pieces may be joined to each other in a waterproof manner. For example, the multiple waterproof, breathable laminate pieces may be sewn together, with a waterproof seam tape providing for an overall waterproof structure.

[0065] According to a further embodiment, the multiple waterproof, breathable laminate pieces comprise an upper waterproof, breathable laminate, arranged in an upper portion of the inner space, and a lower waterproof, breathable laminate, arranged in a lower portion of the inner space. The upper and lower portions may correspond substantially to the portions of the bootie above and below the foot. It is also possible that the connection line between the upper waterproof, breathable laminate and the lower waterproof, breathable laminate is somewhat above or below the side portion of the user's foot.

[0066] According to a further alternative embodiment, the waterproof, breathable laminate construction comprises multiple functional layer pieces and at least one textile layer. In particular, the waterproof, breathable lam-

inate constructions may comprise multiple functional layer pieces joined together, e.g. by gluing or welding, and the resulting composite functional layer may be joined with an inner sock-shaped textile layer and/or with an outer sock-shaped textile layer.

[0067] According to a further embodiment, the upper assembly has an upper material and the upper assembly has one of a mono tongue, wherein part of the upper material forms a tongue of the footwear, a separate tongue, wherein a tongue piece is attached to the upper material, and a gusset-type tongue, wherein a tongue piece is attached to the upper material via an intermittent bridge piece. In other words, the method of waterproofing in accordance with exemplary embodiments of the invention is applicable to all said tongue constructions. In this way, a large variety of footwear constructions may be made waterproof after manufacture, as described herein.

[0068] According to a further embodiment, the step of permanently fixing the waterproof, breathable bootie in position in the inner space comprises attaching the waterproof, breathable bootie to said one of the mono tongue, the separate tongue, and the gusset-type tongue.

[0069] Exemplary embodiments of the invention further include a method for producing waterproof footwear, said method comprising the step providing footwear, comprising an upper assembly and a sole, and the steps of the method of permanently waterproofing footwear, as given in any of the embodiments described herein. The step of providing footwear may comprise manufacturing footwear. The step of manufacturing footwear may comprise attaching the upper assembly and the sole to each other. The additional features, modifications, and beneficial effects, described with respect to the method for permanently waterproofing footwear, apply to the method for producing waterproof footwear, in an analogous manner.

[0070] Exemplary embodiments of the invention further include footwear produced in accordance with the method for permanently waterproofing footwear, as described in any of the embodiments given above. The additional features, modifications, and beneficial effects, described with respect to the method for permanently waterproofing footwear, apply to the footwear in an analogous manner.

[0071] Further exemplary embodiments of the invention are described below with reference to the accompanying drawings, wherein:

Fig. 1 illustrates an exemplary embodiment of providing a waterproof, breathable bootie, as may be used in methods for waterproofing footwear in accordance with exemplary embodiments of the invention, by depicting various process steps in a schematic manner;

Fig. 2 illustrates a method for waterproofing footwear in accordance with an exemplary embodiment of the

invention by depicting various process steps in a schematic manner;

Fig. 3 illustrates a method for waterproofing footwear in accordance with another exemplary embodiment of the invention by depicting various process steps in a schematic manner;

Fig. 4 shows footwear in accordance with various exemplary embodiments of the invention, made waterproof by methods for waterproofing footwear in accordance with exemplary embodiments of the invention, in schematic, longitudinal cross-sectional views;

Fig. 5 shows footwear in accordance with various exemplary embodiments of the invention, made waterproof by methods for waterproofing footwear in accordance with exemplary embodiments of the invention, in schematic, transverse cross-sectional views;

Fig. 6 shows various tongue constructions, as may be present in footwear in accordance with exemplary embodiments of the invention, in a schematic manner;

Fig. 7 shows exemplary embodiments of waterproof, breathable laminates, to be used in waterproof, breathable booties for methods for waterproofing footwear in accordance with exemplary embodiments of the invention.

[0072] Fig. 1 illustrates an exemplary embodiment of providing a waterproof, breathable bootie 10, which may be used for methods for permanently waterproofing footwear in accordance with exemplary embodiments of the invention. Fig. 1A depicts a bootie trimming tool 80 in a schematic side view. The bootie trimming tool 80 is generally sock-shaped. It has trim marks 82, which indicate the desired length of the bootie for a footwear model in question.

[0073] Fig. 1B depicts the bootie trimming tool 80 of Fig. 1A together with a waterproof, breathable bootie 10 in a schematic side view. The waterproof, breathable bootie 10 has been slid over the bootie trimming tool 80 and is shown arranged on the bootie trimming tool 80. In other words, the bootie trimming tool 80 is arranged within the waterproof, breathable bootie 10 in Fig. 1B. The waterproof, breathable bootie 10 has a waterproof, breathable laminate construction comprising a functional layer and at least one textile layer. In the exemplary embodiment of Fig. 1, the waterproof, breathable laminate construction comprises a seamless, one-piece functional layer and a textile layer attached to one side thereof, as described in detail above. It is pointed out that any other suitable kind of waterproof, breathable bootie may be used as well.

[0074] With the help of the trim marks 82 of the bootie trimming tool 80, a trim line 86 is provided on the waterproof, breathable bootie 10. The trim line 86 may be drawn or embossed on the waterproof, breathable bootie 10 or provided in any other suitable manner.

[0075] Fig. 1C depicts the waterproof, breathable bootie 10 without the bootie trimming tool 80 and illustrates the cutting of the waterproof, breathable bootie 10 along the trim line 86 via a stylized pair of scissors 88. In the exemplary embodiment of Fig. 1, the waterproof, breathable bootie 10 is originally too long for the footwear model in question, i.e. the leg portion of the waterproof, breathable bootie 10 extends too far up. Using such a waterproof, breathable bootie 10 may be beneficial in terms of manufacturing efficiency, because one kind of waterproof, breathable bootie 10 may be used for different footwear models. For example, the waterproof, breathable bootie 10, as depicted in Fig. 1B, may be used for both low ankle shoes and boots, depending on the trimming. The waterproof, breathable bootie 10 may be used for one shoe size, but different shoe models. It is also possible that the waterproof, breathable bootie has sufficient elasticity to be used for various shoes sizes, such as a nominal shoe size and one or two shoe sizes bigger.

[0076] Fig. 1D illustrates the sewing of an adhesive tape 14 to the waterproof, breathable bootie 10. The adhesive tape 14 is arranged along the opening of the waterproof, breathable bootie 10. It may also be arranged somewhat spaced from the opening of the waterproof, breathable bootie 10. In either case, the adhesive tape 14 is considered to be arranged in a collar region of the waterproof, breathable bootie 10. The sewing of the adhesive tape 14 to the waterproof, breathable bootie 10 is illustrated by zigzag line 90. The adhesive tape 14 comprises a thermoplastic glue, such as thermoplastic polyurethane. The resulting waterproof, breathable bootie 10 is thus configured to be attached to the inner space of footwear by inserting the waterproof, breathable bootie 10 into the inner space and activating the thermoplastic glue of the adhesive tape 14.

[0077] Fig. 2 illustrates a method for permanently waterproofing footwear in accordance with an exemplary embodiment of the invention by depicting various process steps in a schematic manner. Fig. 2A is a schematic side view. In Fig. 2A, a waterproof, breathable bootie 10 is provided on a last 20. The last 20 is the first last used in the process described with respect to Fig. 2, as will become apparent below.

[0078] The last 20 is an expandable and heatable last. The last 20 is depicted in a non-expanded state in Fig. 2A. The last 20 has a forward last portion 24 and a rearward last portion 26. The forward last portion 24 and the rearward last portion 26 are movable with respect to each other. In particular, the space between the forward last portion 24 and the rearward last portion 26 may be increased in the front-to-rear direction of the last. The last 20 may also be referred to as a split last. Both the forward last portion 24 and the rearward last portion 26 are sup-

ported by a last support arm structure 28. The last support arm structure allows for the last 20 to float, such that any structure arranged on the last does not have to be supported from the bottom. It is also possible that the forward last portion 24 and the rearward last portion 26 are coupled to each other via an extendable cylinder or any other suitable expanding mechanism.

[0079] Fig. 2A further depicts a sole pressure plate 30. The sole pressure plate 30 is movable in a vertical direction. It is also possible that the support arm structure 28 is movable in a vertical direction. The sole pressure plate 30 is configured to exert pressure onto the underside of the last 20 and any interposed structure, i.e. any interposed part of the footwear. In Fig. 2A, the sole pressure plate 30 is depicted as spaced from the last 20.

[0080] As stated above, a waterproof, breathable bootie 10 is provided on the last 20. The waterproof, breathable bootie 10 may be the waterproof, breathable bootie 10 as described above with respect to Fig. 1. It may also be any other suitable kind of waterproof, breathable bootie 10.

[0081] The waterproof, breathable bootie 10, as depicted in Fig. 2A, comprises an adhesive tape 14 in its collar region. The adhesive tape 14 is depicted with a dotted pattern. In addition, the waterproof, breathable bootie 10 comprises a bootie-side adhesive patch 16 in a toe region of the waterproof, breathable bootie 10. The bootie-side adhesive patch 16 is provided both on the front side and the underside of the waterproof, breathable bootie 10 in the toe region. The bootie-side adhesive patch 16 may be applied via spraying or brushing. An exemplary adhesive for the bootie-side adhesive patch 16 is latex-based adhesive Technicoll® 9222-1.

[0082] Fig. 2B depicts the last 20 and the waterproof, breathable bootie 10 inserted into footwear 2. In other words, in between the depictions of Figs. 2A and 2B, the footwear 2 has been slid over the last 20, having the waterproof, breathable bootie 10 arranged thereon. Fig. 2B is also a schematic side view.

[0083] The footwear 2 has an upper assembly 4, having an outer construction, and a sole 8. To the inside of the upper assembly 4 and the sole 8, there is an inner space 12. This inner space 12 may be referred to as the inner space 12 of the footwear 2. The last 20 and the waterproof, breathable bootie 10 are depicted as inserted into the inner space 12.

[0084] Further, a footwear-side adhesive patch 18 in the heel region of the inner space 12 is provided. The footwear-side adhesive patch 18 is provided on the rear portion of the inner space 12, i.e. on the portion of the inner space 12 that extends upwards behind the heel of the user, and the rear of the sole portion of the inner space. The footwear-side adhesive patch 18 may be applied via spraying or brushing. An exemplary adhesive for the footwear-side adhesive patch 18 is latex-based adhesive Technicoll® 9222-1.

[0085] Fig. 2C illustrates a first step of fixing the waterproof, breathable bootie 10 in position in the inner

space 12. In other words, Fig. 2C illustrates a first step of attaching the waterproof, breathable bootie 10 to the footwear 2. Fig. 2C is also a schematic side view.

[0086] As compared to the situation in Fig. 2B, the forward last portion 24 and the rearward last portion 26 are spaced. As a consequence, the waterproof, breathable bootie 10 is pushed towards the front and the back of the outer construction of the upper assembly 4. In addition, the sole pressure plate 30 is moved against the sole 8. Given the pressure exerted by the last 20 and the sole pressure plate 30 and given the inherent stability of the footwear 2, the waterproof, breathable bootie 10 is pushed against the upper assembly 4 and against the sole 8. At the same time, the last 20 is heated. Via exertion of pressure and heating, the bootie-side adhesive patch 16 in the toe region and the footwear-side adhesive patch 18 in the heel region bond the waterproof, breathable bootie 10 and the upper assembly 4. In this way, the waterproof, breathable bootie 10 is fixed in position in the inner space 12 of the footwear 2. It is pointed out that, depending on the specific footwear construction in question, the waterproof, breathable bootie 10 may be attached to one or all or a subset of the outer construction of the upper assembly 4, a hidden portion of the upper assembly 4, such as an assembly insole thereof, and the sole 8. While the exertion of pressure and heating, as depicted in Fig. 2C, is primarily intended to activate the bootie-side adhesive patch 16 in the toe region and the footwear-side adhesive patch 18 in the heel region, the adhesive tape may also experience some preliminary positional fixing.

[0087] In the exemplary embodiment of Fig. 2C, the last 20 is heated to about 78° C, the forward last portion 24 and the rearward last portion 26 are spread apart with a pressure of about 2.5 bar, and the sole pressure plate is pressed against the sole 8 with a pressure of about 4 bar. These temperature and pressure values are maintained for about 15 min. It is pointed out that the temperature and pressure values may depend on the footwear in question, the adhesive used, the tooling used, and other factors. For example, the forward last portion 24 and the rearward last portion may be spread apart with a pressure of between 0.5 bar and 7 bar. Also, the sole pressure plate may be pressed against the sole with a pressure of between 1 bar and 5 bar.

[0088] Fig. 2D illustrates the fixing of the adhesive tape 14 in position in the inner space 12 of the footwear 2. The footwear 2 and the waterproof, breathable bootie 10 are arranged on another last 22 in Fig. 2D. This other last 22 is also referred to as second last 22 herein, as it is used in a second step of fixing the waterproof, breathable bootie 10 in position. The last 22 is not expandable. In particular, the last 22 is not a split last in the exemplary embodiment of Fig. 2D. Rather, the last 22 provides a continuous structure to the inside of the adhesive tape 14 arranged in the collar region of the waterproof, breathable bootie 10. Further, the last 22 is heatable. The last 22, the footwear 2, and the waterproof, breathable bootie

10 are depicted in a schematic side view on top of Fig. 2D and in a schematic horizontal cross-sectional view on the bottom of Fig. 2D.

[0089] In the process step depicted in Fig. 2D, pressure is exerted onto the last 22 from outside of the footwear via an instep pressuring device 32 and via a forked heel pressuring device 34. The instep pressuring device 32 and the last 22 form a press for a forward portion of the collar region of the waterproof, breathable bootie 10, thus helping in the creation of the attachment between the adhesive tape 14 of the waterproof, breathable bootie 10 and the upper assembly 4 in that part. The forked heel pressuring device 34 and the last 22 form a press for a rearward portion and the left and right side portions of the collar region of the waterproof, breathable bootie 10, thus helping in the creation of the attachment between the adhesive tape 14 of the waterproof, breathable bootie 10 and the upper assembly 4 in that part.

[0090] In the exemplary embodiment of Fig. 2D, the last 22 is heated to between 20° C and 130° C. The instep pressuring device 32 and the forked heel pressuring device 34 are pushed against the outer construction of the upper assembly 4 with a pressure of between 0.2 bar and 5 bar. These temperature and pressure values are maintained for about 3 min. It is pointed out that the temperature and pressure values may depend on the footwear in question, the adhesive used, the tooling used, and other factors.

[0091] Similar to the forked heel pressuring device 34, a dome-shaped toe region pressuring device may be used, which may exert pressure on the upper assembly 4 and, potentially, to the sole, with a suitable last extending into the toe box of the footwear 2.

[0092] While it has been described with respect to Fig. 2 that the attachments in the toe region and heel region are achieved first, before the attachment via the adhesive tape 14 is effected, it is pointed out that this order may also be reversed. In particular, the waterproof, breathable bootie 10 and the footwear 2 may be arranged on the last 22, depicted in Fig. 2D, first, with the attachment via the adhesive tape 14 being effected, before placing the waterproof, breathable bootie 10 and the footwear onto the last 20, depicted in Figs. 2A to 2C, where the attachments in the toe region and the heel region are made. It is also possible to have a single last that allows for all attachments operations. In particular, this single last may be shaped to form a solid structure at substantially all positions where the attachment between the waterproof, breathable bootie 10 and the upper assembly and/ or sole takes place.

[0093] Fig. 3 illustrates a method for permanently waterproofing footwear 2 in accordance with another exemplary embodiment of the invention by depicting various process steps in a schematic manner. Fig. 3A is a schematic side view. In Fig. 3A, a last 23 is depicted. The last 23 is a heatable last. It has a heating device 36 and an electric cord 38, with which the heating device 36 is provided with electric power.

[0094] Fig. 3B depicts a waterproof, breathable bootie 10 arranged on the last 23 of Fig. 3A. Fig. 3B is also a schematic side view. The waterproof, breathable bootie 10 comprises an adhesive tape 14 in the collar region of the waterproof, breathable bootie 10. It further comprises a bootie-side adhesive patch 16 in the toe region and a bootie-side adhesive patch 16 in the heel region of the waterproof, breathable bootie 10.

[0095] Fig. 3C depicts the last 23 and the waterproof, breathable bootie 10 of Fig. 3B inserted into footwear 2. Fig. 3C is also a schematic side view. In particular, the last 23 and the waterproof, breathable portion 10 are inserted into an inner space of the footwear 2, in particular into an inner space formed by an upper assembly 4 of the footwear 2 and a sole 8 of the footwear 2.

[0096] Fig. 3D depicts the beginning of an arrangement of a bag 39 around the last 23, the waterproof, breathable bootie 10, and the footwear 2. Fig. 3D is also a schematic side view. While depicted in a schematic two-dimensional manner, it is understood that the bag 39 forms a three-dimensional structure around the last 23, the waterproof, breathable bootie 10, and the footwear 2.

[0097] Fig. 3E depicts the components of Fig. 3D, with the bag 39 having been evacuated. Fig. 3E is also a schematic side view. Due to the evacuation of the bag 39, the bag 39 conforms to the outer shape of the footwear 2 and the last 23, thus exerting an all-around pressure onto the footwear 2 against the last 23. The pressure onto the footwear 2 may be further increased by increasing the air pressure around the bag 39 above atmospheric pressure. At the same time, the last 23 is heated, thus activating the adhesive tape 14 and the bootie-side adhesive patches 16 in the toe and heel regions. An effective fixing in position of the waterproof, breathable bootie 10 in the inner space of the upper assembly 4 and the sole 8 takes place. The evacuation may be carried out with any suitable source of suction. The application of additional pressure from outside of the bag may be carried out with any suitable pressure source, such as within a pressurized air chamber.

[0098] Fig. 4 shows footwear 2 in accordance with various exemplary embodiments of the invention, made waterproof by methods for permanently waterproofing footwear in accordance with exemplary embodiments of the invention. The footwear 2 of Fig. 4 is shown in schematic, longitudinal cross-sectional views. The footwear 2 of Fig. 4 may be made waterproof in accordance with any of the methods described herein, in particular with any of the methods described above with respect to Figs. 1 to 3.

[0099] Fig. 4A shows footwear 2 in accordance with an exemplary embodiment of the invention, depicted in a longitudinal cross-sectional view, with the cross-sectional plane of Fig. 4A running substantially through the center of the footwear 2. The footwear 2 comprises an upper assembly 4 and a sole 8. The footwear 2 is of a lasted construction. The upper assembly 4 comprises a breathable upper material 40, such as leather, suede, textile or any other suitable material, and an assembly

insole 44. The breathable upper material 40 is perimet-
rically lasted onto the assembly insole 44 from the bot-
tom. In particular, the breathable upper material 40 is
glued onto the bottom of the assembly insole 44 around
its perimeter with a lasting glue.

[0100] The upper assembly 4 further comprises a
tongue 42. In the exemplary embodiment of Fig. 4A, the
tongue 42 is an originally separate structure from the
breathable upper material 40 and is attached thereto,
e.g. via sewing or gluing. It is also possible that the tongue
42 and the breathable upper material 44 are integrally
formed from a continuous piece of material. The breath-
able upper material 40 and the tongue 42 form an outer
construction 6 of the footwear 2. In general, the outer
construction 6 of the footwear 2 may be a single integrat-
ed structure, such as a three-dimensional knit, or may
be assembled from various originally separate pieces of
a breathable material, as is for example common in leath-
er shoes / boots.

[0101] The upper assembly 4 further comprises a collar
5. The collar 5 forms the upper end of the upper assembly
4. It surrounds the foot insertion opening.

[0102] In the exemplary embodiment of Fig. 4A, the
sole 8 is a solid structure of a non-breathable material,
e.g. a solid plastic structure. In the exemplary embodi-
ment of Fig. 4A, the sole 8 is injected onto the lower side
of the upper assembly 4, forming a strong bond to the
lasted portion of the upper material 40 and to the assem-
bly insole 44 in the process of injection. The sole 8 may
also be glued to the lower portion of the upper assembly
4. It is further possible that the sole 8 is made from in-
herently breathable materials, such as leather, and/or
that the sole has a structure that allows for breathability
through the sole, as will be described below.

[0103] A waterproof, breathable bootie 10 is arranged
in an inner space 12 of the footwear 2. In particular, the
waterproof, breathable bootie 10 is arranged in the inner
space 12, as provided by the upper assembly 4 and the
sole 8. With the footwear 2 of Fig. 4A having a lasted
construction, the waterproof, breathable bootie 10 is pro-
vided in the inner space 12, as provided by the outer
construction 6 and the assembly insole 44. The water-
proof, breathable bootie 10 has been inserted into the
inner space 12 and fixed in position in the inner space
12, as described in any of the exemplary embodiments
above. The waterproof, breathable bootie 10 is a sock-
like structure. Being arranged in the inner space 12, the
waterproof, breathable bootie 10 may also be referred to
as a shoe insert. The waterproof, breathable bootie 10
may be any suitable waterproof, breathable bootie, in
particular any kind of waterproof, breathable bootie as
described herein. In the exemplary embodiment of Fig.
4A, the upper end of the waterproof, breathable bootie
10 is at the same height as the upper end of the outer
material 40. It is also possible that the upper end of the
waterproof, breathable bootie 10 ends below the upper
end of the outer material 40 or extends above the upper
end of the outer material 40.

[0104] The footwear 2 has a forefoot portion 90, a mid-
foot portion 92, and a rearfoot portion 94. The forefoot
portion 90, the mid-foot portion 92, and the rearfoot por-
tion 94 are separated by dashed lines in Fig. 4A. The
forefoot portion 90 may also be referred to as a toe region
of the footwear. The rearfoot portion 94 comprises a heel
region 96 in its lower portion. The footwear further com-
prises a donning region 98. The donning region 98 may
be an upper portion of the rearfoot portion 94 or may
extend both in an upper portion of the rearfoot portion 94
and an upper portion of the mid-foot portion 92.

[0105] The waterproof, breathable bootie 10 is at-
tached to the breathable upper material 40, to the tongue
42, and to the assembly insole 44 in the forefoot portion
/ toe region 90, in the heel region 96, and the donning
region 98. In particular, the waterproof, breathable bootie
is fixed in position by various adhesive elements, as will
be described below.

[0106] The waterproof, breathable bootie 10 is at-
tached to the breathable upper material 40 and the
tongue 42 in the donning region 98 via an adhesive tape
14, which surrounds the circumference of the waterproof,
breathable bootie 10. The waterproof, breathable bootie
10 is further attached to the breathable upper material
40 and to the assembly insole 44 in the heel region 96
via two bootie-side adhesive patches 16. Yet further, the
waterproof, breathable bootie 10 is attached to the
breathable upper material 40 and to the assembly insole
44 in the toe region 90 via two bootie-side adhesive
patches 16. The attachment may have been achieved,
as described above with respect to Figs. 1 to 3. All of the
adhesive tape 14 and the bootie-side adhesive patches
16 may comprise heat activated adhesive. It is under-
stood that the arrangement of the adhesive elements is
exemplary in nature and that the positional fixation of the
waterproof, breathable bootie 10 may be achieved via
other adhesive arrangements as well. Also, while the ad-
hesive patches 16 have been described as bootie-side
adhesive patches, because they had been applied to the
waterproof, breathable bootie 10 before bonding, it is also
possible that footwear-side adhesive patches may be
used. A combination of bootie-side adhesive patches and
footwear-side adhesive patches is possible as well. In
the exemplary embodiment of Fig. 4A, the waterproof,
breathable bootie 10 extends somewhat higher than the
adhesive tape 14. However, it is also possible that the
adhesive tape 14 forms the uppermost portion of the wa-
terproof, breathable bootie 10, as shown in Figs. 1 to 3
above.

[0107] In the exemplary embodiment of Fig. 4A, the
waterproof, breathable bootie 10 is free of attachments
to the remainder of the upper assembly 4 in the mid-foot
portion 92. In particular, in the exemplary embodiment
of Fig. 4A, the waterproof, breathable bootie 10 is neither
attached to the outer construction, comprising the breath-
able upper material 40 and the tongue 42, nor to the
assembly insole 44 in the mid-foot portion 92. In this way,
the waterproof, breathable bootie 10 is free to move with

respect to the surrounding elements of the upper assembly 4 in the mid-foot portion 92. This provides a comfortable fit to the user. The waterproof, breathable bootie 10 may further be elastic, at least in said mid-foot portion. In that way, the bootie may conform well to the user's foot.

[0108] Fig. 4B shows footwear 2 in accordance with another exemplary embodiment of the invention. The footwear 2 of Fig. 4B is very similar to the footwear 2 of Fig. 4A. Like elements are denoted with like reference numerals, and reference is made to the description thereof above. In the exemplary embodiment of Fig. 4B, the waterproof, breathable bootie 10 extends above the collar 5. In other words, the foot insertion portion of the waterproof, breathable bootie 10 extends further upwards than the foot insertion portion of the outer construction 6. This extension of the waterproof, breathable bootie 10 may provide for a more convenient, more sock-like feel to the user of the footwear 2.

[0109] Fig. 4C shows footwear 2 in accordance with yet another exemplary embodiment of the invention. The footwear 2 of Fig. 4C is very similar to the footwear 2 of Fig. 4A. Like elements are denoted with like reference numerals, and reference is made to the description thereof above. In the exemplary embodiment of Fig. 4C, the upper end of the waterproof, breathable bootie 10 is wrapped around the collar 5 of the upper assembly 4. The wrapped around portion of the waterproof, breathable bootie 10 is attached to the outer upper end of the outer construction 6 via additional bootie-side adhesive patches 16. The attachment via these additional bootie-side adhesive patches 16 may be effected at the same time as the attachment via the adhesive tape 14. It is also possible that the adhesives are activated separately. Further, it is possible that additional footwear-side adhesive patches are provided instead of the additional bootie-side adhesive patches 16. The wrapped around portion of the waterproof, breathable bootie 10 may provide a particularly convenient insertion of the foot for the user, as the foot is led into the waterproof, breathable bootie 10 in a funnel-like manner.

[0110] Fig. 4D shows footwear 2 in accordance with yet another exemplary embodiment of the invention. The footwear 2 of Fig. 4D is very similar to the footwear 2 of Fig. 4A. Like elements are denoted with like reference numerals, and reference is made to the description thereof above. In the exemplary embodiment of Fig. 4D, the waterproof, breathable bootie 10 is sewn to the upper assembly 4 via a sewn seam 15 in the donning region 98 of the footwear 2. Instead of relying on the adhesive tape 14, the sewn seam 15 achieves the attachment between waterproof, breathable bootie 10 and footwear 2 in the donning region 98. It is also possible that a weld between the waterproof, breathable bootie 10 and the upper assembly 4 is provided as an alternative means of attachment.

[0111] Fig. 5 shows footwear 2 in accordance with various exemplary embodiments of the invention, made waterproof by methods for permanently waterproofing foot-

wear in accordance with exemplary embodiments of the invention, in schematic, transverse cross-sectional views. In particular, Fig. 5A shows the footwear 2 of Fig. 4A along the cross-sectional plane indicated by A-A in Fig. 4A. The cross-sectional plane of Fig. 5A cuts through the mid-foot portion 92 roughly in the middle thereof. As stated above, the sole 8 is a solid structure, such as an injected plastics structure in the exemplary embodiment of Figs. 4A and 5A.

[0112] Fig. 5B shows footwear 2 in accordance with another exemplary embodiment of the invention. The footwear 2 of Fig. 5B is a variation of the footwear 2 of Figs. 4A and 5A. In particular, while the upper assembly 4 of the footwear 2 of Fig. 5B is the same as the upper assembly 4 of Figs. 4A and 5A, the sole 8 of the footwear 2 of Fig. 5B is a variation of the sole 8 of Figs. 4A and 5A. Fig. 5B shows a cross-sectional view analogous to the cross-sectional view of Fig. 5A.

[0113] The sole 8 of the footwear 2 of Fig. 5B is a breathable sole. In particular, the sole 8 is of a breathable structure. The sole 8 has a circumferential portion 60 and stabilizing bars 62. The stabilizing bars 62 and the circumferential portion 60 may be integrally molded from a plastics material. While the stabilizing bars 62 are depicted as longitudinal bars in the cross-sectional view of Fig. 5B, the stabilizing bars 62 may be arranged in different directions. In particular, the stabilizing bars 62 may form a stabilization grid within the circumferential portion 60. The stabilizing bars 62 / the stabilization grid may extend over one or more portions of the sole 8, e.g. over a fore-foot portion of the sole 8 and/or over a heel portion of the sole 8.

[0114] In between the stabilizing bars 62 / stabilizing grid, there are provided water vapor discharge holes 66. The water vapor discharge holes 66 are comparably large in diameter and thus allow for the discharge of large amounts of water vapor through the sole 8. The water vapor discharge holes 66 extend substantially vertically through the sole 8. Above the water vapor discharge holes 66, there is provided a barrier material 64. In particular, the barrier material is provided between the circumferential portion 60 of the sole 8, below the assembly insole 44, and above the stabilizing bars 62. The barrier material is breathable, i.e. water vapor permeable, and protects the upper assembly 4 there above from foreign objects that may penetrate through the water vapor discharge holes 66.

[0115] The footwear 2 of Fig. 5B allows for water vapor discharge through the breathable upper material 40 as well as through the sole 8. Water vapor can travel from the underside of the wearer's foot through the waterproof, breathable bootie 10, through the assembly insole 44, through the barrier material 64, and through the water vapor discharge holes 66 to an outside environment of the footwear 2. With the bootie being having a breathable, waterproof laminate construction, the wearer's foot is protected from water, also from water entering through the water vapor discharge holes 66.

[0116] Fig. 5C shows footwear 2 in accordance with yet another exemplary embodiment of the invention. The footwear 2 of Fig. 5C is a variation of the footwear 2 of Figs. 4A and 5A. In particular, while the upper assembly 4 of the footwear 2 of Fig. 5C is the same as the upper assembly 4 of Figs. 4A and 5A, the sole 8 of the footwear 2 of Fig. 5C is a variation of the sole 8 of Figs. 4A and 5A. Fig. 5C shows a cross-sectional view analogous to the cross-sectional view of Fig. 5A.

[0117] The sole 8 of the footwear 2 of Fig. 5C is a breathable sole, as is the sole 8 of the footwear 2 of Fig. 5B. While the sole 8 of Fig. 5B relies on water vapor discharge towards the bottom of the sole, the sole 8 of Fig. 5C relies on water vapor discharge towards the lateral sides of the sole. The bottom surface of the sole 8 of Fig. 5C is free of water vapor discharge holes. However, it is also possible that the sole of footwear in accordance with exemplary embodiments of the invention has water vapor discharge holes towards the bottom and towards the side.

[0118] The sole 8 of Fig. 5C has a structure or material for allowing air flow through it, generally indicated with reference numeral 68. The structure or material 68 may be any suitable structure or material that allows for air flow there through and, thus, allows for the transport of water vapor, coming from the inside of the shoe, towards the lateral sides and out of the shoe. The structure or material 68 may for example be a channel structure or a spacer fabric or a granulate fill or any other suitable structure or material. The sole 8 further comprises a plurality of water vapor discharge holes 66. In the cross-sectional view of Fig. 5C, two of the plurality of water vapor discharge holes 66 are shown. It is understood that a suitable number of water vapor discharge holes 66 may be arranged around the periphery of the sole 8.

[0119] The water vapor discharge holes 66 are provided from the structure or material 68 towards the lateral sides of the sole 8. In particular, the water vapor discharge holes 66 are substantially horizontal in the exemplary embodiment of Fig. 5C. Further, the water vapor discharge holes 66 are substantially circular in cross-section in the exemplary embodiment of Fig. 5C. However, the water vapor discharge holes may have any suitable cross-section.

[0120] The footwear 2 of Fig. 5C also allows for water vapor discharge through the breathable upper material 40 as well as through the sole 8. Water vapor can travel from the underside of the wearer's foot through the waterproof, breathable bootie 10, through the assembly in sole 44, into and through the structure or material 68, and through the water vapor discharge holes 66 to an outside environment of the shoe. Due to the straight air flow path between the left and right sides of the sole 8, an efficient water vapor discharge through the sole 8 may be achieved. With the bootie being having a breathable, waterproof laminate construction, the wearer's foot is protected from water, also from water entering through the water vapor discharge holes 66.

[0121] Fig. 6 shows various tongue constructions, as may be present in footwear in accordance with exemplary embodiments of the invention, in a schematic manner. Fig. 6 shows schematic top views of the respective tongue constructions. Fig. 6A depicts a portion of the upper material 40 of the upper assembly 4 and an originally separate tongue 42. The tongue piece 42 is attached to the upper material 40. In particular, the tongue 42 is sewn to the upper material 40. Fig. 6B depicts a portion of the upper material 40 of the upper assembly 4. In the embodiment of Fig. 6B, the tongue 42 is an integral part of the upper material 40. It can be said that the outer construction has a mono tongue. Fig. 6C depicts a portion of the upper material 40 of the upper assembly 4, a tongue 42, and an intermittent bridge piece 46. Both the upper material 40 and the tongue 42 are attached to the intermittent bridge piece 46. In particular, both the upper material 40 and the tongue 42 are sewn to the intermittent bridge piece 46. The method of waterproofing footwear, including the inserting of the waterproof, breathable bootie 10 and fixing the waterproof, breathable bootie 10 in position, as described in any of the embodiments above, is applicable to footwear having all of the depicted tongue constructions. The fixing of the waterproof, breathable bootie 10 may be adapted to the tongue construction of the footwear in question.

[0122] Fig. 7 shows exemplary embodiments of waterproof, breathable laminates, to be used in waterproof, breathable booties for methods for waterproofing footwear in accordance with exemplary embodiments of the invention. Fig. 7A shows a waterproof, breathable three-layer laminate 51. The three-layer laminate 51 has a functional layer 54, which is an ePTFE membrane in the exemplary embodiment of Fig. 7A, a first textile layer 56, and a second textile layer 58. The first and second textile layers 56, 58 are knitted layers in the exemplary embodiment of Fig. 7A.

[0123] Fig. 7B shows a waterproof, breathable two-layer laminate 51. The two-layer laminate 51 has a functional layer 54, which is an ePTFE membrane in the exemplary embodiment of Fig. 7B, and a textile layer 56, which is a knitted layer in the exemplary embodiment of Fig. 7B. The laminate 51 can be used in any orientation for the waterproof, breathable bootie 10, i.e. the two-layer laminate 51 can be used with the functional layer 54 facing the wearer's foot and with the textile layer 56 facing the wearer's foot.

Test methods and definitions

[0124] A functional layer and a laminate are considered to have waterproof characteristics in case the requirements specified in DIN EN 343 (2010) are met, i.e. a test of the liquid water resistance with respect to hydrostatic water pressure according to EN 20 811 (1992) yields a liquid water resistance W_p of 8000 Pa, or more.

[0125] Water vapor permeability, as used herein concerning the functional layer and the laminate comprising

the functional layer, is tested and defined in EN ISO 15496, also known as the "Cup Test". A 20 x 20cm or Ø 100mm sample of the waterproof, breathable laminate is placed onto a container containing water and covered with a membrane. Then a cup containing potassium acetate and being covered by the same membrane is placed on the sample. Water vapor passes through the laminate into the cup, whose weight increase is then determined. The laminate is considered water vapor permeable or breathable if the water vapor permeability is greater than or equal to 0,01 g/(Pa*m2*h). If the required size of the sample cannot be obtained, a smaller sample may be used for the measurement using a smaller cup containing half the amount of potassium acetate specified in the Norm, i.e. 50g instead of 100g and mixed with 15,6g of water. The terms water vapor permeability and breathability are used interchangeably herein. Accordingly, the waterproof, breathable laminate may also be referred to as waterproof, water vapor permeable laminate.

[0126] The waterproofness of footwear may be determined by use of the Centrifuge test described in U.S. Pat. No. 5,329,807, and incorporated by reference herein in its entirety. The centrifuge tests may be carried out for 30 minutes. The footwear article is considered to be waterproof if no leakage is seen after 30 minutes.

[0127] The breathability of footwear may be assessed in accordance with the determination of the Whole Boot Moisture Vapor Transmission Rate Test in accordance with the Department of Defense Army Combat Boot Temperature Weather Specifications. The specifications are as follows:

Whole boot breathability

[0128] The boot breathability test shall be designed to indicate the Moisture Vapor Transmission Rate (MVTR) through the test sample by means of a difference in concentration of moisture vapor between the interior and the exterior environment.

Apparatus

[0129]

- a. The external test environment control system shall be capable of maintaining $23 (\pm 1) ^\circ\text{C}$ and $50\% \pm 2\%$ relative humidity throughout the test duration.
- b. The weight scale shall be capable of determining the weight of test samples filled with water to an accuracy of (± 0.01) gram.
- c. The water holding bag shall be flexible so that it can be inserted into the test sample and conform to the interior contours; it must be thin enough so that folds do not create air gaps; it must have much higher MVTR than the footwear product to be tested; and it must be waterproof so that only moisture vapor contacts the interior of the footwear product rather

than liquid water.

d. The internal heater for the test sample shall be capable of controlling the temperature of the liquid water uniformly in the test sample to $35 (\pm 1) ^\circ\text{C}$.

e. The sealing method around the collar of the test sample shall be impervious to both liquid water and water vapor.

Procedure

[0130]

- a. Place sample in test environment and condition for at least 12 hours.
- b. The heating device is inserted into the water holding bag and the complete assembly is then placed into the test sample opening and filled with water to a height of 5cm measured from inside sole.
- c. Seal opening around the collar with plastic wrap around the top of the footwear and tape over using packaging tape.
- d. Heat water in test sample to $35 ^\circ\text{C}$.
- e. Weigh test sample and record as W_i .
- f. Hold temperature in test sample after weighing for a minimum of 4 hours.
- g. After a minimum of 4 hours, reweigh test sample. Record weight as W_f and test duration as T_d .
- h. Calculate MVTR of the test sample in grams/hour from the equation below: $MVTR = (W_i - W_f)/T_d$.

[0131] This test is in accordance with ASTM D8041 (2016).

[0132] For example, for a low ankle shoe of European shoe size 42, the footwear may be considered breathable if above calculated value is above 1.5 grams/hour. For larger / smaller shoe sizes, said limit value may be extrapolated in accordance with the increased / decreased surface area of the shoe.

[0133] The waterproofness and the breathability of the bootie as a whole may also be determined by use of the Centrifuge test and the Whole Boot Moisture Vapor Transmission Rate Test, respectively, as laid out above.

[0134] The elasticity of the laminate and of the bootie may be measured according to DIN EN 14704-1 (July 2005), method A. The test may be carried out as set out therein, while using test samples of the following configuration: Test sample width = 25 mm, test sample testing length = 50 mm (testing length referred in DIN EN as gauge length, the length of the sample between the tensile machine clamps), whole length of test sample = 100 - 150 mm. The test sample is subject to 3 to 5 consecutive test cycles. In each test cycle, the test sample is subject to a constant extension of 30% of said gauge length, in samples cut circumferentially and 10% of said gauge length in samples cut longitudinally to the formed bootie, and the maximum force of the last cycle is measured. The extension and retraction rate of the sample should be set to 250 mm/min. The specimen length is measured

after final cycle finishes by laying it on a flat surface and measuring the length between applied reference markers within the gauge length with a calibrated ruler. The elastic recovery expressed in % is calculated through subtracting the final length between applied reference markers from the original length between said reference markers, dividing then by the original length between said reference markers, and finally multiplying the result by 100. Otherwise, test conditions are as set out in DIN EN 14704-1 (July 2015), method A. Elasticity is defined as a property of material in which the material extends at the application of a force or extension and recovers towards its original length after removing the applied force or extension. The elasticity of the specimen is therefore determined via measuring the force recorded during applied extension (or vice versa) and the ability of the material to recover towards its original length after said applied force or extension has been removed.

[0135] While the invention has been described with reference to exemplary embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed, but that the invention will include all embodiments falling within the scope of the appended claims.

Claims

1. Method for permanently waterproofing footwear (2), comprising:

providing a waterproof, breathable bootie (10) having a waterproof, breathable laminate construction, the waterproof, breathable laminate construction comprising a functional layer (54) and at least one textile layer (56, 58), inserting the waterproof, breathable bootie (10) through a collar (5) of the footwear (2) into an inner space (12) of the footwear (2), after the inner space (12) of the footwear (2) has been closed, and permanently fixing the waterproof, breathable bootie (10) in position in the inner space (12) of the footwear (2) by

attaching the waterproof, breathable bootie (10) to the footwear (2) in a donning region (98) of the footwear (2), and attaching the waterproof, breathable bootie (10) to the footwear (2) in at least one further attachment region of the footwear (2).

2. Method according to claim 1,

wherein the inserting of the waterproof, breathable bootie (10) takes place, after the inner space (12) has been formed by an upper assembly (4) of the footwear (2), wherein the inserting of the waterproof, breathable bootie (10) in particular takes place, after a sole (8) of the footwear (2) has been applied to the upper assembly (4), or wherein the inserting of the waterproof, breathable bootie (10) in particular takes place, before a sole (8) of the footwear (2) is applied to the upper assembly (4);

or

wherein the inserting of the waterproof, breathable bootie (10) takes place, after the inner space (12) has been jointly formed by an upper assembly (4) of the footwear (2) and a sole (8) of the footwear (2).

3. Method according to claim 1 or 2, wherein the waterproof, breathable bootie (10) consists of the waterproof, breathable laminate construction.

4. Method according to any of the preceding claims,

wherein the attaching of the waterproof, breathable bootie (10) to the footwear (2) in the donning region (98) of the footwear (2) comprises adhering an adhesive tape (14) of the waterproof, breathable bootie (10), arranged in a collar region of the waterproof, breathable bootie (10), to the donning region (98) of the footwear;

or

wherein the attaching of the waterproof, breathable bootie (10) to the footwear (2) in the donning region (98) of the footwear (2) comprises sewing the waterproof, breathable bootie (10) in a collar region thereof to the donning region (98) of the footwear.

5. Method according to any of the preceding claims, wherein the attaching of the waterproof, breathable bootie (10) to the footwear (2) in the donning region (98) of the footwear (2) comprises attaching the waterproof, breathable bootie (10) to the footwear at a distance of at least 2 cm from a sole portion of the inner space (12).

6. Method according to any of the preceding claims,

wherein the attaching of the waterproof, breathable bootie (10) to the footwear (2) in at least one further attachment region of the footwear (2) comprises attaching the waterproof, breathable bootie (10) to the footwear (2) in at least one of a toe region of the footwear (2) and a heel region of the footwear (2);

- wherein the attaching of the waterproof, breathable bootie (10) to the footwear in at least one further attachment region of the footwear (2) in particular comprises adhering the waterproof, breathable bootie (10) to the footwear (2) in at least one of the toe region of the footwear (2) and the heel region of the footwear (2).
7. Method according to any of the preceding claims, wherein the step of permanently fixing the waterproof, breathable bootie (10) in the inner space (12) of the footwear (2) comprises adhering the waterproof, breathable bootie (10) to the footwear (2) substantially all around its outer surface.
8. Method according to any of the preceding claims, wherein the step of inserting the waterproof, breathable bootie (10) into the inner space (12) comprises arranging the waterproof, breathable bootie (10) on a last (20, 22, 23) and inserting the last (20, 22, 23) together with the waterproof, breathable bootie (10) into the inner space (12).
9. Method according to claim 8,
- wherein the last (20) is expandable and wherein the step of permanently fixing the waterproof, breathable bootie (10) in position in the inner space (12) comprises expanding the last (20) within the inner space (12), wherein the last (20) in particular comprises at least two last portions (24, 26) and wherein the step of expanding the last (20) within the inner space (12) in particular comprises spacing the at least two last portions (24, 26);
and/or
wherein the last (20, 22, 23) is heatable and wherein the step of permanently fixing the waterproof, breathable bootie (10) in position in the inner space (12) comprises heating the last (20, 22, 23), when inserted into the inner space (12).
10. Method according to claim 8 or 9, wherein the step of permanently fixing the waterproof, breathable bootie (10) in position in the inner space (12) comprises applying pressure to the last (20, 22, 23) from outside of an upper assembly (4) of the footwear (2) and/or from outside of a sole (8) of the footwear (2), with the step of applying pressure to the last (20, 22, 23) from outside of the the upper assembly (4) and/or from outside of the sole (8) in particular comprising at least one of:
- applying pressure to an instep portion of the upper assembly (4) via an instep pressuring device (32),
applying pressure around a heel portion of the upper assembly (4) via a forked heel pressuring device (34),
applying pressure to the sole (8) via a sole pressure plate (30),
applying pressure around substantially the entire upper assembly (4) and sole (8) via a bag (39) around the footwear (2) and the last (23).
11. Method according to any of the preceding claims, wherein the waterproof, breathable bootie (10) is at least partly elastic.
12. Method according to claim 11,
- wherein the waterproof, breathable bootie (10) is elastic at least in a mid-foot portion thereof, in particular at least in a mid-foot portion that extends along at least 50% of the length from the tip of the waterproof, breathable bootie (10) to the rear of the waterproof, breathable bootie (10), and/or
wherein the waterproof, breathable bootie (10) is elastic at least in a top portion thereof, in particular at least in a top portion that extends along at least 40%, in particular along at least 50%, of the circumference of the waterproof, breathable bootie (10).
13. Method according to any of the preceding claims,
- wherein the waterproof, breathable laminate construction comprises a one-piece functional layer and at least one textile layer, with the one-piece functional layer in particular being a seamless, one-piece functional layer, or
wherein the waterproof, breathable laminate construction comprises multiple waterproof, breathable laminate pieces, with each of the multiple waterproof, breathable laminate pieces comprising a functional layer piece and at least one textile layer piece, or
wherein the waterproof, breathable laminate construction comprises multiple functional layer pieces and at least one textile layer.
14. Method according to any of the preceding claims, wherein the upper assembly (4) has an upper material (40) and wherein the upper assembly (4) has one of a mono tongue, wherein part of the upper material (40) forms a tongue of the footwear (2), a separate tongue (42), wherein a tongue piece is attached to the upper material (40), and a gusset-type tongue, wherein a tongue piece (42) is attached to the upper material (40) via an intermittent bridge piece (46), and wherein the step of permanently fixing the waterproof, breathable bootie (10) in position in the inner space (12) comprises attaching the waterproof, breathable bootie (10) to said one of the mono tongue, the separate tongue, and the gusset-type

tongue.

15. Footwear (2) produced in accordance with a method according to any of the preceding claims.

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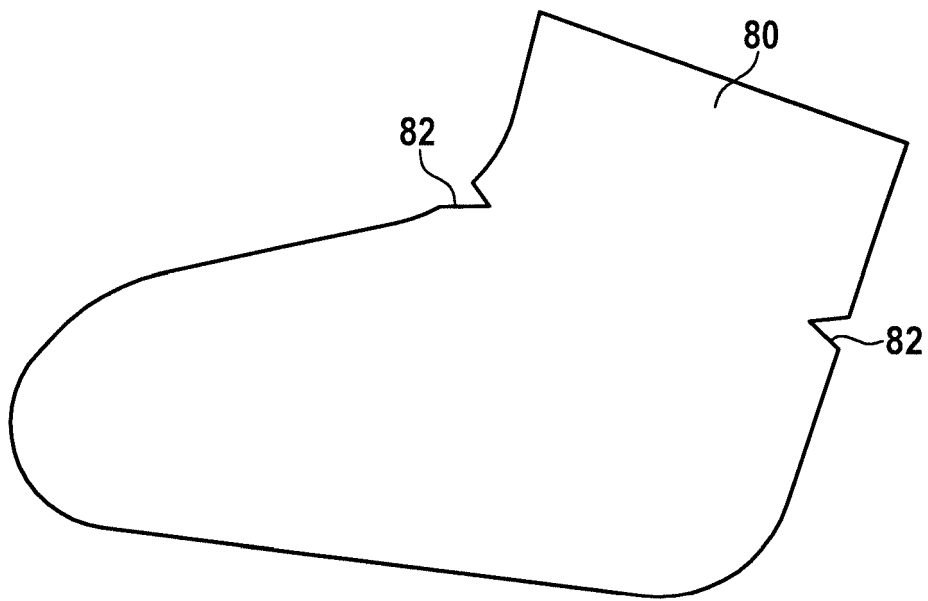


Fig. 1A

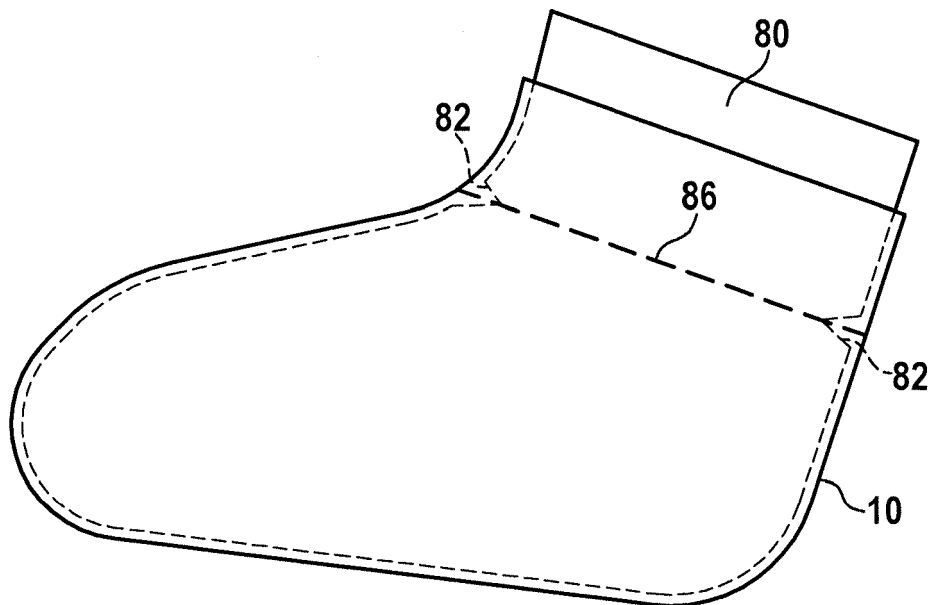


Fig. 1B

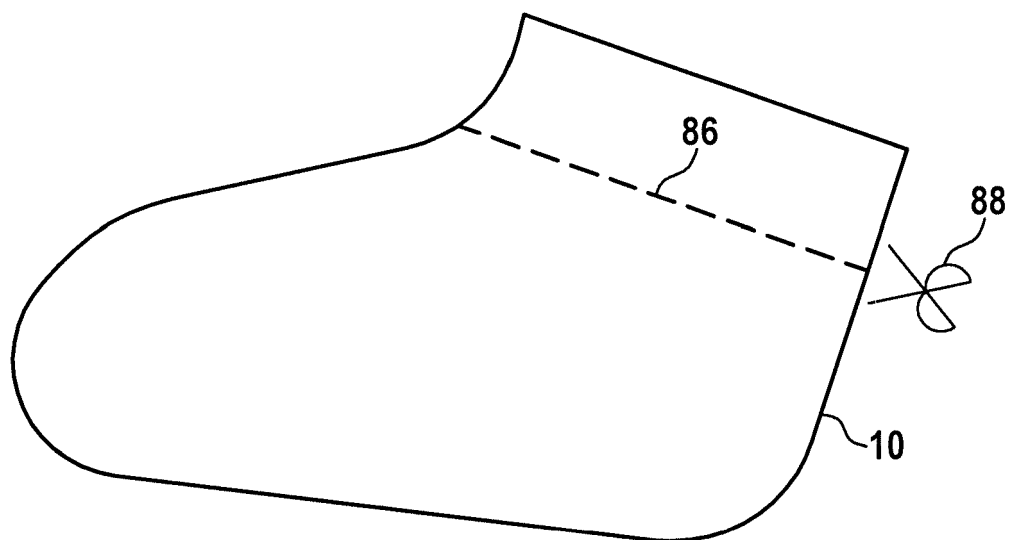


Fig. 1C

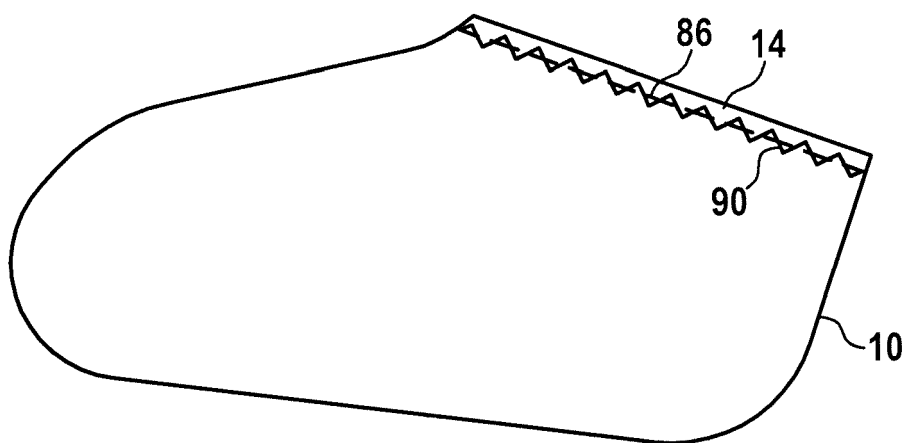


Fig. 1D

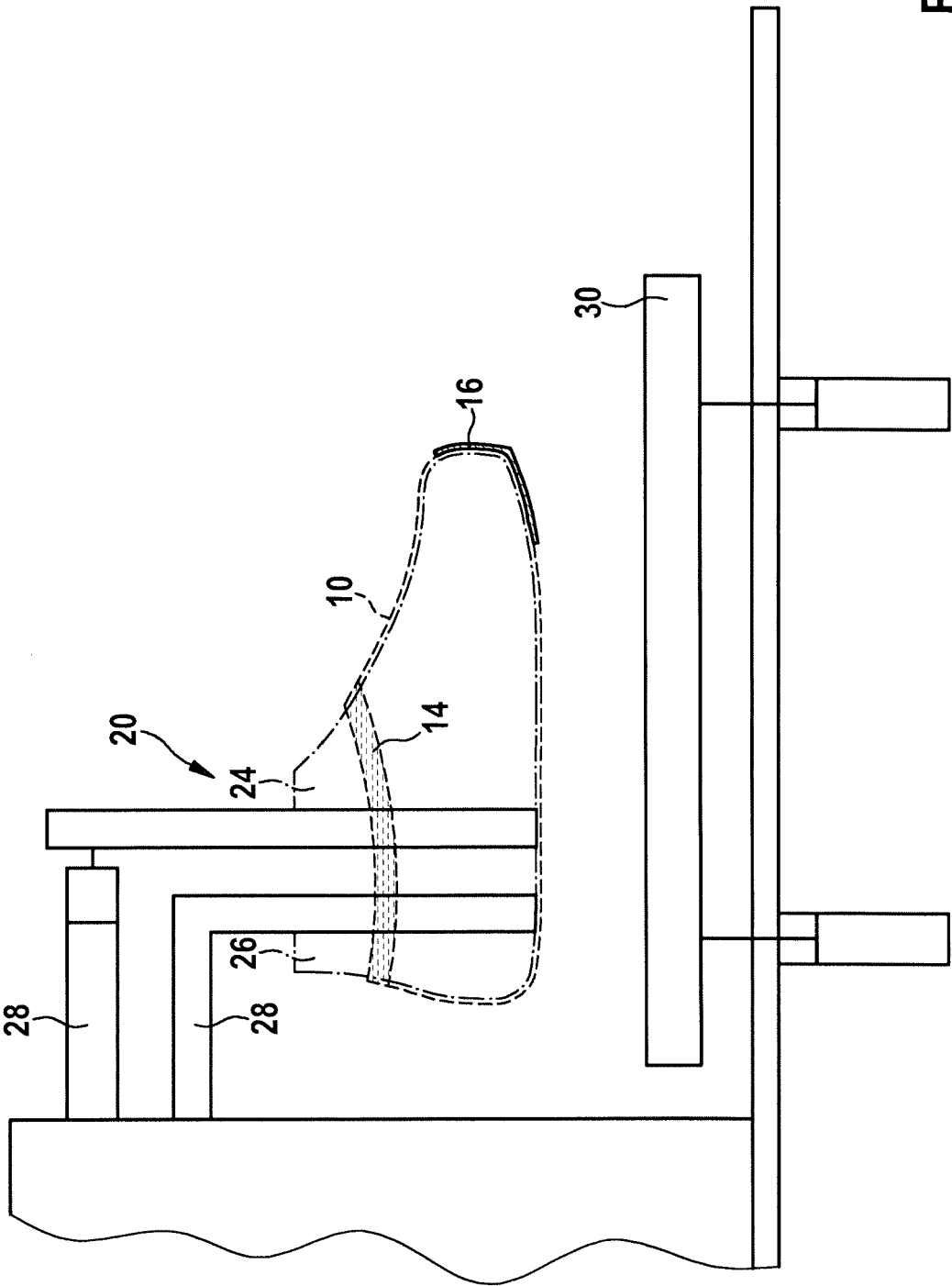


Fig. 2A

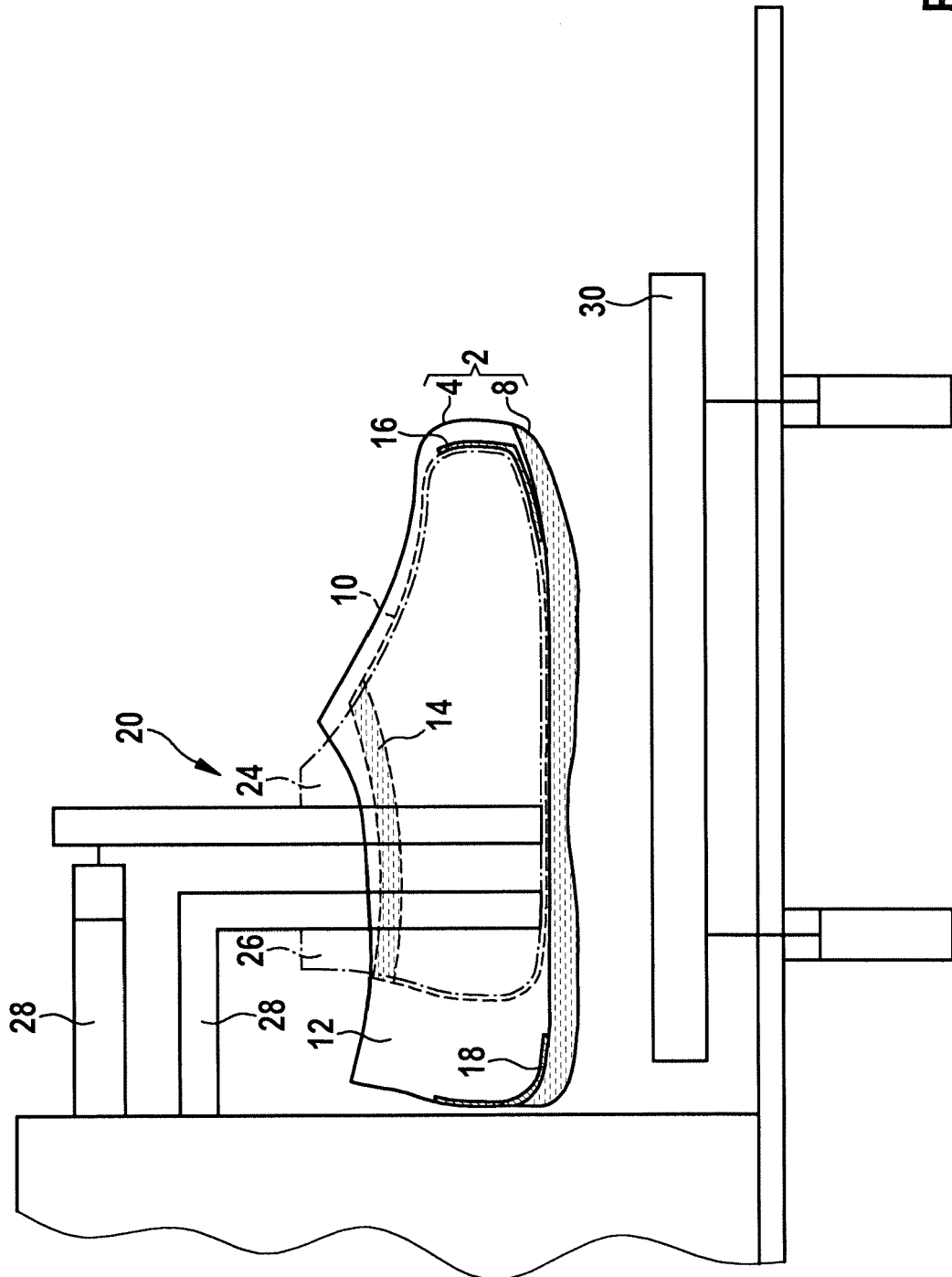


Fig. 2B

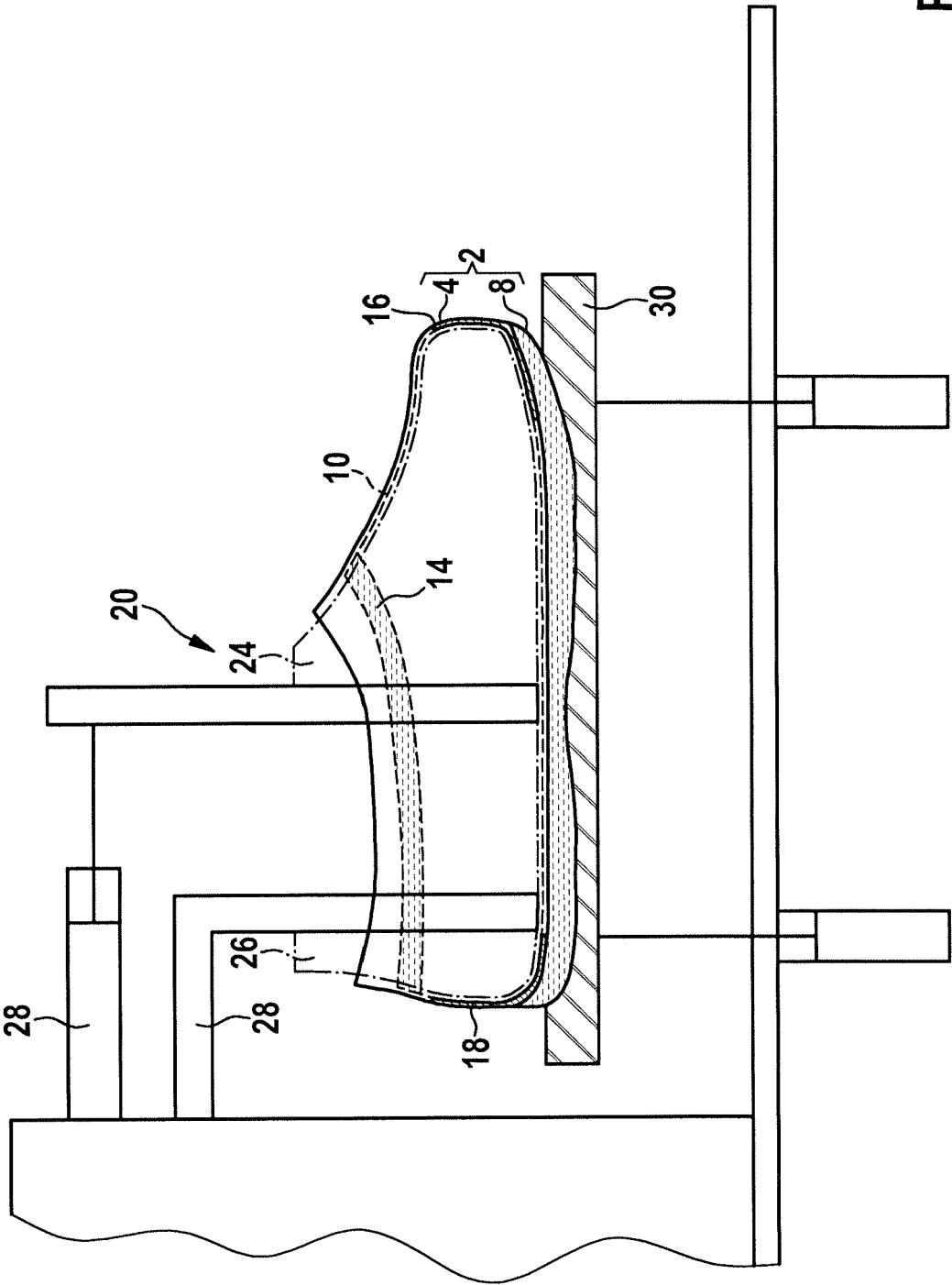


Fig. 2C

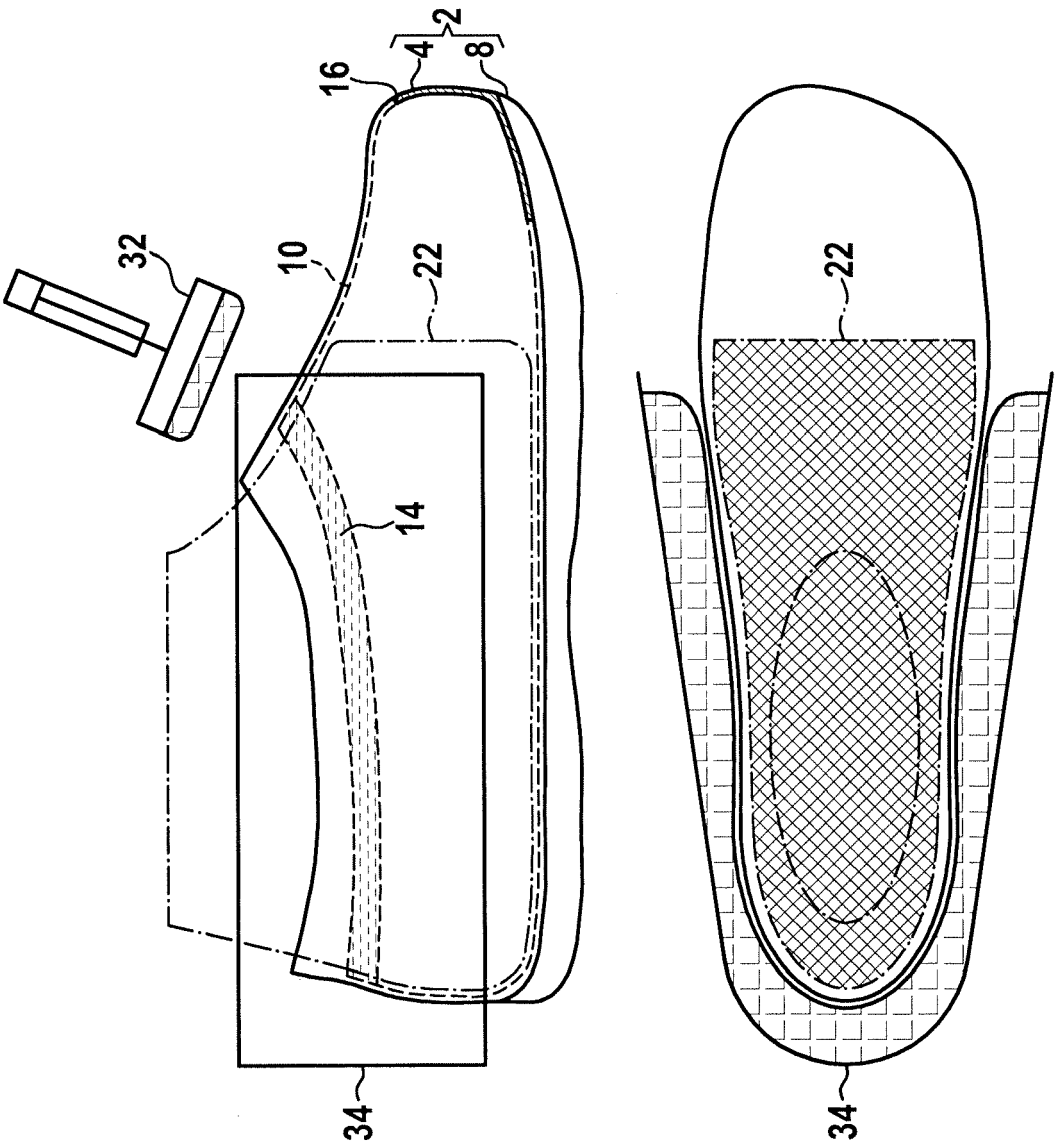


Fig. 2D

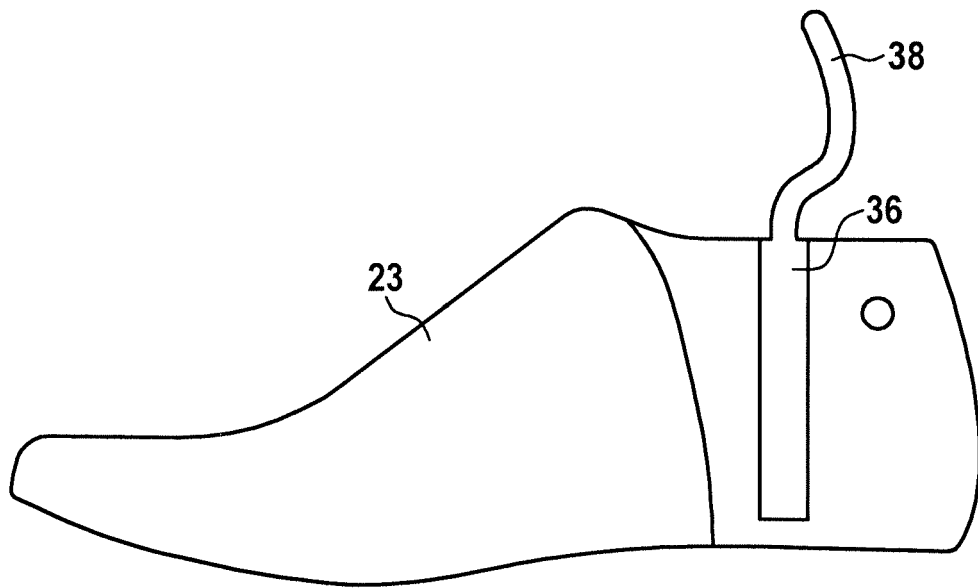


Fig. 3A

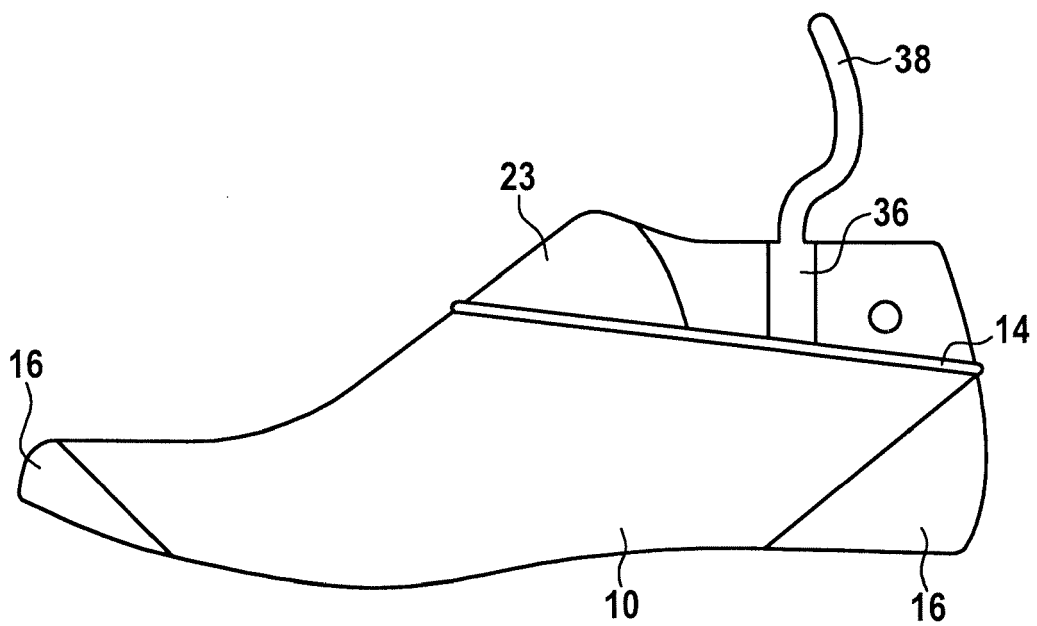


Fig. 3B

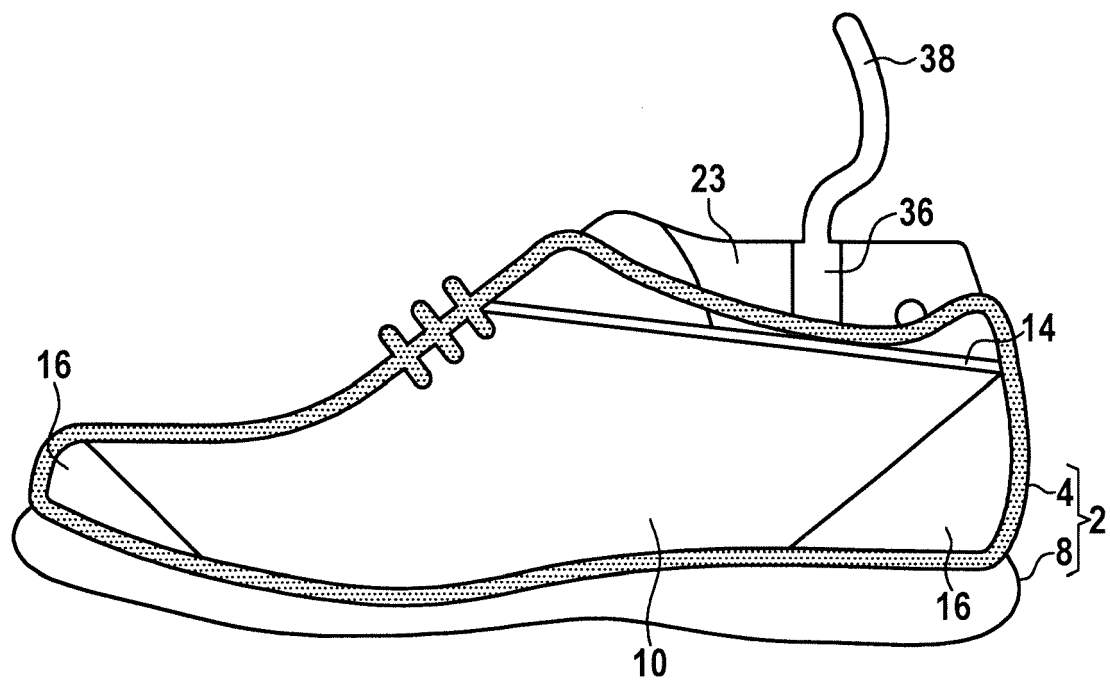


Fig. 3C

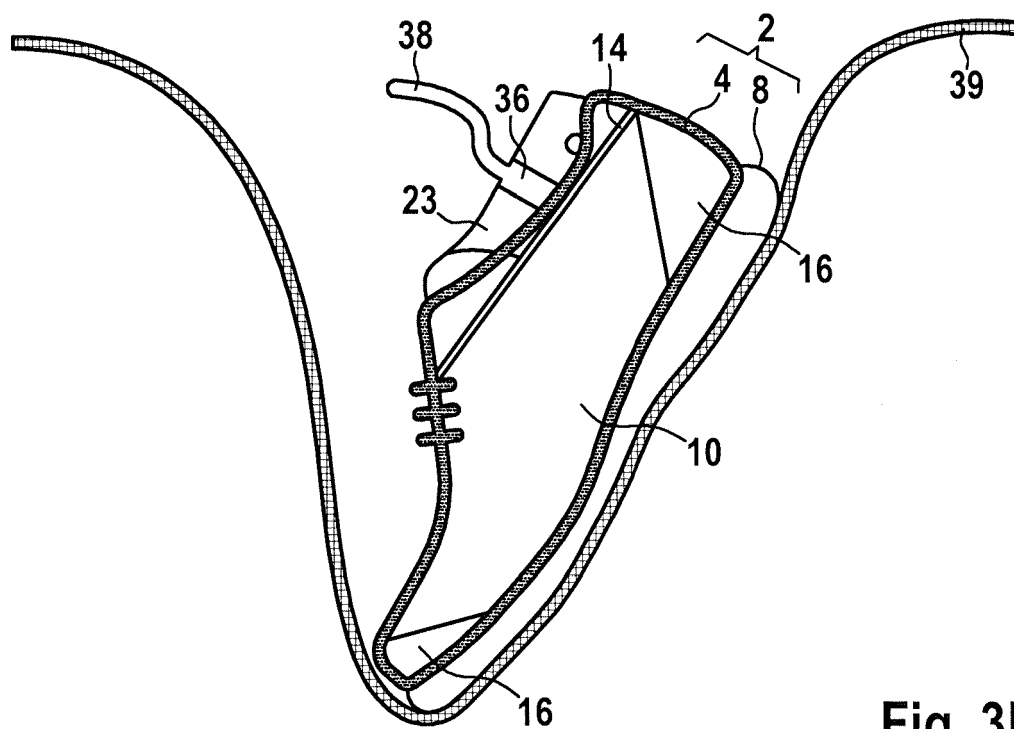


Fig. 3D

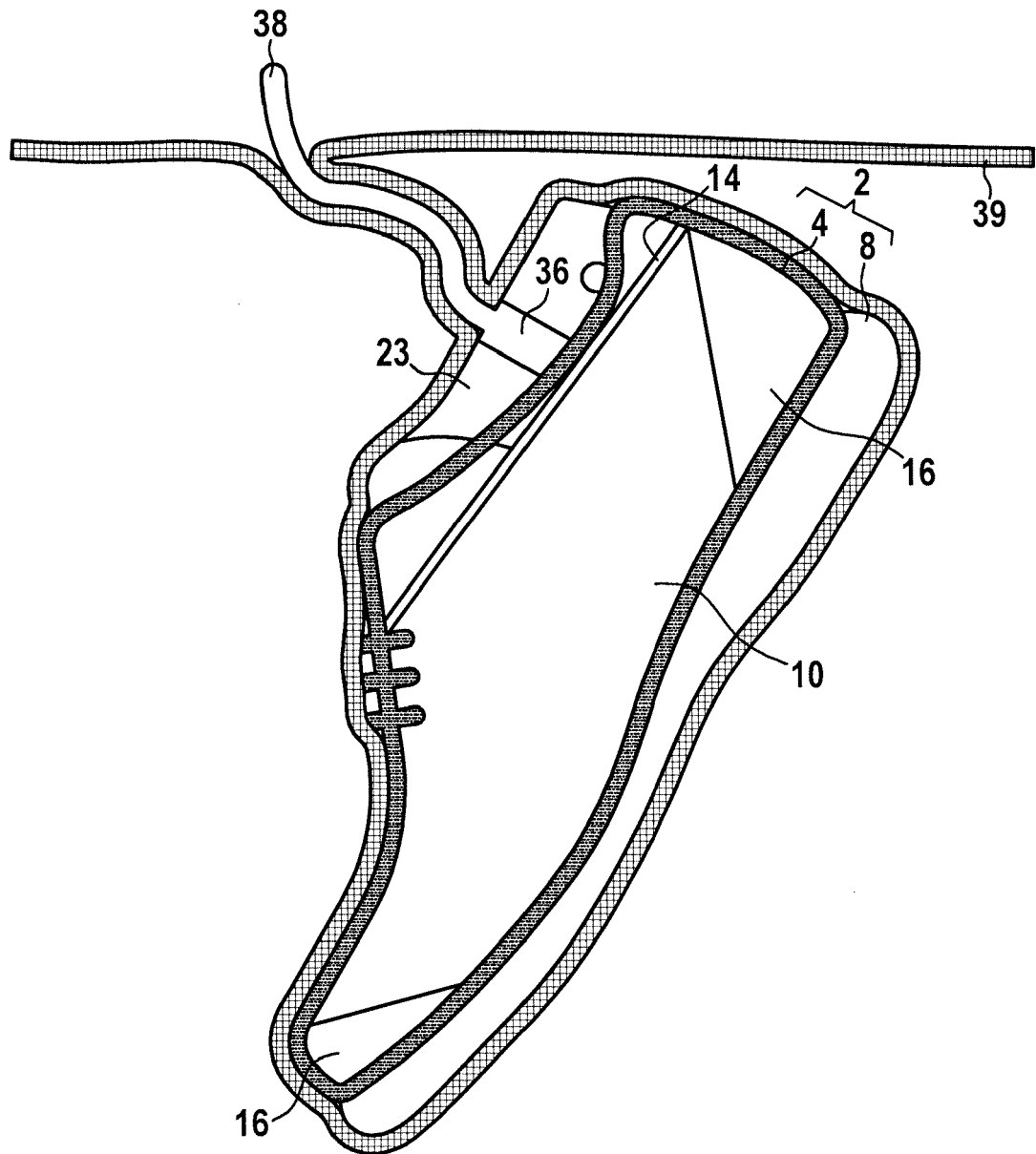


Fig. 3E

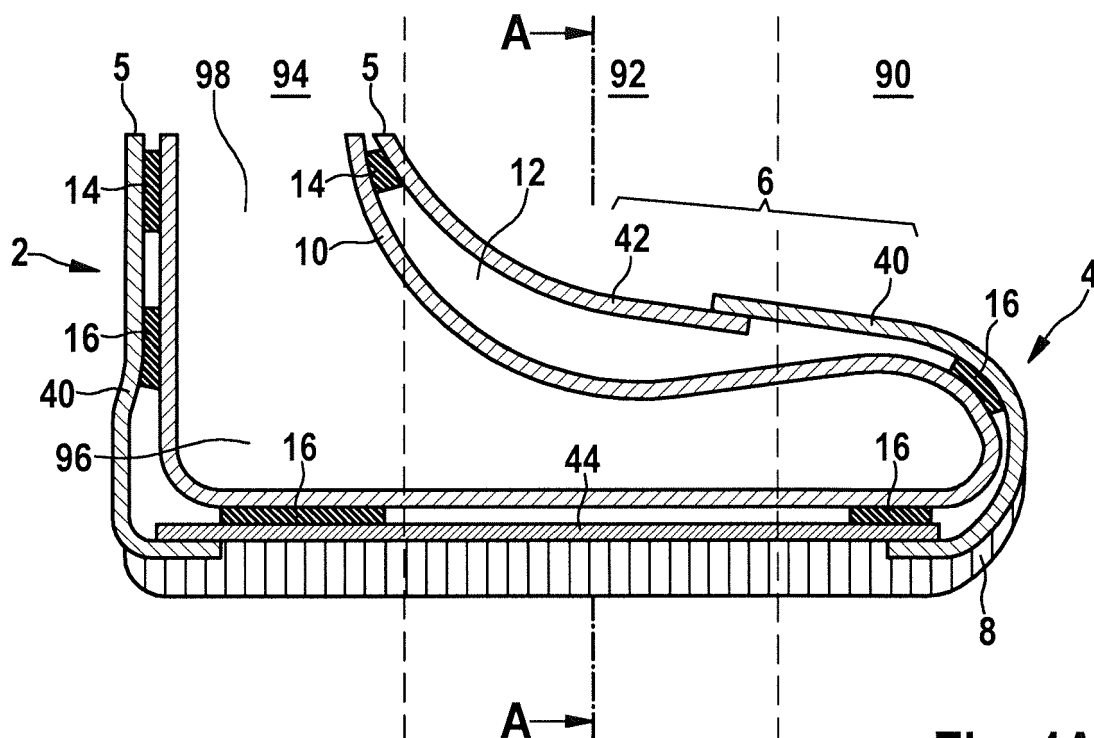


Fig. 4A

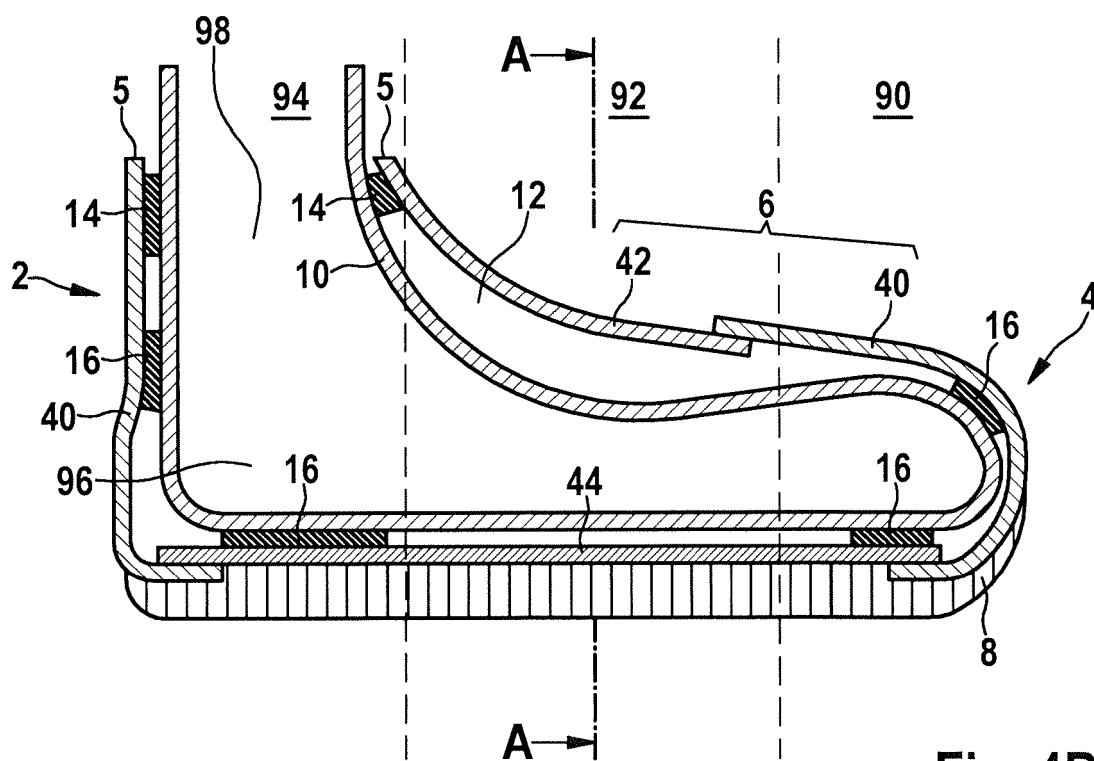


Fig. 4B

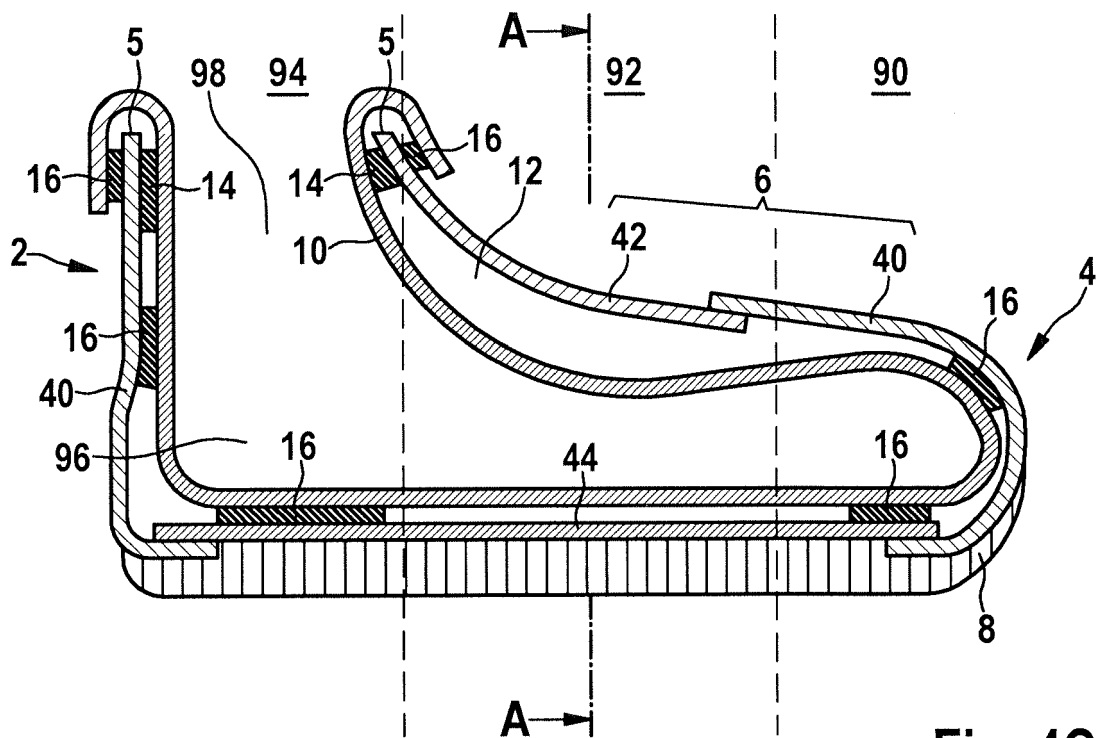


Fig. 4C

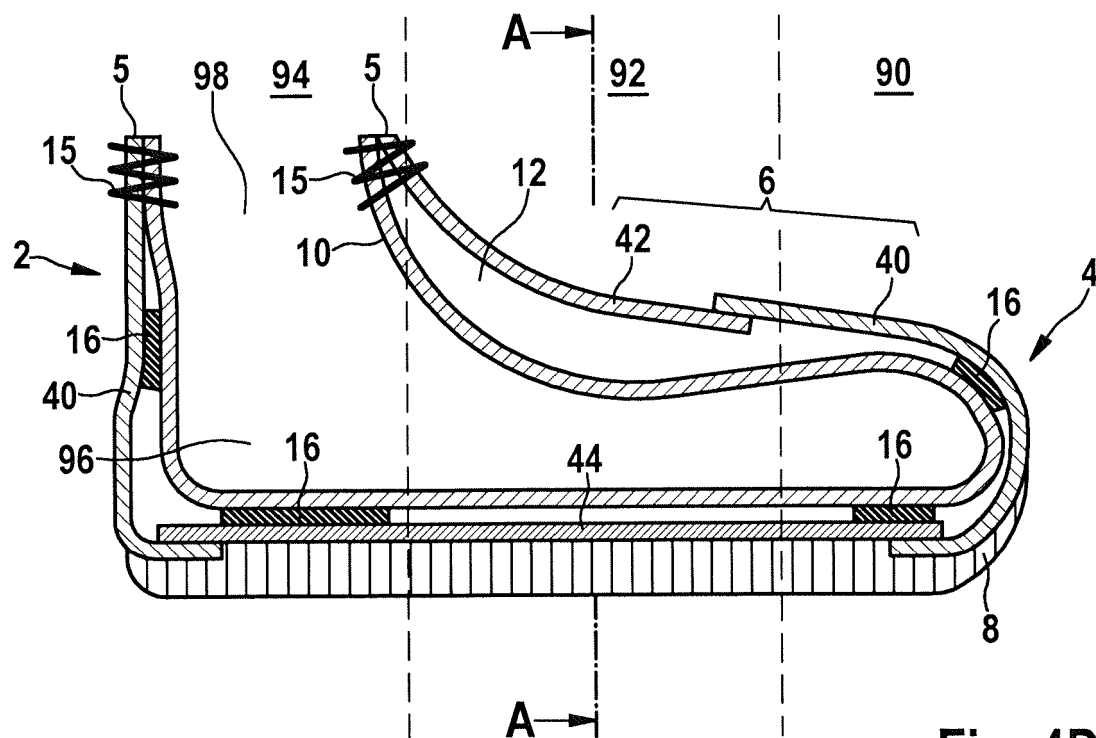


Fig. 4D

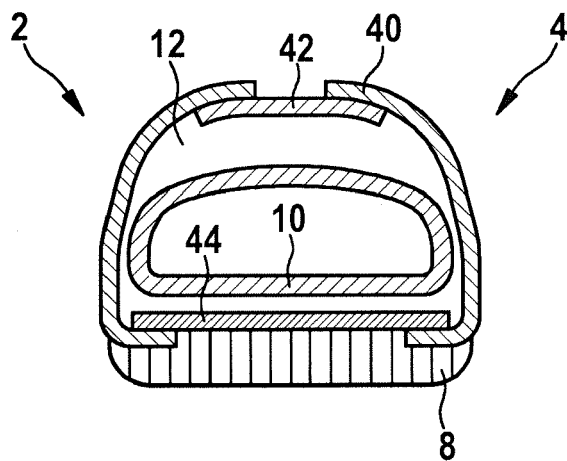


Fig. 5A

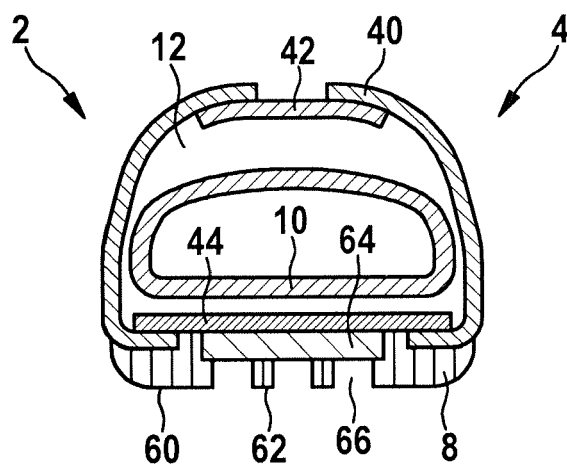


Fig. 5B

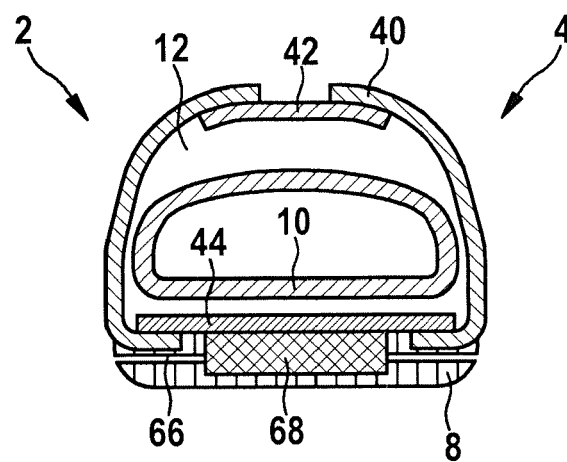


Fig. 5C

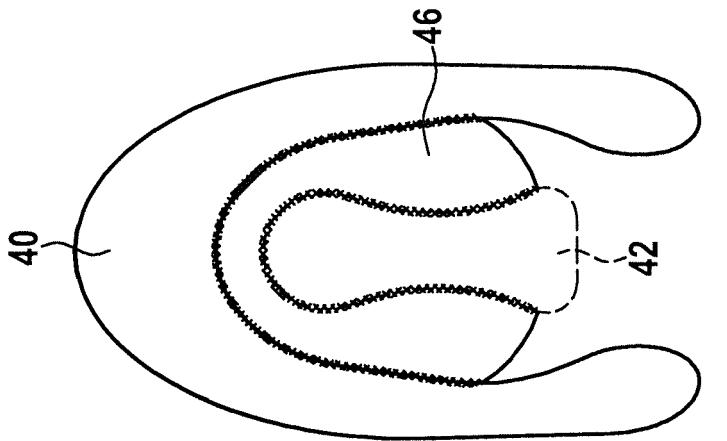


Fig. 6A

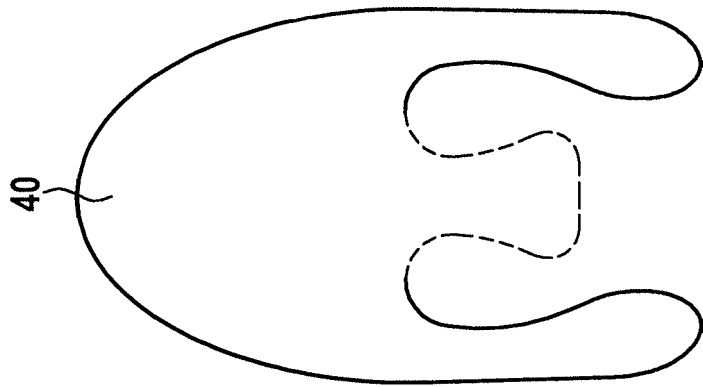


Fig. 6B

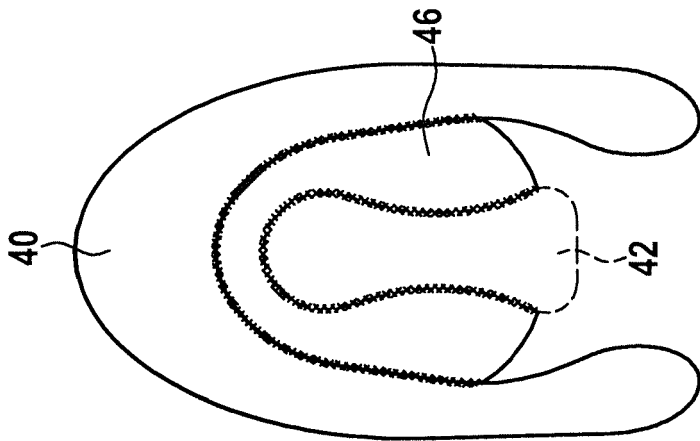


Fig. 6C

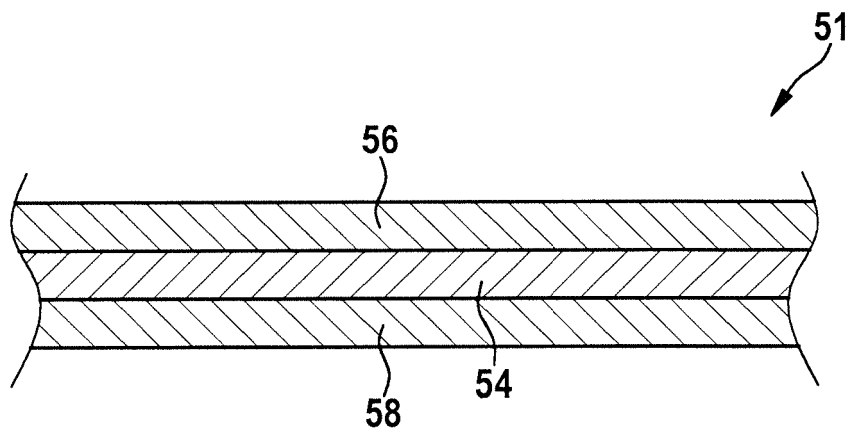


Fig. 7A

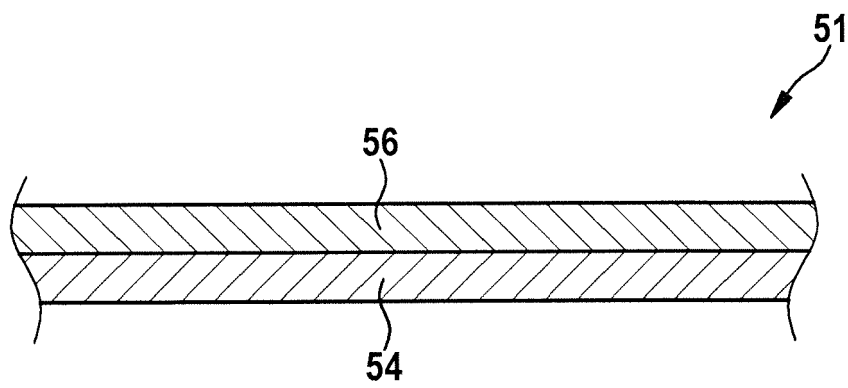


Fig. 7B

REFERENCES CITED IN THE DESCRIPTION

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