(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
22 April 2010 (22.04.2010)

PCT

(10) International Publication Number
WO 2010/044657 A2

(51) International Patent Classification:
B32B 27/18 (2006.01) *A43B 7/00* (2006.01)
A41D 31/00 (2006.01) *F16F 9/30* (2006.01)

(21) International Application Number:
PCT/NL2009/000199

(22) International Filing Date:
16 October 2009 (16.10.2009)

(25) Filing Language: Dutch

(26) Publication Language: English

(30) Priority Data:
2002107 16 October 2008 (16.10.2008) NL

(71) Applicant *(for all designated States except US)*: **VERENIGDE BEDRIJVEN NIMCO B.V.** [NL/NL]; Landgoed "de Wychert", 119, Oude Kleefsebaan, NL-6572 AK Berg en Dal (NL).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **KROL, Johannes, Andreas, Wilhelmus** [NL/NL]; 119, Oude Kleefsebaan, NL-6572 AK Berg en Dal (NL). **VAN DER MIJN, Leonardus, Johannes, Maria** [NL/NL]; 120, Gen. van Heutszlaan, NL-7316 CK Apeldoorn (NL).

(74) Agent: **HOLLAAR, K.**; Exter Polak & Charlouis B.V., P.O. Box 3241, NL-2280 GE Rijsswijk (NL).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

(54) Title: LAMINATE MATERIAL FOR PRODUCING FOOTWEAR, AND DEVICE PRODUCED THEREFROM

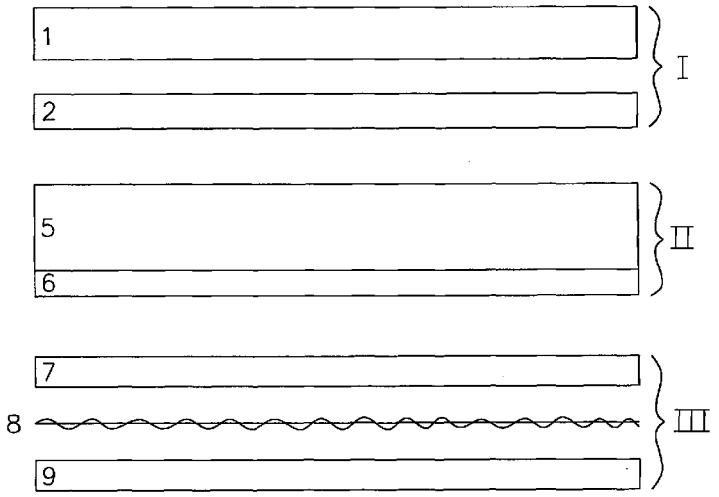

Fig 3

(57) Abstract: The laminate material for the production of an item of footwear has a sublaminate which is constructed from a support layer which can be stretched in two directions and a compressible layer. The support layer has at least two sorts of interwoven fibres, at least one sort of fibres being made of an elastic substance. The sublaminate is at the same time flexible, shape-restoring, soft, protective, and also breathable. A characteristic feature of the invention is the fact that the laminate material comprises a layer with a phase change material (PCM), known as a PCM-containing layer. An example of a PCM is paraffin. In the case of a supply or discharge of energy in the range of the melting point of the PCM, the material maintains its melting temperature during the phase transition from a solid to a liquid state or vice versa. This effect is used to regulate the temperature of the laminate material. This allows the temperature of a body part within the laminate material to be kept at a constant temperature.

WO 2010/044657 A2

Title in brief: Laminate material for producing footwear, and device produced therefrom

The present invention relates to a laminate material according to the preamble of claim 1.

The laminate materials for the production of footwear, in particular orthopaedic footwear, must at the same time satisfy the requirements of flexibility, shape-restoring capacity, protection of body parts to be covered and breathability. These demands are imposed, for example, on shoes and other items of clothing for people with diabetes, deformities or other disorders which impair the circulation or whose skin is very easily damaged otherwise.

EP 1 368 148 describes a laminate material which already satisfies to an appropriate degree the, sometimes conflicting, requirements set. However, the heat and moisture regulation of the known laminate material is still not entirely satisfactory. It would be desirable to improve the heat regulation of the material but, as has been found, this is often achieved at the cost of the moisture regulation or of the flexibility of the laminate material.

The object of the present invention is at least partially to overcome at least one of the above-mentioned drawbacks, or else to provide a usable alternative. In particular, the object of the invention is to provide laminate material which is suitable for the production of footwear, both moisture and heat regulation being improved.

This object is achieved by a laminate material as defined in claim 1.

The laminate material for the production of an item of footwear has a sublaminate which is constructed from a support layer which is stretchable in two directions and a compressible layer. The sublaminate can form a lower layer in the laminate material. The support layer has at least two sorts of interwoven fibres, at least one sort of fibres being made of an elastic substance. The support layer is for example made of Lycra. Furthermore, the sublaminate has a layer which is stretchable in three mutually perpendicular directions, the compressible layer made for example of latex, a PU foam or a combination of latex and PU foam. The compressible, stretchable layer is connected to the support layer over substantially the entire surface of the support layer. The sublaminate is at the same time flexible, shape-restoring, soft and protective, and also breathable. The support layer made of interwoven elastic fibres and other fibres ensures above all flexibility and more rapid recovery of a leather material attached to the support layer, the stretchable layer above all softness and protection, while it is in part the combination of the two that provides the shape-restoring capacity.

The laminate material is thus a suitable and comfortable material for shoes for diabetics, for example. Other applications will be examined in greater detail hereinafter.

The elastic substance of the sort of fibres from the support layer can be selected from the usual elastic substances, for example the substance having the trade name Lycra or equivalent products. Other elastomers are also possible, wherein if necessary the ratio to the other fibres used must be adapted on the basis of the elasticity and other mechanical properties of the elastomer.

A characteristic feature of the invention is the fact that the laminate material comprises a layer with a phase change material (PCM), known as a PCM-containing layer. In particular, the PCM is added to the lower layer. An example of a PCM is paraffin. In the case of a supply or discharge of energy in the range of the melting point of the PCM, the material maintains its melting temperature during the phase transition from a solid to a liquid state or vice versa. Only after the course of the phase transition will the temperature continue to rise or else fall. This effect is used to regulate the temperature of the laminate material. This allows the temperature of a body part within the laminate material to be kept at a constant temperature. When footwear, such as boots or shoes, is made of the laminate material according to the invention, it is advantageously possible to ensure a good heat management of the footwear. It is thus possible to prevent the footwear from becoming too warm, but also to prevent the footwear from providing insufficient insulation.

Preferably, the laminate material has a PCM in the form of particles. Preferably, the particles have a size of at least 0.6 mm to at most 4 mm, more preferably at most 2 mm. In particular, the PCM-containing layer is covered with PCM, in a plane in longitudinal cross section, for at least 25 %, but preferably at least 35 % of the surface. Preferably, the PCM-containing layer comprises at least 80 g/m^2 of PCM, but more preferably 100 to 300 g/m^2.

In one embodiment of the laminate material according to the invention, the PCM-containing layer has a composition of at least 30 % to at most 45 % of PU, in particular approximately 37 % and at least 10 % to at most 40 %, in particular 31 % of paraffin. In this case, the aforementioned percentage is a percentage by volume. Preferably, the PCM-containing layer has a thickness of at most 2 mm, in particular at most 1.6 mm, preferably at most 1.4 mm. As a result of the proposed thickness and amount of PCM, the laminate material according to the invention is eminently suitable for the heat and moisture regulation that is necessary in footwear. In normal use of footwear, the laminate material experiences a specific development of heat and mechanical loading. The thickness found and the provision of PCM can provide the footwear with desired flexibility, restoring capacity and breathability, and heat regulation and thus meet a number of requirements which are contradictory from the point of

view of material.

Preferably, the PCM-containing layer comprises a crystallizable organic substance as the PCM. This may for example be an n-paraffin having a melting point of between –10 °C and 65 °C (n-docadene to n-octacosane). The paraffin can have a form bound in a porous structure, but can also be applied in a micro-encapsulated form in an evaporated polymer dispersion.

Further additives can be added to the PCM-containing layer. In one embodiment according to the invention, the PCM-containing layer further comprises an evaporated polymer dispersion. The polymer can for example form part of the group of acrylates, polyurethanes, styrene-butadiene latexes, silicones or mixtures of polymers of this type.

In one embodiment, the PCM-containing layer can also comprise dyes, or antibacterial substances.

In a preferred embodiment of the laminate material according to the invention, the stretchable layer of the sublaminate is the PCM-containing layer.

In one embodiment of the laminate material according to the invention, the compressible layer of the lower layer comprises a mixture of PU foam (polyurethane foam) and latex foam. In particular, the compressible layer comprises 60 % – 80 % of PU foam in combination with 40 % – 20 % of latex foam. As a result, the compressible layer may advantageously be sufficiently permeable to air. In addition, the lower layer may be antibacterial. Preferably, the compressible layer is provided with PCM. In particular, the compressible layer is provided with 15 % – 30 % of PCM. Preferably, the PCM is applied in the form of particles, for example as microspheres of paraffin.

In an alternative embodiment, the compressible layer comprises substantially latex foam. Preferably, the compressible layer comprises at least 50 %, in particular at least 70 %, and preferably at least 90 % of latex foam. In particular, the latex foam is an SBR latex. The latex foam may be a synthetic latex. The latex can be produced by an emulsion polymerization using a monomer comprising styrene butadiene (SBR). Preferably, the compressible layer is made of latex foam provided with PCM. In particular, the compressible layer is made of latex foam provided with 15 % – 30 % of PCM. Preferably, the PCM is applied in the form of particles, for example as microspheres of paraffin.

In one embodiment of the laminate material according to the invention, the lower layer comprises a membrane comprising PCM. The membrane can comprise PCM in the form of

microspheres of paraffin. The spheres can for example have a size of between 25 μm and 30 μm. The membrane can be attached directly against the compressible layer and function as a substitute support layer. The membrane with PCM is preferably elastic and can be stretched in two directions. The membrane has preferably a latex base and has in particular a thickness of at least 0.2 mm and at most 0.8 mm. The antibacterial properties of the laminate material can be further improved with the aid of the membrane. As a result of the replacing of the support layer, this embodiment may have the advantage that the laminate material can be embodied so as to be thin. This can benefit the flexibility of the laminate material. In addition, the laminate material can have better breathability as a result of improved moisture regulation.

In one embodiment, the compressible layer of the lower layer can comprise substantially a latex foam, the membrane with PCM being indirectly or directly attached against the layer of latex foam. Indirectly, the membrane can be attached against the compressible layer via the support layer of the lower layer. As a result, the lower layer of the laminate material according to the invention can be constructed from an underlying membrane, an intermediate support layer and an overlying compressible layer. The support layer can be received at any desired position in the laminate material. Advantageously, the restoring capacity of the laminate material can be increased as a result of the presence of the support layer.

In one embodiment of the laminate material according to the invention, the membrane is received between two polyamide layers. The polyamide layers preferably comprise approximately 18 % of elastomer fibres. Preferably, the membrane is received between the support layer of the lower layer and a lower support layer of a lining layer. This allows the antibacterial properties to be improved.

In one embodiment of the laminate material according to the invention, the compressible substance of the stretchable layer advantageously comprises a substantially open-cell cured plastic foam. This material combines softness and flexibility, and thus also a protective action against external influences with the required breathability. In addition, it is very light; this has a favourable and comfortable effect on any body parts to be protected by the material.

In one particular embodiment of the laminate material according to the invention, the plastic foam comprises latex foam. Latex is a suitable material which is very simple to foam and to cure so as to form a very light and yet flexible, resilient and stretchable open-cell cured latex foam. Nevertheless, other breathable, light, plastics materials, such as polyester sponge and the like, are also conceivable.

The open-cell cured latex foam has preferably a density of between 25 and 35 kg/m^3. This

density provides a good compromise between weight of the material, flexibility and strength. Nevertheless, other densities are also conceivable. For example if the requirement of protection is more important, a denser and heavier foam may be taken.

The layer which can be compressed in three mutually perpendicular directions has preferably a thickness of between 0.5 and 2.5 mm, and more preferably between 1.0 and 2.0 mm. This thickness provides a protective action which is adequate in most cases. This provides, partly in combination with the other layers of the laminate material, a material that is suitable for many different applications and is not too thick. It goes without saying that, for example, a different, greater thickness can be selected if protection is a more important factor than flexibility. It is also possible to vary the thickness of the material over the surface. This affords the possibility of offering additional protection only where it is desired, by providing a greater material thickness, whereas at locations where flexibility is necessary, for example at the instep of a shoe, no additional material is attached so that this does not have a negative influence on the flexibility.

For the support layer, it is possible to select, in addition to the fibres made of stretchable material, in principle many sorts of fibres such as plastic fibres, such as polyamide fibres, and other usual textile fibres, such as cotton and the like. In an advantageous embodiment, the support layer comprises between 82 % and 95 % of fibres made of a polyester material and between 18 % and 5 % of fibres made of an elastic material. Preferably, the support layer comprises approximately 18 % of fibres made of an elastomer. A support layer of this type has particularly good shape-restoring properties in combination with the required flexibility. In addition, polyester material displays unexpectedly good adhesion to latex, so that the combination of polyester material as the plastic fibre for the support layer and latex for the compressible layer provides a particular advantage.

At this point, it should be noted that throughout the present document percentages relate in each case to ratios by mass, unless otherwise stated.

The support layer may in principle be located either between a layer of leather material as the top layer and the compressible layer, or at the side of the compressible layer that is remote from the layer of leather material. Preferably, the support layer is located between the layer of leather material and the layer of the compressible substance. This offers the advantage that the layer of leather material is better protected against excessively high stresses. Above all in the case of external influences, for example impacts against a hard object, the layer of leather material could be dented fairly deeply, as a result of which the layer of leather material could be greatly stretched and could thus tear, because the layer is so thin. By attaching the support layer directly below the layer of leather material, for

example by means of gluing using a breathable adhesive layer, such external pressure is distributed over a larger surface and the layer of leather material is better protected.

The mass per unit surface area of the support layer is not limited to any particular extent, although preferably the support layer has a mass per unit surface area of between 140 and 250 g/m^2, in particular 140 and 180 g/m^2. This is a range in which a particularly favourable combination is achieved between a not excessively high total mass and a favourable preponderance of the support layer over the layer of leather material. The intention of this measure is for the shape-restoring properties of the support layer not to be adversely influenced, or to be adversely influenced only slightly, by the specific resilience of the layer of leather material. In addition, a mass per unit surface area of this type is suitable for offering sufficient protection to the layer of leather material, as described above. Should a somewhat stronger, less flexible product be desired, then a slightly higher mass per unit surface area, for example 200 – 220 g/m^2, could be selected.

The manner in which the fibres in the support layer are interwoven may, for example, be in the form of a woven fabric. Nevertheless, in the case of a woven fabric, it is only possible to achieve sufficient elasticity if there is a large number of fibres made from an elastic material in at least one direction. Preferably, the support layer has a knitted structure. More preferably, the support layer comprises an embroidery structure which is obtained by warping. By giving the support layer a structure of this type, that layer is provided with its own flexibility and above all stretchability. This allows the proportion of fibres made of an elastic material to be reduced if desired, so that the support layer becomes less dependent on the further mechanical properties of the elastic substance.

The leather material comprises preferably natural leather, for example sheepskin, cowhide, or in particular hair-sheep leather having a thickness of between 0.2 and 1.0 mm, in particular between at least 0.2 and at most 0.6 mm. Natural leather has an outstanding combination of flexibility, stretchability, breathability and a good moisture balance. In addition, natural leather satisfies the visual demands which are imposed on shoes and can be provided with virtually any desired colour. Preferably, the leather is pre-tensioned in two directions before it is attached to the sublaminate material. Higher stretchability of the final laminate material obtained can thus advantageously be obtained.

In one embodiment of the laminate material, the top layer can comprise a stretch suede, an imitation leather made of, for example, PU. In one embodiment of the laminate material according to the invention, the top layer can comprise a nylon or cotton woven fabric.

Preferably, the layer of natural leather is between 0.4 and 0.6 mm thick, if large shoe

components are produced, such as for example the entire upper shoe. For smaller portions, which often have to be somewhat less pliable, thinner material, for example having a thickness of 0.2 mm, is also suitable.

The natural leather is preferably selected from the grain layer of a hide. This provides the finest texture and, after tanning, the best flexibility. Nevertheless, a different layer is also possible, for example a suede layer from the deeper hide layer. It is advantageous to select hair-sheep leather, preferably from small animals. This provides natural leather of optimum flexibility and stretchability. Other sorts of leather, such as cowhide and sheepskin, are however not ruled out.

In another attractive embodiment, the leather comprises artificial leather comprising a layer with interwoven fibres made of a polyester material and fibres made of a stretchable material. A layer of this sort can be given an appearance which bears a strong resemblance to natural leather, the breathability still being maintained and the stretchability even being somewhat better. The artificial leather comprises preferably 92 % of polyester and 8 % of elastane, and the density is roughly 260 g/m^2. This ratio and density ensure very good stretchability and strength. An example of a material of this sort is "microfibre" material which is produced by Texpiel. Other ratios, between 88 and 93 % of polyester, and also a density between roughly 230 and 270 g/m^2 can be used in cases in which there are other requirements with regard to stretchability or strength.

In an advantageous embodiment of the laminate material according to the invention, the layer of the compressible material is connected at the side remote from the layer of leather material, over substantially its entire surface, to a lower support layer, which can be stretched in two directions, in a lining layer. In this way, the layer of leather material is additionally protected from external influences, by a supplementary support layer at the underside of the compressible layer. In addition, any external influence on the compressible layer is better distributed thereover. In the case of a shoe, a deformity or a toe can for example exert undesirably high pressure on the compressible layer. The lower support layer allows this pressure to be better distributed.

Advantageously, the lower support layer is constructed from substantially the same fibres as the support layer and the lower support layer has a mass per unit surface area of between 100 and 120 g/m^2. In this way, use is made of the smallest possible number of different materials, with the result that there will be the smallest possible number of compatibility problems and it will be possible to control the mechanical properties very successfully. In addition, the lower mass per unit surface area ensures that the lower support layer does not become too strong, thus allowing any excessively high pressure on body parts or other

objects covered by the laminate material to be prevented. It is however not necessary to select the same sort of fibres if certain other requirements are more important for the lower support layer.

The leather material used often has a direction having maximum stretchability. The stretchability in another direction, for example perpendicularly to the direction of maximum stretchability, is then much lower. Preferably, at least one of the support layer and the lower support layer has a direction having maximum stretchability and a direction which has lower stretchability and lies perpendicularly to the direction of maximum stretchability, the lower stretchability being between 40 and 60 % of the maximum stretchability. More particularly, the lower stretchability is 50 % of the maximum stretchability.

Preferably, the direction of maximum stretchability of the support layer and/or the lower support layer coincides with the direction of maximum stretchability of the leather material used. This orientation of directions of maximum stretchability imparts better stretching properties to the laminate material and offers a better distribution of pressure when the material is in use. In the present context, the term "coinciding of the direction" is intended to mean that the directions enclose an angle which is less than 15°, preferably less than 5°.

In principle, the laminate material according to the invention is particularly suitable as a material for shoes, for example. In that case, in a number of situations a sort of lining will also be attached to the inner side. In a preferred embodiment of the laminate material, the lower layer also comprises, at the side remote from the leather layer, a covering layer which is made of a water-absorbent material and can be stretched in two directions. Preferably, use is made of a Jacquard material which consists of polyester, polyamide and silver ions and is moisture-absorbent and antibacterial. This allows the moisture regulation and heat regulation to be improved. In part, this material can serve as a lining, as additional protection for the laminate material, but above all it can absorb moisture which is produced during use of the material and release it again. Above all in the case of shoes and the like made of the laminate material according to the invention, there are important advantages involved in combining a moisture-absorbent lining layer of this type with the laminate material, for example by gluing using a breathable adhesive. This prevents any displacement of the layers with respect to one another. Suitable sorts of glue include for example MOR-AD 909 and MOR-AD 903-45 EA, produced by Arly. These are polyurethane contact glues. They are eminently suitable for flexible substrates, such as leather and polyester foam.

The material of the covering layer can be selected from all suitable lining materials, but it is preferable for the covering layer to comprise a thin layer of leather material or a layer of fibres which are made of a water-absorbent plastics material and woven with elastic fibres.

These materials have very suitable moisture-absorbing properties, while the mechanical and, in particular, the stretchability properties are very well matched to those of the other layers of the laminate material. The layer of leather material used may preferably be a layer of a similar type to the outermost layer (the top layer) of the laminate material, with a thickness preferably of between 0.2 and 0.6 mm. Since the visual requirements are much less important, while resistance to damage caused by friction is much more important, it is also possible to select a sort of leather material that is matched to these demands but still has the required flexibility and stretchability.

The water-absorbent plastics material can in principle be selected from numerous such materials, such as viscose, ethylene vinyl acetate and the like, but it is advantageous for the water-absorbent plastics material to be a polyamide material. This material has the additional advantage that it is a material with a soft feel, causing relatively little inconvenience or damage to the skin on contact. This makes it a particularly suitable material for the covering layer of, for example, shoes and the like.

An embodiment in which polyamide material together with elastic fibres are selected for the support layer, if appropriate the lower support layer and the covering layer, has the advantage that it has a positive effect on the stretching properties. This embodiment is preferred over those with polyester fibres if stretching is extremely important. A material of this type is used, for example, in small, stretchable components of, for example, a shoe.

In an advantageous embodiment, the covering layer comprises between 75 % and 85 % of fibres made of polyamide material and between 25 % and 15 % of fibres made of an elastic substance. This ratio provides the covering layer with very good flexibility and stretching properties, while the moisture-absorbing capacity remains very good. The proportion of polyamide fibres is preferably 81 – 82 %.

The covering layer advantageously has a mass per unit surface area of between 150 and 180 g/m^2, more advantageously of approximately 170 g/m^2. A mass per unit surface area of this type provides the covering layer with sufficient strength, flexibility, moisture-absorbing capacity and a sufficiently low inherent weight.

The covering layer can be connected to the lower support layer in a wide range of ways. For example, it can be connected by gluing over the entire surface using a breathable adhesive. Preferably, however, the lower support layer is connected to the covering layer by means of flame-melting of a layer of spongy polyester material positioned therebetween. What this is intended to mean is that a layer of spongy polyester material is placed between a covering layer and the lower support layer of a layer of laminate material, the polyester material being

partially melted by means of heating, for example with the aid of a flame. As a result, the polyester material can be connected both to the covering layer and to the lower support layer.

Therefore, one advantage of this adhesive layer and associated method is that there is little if any risk of spots forming. Moreover, the spongy material also provides the overall laminate material with a certain extra softness.

The polyester material comprises substantially pure polyester material which is foamed to approximately 20 kg/m^3 for a starting thickness of approximately 2 mm. Naturally, this starting thickness is reduced during the flame-melting.

Generally, it is advantageous for at least one support layer also to be connected to a layer comprising polyamide fibres woven with fibres made of an elastic material. This combination offers a material which can provide the skin of body parts covered therewith with good protection against shear forces which may occur in the event of movements. Moreover, it offers protection and is soft, flexible and breathable, and the layers exhibit unexpectedly good adhesion.

In one embodiment of the laminate material according to the invention, the covering layer is provided with an antibacterial agent. In particular, the covering layer is provided with an agent against 'staphylococcus aureus' and 'klebsiella pneumoniae'. In particular, the antibacterial agent comprises silver ions. In one embodiment of the covering layer according to the invention, the covering layer can comprise silver thread as the antibacterial agent. Preferably, the composition of the covering layer has at least 1 % of the volume as silver ions. In one particular embodiment of the covering layer of the laminate material according to the invention, the covering layer has a composition of 54 % of PES (polysulphones), 44 % of PA (polyamide) and 2 % of CLY (silver ions). In one embodiment, the covering layer has a weight of approximately 156 g/m^2. Advantageously, the antibacterial agent offers resistance to the growth and/or activity of bacteria present in a shoe. Tests have revealed that the use of silver ions, in particular, as an antibacterial agent can be expedient. Apart from use in the covering layer of the laminate material according to the invention, the use of silver ions as a bacteria-inhibiting agent is advantageous in footwear material in general.

The invention also relates to a device for protecting a body part of a human or an animal, comprising a laminate material according to the invention. In particular, a device of this type is selected from the group consisting of shoes, shin pads, knee pads, elbow pads and slings. A certain degree of flexibility and strength in combination with protection is important for all these examples. With regard to shin pads and knee pads and the like, consideration may be

given not only to humans, but also to, for example, horses or other riding animals or pack animals. In particular, consideration should be given to products which are prescribed for a medical condition. In particular, diabetics, for example, have a skin which is very easily damaged and, moreover, particularly in the case of the legs and feet, has relatively little feeling. Consequently, chafing and pinching parts of shoes can quickly cause injuries which, moreover, are often difficult to heal. For these people, but also for people who have, for example, growths or other deformities on the foot, well-fitting and appropriate, i.e. flexible and protective, footwear is extremely important. Nevertheless, anyone can make use of the advantages of the invention, for example for more comfortable footwear.

The invention further relates to a method for the production of the laminate material according to the invention.

Further embodiments are described in the dependent claims.

The invention will be explained in more detail with reference to the appended drawings. The drawings form a practical embodiment of the invention that may not be regarded in a limiting sense. Specific detailed features may also be viewed, independently of the exemplary embodiment, as being in the general sense characteristic of the invention. Figures 1 – 3 show a schematic structure of various laminate materials according to the invention.

Figure 1 shows, by way of non-limiting example, a schematic cross section through a laminate material according to the invention with a layer of leather material I, also known as a top layer I, a lower layer II and a lining layer III.

The layer of leather material I comprises a layer of leather 1.

The lower layer II comprises a layer of adhesive, a support layer 3, and a stretchable layer 5 made of a compressible material.

The lining layer III comprises a support layer 7 and a covering layer 9.

The layer of leather material I in this case comprises a layer of natural leather with a thickness of approximately 0.2 to 1.0 mm. The thickness is preferably approximately 0.2 mm to 0.6 mm. At this thickness, leather is sufficiently flexible and stretchable for use in the laminate material according to the invention.

The natural leather comprises, for example, hair-sheep leather, both the grain and the suede. The leather is characterized by an extremely high flexibility with a relatively fine implantation

of hair, and therefore a fine surface. It is preferable to select hides of small animals, which provides the leather with even further flexibility.

After the chrome-tanning of the hides, with a combination of oils selected for optimum flexibility of the leather, the hides are split to the desired thickness, preferably electronically. During the tanning, the initially parallel fibres start to "turn", i.e. they become increasingly interwoven with one another. Although this provides the leather with greater strength, it also loses some of its flexibility and stretchability. It has been found that this "turning" does not occur, or at least occurs to a much lesser extent, in the top layer, the grain layer. Therefore, it is preferable to select this grain layer for the leather which is used in the laminate material according to the invention.

The leather material is treated with an agent making it water-repellent. However, the leather material still remains breathable, i.e. water vapour can still be dissipated to the environment.

A lower leather layer 2 is provided below the layer of leather 1. The lower leather layer 2 can be stretched in at least one direction. Preferably, the lower leather layer 2 can be stretched in two directions. The lower leather layer 2 can comprise a cotton with an elastomer fibre, for example Lycra yarns. Preferably, the cotton lower leather layer has approximately 18 % of elastomer fibres. After the laminating of the layer of leather 1 with the lower leather layer 2, a washing is carried out, thus shrinking the cotton lower leather layer 2.

In a variant embodiment, the lower leather layer 2 can comprise a polyamide with approximately 18 % of elastomer fibres. The polyamide lower leather layer 2 can advantageously be stretched in two directions. Preferably, the lower leather layer 2 has a weight of at least 150 to at most 250 g/m^2.

The layer of leather material I is fastened to the lower layer II over substantially its entire surface by means of gluing using an adhesive layer of breathable, self-binding adhesive gel.

The support layer 3 comprises, for example, a knitted fabric made up of 92 % of polyester material with 8 % of Lycra and having a mass per unit surface area of 160 g/m^2. This support layer 3 is in turn glued over substantially its entire surface, by means of an adhesive layer of breathable, self-binding adhesive gel, to a stretchable, compressible layer 5 of open-cell cured latex foam, although another soft, flexible and elastic substance may also be suitable. It is preferable for the latex to be a foamed natural latex with a density of between 20 and 50 kg/m^3, more preferably of approximately 30 kg/m^3. The thickness of the stretchable layer is, for example, between 1 and 2 mm, but is preferably between 1.4 mm and 1.6 mm. If desired, the thickness of the layer may vary over the surface of the material, in order to provide a

slightly greater strength where desired, by using a greater thickness, or conversely to allow greater flexibility and freedom of movement by using a reduced thickness.

The moisture and heat-regulating properties of the stretchable, compressible layer 5 are improved by adding a phase change material (PCM). The stretchable, compressible layer comprises particles of PCM.

A bacteria-inhibiting agent or an odour-suppressing agent, or a combination thereof, may also be added to the latex material. The odour-suppressing agent is for example selected to be carbon, in a ratio of from 2 % to 6 % of carbon, the remainder being latex. The proportion of carbon is preferably approximately 4 %. The bacteria-inhibiting agent which is added if appropriate makes a negligible contribution to the weight and is not included when specifying the ratios.

The latex layer 5 is connected to the lower support layer 7 by means of yet another layer of breathable, self-binding adhesive gel, which is this time not illustrated. The adhesive gel is, for example, a hot-melt adhesive which is activated at a temperature of around 170 °C.

The lower support layer 7 forms part of the lining layer III and comprises, for example, substantially the same material as the support layer 3, except that in this case the mass per unit surface area is selected to be approximately 110 g/m^2. In one embodiment, it is possible to select a mass per unit surface area of from at least 100 g/m^2 to at most 150 g/m^2.

By flame-melting of the polyester sponge 8, the lower support layer 7 and the one covering layer 9 are joined together. In the process, the polyester sponge is partially melted, resulting in an adhesive action which is able to connect the two layers substantially without spots.

Finally, the covering layer 9 is in this case, for example, a knitted fabric made up of 81 % of polyamide and 19 % of Lycra, with a mass per unit surface area of approximately 170 g/m^2.

Figure 2 shows a schematic structure of a heat-regulating laminate material. Just like the laminate material as described in Figure 1, the laminate material has a top layer I and a lining layer III. The laminate material has a lower layer comprising three layers. The lower layer II has a compressible layer 5, a support layer 3 and a membrane 6. The membrane 6 comprises a PCM. The membrane is elastic and can be stretched in two directions. The membrane has a thickness which is between at least 0.2 mm and at most 0.8 mm. The membrane 6 is provided with microspheres of paraffin as the PCM. The membrane is laminated between the support layer 3 and the lower support layer 7. In one embodiment, the support layer 3 and/or the lower support layer 7 can be provided with an antibacterial agent,

for example with silver ions. As a result of the presence of both support layers 3 and 7, the restoring capacity of the laminate material can be further increased.

Figure 3 shows a schematic structure of a heat-regulating laminate material. Just like the laminate material as described in Figure 1, the laminate material has a top layer I and a lining layer III. A lower layer II is laminated between the top layer I and the lining layer III. The lower layer is constructed from two layers, a compressible layer 5 and a membrane 6. The membrane 6 has a latex base and a thickness of from 0.2 – 0.6 mm. The membrane 6 comprises a PCM in the form of paraffin microspheres. As a result of the absence of the support layer 3 and the at least partial compensation therefor provided by the membrane 6, it is possible to obtain a thinner and, as a result, more flexible laminate material without thereby excessively detracting from the restoring capacity of the laminate material. The invention therefore provides a laminate material which is suitable for the production of footwear. The laminate material has improved heat-regulating and moisture-regulating properties. As a result of the presence of the phase change material (PCM), it is possible to obtain improved moisture absorption, improved temperature regulation, improved elasticity, improved breathability, good stretchability, and improved antibacterial properties.

Further embodiments of the invention are described in the following clauses:

1. Laminate material for the production of an item of footwear comprising:
a sublaminate (II) which is constructed from
a support layer (3) which can be stretched in two directions, the support layer (3) having at least two sorts of interwoven fibres, at least one sort of fibres being made of an elastic substance; and
a layer (5) which can be stretched in three mutually perpendicular directions, the stretchable layer (5) being connected to the support layer over substantially the entire surface of the support layer,
characterized in that the laminate material comprises a layer with a phase change material (PCM).

2. Laminate material according to clause 1, wherein the stretchable layer (5) forms the layer with PCM.

3. Laminate material according to clause 1 or 2, wherein the PCM is a paraffin.

4. Laminate material according to one of the preceding clauses, wherein the stretchable layer (5) is a compressible substance, the compressible substance comprising substantially open-cell cured plastic foam.

5. Laminate material according to one of the preceding clauses, wherein the plastic foam comprises latex foam.

6. Laminate material according to one of the preceding clauses, wherein the open-cell cured latex foam has a density of between 25 and 35 kg/m^3.

7. Laminate material according to one of the preceding clauses, wherein the layer (5) which can be stretched in three mutually perpendicular directions has a thickness of between 0.5 and 2.5 mm, but preferably has a thickness lying between 1 mm and 2 mm, but more preferably between 1.4 mm and 1.6 mm.

8. Laminate material according to one of the preceding clauses, wherein the support layer (3) comprises between 82 % and 95 % of fibres made of a polyester material and between 18 % and 5 % of fibres made of an elastic material.

9. Laminate material according to one of the preceding clauses, wherein the support layer (3) comprises polyamide fibres.

10. Laminate material according to one of the preceding clauses, wherein the support layer (3) has a mass per unit surface area of between 140 and 180 g/m^2.

11. Laminate material according to one of the preceding clauses, wherein the support layer (3) has a knitted structure.

12. Laminate material according to one of the preceding clauses, wherein the sublaminate forms a lower layer (II), the sublaminate being connected to an upper layer (I) over substantially the entire surface, the upper layer (I) comprising a thin leather layer (1) made of a leather material having a thickness of between 0.2 and 1.0 mm.

13. Laminate material according to one of the preceding clauses, wherein the upper layer (I) further comprises a leather lower layer (2) between the support layer (3) and the leather layer (1), the leather lower layer (2) being a layer with at least two sorts of interwoven fibres, at least one sort of fibres being made of an elastic substance comprising a polyamide or a cotton.

14. Laminate material according to one of the preceding clauses, wherein the leather material comprises natural leather, in particular hair-sheep leather.

15. Laminate material according to one of the preceding clauses, wherein the leather material comprises artificial leather comprising a layer of interwoven fibres made of a polyester material and fibres made of an elastic material.

16. Laminate material according to one of the preceding clauses, wherein the layer (5) made of the compressible material is connected at the side remote from the support layer (3), over substantially its entire surface area, to a lower support layer (7) which can be stretched in two directions.

17. Laminate material according to one of the preceding clauses, wherein the lower support layer (7) is constructed from substantially the same fibres as the support layer (3) and has a mass per unit surface area of between 100 and 120 g/m^2.

18. Laminate material according to one of the preceding clauses, wherein at least one of the support layers (3) and the lower support layer (7) has a direction of maximum stretchability and, perpendicular to this direction, a direction of lower stretchability, the lower stretchability being between 40 and 60 %, preferably 50 %, of the maximum stretchability.

19. Laminate material according to one of the preceding clauses, wherein the direction of maximum stretchability coincides with a direction of maximum stretchability of the leather material.

20. Laminate material according to one of the preceding clauses, wherein the lower layer (II) also comprises, at the side remote from the leather layer (1), a covering layer (9) which is made of a water-absorbent material and can be stretched in two directions.

21. Laminate material according to one of the preceding clauses, wherein the covering layer (9) is a Jacquard material made of polyester, polyamide with silver ions.

22. Laminate material according to one of the preceding clauses, wherein the covering layer (9) is made substantially of polyester material.

23. Laminate material according to one of the preceding clauses, wherein the covering layer (9) comprises a thin layer of leather or a layer of fibres which are made of a water-absorbent plastics material and are woven with elastic fibres.

24. Laminate material according to one of the preceding clauses, wherein the water-absorbent plastics material is a polyamide material.

25. Laminate material according to one of the preceding clauses, wherein the covering layer (9) comprises between 75 % and 85 % of fibres made of polyamide material and between 25 % and 15 % of fibres made of an elastic substance.

26. Laminate material according to one of the preceding clauses, wherein the covering layer (9) has a mass per unit surface area of between 150 and 180 g/m^2.

27. Laminate material according to one of the preceding clauses, wherein the lower support layer (7) is connected to the covering layer (9) by means of flame-melting of a layer (8) of spongy polyester material positioned therebetween.

28. Device for protecting a body part of a human or an animal, comprising a laminate material according to one of clauses 1 – 27.

29. Device according to clause, wherein the device is an item of footwear, such as a boot or shoe.

30. Device according to clause, wherein the device is selected from the group consisting of shoes, shin pads, knee pads, elbow pads and slings.

31. Method for the production of a laminate material according to one of clauses 1 – 27, wherein a sublaminate is produced as expressed in clause 1, a layer being provided with a PCM, such as paraffin.

CLAIMS

1. Laminate material for the production of an item of footwear comprising:
a sublaminate (II) which is constructed from
a support layer (3) which is stretchable in two directions, the support layer (3) having at least two sorts of interwoven fibres, at least one sort of fibres being made of an elastic substance; and
a layer (5) which is stretchable in three mutually perpendicular directions, the stretchable layer (5) being connected to the support layer over substantially the entire surface of the support layer,
characterized in that the laminate material comprises a layer with a phase change material (PCM).

2. Laminate material according to claim 1, wherein the stretchable layer (5) forms the layer with PCM.

3. Laminate material according to claim 1 or 2, wherein the PCM is a paraffin.

4. Laminate material according to one of the preceding claims, wherein the stretchable layer (5) is a compressible substance, the compressible substance comprising substantially open-cell cured plastic foam.

5. Laminate material according to one of the preceding claims, wherein the plastic foam comprises substantially latex foam.

6. Laminate material according to one of the preceding claims, wherein the stretchable layer (5) has a thickness of at most 2 mm.

7. Laminate material according to one of the preceding claims, wherein the support layer (3) comprises between 80 % and 95 % of fibres made of a polyester material and between 20 % and 5 % of fibres made of an elastic material.

8. Laminate material according to one of the preceding claims, wherein the lower layer (II) comprises a membrane (6), the membrane (6) being provided with PCM.

9. Laminate material according to one of the preceding claims, wherein, in the lower layer (11), the membrane (6) forms the support layer (3).

10. Laminate material according to one of the preceding claims, wherein the sublaminate

forms a lower layer (II), the sublaminate being connected to an upper layer (I) over substantially the entire surface, the upper layer (I) comprising a thin leather layer (1) made of a leather material having a thickness of between 0.2 and 1.0 mm.

11. Laminate material according to one of the preceding claims, wherein the lower layer (II) also comprises, at the side remote from the leather layer (1), a lining layer (III) with a covering layer (9) which can be stretched in two directions and has an antibacterial agent with, in particular, silver ions.

12. Device, in particular an item of footwear, such as a boot or shoe for protecting a body part of a human or an animal, comprising a laminate material according to one of claims 1 – 11.

13. Covering layer for a footwear material provided with an antibacterial agent containing silver ions, in particular wherein the covering layer comprises silver thread.

14. Method for the production of a laminate material according to one of claims 1 – 11, wherein a layer is laminated with a PCM, such as paraffin.

15. Method according to claim 14, wherein a layer is laminated, in particular a covering layer (9), with an antibacterial agent, in particular an agent containing silver ions.

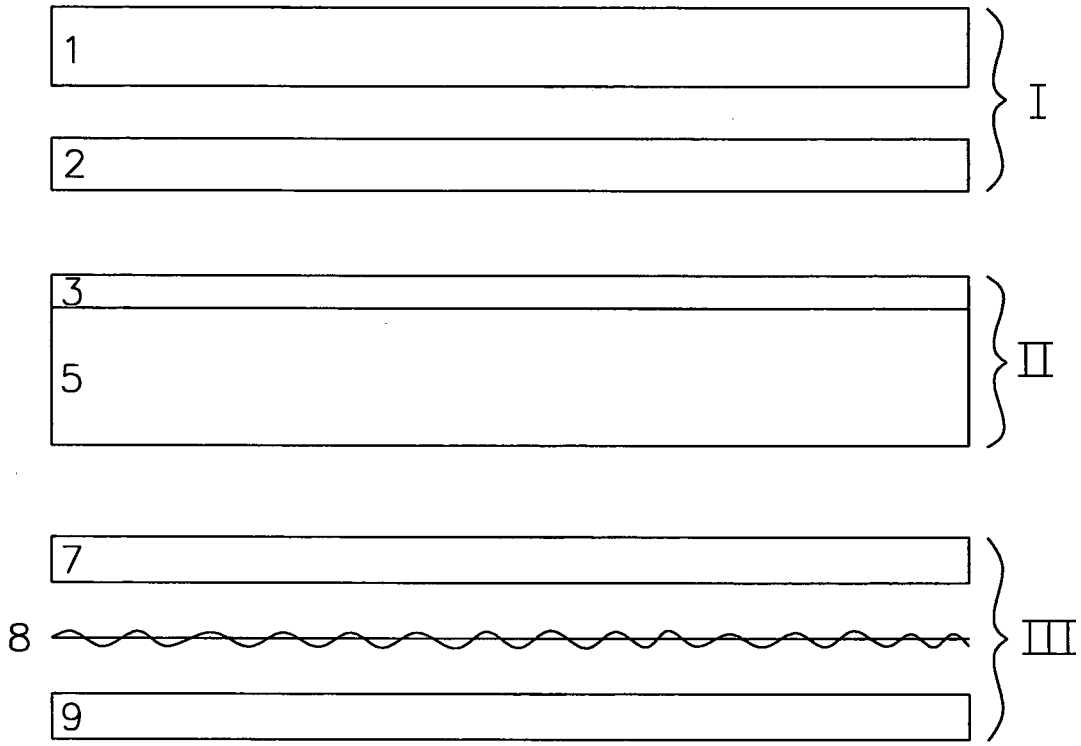

Fig 1

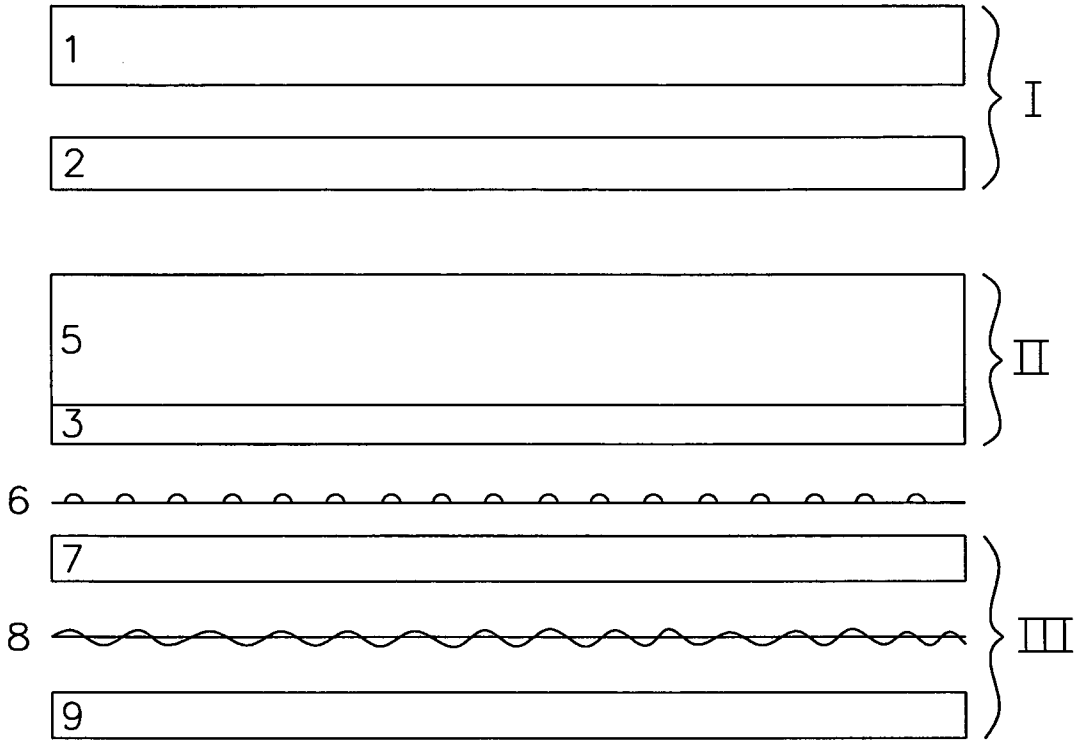

Fig 2

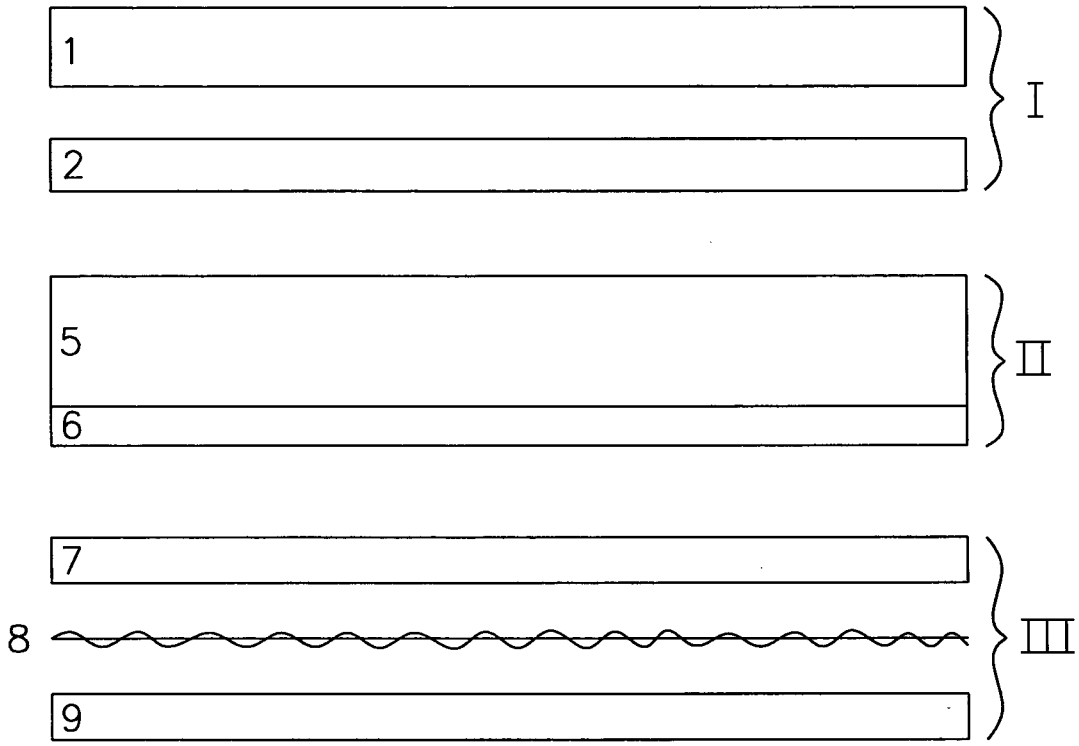

Fig 3