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## (54) Vapor-permeable shoe with waterproof and vapor-permeable sole

(57) A vapor-permeable shoe (10) with waterproof and vapor-permeable sole, which comprises
- an upper assembly (11),
- a sole (12), which is joined to the upper assembly (11) and comprises a body (13) made of waterproof material which has a tread (14) and has at least one region (15) that is permeable to water vapor,
- at least one waterproof and vapor-permeable membrane (16), which covers the region (15), toward the inside of the shoe (10),
- at least one protective element (17), which covers at least partially the lower face (16a) of the membrane (16),
- at least one protective shield (18) which is waterproof and vapor-permeable, covers the region (15) and is substantially interposed between the region and the protective element (17), the protective shield (18) being sealed in a waterproof manner to the body (13) at at least one zone (13a) of the body (13) that is peripheral to the region (15).

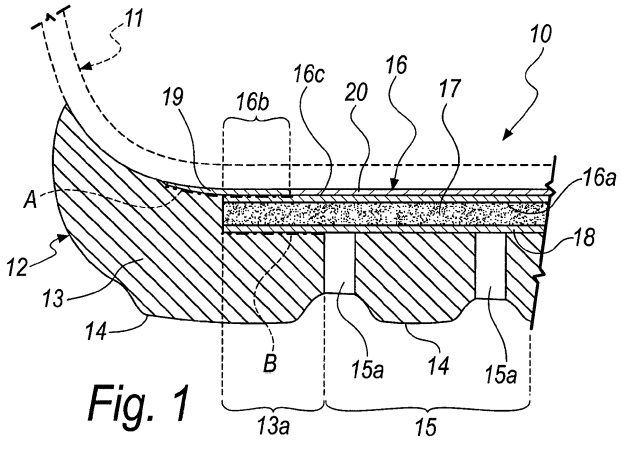


Fig. 1

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## Description

### Technical Field

**[0001]** The present invention relates to a vapor-permeable shoe with waterproof and vapor-permeable sole.

### Background Art

**[0002]** As is known, the part of the foot that has the greatest perspiration effect is the sole of the foot.

**[0003]** Therefore, the region of the shoe where moisture caused by sweating can accumulate the most is the interface between the sole of the foot and the sole of the shoe.

**[0004]** There, the sweat generated saturates the air with humidity and mostly condenses, stagnating on the plantar insert.

**[0005]** Only a small amount of the moisture produced by sweating spreads to the sides of the upper and exits from them if they are vapor-permeable.

**[0006]** Such effect of sweat stagnation in the plantar region is particularly conspicuous in rubber-sole shoes; in these cases vapor permeation through the sole of the shoe is in fact prevented by its total impermeability.

**[0007]** As is known, the stagnation of sweat in the plantar region causes to the user of the shoe a feeling of discomfort and also constitutes a preferential site for the growth of bacterial cultures, which are known to be the source of bad odors.

**[0008]** Therefore, it is a commonly felt need to obviate the stagnation of moisture from sweating at the plantar region of shoes.

**[0009]** A first attempt aimed at meeting this need consists of the solution disclosed in EP 0382904.

**[0010]** The teaching contained in such patent consists in dividing the rubber sole into two layers, the lower one of which has through micro-perforations, and in interposing thereat a semipermeable membrane which is joined perimetrically to the two layers, in order to avoid water infiltrations and thus to obtain a sole that is impermeable to water in the liquid state and permeable to water vapor.

**[0011]** For the sake of simplicity, hereinafter an element with the property of being impermeable to water in the liquid state and permeable to water vapor is referenced as waterproof and vapor-permeable.

**[0012]** The semipermeable membranes that EP 0382904 teaches to use are for example of the type disclosed in US 4,187,390 and US 4,194,041 by W. L. Gore or US 6,228,477 by BHA Technologies.

**[0013]** Such membranes are provided by means of thin films which are made of expanded polytetrafluoroethylene, e-PTFE, with thicknesses that vary generally from 19 microns to 70 microns, and are waterproof and vapor-permeable.

**[0014]** Their microstructure is characterized by the presence of dense areas, called nodes, interconnected by stretched filaments known as fibrils.

**[0015]** These semipermeable membranes, conceived initially for the military field, have been developed and used in the clothing and footwear field in order to avoid the accumulation of vapor from sweating in items of clothing and to provide shoes with uppers with waterproof and vapor-permeable linings.

**[0016]** Because the market of the clothing and footwear field has always demanded soft and comfortable items, in the described applications there is a strong need to ensure that the membrane, intended as a functional layer, does not compromise such characteristics.

**[0017]** This need has been expressed in a true technical preconception that has entailed the use of membranes provided with low thicknesses in order to be laminated with supporting and/or aesthetic finishing materials, such as fabric or leather, so as to obtain finished laminated elements that have considerable characteristics of flexibility, easy folding, softness, surface slipperiness, compressibility and extensibility, and low weight per unit surface.

**[0018]** However, the films that provide such membranes have poor characteristics of mechanical strength, indeed because of their low thickness.

**[0019]** In fact, it should be noted that the value of the strength of the lamination mainly derives from the characteristics of the fabric layer or supporting layer to which the membrane is coupled.

**[0020]** In particular, available films made of polymeric materials, used to provide such membranes as mentioned, have thicknesses generally between 19 and 70 microns, which give them poor penetration resistance, i.e., less than 5 N.

**[0021]** The expression "penetration resistance" designates the characteristic defined by a measurement performed according to the method illustrated in the ISO 20344 - 2004 standard, chapter 5.8.2 "Determination of the penetration resistance of the sole" regarding safety footwear.

**[0022]** This poor mechanical penetration resistance has led the inventor of EP 0382904 to prevent contact of the membrane with foreign objects by limiting the diameter of the holes of the sole that the membrane faces.

**[0023]** This solution, however, has been shown to limit the area of the sole assigned to vapor permeation and moreover the holes can become obstructed.

**[0024]** The teaching disclosed in EP 858,270, by the same Applicant, discloses a solution aimed at overcoming these drawbacks, but is not yet completely without aspects that can be perfected.

**[0025]** Said patent discloses a shoe with a sole that is made of perforated elastomer and comprises a mid-sole that comprises a waterproof and vapor-permeable membrane that is superimposed on a lower protective layer, preferably made of felt, which is treated in order to be water-repellent.

**[0026]** Since the protective layer is not made of waterproof material, it is not possible to provide a direct seal of the mid-sole with the sole, but a waterproof peripheral

element is used which provides a sealing bridge between the waterproof and vapor-permeable membrane and the sole.

**[0027]** As mentioned, this invention, while allowing an efficient protection of the membrane against the penetration of foreign objects, has some aspects that can be perfected.

**[0028]** In particular, the protective element loses progressively its water-repellent characteristics and therefore tends to become saturated with water and/or mud or other types of dirt, absorbed through the holes of the tread, compromising the breathability of the sole and creating, moreover, an environment favorable to the proliferation of microorganisms, such as molds and bacteria, which can cause the shoe to have a bad odor.

**[0029]** Another drawback consists in that during use the cyclic flexing and traction to which the mid-sole is subjected while walking tends to cause progressive wear and tearing of the membrane, thus causing the sole to lose its waterproofness.

**[0030]** A further solution is proposed in US 6508015 by Rauch Max, which discloses a sole structure with two superimposed layers, the topmost of which, designed to be directed toward the upper part of the shoe, is elastic and permeable to water vapor.

**[0031]** The lower layer, which covers less than 70% of the upper layer, has a function of support thereof and provides the tread.

**[0032]** The upper layer is made for example of sintered plastics or nonwoven fabrics so as to have a microporous structure, which in any case is not waterproof.

**[0033]** A drawback of this solution consists in that during use of the shoe the microporous upper layer, left extensively exposed by the lower layer, tends to become saturated with water when it comes into contact with it, absorbing it, retaining it and partly releasing it over time, dirtying the surfaces on which one walks.

**[0034]** Moreover, the upper layer tends to degrade in contact with the absorbed water.

**[0035]** In order to obtain the waterproofness of the sole, such patent discloses the teaching of treating the upper layer so as to make it water-repellent or cover it with a waterproof and vapor-permeable membrane arranged above it.

**[0036]** However, the hydrophobic treatment has a short life, causing the sole to lose its waterproofness, whereas the application of a vapor-permeable and waterproof membrane over the upper layer in fact reproduces a structure that can be likened to the one already described, in which the membrane is supported by one or more protective layers, therefore facing again the same drawbacks and limitations in quantitative terms of vapor permeability.

## Disclosure of the Invention

**[0037]** The aim of the present invention is to provide a vapor-permeable shoe with waterproof and vapor-permeable sole that allows to overcome the limitations of currently known shoes and soles, particularly by allowing to prevent the retention and release of the water with which it might come into contact during use, at the same time having an efficient and durable vapor-permeability and waterproofness.

**[0038]** Within this aim, an object of the invention is to devise a vapor-permeable shoe with waterproof and vapor-permeable sole which, with respect to currently known products, has a greater resistance to the damage caused by foreign objects that, during its use, tend to penetrate its sole, such as for example pebbles, particularly if they are sharp, or the like.

**[0039]** Another object of the invention is to provide a vapor-permeable shoe with waterproof and vapor-permeable sole whose waterproofness and vapor permeability are more durable than in currently known products.

**[0040]** This aim and these and other objects that will become better apparent hereinafter are achieved by a vapor-permeable shoe with waterproof and vapor-permeable sole, comprising

- an upper assembly,
- a sole, which is joined to said upper assembly and comprises a body made of waterproof material which has a tread and has at least one region that is permeable to water vapor,
- at least one waterproof and vapor-permeable membrane, which covers said at least one region, toward the inside of said shoe,
- at least one protective element, which covers at least partially one lower face of said at least one membrane,

said shoe being characterized in that it further comprises at least one protective shield which is waterproof and vapor-permeable, covers said at least one region and is substantially interposed between said region and said at least one protective element, said protective shield being sealed in a waterproof manner to said body at at least one zone of said body that is peripheral to said at least one region.

## Brief description of the drawings

**[0041]** Further characteristics and advantages of the invention will become better apparent from the description of preferred but not exclusive embodiments of the waterproof and vapor-permeable sole according to the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a transverse sectional view of a vapor-permeable shoe according to the invention, in a first embodiment;

Figure 2 is a transverse sectional view of a vapor-permeable shoe according to the invention, in a second embodiment;

Figure 3 is a transverse sectional view of a vapor-

permeable shoe according to the invention, in a variation of the second embodiment;

Figure 4 is a transverse sectional view of a vapor-permeable shoe according to the invention, in a third embodiment.

**Ways of carrying out the Invention**

**[0042]** With reference to the figures, a vapor-permeable shoe with waterproof and vapor-permeable sole is generally designated by the reference numeral 10 in a first embodiment, which comprises

- an upper assembly 11,
- a sole 12, which is joined to the upper assembly 11 and comprises a body 13 made of waterproof material which has a tread 14 and has at least one region 15 that is permeable to water vapor,
- a waterproof and vapor-permeable membrane 16, which covers a region 15, toward the inside of the shoe 10,
- a protective element 17, which covers a lower face 16a of the membrane 16.

**[0043]** According to the invention, the shoe 10 has the peculiarity in that it comprises moreover a protective shield 18, which is waterproof and vapor-permeable, covers the region 15 and is substantially interposed between such region and the protective element 17, the protective shield 18 being sealed in a waterproof manner to the body 13 at a zone 13a of the body 13 that is peripheral to the region 15, preferably as described hereinafter.

**[0044]** The tread 14 is conveniently the lower surface of the body 13 that, when in use, makes contact with the ground, but in an equivalent manner in alternative embodiments of the invention it can be an element that is separate from said body 13 and associated with it in a downward region.

**[0045]** Conveniently, the region 15 is defined by a plurality of holes 15a that pass through the body 13.

**[0046]** In alternative embodiments of the invention, in a substantially equivalent manner, said region can be defined by at least one wide opening, in which structural elements for reinforcement and support for said protective shield, for example in order to form a grid, can be provided.

**[0047]** Depending on the contingent requirements, in alternative embodiments of a vapor-permeable shoe according to the invention, the shoe comprises a sole that generally has at least one region that is permeable to the water vapor and is covered by at least one waterproof and vapor-permeable membrane, below which at least one protective element is provided, at least one of said protective shield being moreover provided at said at least one region.

**[0048]** Advantageously, the protective shield 18 is microporous and has pores with an average aperture of less than 1 μm; preferably, said pores have an average aperture of less than 0.5 μm and in particular conveniently at least 50% of said pores has an average aperture of less than 0.5 μm.

**[0049]** Advantageously, the protective shield 18 is constituted by a sheet made of material obtained from a substantially uniform mixture composed of

- a polyolefin with high molecular weight, in a percentage concentration of the volume of said mixture comprised between 8% and 98%,
- a filler, which is adapted to promote the formation of micropores, in a percentage concentration of the volume of said mixture comprised between 1% and 92%,
- a plasticizer, in a percentage concentration of the volume of said mixture comprised between 1% and 40%.

**[0050]** Where said polyolefin is preferably a UHMW polyethylene (UHMW meaning Ultra High Molecular Weight) and conveniently said filler is selected between silicon dioxide and silicic acid, said plasticizer is a water-insoluble oil, preferably petrol oil.

**[0051]** As an alternative, the protective shield 18 is conveniently made of a material selected among expanded polytetrafluoroethylene, e-PTFE, polyurethane, PU, polyester, PES, polypropylene, PP, polyethylene, PE, and the like.

**[0052]** Preferably, the protective shield 18 has a structure selected among

- a structure constituted by a single integral layer, which is preferably extruded, having a thickness substantially comprised between 0.1 and 5 mm,
- a structure constituted by a plurality of layers joined by lamination to form a multilayer element whose thickness is substantially comprised between 0.1 and 5 mm,
- a structure constituted by a plurality of laminated layers, a permeable material being provided between them and being cohesive with them.

**[0053]** The protective element 17 is conveniently made of a material that is resistant to hydrolysis and vapor-permeable, selected among felt, nonwoven fabric and the like, treated so as to be water-repellent, and conveniently of a thickness substantially comprised between 0.5 mm and 5 mm.

**[0054]** The membrane 16 is conveniently of the type of commonly commercially available vapor-permeable and waterproof membranes, for example made of expanded polytetrafluoroethylene, e-PTFE, polyurethane, PU, or the like, and at least one mesh that reinforces it is conveniently associated therewith.

**[0055]** Moreover, advantageously an element 19 is provided for sealing the peripheral portion 16b of the membrane 16 to the body 13 that conveniently connects in a bridge-like manner its laterally adjacent edges, seal-

ing them to each other.

**[0056]** By way of non-limiting example, the portion in which the sealing element 19 provides the waterproof seal of the peripheral portion 16b of the membrane 16 to the body 13 is shown in Figure 1 by means of a segment of a dot-and-dash line, designated by the reference letter A.

**[0057]** The sealing element 19 is made advantageously of waterproof polymeric material and adheres hermetically to the peripheral portion 16b of the membrane 16 and to the body 13 with a layer of glue that is resistant to hydrolysis and capable of ensuring an effective seal, preferably of the polyurethane type.

**[0058]** The waterproof polymeric material of which the sealing element 19 is made is conveniently polyvinyl chloride, PVC, or thermoplastic polyurethane, TPU, or the like.

**[0059]** In alternative and substantially equivalent embodiments, the sealing element is advantageously a film of hot-melt thermoplastic adhesive, made of polyurethane or polyester, polyamide or polyolefin, that can be activated by means of heat and pressure.

**[0060]** A film that is particularly suitable for providing said sealing element is marketed by the company Bemis Associates Inc with product code 3218, or by the company Collano AG, XIRO Adhesive Films with product code XAF 36.004 (Puro).

**[0061]** Moreover, in a further and alternative method of embodiment of the sealing element, in a substantially equivalent manner, such element is provided by the material that constitutes the body of the sole, joined so as to form a waterproof seal at the peripheral region of the membrane.

**[0062]** Advantageously, the protective shield 18 and the body 13 are connected as to form a waterproof seal, conveniently at the zone 13a that is peripheral to the region 15.

**[0063]** Said waterproof seal connection is preferably provided by adhesive bonding or by high-frequency welding.

**[0064]** As an alternative, depending on the contingent requirements of embodiment of the invention, said sealing connection is conveniently provided by gripping to the protective shield 18 of the material for providing the body 13 injected in a mold during the formation step.

**[0065]** In particular, in this case, said sealing connection is obtained by co-molding on the protective shield 18 the material that forms the body 13, or a component thereof such as, for example, if it is formed by a lower portion and by a mid-sole.

**[0066]** In this manner, in fact, the material that forms the body 13, or its component, grips the protective shield 18 so as to form a waterproof seal, conveniently at the zone 13a of the body 13, which is peripheral to the region 15 that is permeable to water vapor.

**[0067]** In the accompanying figures, by way of non-limiting example, said sealing connection is illustrated by way of a dot-and-dash line designated by the reference letter B.

**[0068]** Advantageously, the upper assembly 11, the profile of which is shown schematically in dashed lines in Figures 1, 2 and 3, depending on the actuation requirements of the invention, comprises at least

- an outer vapor-permeable upper,
- an inner vapor-permeable lining, and
- a vapor-permeable insole, to which the lower flaps of the upper and of the lining are joined in a per se known manner, for example according to a lasting construction or by sewing, for example of the Strobel type.

**[0069]** In Figures 1, 2 and 3, the upper assembly 11 is shown schematically in dashes and the upper, the lining and the insole are not shown, because they are per se known elements whose structure is advantageously selected among known ones in a manner that is consistent with the contingent requirements of execution of the invention.

**[0070]** Preferably, a spacer 20 is provided that covers the upper face 16c of the membrane 16.

**[0071]** The main purpose of the spacer 20 is to protect the membrane 16 against the possible abrasive action of the insole, being interposed between them.

**[0072]** Conveniently, the spacer 20 is made of vapor-permeable or perforated material, for example felt, or fabric or polymeric material or cellulose material.

**[0073]** In a second embodiment of a shoe according to the invention, illustrated by way of non-limiting example in Figure 2, where it is designated by the reference numeral 100 and where the elements that correspond to those described so far are also designated by the same reference numerals, the body 13 advantageously comprises a lower portion 21 and an upper portion 22, the protective shield 18 being sealed to the lower portion 21, in which the zone 13a is peripheral to the region 15.

**[0074]** Conveniently, the upper portion 22 is joined so as to provide a waterproof seal to the peripheral portion 16b of the membrane 16.

**[0075]** Said waterproof sealing joint, illustrated by way of non-limiting example in Figures 2 and 3 by a segment of dot-and-dash line designated by the reference letter C, is preferably provided by glueing or, as an alternative, according to the contingent requirements of execution of the invention, is conveniently provided by gripping to the peripheral portion 16b of the membrane 16 of the material for providing the upper portion 22 injected in a mold during the step for forming the sole 13.

**[0076]** In particular, in this case, said sealed connection is obtained by co-molding on the peripheral portion 16b the material that forms the upper portion 22.

**[0077]** In particular, the sole 100 preferably comprises a spacer 20 that is permeable to water vapor and superimposed on the membrane 16 in order to cover it to protect it against any abrasive action that the insole may apply to it during use of the shoe 10.

**[0078]** Advantageously, the spacer 20 is made of vapor-permeable or perforated material, for example felt or fabric or plastics or cellulose material.

**[0079]** If the upper portion 22 is provided by co-molding, advantageously the spacer 20 also acts as a barrier to the passage, toward the membrane 16, of the material for providing the upper portion 22 during injection in the mold.

**[0080]** In an alternative constructive variation, not shown in the accompanying figures, the spacer is replaced by a central portion of said upper portion, which has holes or through openings so as to be permeable to water vapor, so as to define part of said region, of said body of the sole, that is permeable to water vapor.

**[0081]** In said alternative variation, the lower portion of the sole body is completely covered by the upper portion of the sole body.

**[0082]** With particular reference to Figure 3, in a variation of said second embodiment, in a shoe according to the invention, designated by the reference numeral 100a, the protective shield 18 advantageously has a perimetric band 18a that is exposed by the protective element 17 and by the membrane 16 that it covers in a downward region.

**[0083]** At said perimetric band 18a, the protective shield 18 is associated so as to provide a waterproof seal with the upper portion 22 of the body 13 of the sole 12.

**[0084]** Said waterproof sealing association, illustrated by way of non-limiting example by means of a a dot-and-dash segment designated by the reference letter D in Figure 3, is conveniently provided by glueing or, in case of formation of the upper portion 22 by co-molding, by gripping to the perimetric band 18a of the material for providing the upper portion 22, injected in a mold.

**[0085]** In a third embodiment of a vapor-permeable shoe with waterproof and vapor-permeable sole according to the invention, illustrated by way of non-limiting example in Figure 4, where it is generally designated by the reference numeral 200 and where the elements that correspond to the ones described so far are designated by the same reference numerals, the upper assembly 11 comprises conveniently an outer vapor-permeable upper 23, a vapor-permeable lining 24 and a vapor-permeable insole 25.

**[0086]** Generally, depending on the contingent requirements, the upper assembly comprises conveniently at least one upper, one lining and one insole which are vapor-permeable.

**[0087]** Advantageously, the membrane 16 constitutes a lower layer of the insole 25 or, in a substantially equivalent manner, is conveniently associated with a layer of the insole 25.

**[0088]** The lower flaps of the upper 23 and of the lining 24 are conveniently jointed to the insole 25, preferably by means of stitched seams.

**[0089]** In this case, the peripheral portion 16b of the membrane 16 and the body 13 of the sole 12 are connected so as to provide a waterproof seal conveniently by means of the material for providing the body 13, or a component thereof, which grips so as to provide a waterproof seal the peripheral portion 16b when the body 13 is formed by co-molding on the upper assembly 11.

**[0090]** As an alternative, the peripheral portion 16b of the membrane 16 and the body 13 of the sole 12 are connected so as to provide a waterproof seal conveniently by glueing the membrane 16 to the body 13 of the sole 12, or to a component thereof, such as a mid-sole.

**[0091]** Moreover, the protective shield 18 and the body 13 are advantageously connected so as to provide a waterproof seal at the zone 13a, which is peripheral to the region 15 that is permeable to water vapor.

**[0092]** The sealed connection between the membrane 16 and the body 13 of the sole 12 is illustrated by way of non-limiting example in Figure 4 with a segment of a dot-and-dash line designated by the reference letter E.

**[0093]** Thus, the sealed connection between the protective shield 18 and the body 13 of the sole is illustrated by way of non-limiting example in Figure 4 with a segment of a dot-and-dash line designated by the reference letter B, by analogy with what has been described so far.

**[0094]** Advantageously, the waterproof sealed connection of the body 13 to the protective shield 18 is provided by gluing or co-molding the material that constitutes the body 13, as already described with reference to the sealed connection of the body 13 to the membrane 16.

**[0095]** In practice, it has been found that the invention achieves the intended aim and objects, by providing a vapor-permeable shoe with waterproof and vapor-permeable sole that allows to overcome the limitations of currently known shoes and soles, particularly allowing to prevent the retention and the release of water with which the sole might come into contact during use, thanks to the presence of the protective shield, which by being impermeable to water and sealed to the body of the sole prevents the water from reaching the protective element of the membrane, though being vapor-permeable.

**[0096]** Moreover, a vapor-permeable shoe with waterproof and vapor-permeable sole according to the invention, with respect to currently known products, has a greater resistance to the damage that can be induced by foreign objects which, during its use, tend to penetrate its sole, such as for example pebbles, particularly if sharp, or the like; in fact even in case of penetration of the protective shield, the membrane, protected by the protective element, preserves the waterproofness and the vapor permeability of the sole.

**[0097]** A shoe with waterproof and vapor-permeable sole according to the invention also has a more durable waterproofness and vapor-permeability than currently known products, thanks to the collaboration of the membrane and of the protective shield, which cooperate in protecting the waterproofness of the sole and are moreover vapor-permeable.

**[0098]** The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details

may further be replaced with other technically equivalent elements.

**[0099]** In practice, the materials used, so long as they are compatible with the specific use, as well as the contingent shapes and dimensions, may be any according to requirements and to the state of the art.

**[0100]** The disclosures in Italian Patent Application No. PD2010A000286 from which this application claims priority are incorporated herein by reference.

**[0101]** Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

## Claims

1. A vapor-permeable shoe (10, 100, 100a, 200) with waterproof and vapor-permeable sole, comprising

   - an upper assembly (11),
   - a sole (12), which is joined to said upper assembly (11) and comprises a body (13) made of waterproof material which has a tread (14) and has at least one region (15) that is permeable to water vapor,
   - at least one waterproof and vapor-permeable membrane (16), which covers said at least one region (15), toward the inside of said shoe (10, 100, 100a, 200),
   - at least one protective element (17), which covers at least partially the lower face (16a) of said at least one membrane (16),

   said shoe (10, 100, 100a, 200) being **characterized in that** it further comprises at least one protective shield (18) which is waterproof and vapor-permeable, covers said at least one region (15) and is substantially interposed between said region and said at least one protective element (17), said protective shield (18) being sealed in a waterproof manner to said body (13) at at least one zone (13a) of said body (13) that is peripheral to said at least one region (15).

2. The shoe according to claim 1, **characterized in that** a peripheral portion (16b) of said at least one membrane (16) is sealed impermeably to said body (13).

3. The shoe according to claim 2, **characterized in that** a permeable spacer (20) is superimposed at least partially on said membrane (16) in order to protect it.

4. The shoe according to claims 2 or 3, **characterized in that** said at least one protective shield (18) is microporous and has pores with an average aperture of less than 1 μm.

5. The shoe according to any one of claims 2 to 4, **characterized in that** said at least one protective shield (18) comprises a sheet made of material obtained from a substantially uniform mixture composed of

   - a polyolefin with high molecular weight, in a percentage concentration of the volume of said mixture comprised between 8% and 98%,
   - a filler, which is adapted to promote the formation of micropores, in a percentage concentration of the volume of said mixture comprised between 1% and 92%,
   - a plasticizer, in a percentage concentration of the volume of said mixture comprised between 1% and 40%.

6. The shoe according to claim 5, **characterized in that** said polyolefin is a UHMW polyethylene (UHMW meaning Ultra High Molecular Weight).

7. The shoe according to claims 5 or 6, **characterized in that** said filler is selected between silicon dioxide and silicic acid, said plasticizer being a water-insoluble oil.

8. The shoe according to claim 1, **characterized in that** said at least one protective shield (18) is made of a material selected among polytetrafluoroethylene, polyurethane, polyester, polypropylene, polyethylene and the like.

9. The shoe according to claim 8, **characterized in that** said at least one protective shield (18) has a structure selected among

   - a structure constituted by a single integral layer having a thickness substantially comprised between 0.1 and 5.0 mm,
   - a structure constituted by a plurality of layers joined by lamination to form a multilayer element whose thickness is substantially comprised between 0.1 and 5.0 mm,
   - a structure constituted by a plurality of laminated layers, a permeable material being provided between them and being cohesive with them.

10. The shoe according to any one claims 2 to 9, **characterized in that** said at least one protective shield (18) is sealed impermeably to said body (13), at said at least one zone (13a) of said body (13), which is peripheral with respect to said at least one region (15), by adhesive bonding.

11. The shoe according to any one of claims 2 to 10, **characterized in that** the material that forms at least one component of said body (13) is comolded on

said at least one protective shield (18) so as to grip it and form a waterproof seal at said at least one zone (13a) of said body (13), which is peripheral to said at least one region (15).

**12.** The shoe according to any one of claims 2 to 11, **characterized in that** it comprises a lower portion (21) and an upper portion (22) of the body (13), said at least one protective shield (18) being sealed to said lower portion (21) which has said at least one zone (13a) which is peripheral to said at least one region (15).

**13.** The shoe according to claim 12, **characterized in that** said protective shield (18) has a perimetric band (18a), which is exposed by said protective element (17) and by said membrane (16), said protective shield (18), at said perimetric band (18a), being associated so as to provide a waterproof seal with said upper portion (22).

**14.** The shoe according to claims 12 or 13, **characterized in that** said upper portion (22) has a central portion that has through openings or holes that form part of said region (15).

**15.** The shoe according to any one of claims 2 to 14, **characterized in that** the upper assembly (11) comprises at least one outer vapor-permeable upper (23), a vapor-permeable lining (24) and a vapor-permeable insole (25), which comprises said membrane (16), the lower flaps of said at least one upper (23) and of said at least one lining (24) being joined to said insole (25), said body (13) being further connected so as to provide a waterproof seal

- in a downward region to said peripheral portion (16b) of said at least one membrane (16), and
- to said at least one protective shield (18) at said zone (13a), which is peripheral to said region (15) that is permeable to water vapor.

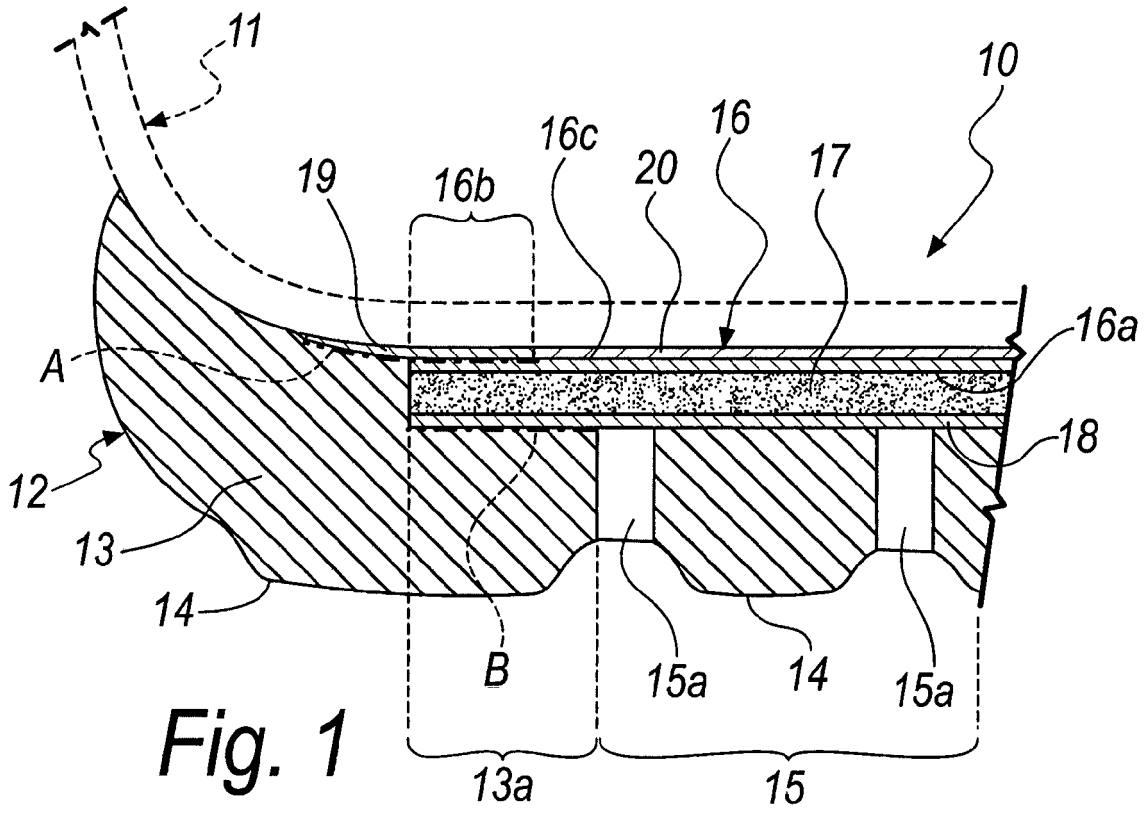
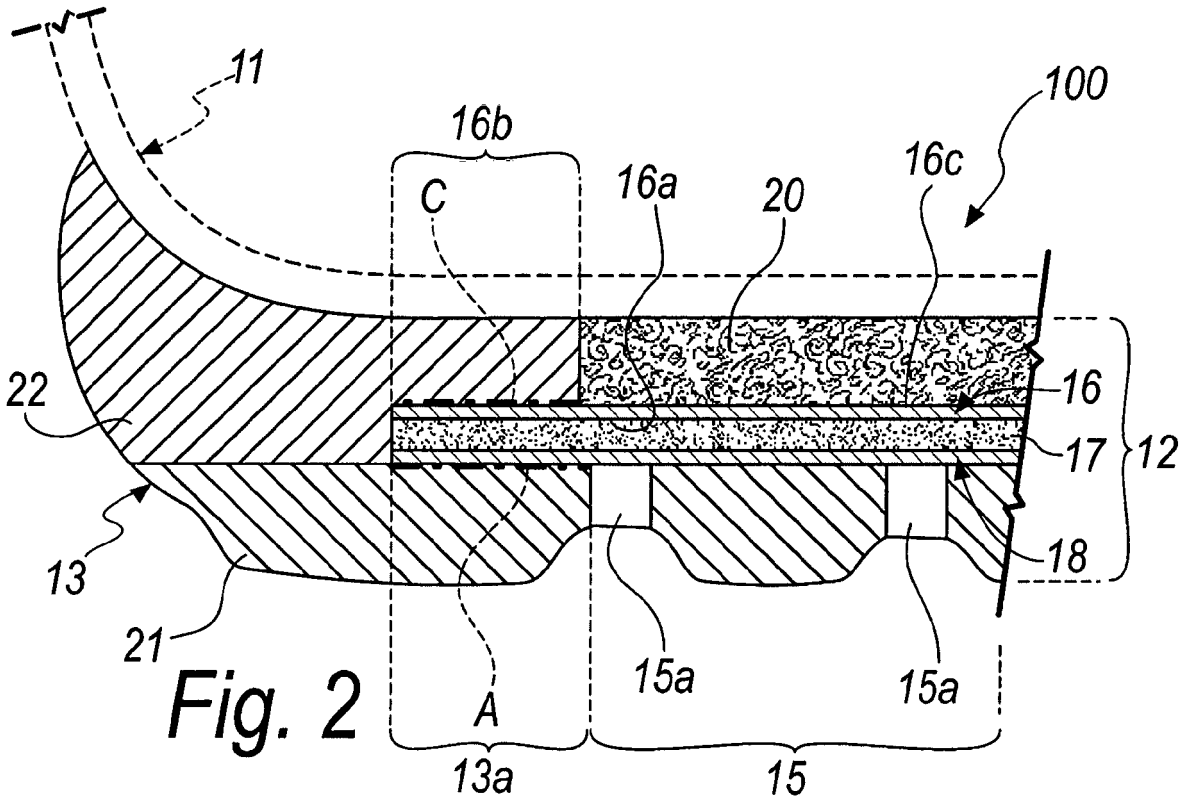

11
10
19
16b
16c
20
16
17
16a
A
18
12
13
14
B
15a
14
15a
13a
15

Fig. 1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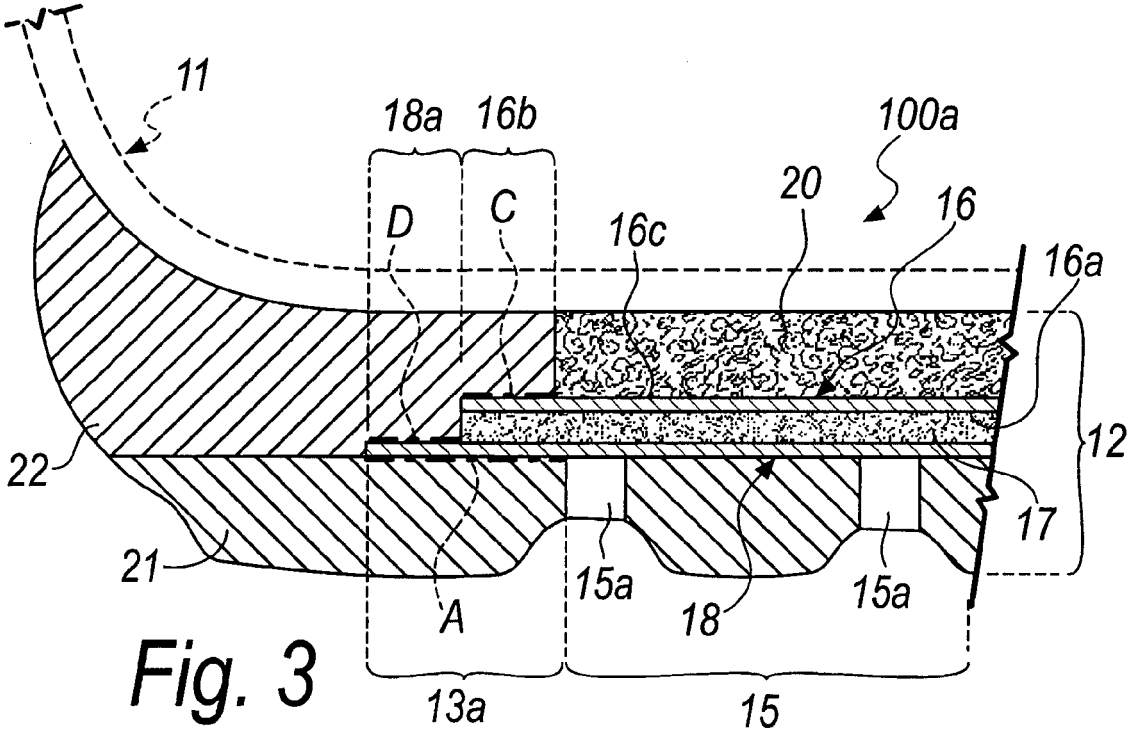
100
16b
C
16a
20
16c
22
16
17
12
13
18
21
A
15a
15a
13a
15

Fig. 2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18a
16b
100a
D
C
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16
16c
16a
12
22
17
21
15a
15a
18
A
13a
15

Fig. 3

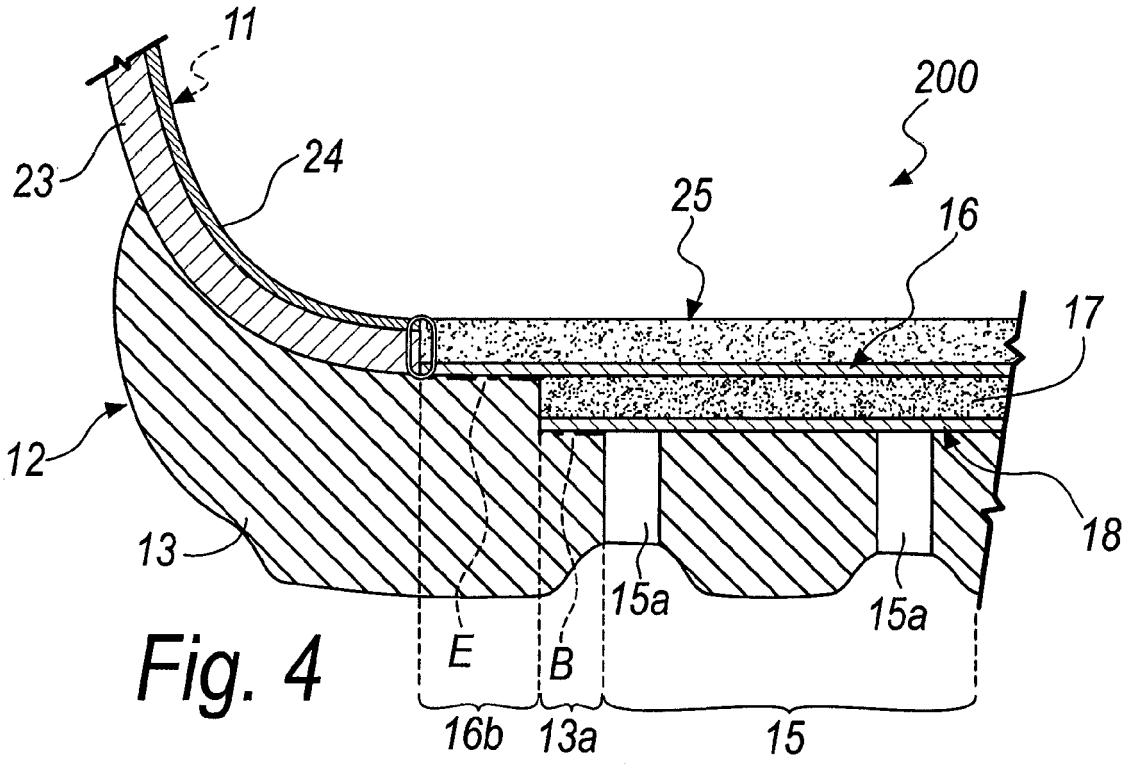
11
200
23
24
25
16
17
12
18
13
15a
15a
E
B
16b
13a
15

Fig. 4

## REFERENCES CITED IN THE DESCRIPTION

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