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(54) **ULTRA-RESILIENT PAD**
ULTRANACHGIEBIGE AUFLAGE
COUSSINET ULTRA-FLEXIBLE

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to an ultra-compressible/resilient structure with excellent compressibility and resiliency for various uses such as, for example, athletic shoes, regular shoes, boots, floor carpets, carpet pads, sports floors etc. The structure itself can be the final product or the structure can be a component of another structure. Uses envisioned include, but are not limited to: automobile parts and other composites; flooring; subfloors especially in gymnasiums or other sports arenas; press pads; ballistic cloth such as body armor or hurricane window protection; sporting equipment padding such as baseball catcher chest protectors; knee/elbow pads for runners, racers, skaters, volleyball players; cricket shin/knee pads; football hip pads; wall padding in stadiums, gymnasiums, arenas; shoe inserts (orthotics); heels/soles for athletic shoes e.g. running shoes; cushioning layer for bedding, vehicle seats, pillows; and other industrial uses where through thickness compressibility and resiliency is required.

BACKGROUND OF THE INVENTION

[0002] While composites are usually a fiber reinforced resin matrix that is rigid and incompressible in all dimensions, certain uses such as for automobile bumpers require some flexibility and shock absorbing capability, plus the ability to return to the original shape once an impact force is removed. Similarly, pads used in athletic shoes, floor carpets, carpet pads, gym floors etc. require the structures to have a high degree of both compressibility and resiliency so they can spring back to their original shape and size upon removal of an applied load.

[0003] In soles/heels for sports shoes, which are usually solid viscoelastomeric materials, some attempts to improve "cushioning" have been to mold in for example "air channels or pockets." However, the rigidity of the molded material is such that cushioning effects are limited. In related art, U.S. Pat. No. 3,553,857 to Pettit describes a sole unit of elastomeric soling material other than thermoplastic rubber and carrying a dried film of a solvent-based polyurethane or polychloroprene adhesive superimposed on a halogenated surface of the sole unit.

[0004] U.S. Pat. No. 3,733,721 to Clemens describes a resilient pad, for example, foamed elastomeric material with the pad being generally contoured for mounting on the bottom of an article of footwear, such as a shoe, or the like. The pad is provided with pressure sensitive adhesive on the upper side so that it can be adhered to the bottom of an article of footwear to provide a cushion, while the pad can readily be removed from the articles of footwear when desired.

[0005] U.S. Pat. No. 4,608,768 to Cavanagh describes an athletic shoe having a shock-absorbing running sole

which has at least one intermediate support extending at least approximately in parallel with a major plane of the running sole. The intermediate openwork support is disposed in a softly elastic midsole provided between an insole and a running sole.

[0006] U.S. Pat. No. 5,480,646 to Vu relates to a pad for applying medicaments, such as an insole worn in footwear, lined with a mixture of cinnamon, aloe wood and anise star powders having a pervious surface for contacting the skin and exposing the skin to emanations from the powders. The pad has a plurality of chambers which contain portions of the powder and maintain the even distribution of the powder as a lining in the pad. See also patents discussed in the background of the '646 patent.

[0007] Document EP 0 306 813 A2 relates to a compressible resilient pad according to the preamble of claim 1.

[0008] These structures, however, lack the required through thickness compression and spring back property. Incorporating "elastic" (in the thickness or radial direction) media into soles has affected to some degree the resiliency or spring back of the soles once a normal load is removed. But again, using these media, the compressibility and spring back is limited to some portion of the media thickness at most.

[0009] Therefore, it would be an advancement in the state of the "pad-making" art to provide a pad that provides excellent elastic behavior under load with high through thickness recovery.

SUMMARY OF THE INVENTION

[0010] The present invention is a 'shock-absorbing pad' that utilizes a unique structure which provides extremely elastic behavior under load with high through thickness recovery. The instant structure utilizes a hollow elastic media in any direction, which allows the entire structure to 'collapse' into itself, based primarily upon the elasticity of this media and the structure to conform under pressure, thus allowing this unique behavior.

[0011] One embodiment of the invention is an ultra-resilient pad for use in a sports shoe, running shoes, regular shoes, boots etc. The structure may be a woven or nonwoven fabric including functional yarns in a longitudinal or shute direction, layered both over as well as under the hollow elastic media layered in a cross-direction or warp direction. The hollow elastic media used in the cross-direction may be polyurethane, rubber or Lycra® or Estane® or any deformable material that has excellent elasticity, as in compressibility and resiliency, as well as strength to allow the structure to compress and rebound, or 'spring back.' The entire structure can be 'bound' together utilizing a "binder pick," or a yarn that is woven into the structure in order to bind the structure together to allow further processing of the said structure. Although binder picks are referred to herein, the binder yarns may be in a cross-direction instead, or in both longitudinal and cross-directions. Other means such as adhesives, weld-

ing technology or laser bonding can also be utilized for this bonding function.

[0012] The invention according to one embodiment is an ultra-resilient 'carpet pad' for use in floor carpets, sports floor, floor coverings etc. The structure may be a woven or nonwoven fabric including functional yarns in a longitudinal or shute direction, layered both over as well as under the hollow elastic media layered in a cross or warp direction. The hollow elastic media used in the warp direction may be polyurethane, rubber or Lycra® or Estane® or any deformable material that has sufficient elasticity as well as strength to allow the structure to compress and rebound, or 'spring back.' The entire structure can be 'bound' together utilizing a "binder pick," or a yarn that is woven into the structure in order to bind the structure together to allow further processing of the said structure. Again, although binder picks are referred to herein, the binder yarns may be in a cross-direction instead, or in both longitudinal and cross-directions. Other means such as adhesives, welding technology or laser bonding can also be utilized for this function.

[0013] An object of the invention is to provide a structure that has improved recovery characteristics over memory foams, gels, spring systems, etc.

[0014] Another object of the invention is to form a smooth and uniform surface over the pad in order to improve support for the shoe and the foot.

[0015] Yet another object of the invention is to form a 'planar,' crossless structure with improved support of the carpet/sport floor/floor material.

[0016] Yet another object of the invention is to provide excellent retention of the recovery/dampening characteristics by utilizing the hollow elastic material's 'full' recovery within the structure, as opposed to straight compression of materials. This is achieved due to the structure providing support between the sections of the hollow elastic material, which avoids 'overstressing' the material, keeping it 'alive' and resulting in a longer useful lifetime.

[0017] Yet another object of the invention is to provide excellent resistance to moisture damage or problems due to water holding in certain applications due to the self-cleaning effect due to compression and subsequent recovery.

[0018] Yet another object of the invention is to provide an excellent compression recovery versus weight ratio, allowing significant dampening capability with light weight on structures.

[0019] Yet another object of the invention is to provide excellent 'breathability' of the shock absorbing structure, allowing perspiration and other moisture to evaporate and/or be removed during the compression phase.

[0020] Accordingly, disclosed is a compressible resilient pad, wherein the pad includes a structure comprising: a plurality of parallel cross-direction or warp yarns and a plurality of parallel longitudinal or shute yarns, wherein either or both of shute yarns or warp yarns are comprised of a hollow elastic (in the thickness or radial

direction and in the length or axial direction) material members with excellent compressibility and resiliency. The structure comprises a first layer of the parallel yarns running in either the warp or the shute direction, a second layer of the parallel yarns on one side of the first layer, the second layer's yarns running in the warp or shute direction different from that of the first layer and comprising the hollow elastic members and a third layer of the parallel yarns on the opposite of the second layer as the first layer and running in the same direction as those of the first layer. The parallel yarns of the third layer are aligned such that they nest between the spaces created between the parallel yarns of the first layer. In other words, this design can be classified as "crossless" in that the yarns or members in the warp and shute or shute direction do not interweave with each other, but are stacked orthogonal to each other and lie in separate planes. The structure can further comprise a binder yarn system. Binder yarns may be in the warp or shute direction or in both warp and shute directions. In the pad the number of yarns in the third layer can be less than the number of yarns in the first layer. The yarns of the second layer can be orthogonal to those of the first and third layers. The second layer can be at an angle of less than 90 degrees of the first and third layer, such as at an angle of 45 degrees.

[0021] The pad's structure can comprise a fourth layer of parallel members in the same direction as the second layer, the yarns comprising the hollow elastic members, and a fifth layer of parallel yarns in the same direction as the first layer, wherein the yarns of the fifth layer are aligned in the same vertical plane in a through thickness direction as that of the first layer.

[0022] In yet another embodiment, disclosed is a compressible resilient pad, wherein the pad includes a structure comprising: a plurality of warp yarns, a plurality shute yarns, wherein any number of the shute yarns and warp yarns are interwoven to form a woven structure; and wherein any number of the yarns are comprised of an axially and radially elastic hollow material members. The pad can further comprise a binder yarn system. In one embodiment, the pad can be woven in a 2-8-shed pattern.

[0023] It will be noted that in each of the embodiments described herein, the hollow elastic members can be incorporated into any or both of the warp and shute directions to give the desired qualities of compressibility and resilience. Also, any number of layers can include any number of hollow elastic members, provided at least one layer of the final structure entirely consists of the hollow elastic members. The hollow elastic members can have any form as appropriate for the application and can be, for example, single monofilament, plied monofilament or multifilament, wrapped member of different materials, multicomponent member, knitted member, twisted member, or braided. The hollow elastic members can be partially composed of an elastic material, such as a multicomponent member where one component is the elastic material, or the hollow elastic member can be wholly com-

prised of the elastic material. The hollow elastic member may have a circular or non-circular cross sectional shape. The non-circular cross sectional shapes may include, but are not limited to, square, rectangular, triangular, elliptical, trapezoidal, polygonal, and lobate shapes. The hollow elastic member can have one or more holes running along its length or axial direction, and the holes themselves can have a circular or non-circular cross sectional shape including square, rectangular, triangular, elliptical, trapezoidal, polygonal, and lobate shapes, and can be of any suitable size. Examples of good elastic materials include, but are not limited to, polymers such as polyurethane, rubber or that sold under trademarks Lycra® by Invista or Estane® by Lubrizol.

[0024] In the disclosure and the embodiments therein, the pad's structure can comprise a laminated structure. The laminated structure can include two independently woven fabric layers with the hollow elastic member layer there between. The laminated structure can also include a binder yarn system weaving between the layers of the laminate.

[0025] In the disclosure and the embodiments therein, the pad can also include a structure where the binder yarn system and the hollow elastic members are in the same direction. The direction of the hollow elastic members and the binder yarns can be the warp or shute direction. Such a structure can include a layer of hollow elastic members that are inside a double layer construction. In the pad the structure can include the hollow elastic members composed of a coarser (larger) warp, and the binder yarns composed of a warp smaller than that of the hollow elastic members.

[0026] In the disclosure and the embodiments herein, in the pad, the structure can be either a final product or the structure can be a component of another structure. The pad can be included in or can be a product selected from the group of products including: footwear; shoes; athletic shoes; boots; flooring; carpets; carpet pads; sports floors; automobile parts; composites; subfloors; gymnasium subfloors; sports arena subfloors; press pads; ballistic cloth; body armor; hurricane window protection; padding; sporting equipment padding; baseball catcher chest protectors; knee/elbow pads; hip pads; wall padding; shoe inserts and orthotics; heels/soles for athletic shoes; a cushioning layer for bedding, and vehicle seats. The structure can also include a material that allows a surface to be exchangeable; the material can be a hooked loop yarn.

[0027] For example, an automobile bumper with the inventive structure as a layer, the structure layer free of resin in its interior to allow movement as desired, is an improvement over that currently used. The present invention can also be used as shoe inserts or orthotic inserts, which are usually molded solid resin. Incorporation of a layer of the ultra-resilient pad according to the present invention improves the cushioning effect thereof. Incorporation of the ultra-resilient pad according to the present invention as a layer in a cast structure, free of

"resin" to allow movement, substantially improves the cushioning effect of running/athletic shoes.

[0028] In the disclosure and the embodiments herein, the layers of the structure can comprise a plurality of adjoining layers comprising the hollow elastic material.

[0029] For a better understanding of the invention, its operating advantages and specific objects attained by its uses, reference is made to the accompanying descriptive matter in which preferred, but non-limiting, embodiments of the invention are illustrated.

[0030] Terms "comprising" and "comprises" in this disclosure can mean "including" and "includes" or can have the meaning commonly given to the term "comprising" or "comprises" in US Patent Law. Terms "consisting essentially of" or "consists essentially of" if used in the claims have the meaning ascribed to them in U.S. Patent Law. Other aspects of the invention are described in or are obvious from (and within the ambit of the invention) the following disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] The accompanying drawings, which are included to provide a further understanding of the invention, are incorporated in and constitute a part of this specification. The drawings presented herein together with the description serve to explain the principles of the invention. In the drawings:

Fig. 1 shows an ultra-resilient shoe pad, according to one embodiment of the invention;

Fig. 2 shows installation of the ultra-resilient shoe pad within a shoe, according to one embodiment of the invention;

Fig. 3 shows a woven structure, according to one embodiment of the invention;

Fig. 4 shows the formation of a structure, according to one embodiment of the invention;

Figs. 5A-B are a side view and a profile view of a further embodiment of the inventive pad, respectively;

Fig. 6 shows yet another step in the formation of a structure, according to one embodiment of the invention;

Fig. 7 shows a woven structure, according to one embodiment of the invention;

Fig. 8 shows another structure according to another embodiment of the invention;

Fig. 9 shows an embodiment of the invention including a multi-component wound yarn comprising the hollow elastic member;

Fig. 10A shows an embodiment of a laminated structure;

Fig. 10B shows a woven "crossless" structure;

Fig. 11 shows an embodiment of the invention including a 5-layer compressible resilient fabric comprising a warp binder;

Fig. 12 illustrates another embodiment of the inven-

tion including a weaving in of the warp yarns;

Figs. 13A-13E show another interwoven variant of the embodied fabric; and

Fig. 14 shows different cross sections of the hollow elastic member of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0032] The invention, according to one embodiment, is a 'shock-absorbing' pad that utilizes a unique structure which provides extremely elastic behavior under a normal pressure load with high caliper recovery. This ultra-resilient structure with excellent compressibility and resiliency can be used in various applications such as, for example, athletic shoes, regular shoes, boots, floor carpets, carpet pads, sports floors etc. The structure itself can be the final product or the structure can be a component of another structure. Uses envisioned include, but are not limited to: automobile parts and other composites; flooring; subfloors especially in gymnasiums or other sports arenas; press pads; ballistic cloth such as body armor or hurricane window protection; sporting equipment padding such as baseball catcher chest protectors; knee/elbow pads for runners, racers, skaters, volleyball players; cricket shin/knee pads; football hip pads; wall padding in stadiums, gymnasiums, arenas; shoe inserts (orthotics); heels/soles for athletic shoes e.g. running shoes; cushioning layer for bedding, vehicle seats, pillows; and other industrial uses where through thickness compressibility and resiliency is required.

[0033] This structure utilizes a hollow elastic member in one direction of a woven or non-woven structure or fabric, which allows the entire structure to 'collapse' into itself, based upon the elasticity of this member and the base fabric structure to conform under pressure, and then recover to substantially the same original form and thickness, thus allowing a unique behavior.

[0034] The hollow elastic member is defined as elastic in its thickness or radial direction and length or axial direction and is required for all the embodiments discussed herein. The hollow elastic member can have any form as appropriate for the application and can be, for example, single monofilament, plied monofilament or multifilament, wrapped member of different materials, multicomponent member, knitted member, twisted member, or braided. The hollow elastic members can be partially composed of an elastic material, such as a multicomponent member where one component is the elastic material, or the hollow elastic member can be wholly comprised of the elastic material. The hollow elastic member may have a circular or non-circular cross sectional shape. The non-circular cross sectional shapes may include, but are not limited to, square, rectangular, triangular, elliptical, trapezoidal, polygonal, and lobate shapes. The hollow elastic member can have one or more holes running along its length or axial direction, and the holes themselves can have a circular or non-circular cross sectional shape including square, rectangular, triangular, elliptical,

trapezoidal, polygonal, and lobate shapes, and can be of any suitable size. Some non-limiting examples of cross-sectional shapes for the hollow elastic member are illustrated in Figure 14. It should be noted that the hollow elastic member of the present invention weighs less and compresses more (in a thickness direction) than an elastic member of the same outer diameter but without any hole(s) running along its length or axial direction. Examples of few good elastic materials include, but are not limited to, polymers such as polyurethane, rubber, or that sold under trademarks Lycra® by Invista or Estane® by Lubrizol.

[0035] One embodiment of the invention is shown in Figure 1, which is a shoe pad 10 for use in shoes such as sports shoes, running shoes, regular shoes, boots etc. Figure 2 illustrates an example of the installation of the shoe pad 10 into foot wear, for example, a shoe. Figure 3 is a 'top view' of the structure according to one example of the invention, also referred to as the base fabric, looking from above the fabric. Figure 3 illustrates the use of functional yarns 20, 30 in one direction, for example a longitudinal or shute direction of the fabric, layered both over as well as under the layer of hollow elastic members 40 in the cross-direction or warp direction. At this point, hollow elastic member 40 conforms to the nesting of functional yarns 20, 30, and bends and flattens/stretches around functional yarns 20, 30. Functional yarns can include any type of yarns (as in single monofilaments, multifilaments, texturized multifilaments, etc.) or combined structures (twisted, plied, knitted, braided of any number of materials, etc.), as known by ordinarily skilled artisans.

[0036] The hollow elastic member 40 may be a polymer such as polyurethane, rubber, or that sold under trademarks Lycra® by Invista or Estane® by Lubrizol, or any deformable material that has sufficient elasticity as well as strength to allow the structure to rebound, or 'spring back.' The structure 10 may be made in a 90 degree fashion, switching the longitudinal and cross-direction yarns. It is to be noted that yarns/ material/bands/cords/media 20, 30 are offset in the total structure 10 in order to allow the longitudinal sections to compress almost completely without interfering with one another in order to form a planar structure still with open area, so as to allow permeability. The entire structure 10 can be 'bound' together utilizing "binder picks" 50 as shown in Figure 3, or another yarn that is woven into the structure in order to bind it together in order to allow further processing of the 'base fabric.' Although binder picks are referred to herein, the binder yarns may be in the warp direction instead, or in both warp and shute directions. Other means, such as for example, adhesives, welding technology or laser bonding can also be utilized for this function of holding the structural yarns together.

[0037] Upon application of a compressive load the hollow elastic members 40 will stretch allowing the yarns 20 and 30 to move towards each other and to "nest" between each other, virtually almost in the same plane, as shown in Figure 6. At this point, hollow elastic members 40 con-

form to this nesting, and bend and flatten/stretch around yarns 20, 30 in the top layer and bottom layer. Upon release of the load, due to the elastic behavior of the member 40, they will cause the yarn layers 20 and 30 to move apart from each other or "spring back", returning the fabric to its desired thickness and openness as shown in Figure 4. Therefore, a pad having a total thickness of the thickness of yarns 20 plus the thickness of yarns 30 plus the thickness of hollow elastic member 40 under normal uncompressed state is compressible and resilient to almost an entire yarn thickness, i.e. the thickness lost is some portion of the hollow elastic member 18, and the fabric can be almost as thin as the thicker diameter of yarn 20 or 30, in a compressed state. It is important to note that although functional yarns 20, 30 are illustrated as having a square cross-section in some figures, they can be of any size, shape, material or form suitable for the purpose.

[0038] In another embodiment similar to that of the above, layers of yarns 20 and 30 have the same position and relative orientation/spacing as above, but the layer of hollow elastic member 40 is oriented at less than 90 degree angle to the top and/or bottom layers, preferably at a 45 degree angle.

[0039] Furthermore, there can be more than two layers of functional yarns and more than one layer of the hollow elastic member as shown in Figure 5A. With three layers of functional yarns, for example, two of the three yarn layers must be spaced apart relative to each other to allow nesting. For example, top and middle layers can be oriented such that yarns in the middle layer fit in the space between two adjacent yarns of the top and yarns in the bottom layer are stacked in vertical orientation with either the top or middle layers. Furthermore, both layers in cross-direction can include the hollow elastic members, or only one layer can include the hollow elastic members and the other layer can be a functional yarn layer. Again yarns in the top, middle and bottom layers can be the same or different from each other in form, material, shape, etc.

[0040] A profile view of structure 35 is shown in Figure 5B, which comprises five layers in generally parallel planes with each layer comprising a plurality of parallel yarns/members. The yarns of the first, third and fifth layer (i.e. layers 12, 16 and 22) are oriented in a longitudinal direction, for example, while the hollow elastic members of the second and fourth layers (i.e. layers 14 and 18) are oriented in the cross-direction, for example. As shown therein, functional yarns 30 in the third layer 16 are spaced apart in the manner described above such they fall between the yarns 20 of the first layer 12 and the fifth layer 22, thereby causing the "nesting" described above. The second layer 14 and the fourth layer 18 include the hollow elastic members 40. The binder yarns 50 (not shown) are disposed in the cross-direction, for example, though they can be disposed in the longitudinal direction too. Though some embodiments described herein have the first, third and fifth layer oriented in the longitudinal

direction, and the hollow elastic members of the second and fourth layers oriented in the cross-direction, the layers can be interchangeably used, so long as there is at least one layer of the hollow elastic members. For example, the first and fifth layers can be oriented in the cross-direction, and the hollow elastic members of the second and fourth layers in combination with the functional yarns of the third layer can be oriented in the longitudinal direction. Similarly, the binder yarns 50 can be disposed in either or both directions, as required.

[0041] Layers 12, 14, 16, 18 and 22 are not interwoven, as illustrated in Figure 5. Instead one or more relatively thin threads or binder yarns 50 are used to bind the layers vertically together. This type of construction insures that the individual yarns of the layers do not shift laterally. Binder yarns can alternate from one row to another, each row extending in a cross-direction, for example.

[0042] Also the degree of compression/ resiliency is controlled by the elasticity of the required elastic members, number of layers of the elastic members, size, shape and number of elastic members in each layer of the elastic members, and of course the totality of the structure itself. The inventive structure can also be part of a laminate with other yarn arrays or base fabrics attached thereto. The structure can have a layer of coating on either or both surfaces and the coating can also partially or fully encapsulate or impregnate the entire structure. The coating/impregnant may also be a reticulated or nonreticulated foam.

[0043] Any of the longitudinal yarns can be single in nature (as in single monofilaments, multifilaments, textured multifilaments, etc.) or combined structures (twisted, plied, knitted, braided of any number of materials, etc.), as known by ordinarily skilled artisans. They can be permeable or impermeable to fluids. They can be made of polymers such as polyesters, polyurethanes, polyamides, polyolefins, or metals, rubber, etc. or combinations thereof.

[0044] The fabric can be needled, if necessary, with fibers to produce a smooth surface, and can be coated with foams, coatings, or particulates. Other forms include a membrane, a yarn array, or another yarn fabric can be laminated to the fabric. The structure which includes these hollow elastic members must be constructed to have sufficient degree of compressibility as well as have sufficient elasticity as well as strength to allow the structure to rebound, or 'spring back.' The compression and rebounding of the structure has the following benefits:

- 1.) Improved recovery characteristics over memory foams, gels, spring systems, etc,
- 2.) Smooth and uniform surface characteristics in, for example, items having 'planar,' crossless structure of yarns. (e.g.: to allow for improved support of the shoe and the foot).
- 3.) Excellent retention of the recovery/dampening characteristics due to the hollow elastic material members' 'full' recovery within the structure (as op-

posed to straight compression of materials). This is due to the structure providing support between the sections of the hollow elastic material members; this avoids 'overstressing' the material member, keeping it 'alive' (e.g., for a longer useful lifetime).

4.) Excellent resistance to moisture damage or problems due to water holding due to self-cleaning effect of compression and recovery.

5.) Excellent compression recovery vs. weight ratio, allowing significant dampening capability with light weight.

6.) Excellent 'breatheability' of the shock absorbing structure, allowing perspiration and other moisture to evaporate and/or be removed at compression.

[0045] Structure 35 can be woven flat, endless, or compiled in another manner known to one of skill in the art. The indexing of the said longitudinal layers (or cross-direction layers if oriented in the other direction) can be critical, as the spacing of the structure must allow a uniform compression of the yarns in one layer into the yarns of another layer, thus allowing a uniform behavior over the entire length and width of the structure. It is to be noted that the structure can also be built without weaving, by subsequently laying said yarns/members perpendicular to one another as shown in Figs. 4 and 5 and properly indexing in order to result in the finished structure. These yarns/members can be fixed in place via adhesives, welding techniques (laser and/or ultrasonic, for instance), or adhered with other welding and/or gluing techniques. Numerous layers can also be stacked in a perpendicular or angled fashion over each other to create a thicker, even more compressible structure.

[0046] The invention, according to one embodiment, is a 'carpet pad' that utilizes a unique structure 60 which provides extremely elastic behavior under load with high caliper recovery. This structure 60, for example shown in Figure 7, utilizes a hollow elastic member 140 in one direction of a woven fabric which allows the entire structure to 'collapse' into itself, based primarily upon the elasticity of this hollow member 140 and the base fabric structure to conform under pressure, and rebound when the pressure is released, thus allowing this unique behavior.

[0047] Figure 7 is a 'top view' of the structure according to the invention, also referred to as the base fabric, looking from above the fabric. Yarns 120, 130 are used in one direction, for example a longitudinal direction of the fabric, layered both over as well as under the hollow elastic member 140 in the cross-direction. The hollow elastic member 140 may be polyurethane, rubber or Lycra® or Estane® or any deformable material that has sufficient elasticity as well as strength to allow the structure to rebound, or 'spring back.' The structure 60 may be made in a 90 degree fashion, switching the longitudinal and warp yarns. It is to be noted that yarns/bands/cords 120, 130 are offset in the total structure 60 in order to allow the longitudinal sections to compact totally without interfering with one another in order to form a planar structure

still with open area, so as to allow permeability. The entire structure 60 can be 'bound' together utilizing 'binder picks' 150 as shown in Figure 7, or another yarn that is woven into the structure in order to bind it together in order to allow further processing of the said 'base fabric.' Although binder picks are referred to herein, the binder yarns may be in the warp direction instead, or in both warp and shute directions. Other means such as for example adhesives, welding technology or laser bonding can also be utilized for this function.

[0048] Any of the longitudinal yarns can be single in nature (as in monofilaments, multifilaments, texturized multifilaments, etc.) or combined structures (twisted, plied, knitted, etc.). They can be permeable or impermeable to fluid. They can be comprised of polyesters, polyurethanes, polyamides, polyolefins, metals, rubber, Lycra® or Estane® etc. or combinations thereof. The fabric can be needled, if necessary, with fibers to produce a smooth surface of the fabric, and/or can be coated with foams, resin or latex coatings, or particulates. The structure that contains the hollow elastic members must allow the structure to compress and rebound, or 'spring back.' The rebounding of the structure has the following benefits:

- 1.) Improved recovery characteristics over memory foams, gels, spring systems, etc.
- 2.) Smooth and uniform surface characteristics due to 'planar,' crossless structure of yarns (e.g., to provide improved support of the carpet/sport floor/floor material).
- 3.) Excellent retention of the recovery/dampening characteristics due to the hollow elastic material members' 'full' recovery within the structure (as opposed to straight compression of materials). This is due to the structure providing support between the sections of the hollow elastic material members; this avoids 'overstressing' the material member, keeping it 'alive.' This provides, inter alia, a longer useful lifetime.
- 4.) Excellent resistance to moisture damage or problems due to the water holding due self-cleaning effect of compression.

[0049] The structure 60 can be woven flat, endless, or compiled in another manner known to one of skill in the art. The indexing of the said longitudinal layers (or cross-direction layers if woven in the other direction) may be critical, as the spacing of the structure must allow a uniform compression of the yarns into one another, thus allowing a uniform behavior over the entire length and width of the structure. It is to be noted that the structure can also be built without weaving, by subsequently laying said yarns/members perpendicular or angled to one another and properly indexing in order to result in the finished structure. These yarns/members can be fixed in place via adhesives, welding techniques (laser and/or ultrasonic, for instance), or adhered with other welding

and/or gluing techniques. Numerous layers can also be stacked in a perpendicular fashion or angled over each other to create a thicker, even more compressible structure.

[0050] In yet another embodiment, the layers of a fabric may each be formed by mixing different weave repeats or shed patterns. By way of background, in flat weaving, a warp yarn is threaded through a heddle, and the weave pattern is created by raising and lowering the heddle position for each yarn in the warp direction before the shuttle or pick is inserted into the shed created by raising or lowering the warp yarns. The number of yarns intersected before a weave pattern repeats is known as a shed. With this understanding, a plain weave utilizes, for example two sheds in a loom for changing the warp yarn positions, and can therefore be termed a two shed weave pattern. Accordingly a fabric can be comprised of a 2, 4, 6, 8 shed pattern and so on.

[0051] Figure 8 shows 2-shed pattern with a 0.35 mm shuttle yarn; the figure showing two differing densities for the hollow elastic member 40 and the binder yarn 50. For weaving a 2-shed surface for, for example, a 5-layer fabric with a hollow elastic member 18, a 16 harness ($16/4=4$, $4/2=2$ shed) pattern can be used. In another example, a 2-layer 4/8-shed weave can have a 4 ply Lycra® or Estane® yarn as a shuttle.

[0052] Illustrating other embodiments of the structure, at Figure 9 is shown the multi-component wound yarn comprising hollow elastic member 40 for a multilayer fabric having a 2 layer construction. At Figures 10A and 10B are shown embodiments of laminated structures of the fabric. Figure 10A shows a base structure with the hollow elastic member 40 and functional yarns 20, 30 laminated between two fabrics.

[0053] Figure 10B shows a woven "crossless" base. The base shows the hollow elastic member 40 and the functional yarns 20 and 30 as well as a binder yarn 50. Also contemplated are other embodiments where the hollow elastic member can be a knitted, ply/twisted or a hooked loop yarn.

[0054] For the embodiment including a hooked loop yarn, a fabric can be adapted to, for example, readily attach and replace fabric surfaces that are worn due to the stresses pads and structures undergo. In another example, a fabric can have surfaces that are exchangeable, thus allowing the same fabric to be put to different uses, such as a sports floor where different surfaces are desired for different sports.

[0055] In another embodiment, Figure 11 shows a 5-layer compressible resilient fabric comprising a warp binder 50. The array 116 including the hollow elastic member 40 running in the warp direction is positioned between the first array 112 and the third array 122. A fourth layer 126 including hollow elastic members 40 has the yarns positioned such that they are in alternating spaces in the vertical plane from the parallel hollow elastic members of the second layer 16. The yarns 20 of the fifth layer 128 are the same vertical plane the yarns 20

of the first layer 112. As shown in figures, each warp direction binder yarn 50 alternately weaves under and over three parallel yarns in the first and fifth layers, and is spaced in the shuttle direction such that long floats are created by each of the yarns 20 of the first layer 112 and the fifth layer 128. As shown, the hollow elastic members are inside a double layer weave construction, which can use a 16 harness as for endless weaving or an 8 harness weave for flat weaving. The fabric woven in accord with the embodiment can use the single monofilament warp yarns or 4 ply yarns or other yarn types. It is also possible to use two different warp yarns, a coarser (larger) warp including the hollow elastic member 40, and a smaller warp for the binder yarn 50. A fabric structure as shown in Figure 11 can also be formed using two separate warp beams; for example, the coarser warp including the hollow elastic member 40 on one beam and the smaller warp including the binder yarn 50 on another beam. However, if two warp beams are not desired, the smaller binder yarns can be alternated with the hollow elastic warp members on the same beam. The weave, however, must be such that the hollow elastic members are allowed to stretch and compress, and the base compresses under a normal load then 'springs back' after removal of the load.

[0056] Figure 12 illustrates another embodiment. As shown therein four ends of yarns 20 the first layer 112 weave above the layers 116, 122, 126 of hollow elastic members 40, and changes over to a two-layer binder every second repeat, and four ends of yarns 20 weaving under the layers 116, 122, 126 and changes over to a two-layer binder every second repeat. Each layer need not be composed of hollow elastic members. However, the fabric structure should include at least one layer of hollow elastic members to exhibit the 'spring back' nature desired.

[0057] Another variant of the embodied fabric is shown in Figures 13A - 13E, configuring the fabric with more or less longitudinal crimp weaves, and having the hollow elastic members in the interior layers. The Figures show three layers 212, 216, 220, of hollow elastic members 40; a top layer 212 and bottom layer 220 running in the cross-direction and a middle layer 216 arrayed lengthwise in the longitudinal direction. Binder yarns 50 run or weave through the structure as illustrated, where on the uppermost surface the yarns 50 extend over two of the top cross-direction layer 212 hollow elastic members 40 and weave downward to loop under a single cross-direction hollow elastic member 40 in the bottom layer 220 of the hollow elastic members, whereupon it weaves upward again. As shown, the binder yarns 50 are formed with a crimp 230, resulting in long floats on the top surface of the fabric and small knuckles on the bottom side of the fabric. However, the weave and placement of the hollow elastic members must be such that the hollow elastic members compress and stretch upon a normal load (pressure) being applied to the base fabric, and the base fabric 'springs back' upon removal of that load.

[0058] Modifications to the present invention would be obvious to those of ordinary skill in the art in view of this disclosure, but would not bring the invention so modified beyond the scope of the appended claims.

Claims

1. A compressible resilient pad (10 ; 35 ; 60), wherein the pad includes a structure comprising:

a plurality of parallel longitudinal yarns;
a plurality of parallel cross-direction yarns;
a plurality of parallel hollow elastic members being elastic in their thickness or radial direction and length or axial direction, so that the hollow elastic members stretch and compress so that the pad compresses under a normal load and springs back after removal of the load
characterized in that:

a first layer (12 ; 112 ; 212) of the parallel yarns (20 ; 120) running in either the longitudinal or the cross-direction;
a second layer (14 ; 116 ; 216) of the parallel hollow elastic members (40 ; 140) on one side of the first layer, the second layer's hollow elastic members running in the longitudinal or cross-direction different from that of the first layer; and
a third layer (16 ; 122 ; 220) of the parallel yarns (30 ; 130) on the opposite of the second layer (14 ; 116 ; 216) as the first layer (12 ; 112 ; 212) and running in the same direction as those of the first layer (12 ; 112 ; 212),
wherein the parallel yarns (30 ; 130) of the third layer (16 ; 122 ; 220) are aligned such that the parallel yarns (30 ; 130) of the third layer (16 ; 122 ; 220) nest in the spaces created between the parallel yarns (20 ; 120) of the first layer (12 ; 112 ; 212).

2. The pad of claim 1 wherein the structure comprises:

a binder yarn system, wherein the binder yarns (50 ; 150) binds the first (12 ; 112 ; 212), second (14 ; 116 ; 216), and third layer (16 ; 122 ; 220) together.

3. The pad of claim 1 wherein the number of yarns (30 ; 130) in the third layer (16 ; 122 ; 220) is less than the number of yarns (20 ; 120) in the first layer (12 ; 112 ; 212).

4. The pad of claim 2 wherein the hollow elastic members (40 ; 140) of the second layer are orthogonal, at an angle of less than 90 degrees, or at an angle

of 45 degrees to those of the first and third layers.

5. The pad of claim 1 wherein the structure comprises:

a fourth layer (18 ; 126) of parallel hollow elastic members (40 ; 140) in the same direction as the second layer; and
a fifth layer (22 ; 128) of parallel yarns in the same direction as the first layer, wherein the yarns of the fifth layer are aligned in the same vertical plane in a through thickness direction as that of the first layer.

6. The pad of claim 2 wherein the direction of the hollow elastic member (40 ; 140) and the binder yarn (50 ; 150) are in the cross-direction.

7. The pad of claim 6 wherein the structure includes the hollow elastic members (40 ; 140) are coarser (larger) than the binder yarns (50 ; 150).

8. The pad of claim 1, wherein the pad includes a structure comprising:

a plurality of warp yarns;
a plurality of shute yarns;
a plurality of hollow elastic members (40 ; 140); wherein any number of the shute yarns, warp yarns, and hollow elastic (40 ; 140) members are interwoven to form a woven structure.

9. The pad of claim 8, wherein the structure further comprises:

a binder yarn system.

10. The pad as claimed in claim 1 or 8, wherein the hollow elastic member is selected from the group consisting of: a monofilament, a multifilament, a plied monofilament or multifilament, a wrapped member, a knitted member, a twisted member, a multicomponent member, and a braided member.

11. The pad as claimed in claim 1 or 8, wherein the hollow elastic member is selected from the group consisting of: a polyurethane, a rubber, Lycra®, and Estane®.

12. The pad as claimed in claim 1 or 8, wherein the hollow elastic member is selected from yarns having a cross-section of differing geometric configurations.

13. The pad as claimed in claim 12, wherein the hollow elastic member (40 ; 140) is selected from the group consisting of: circular, non-circular, square, rectangular, triangular, elliptical, polygonal, trapezoidal and lobate.

14. The pad as claimed in claim 1 or 8, wherein the hollow

- elastic member (40 ; 140) has one or more holes running along a length or axial direction thereof.
15. The pad as claimed in claim 14, wherein the one or more holes are selected from the group consisting of: circular, non-circular, square, rectangular, triangular, elliptical, trapezoidal, polygonal, and lobate. 5
16. The pad as claimed in claim 8, wherein the structure comprises a 2-8-shed weave pattern. 10
17. The pad of claim 1 or 8 wherein the structure comprises:
- a laminated structure. 15
18. The pad of claim 17 wherein the structure comprises:
- two woven layers with an elastic hollow member layer there between. 20
19. The pad of claim 17 wherein the structure comprises:
- a binder yarn system weaving between the layers of the laminate. 25
20. The pad of claim 2 or 19 wherein the binder yarn and the hollow elastic member (40 ; 140) are woven in the same direction. 30
21. The pad of claim 20 wherein the direction of the hollow elastic member and the binder yarn is the warp direction, and the hollow elastic member (40 ; 140) and the binder yarn are alternated with each other. 35
22. The pad of claim 6 or 21 wherein the layer of hollow elastic members (40 ; 140) is inside a double layer construction. 40
23. The pad of claim 9 wherein the structure includes the hollow elastic members (40 ; 140) composed of a coarser (larger) warp; and the binder yarn composed of a warp smaller than that of the hollow elastic member. 45
24. The pad of claim 8 wherein the structure comprises:
- four ends weaving above the layer of hollow elastic members (40 ; 140) and changes to a two-layer binder at every second repeat; and 50
- four ends weaving under the layer of hollow elastic members (40 ; 140) and changes to a two-layer binder every second repeat.
25. The pad of claim 1 or 8 wherein the pad is included in or is a product selected from the group of products including: 55
- footwear; shoes; athletic shoes; boots; flooring; carpets; carpet pads; sports floors; automobile parts; composites; subfloors; gymnasium subfloors; sports arena subfloors; press pads; ballistic cloth; body armor; hurricane window protection; padding; sporting equipment padding; baseball catcher chest protectors; knee/elbow pads; hip pads; wall padding; shoe inserts and orthotics; heels/soles for athletic shoes; a cushioning layer for bedding, and vehicle seats.
26. The pad of claims 1 or 8 wherein the structure includes a material that allows a surface to be exchangeable.
27. The pad of claim 26 wherein the material is a hooked loop yarn.
28. The pad of claim 1 or 8 wherein the layers of the structure comprise:
- a plurality of adjoining layers comprising the hollow elastic members.
29. The pad of claim 17, wherein said laminate comprises one or more yarns arrays or base fabrics attached to said compressible resilient pad.
30. The pad of claim 1 or 8, further comprising a layer of coating on either or both surfaces.
31. The pad of claim 30, wherein the coating partially or fully encapsulates or impregnates the structure.
32. The pad of claim 30, wherein the coating may be a reticulated or non-reticulated foam.
33. The pad of claim 1 or 8, wherein the pad is needled with fibers to produce a smooth surface.

Patentansprüche

1. Zusammendrückbares nachgiebiges Polster (10; 35; 60), wobei das Polster eine Struktur aufweist, die Folgendes aufweist:

eine Vielzahl von parallelen longitudinalen Garnen;
 eine Vielzahl von parallelen Querrichtungsgarnen;
 eine Vielzahl von parallelen hohlen elastischen Elementen, die in ihre Dicken- oder Radialrichtung und Längen- oder Axialrichtung elastisch sind, so dass sich die hohlen elastischen Elemente dehnen und zusammenziehen, so dass sich das Polster unter einer senkrechten Belastung zusammendrückt und nach der Entfernung

- der Belastung zurückfedert **gekennzeichnet durch:**
- eine erste Schicht (12; 112; 212) der parallelen Garne (20; 120), die entweder in die Längs- oder die Querrichtung verlaufen; eine zweite Schicht (14; 116; 216) der parallelen hohlen elastischen Elemente (40; 140) auf einer Seite der ersten Schicht, wobei die hohlen elastischen Elemente der zweiten Schicht in die Längs- oder Querrichtung verlaufen, die sich von jener der ersten Schicht unterscheidet; und eine dritte Schicht (16; 122; 220) der parallelen Garne (30; 130) auf der zur ersten Schicht (12; 112; 212) entgegengesetzten Seite der zweiten Schicht (14; 116; 216), die in dieselbe Richtung wie jene der ersten Schicht (12; 112; 212) verlaufen,
- wobei die parallelen Garnen (30; 130) der dritten Schicht (16; 122; 220) so ausgerichtet sind, dass die parallelen Garnen (30; 130) der dritten Schicht (16; 122; 220) in den zwischen den parallelen Garnen (20; 120) der ersten Schicht (12; 112; 212) erzeugten Räumen stecken.
2. Polster nach Anspruch 1, wobei die Struktur aufweist:
- ein Bindegarnsystem, wobei die Bindegarne (50; 150) die erste (12; 112; 212), zweite (14; 116; 216) und dritte Schicht (16; 122; 220) aneinander binden.
3. Polster nach Anspruch 1, wobei die Anzahl der Garne (30; 130) in der dritten Schicht (16; 122; 220) kleiner als die Anzahl der Garnen (20; 120) in der ersten Schicht (12; 112; 212) ist.
4. Polster nach Anspruch 2, wobei die hohlen elastischen Elemente (40; 140) der zweiten Schicht orthogonal, unter einem Winkel von weniger als 90 Grad oder unter einem Winkel von 45 Grad zu jenen der ersten und dritten Schicht verlaufen.
5. Polster nach Anspruch 1, wobei die Struktur aufweist:
- eine vierte Schicht (18; 126) von parallelen hohlen elastischen Elementen (40; 140) in dieselbe Richtung wie die zweite Schicht; und eine fünfte Schicht (22; 128) von parallelen Garnen in dieselbe Richtung wie die erste Schicht, wobei die Garne der fünften Schicht in derselben vertikalen Ebene in einer Durchgangsdickenrichtung wie jene der ersten Schicht ausgerichtet sind.
6. Polster nach Anspruch 2, wobei die Richtung des hohlen elastischen Elements (40; 140) und des Bindegarne (50; 150) in die Querrichtung verläuft.
7. Polster nach Anspruch 6, wobei die Struktur aufweist:
- die hohlen elastischen Elemente (40; 140), die gröber (größer) als die Bindegarne (50; 150) sind.
8. Polster nach Anspruch 1, wobei das Polster eine Struktur aufweist, die aufweist:
- eine Vielzahl von Kettgarnen; eine Vielzahl von Schussgarnen; eine Vielzahl von hohlen elastischen Elementen (40; 140); wobei irgendeine Anzahl der Schussgarne, Kettgarne und hohlen elastischen Elementen (40; 140) verwebt sind, um eine gewebte Struktur zu bilden.
9. Polster nach Anspruch 8, wobei die Struktur ferner aufweist:
- ein Bindegarnsystem.
10. Polster nach Anspruch 1 oder 8, wobei das hohle elastische Element aus der Gruppe ausgewählt ist, die aus Folgendem besteht: einem Monofilament, einem Multifilament, einem gefachten Monofilament oder Multifilament, einem gewickelten Element, einem gestrickten Element, einem gezwirnten Element, einem Mehrkomponentenelement und einem geflochtenen Element.
11. Polster nach Anspruch 1 oder 8, wobei das hohle elastische Element aus der Gruppe ausgewählt ist, die aus Folgendem besteht: einem Polyurethan, einem Gummi, Lycra®, und Estane®.
12. Polster nach Anspruch 1 oder 8, wobei das hohle elastische Element aus Garnen ausgewählt ist, die einen Querschnitt mit unterschiedlichen geometrischen Konfigurationen aufweisen.
13. Polster nach Anspruch 12, wobei das hohle elastische Element (40; 140) aus der Gruppe ausgewählt ist, die aus Folgendem besteht: kreisförmig, nicht-kreisförmig, quadratisch, rechteckig, dreieckig, elliptisch, vieleckig, trapezförmig und gelappt.
14. Polster nach Anspruch 1 oder 8, wobei das hohle elastische Element (40; 140) ein oder mehrere Löcher aufweist, die längs dessen Längen- oder Axialrichtung verlaufen.

15. Polster nach Anspruch 14, wobei das eine oder die mehreren Löcher aus der Gruppe ausgewählt sind, die aus Folgendem besteht: kreisförmig, nichtkreisförmig, quadratisch, rechteckig, dreieckig, elliptisch, trapezförmig, vieleckig, und gelappt.

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16. Polster nach Anspruch 8, wobei die Struktur aufweist ein 2-8-Fach-Bindungsbild aufweist.

17. Polster nach Anspruch 1 oder 8, wobei die Struktur aufweist:

eine Laminatstruktur.

18. Polster nach Anspruch 17, wobei die Struktur aufweist:

zwei gewebte Schichten mit einer Schicht aus elastischen hohlen Elementen dazwischen.

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19. Polster nach Anspruch 17, wobei die Struktur aufweist:

ein Bindegarnsystem, das zwischen den Schichten des Laminats gewebt ist.

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20. Polster nach Anspruch 2 oder 19, wobei das Bindegarn und das hohle elastische Element (40; 140) in dieselbe Richtung gewebt sind.

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21. Polster nach Anspruch 20, wobei die Richtung des hohlen elastischen Elements und des Bindegarns die Kettrichtung ist, und sich das hohle elastische Element (40; 140) und das Bindegarn gegenseitig abwechseln.

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22. Polster nach Anspruch 6 oder 21, wobei die Schicht der hohlen elastischen Elemente (40; 140) sich innerhalb eines Doppelschichtaufbaus befindet.

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23. Polster nach Anspruch 9, wobei die Struktur aufweist die hohlen elastischen Elemente (40; 140), die aus einer größeren (größeren) Kette zusammengesetzt sind; und das Bindegarn, das aus einer kleineren Kette als jene des hohlen elastischen Elements zusammengesetzt ist.

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24. Polster nach Anspruch 8, wobei die Struktur aufweist:

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eine Webart mit vier Enden über der Schicht der hohlen elastischen Elemente (40; 140), die sich an jedem zweiten Rapport zu einem Zwei-Schicht-Binder ändert; und

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eine Webart mit vier Enden unter der Schicht der hohlen elastischen Elemente (40; 140), die sich an jedem zweiten Rapport zu einem Zwei-

Schicht-Binder ändert.

25. Polster nach Anspruch 1 oder 8, wobei das Polster in einem Produkt enthalten oder ein Produkt ist, das aus der Gruppe der Produkte ausgewählt ist, die umfassen:

Fußbekleidung; Schuhe; Sportschuhe; Stiefel; Fußbodenbelag; Teppiche; Teppichunterlagen; Sportböden; Automobilteile; Verbundstoffe; Blindböden; Turnhallenblindböden; Sportarena-Blindböden; Druckstücke; beschusshemmende Bekleidung; Körperpanzerung; Hurrikanfensterschutz; Polsterung; Sportausrüstungspolsterung; Baseballfänger-Brustschutz; Knie-/Ellbogen-Poster; Hüftpolster; Wandpolsterung; Schuheinlagen und orthopädische Einlagen; Absätze/Sohlen für Sportschuhe; eine Polsterschicht für Bettwaren und Fahrzeusitze.

26. Polster nach Anspruch 1 oder 8, wobei die Struktur ein Material aufweist, das es ermöglicht, dass eine Oberfläche austauschbar ist.

27. Polster nach Anspruch 26, wobei das Material ein Haken-Ösen-Garn ist.

28. Polster nach Anspruch 1 oder 8, wobei die Schichten der Struktur aufweisen:

eine Vielzahl von benachbarten Schichten, die die hohlen elastischen Elemente aufweisen.

29. Polster nach Anspruch 17, wobei das Laminat eine oder mehrere Garnanordnungen oder Grundgewebe aufweist, die an dem zusammendrückbaren nachgiebigen Polster befestigt sind.

30. Polster nach Anspruch 1 oder 8, das ferner eine Überzugsschicht auf einer oder beiden Oberflächen aufweist.

31. Polster nach Anspruch 30, wobei der Überzug die Struktur teilweise oder vollständig einkapselt oder imprägniert.

32. Polster nach Anspruch 30, wobei der Überzug ein netzförmiger oder nicht-netzförmiger Schaum sein kann.

33. Polster nach Anspruch 1 oder 8, wobei das Polster mit Fasern genadelt ist, um eine glatte Oberfläche herzustellen.

Revendications

1. Tampon élastique compressible (10; 35; 60), le tam-

pon comprenant une structure qui comporté :

- plusieurs fils longitudinaux parallèles,
plusieurs fils transversaux parallèles,
plusieurs éléments élastiques parallèles creux, 5
élastiques dans la direction de leur épaisseur,
dans la direction radiale ou dans la direction lon-
gitudinale ou axiale, de telle sorte que les élé-
ments élastiques creux s'étirent et se compriment pour que le tampon se comprime sous une
charge normale et reprenne sa forme initiale
après la suppression de la charge, **caractérisé**
en ce que
une première couche (12; 112; 212) de fils pa-
rallèles (20; 120) s'étend dans la direction lon-
gitudinale ou la direction transversale, 10
en ce qu'une deuxième couche (14; 116; 216)
d'éléments élastiques creux (40; 140) parallèles
située d'un côté de la première couche et les
éléments élastiques creux de la deuxième cou-
che s'étend dans la direction longitudinale ou
dans une direction transversale autre que celle
de la première couche,
en ce qu'une troisième couche (16; 122; 220)
de fils parallèles (30; 130) s'étendant dans la
même direction que celle de la première couche
(12; 112; 212) est située sur le côté de la deuxiè-
me couche (14; 116; 216) opposé à celui de la
première couche (12; 112; 212) et 15
en ce que les fils parallèles (30; 130) de la troi-
sième couche (16; 122; 220) sont alignés de tel-
le sorte que les fils parallèles (30; 130) de la
troisième couche (16; 122; 220) et se logent
dans les espaces créés entre les fils parallèles
(20; 120) de la première couche (12; 112; 212). 20
2. Tampon selon la revendication 1, dans lequel la
structure comprend un système de fils de liaison, les
fils de liaison (50; 150) reliant ensemble la première
couche (12; 112; 212), la deuxième couche (14; 116;
216) et la troisième couche (16; 122; 220). 25
3. Tampon selon la revendication 1, dans lequel le
nombre de fils (30; 130) de la troisième couche (16;
122; 220) est inférieur au nombre de fils (20; 120)
de la première couche (12; 112; 212). 30
4. Tampon selon la revendication 2, dans lequel les
éléments élastiques creux (40; 140) de la deuxième
couche sont perpendiculaires, forment un angle in-
férieur à 90 degrés ou un angle de 45 degrés par
rapport à ceux de la première et de la troisième cou-
che. 35
5. Tampon selon la revendication 1, dans lequel la
structure comprend une quatrième couche (18; 126)
d'éléments élastiques creux (40; 140) parallèles
dans la même direction que la deuxième couche et

une cinquième couche (22; 128) de fils parallèles
dans la même direction que la première couche, les
fils de la cinquième couche étant alignés dans une
direction traversant l'épaisseur dans le même plan
vertical que dans la première couche.

6. Tampon selon la revendication 2, dans lequel la di-
rection de l'élément élastique creux (40; 140) et du
fil de liaison (50; 150) est la direction transversale.
7. Tampon selon la revendication 6, dans lequel la
structure comprend les éléments élastiques creux
(40; 140) plus gros (plus grands) que les fils de
liaison (50; 150).
8. Tampon selon la revendication 1, dans lequel le tam-
pon comprend une structure comportant :

plusieurs fils de chaîne,
plusieurs fils de chute,
plusieurs éléments élastiques creux (40; 140),
un nombre quelconque de fils de chute, de fils
de chaîne et d'éléments élastiques creux (40;
140) étant entrelacés de manière à former une
structure tissée.
9. Tampon selon la revendication 8, dans lequel la
structure comprend en outre un système de fils de
liaison.
10. Tampon selon les revendications 1 ou 8, dans lequel
l'élément élastique creux est sélectionné dans l'en-
semble constitué d'un monofilament, d'un multifila-
ment, d'un monofilament ou multifilament stratifié,
d'un élément emballé, d'un élément tricoté, d'un élé-
ment torsadé, d'un élément à plusieurs composants
et d'un élément tressé.
11. Tampon selon les revendications 1 ou 8, dans lequel
l'élément élastique creux est sélectionné dans l'en-
semble constitué du polyuréthane, du caoutchouc,
du Lycra® et de l'Estane®.
12. Tampon selon les revendications 1 ou 8, dans lequel
l'élément élastique creux est sélectionné parmi des
fils présentant différentes configuration géométriques
de leur section transversale.
13. Tampon selon la revendication 12, dans lequel l'élé-
ment élastique creux (40; 140) est sélectionné dans
l'ensemble constitué des sections transversales cir-
culaires, non circulaires, carrées, rectangulaires,
triangulaires, elliptiques, polygonales, trapézoïdales
et lobées.
14. Tampon selon la revendication 1 ou 8, dans lequel
l'élément élastique creux (40; 140) présente un ou
plusieurs trous qui s'étendent dans la direction de

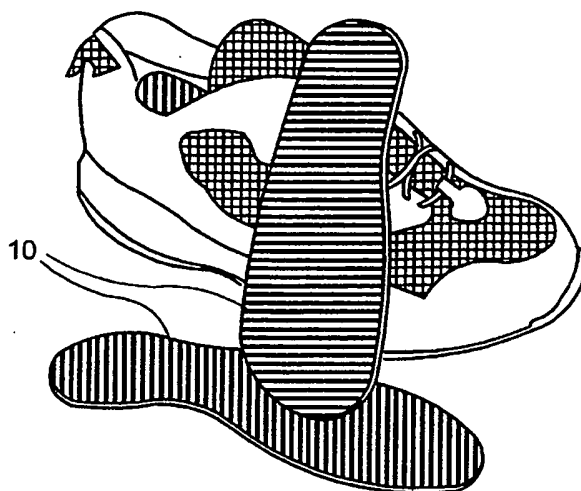
sa longueur ou la direction axiale.

15. Tampon selon la revendication 14, dans lequel le ou les trous sont sélectionnés dans l'ensemble constitué des trous circulaires, non circulaires, carrés, rectangulaires, triangulaires, elliptiques, trapézoïdales, polygonales et lobées. 5
16. Tampon selon la revendication 8, dans lequel la structure comprend un motif de tissage à 2-8 fous. 10
17. Tampon selon les revendications 1 ou 8, dans lequel la structure comprend une structure stratifiée.
18. Tampon selon la revendication 17, dans lequel la structure comprend les deux couches tissées entre lesquelles est placée une couche d'éléments élastiques creux. 15
19. Tampon selon la revendication 17, dans lequel la structure comprend un système de fils de liaison tissés entre les couches de stratifié. 20
20. Tampon selon les revendications 2 ou 19, dans lequel le fil de liaison et l'élément élastique creux (40; 140) sont tissés dans la même direction. 25
21. Tampon selon la revendication 20, dans lequel la direction de l'élément élastique creux et du fil de liaison est la direction de chaîne, l'élément élastique creux (40; 140) et le fil de liaison alternant l'un avec l'autre. 30
22. Tampon selon les revendications 6 ou 21, dans lequel la couche d'éléments élastiques creux (40; 140) est située à l'intérieur d'une structure en double couche. 35
23. Tampon selon la revendication 9, dans lequel la structure comprend des éléments élastiques creux (40; 140) constitués d'un fil de chaîne plus gros (plus grand) et les fils de liaison composés de fils de chaîne plus petits que ceux de l'élément élastique creux. 40
24. Tampon selon la revendication 8, dans lequel la structure comprend quatre extrémités tissées au-dessus de la couche d'éléments élastiques creux (40; 140) et passant à une liaison en deux couches toutes les deux répétitions et quatre extrémités tissées en dessous de la couche d'éléments élastiques creux (40; 140) et passant à une liaison en deux couches toutes les deux répétitions. 45
25. Tampon selon les revendications 1 ou 8, dans lequel le tampon est inclus dans un produit ou est un produit sélectionné dans l'ensemble de produits comprenant : 55

les chaussures, les souliers, les chaussures d'athlétisme, les bottines, les revêtements de sol, les tapis, les carpettes, les sols de sports, les pièces d'automobiles, les matériaux composites, les sous-planchers, les sous-planchers de gymnases, les sous-planchers d'arènes de sports, les tampons d'impression, les vêtements antibalistique, les armures corporelles, les protections de fenêtres contre les ouragans, les tampons, les tampons pour équipement de sports, les éléments de protection de la poitrine des joueurs de baseball, les tampons de genoux ou de coudes, les tampons de hanches, le tamponnage de parois, les inserts et/ou éléments orthopédiques de chaussures, les talons/semelles pour chaussures d'athlétisme, les couches d'amortissement de literie et les sièges de véhicules.

26. Tampon selon les revendications 1 ou 8, dans lequel la structure comprend un matériau qui permet de remplacer une surface.
27. Tampon selon la revendication 26, dans lequel le matériau est un fil à boucles et crochets.
28. Tampon selon les revendications 1 ou 8, dans lequel les couches de la structure comprennent plusieurs couches jointives comprenant les éléments élastiques creux.
29. Tampon selon la revendication 17, dans lequel ledit stratifié comprend une ou plusieurs nappes de fils ou de tissu de base fixés audit tampon élastique compressible.
30. Tampon selon les revendications 1 ou 8, comprenant en outre une couche de revêtement sur une face ou les deux faces.
31. Tampon selon la revendication 30, dans lequel le revêtement encapsule partiellement ou complètement la structure ou l'imprègne.
32. Tampon selon la revendication 30, dans lequel le revêtement comprend une mousse réticulée ou non réticulée.
33. Tampon selon les revendications 1 ou 8, le tampon étant aiguilleté avec des fibres pour produire une surface lisse.

FIG. 1



10

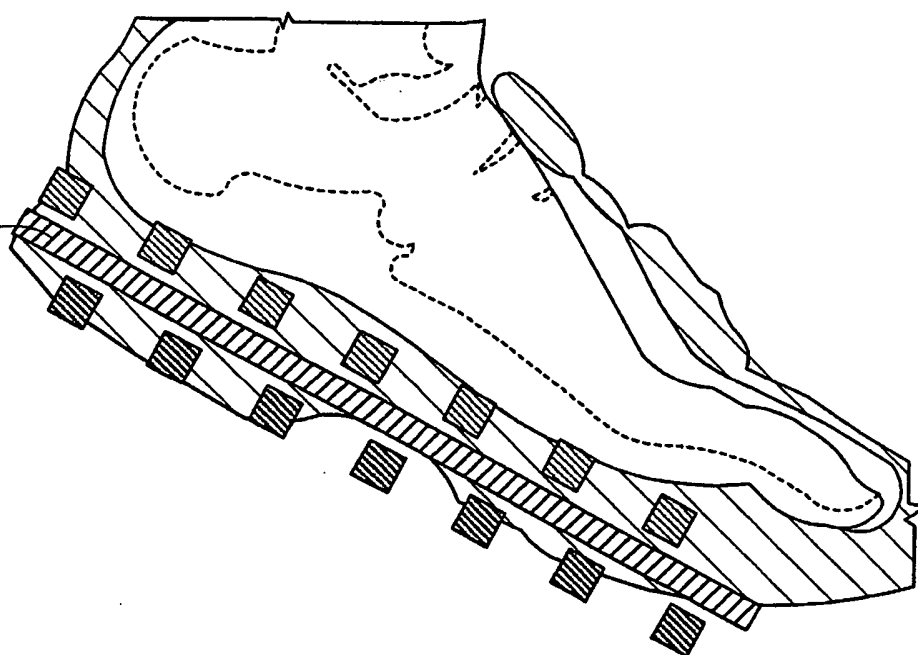


FIG. 2

10 →

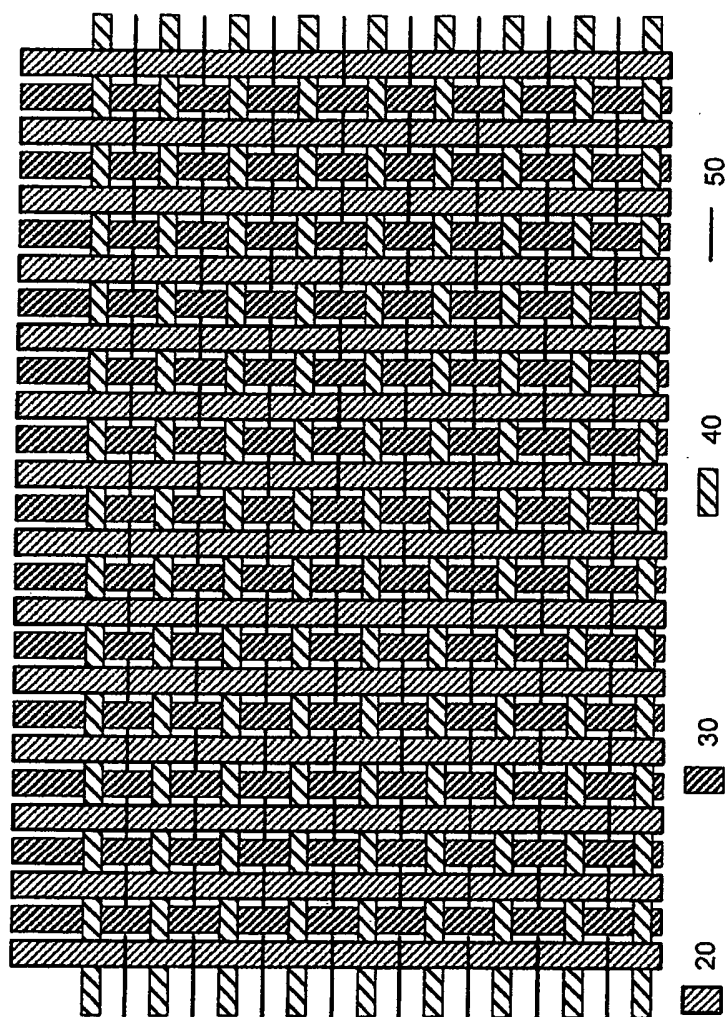
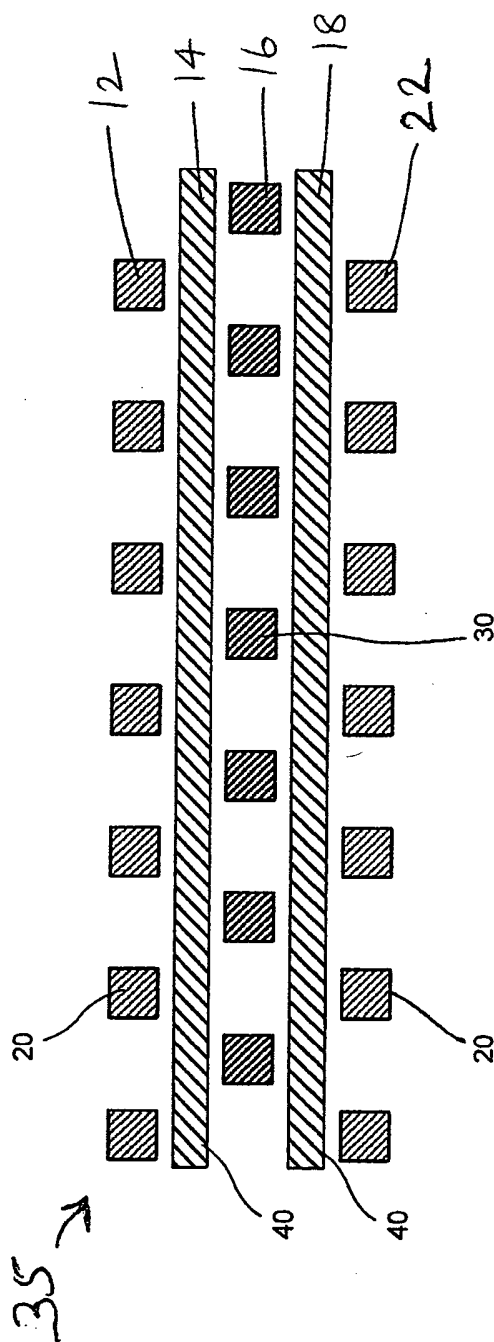
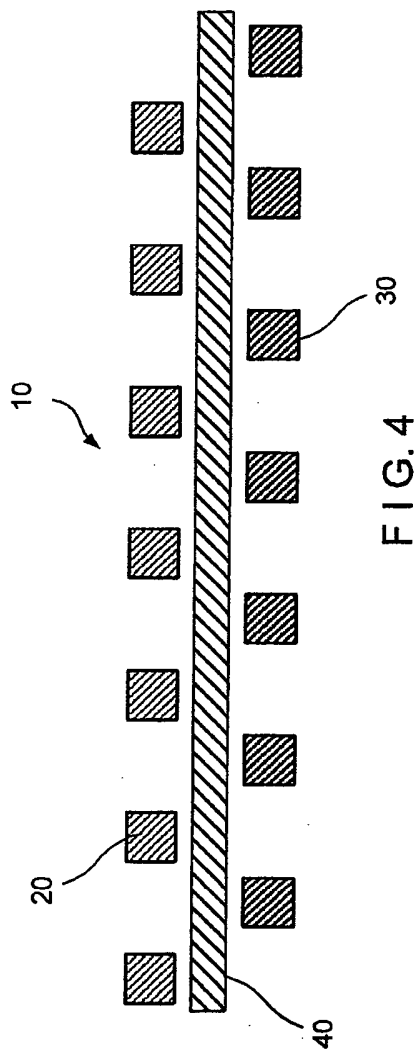


FIG. 3



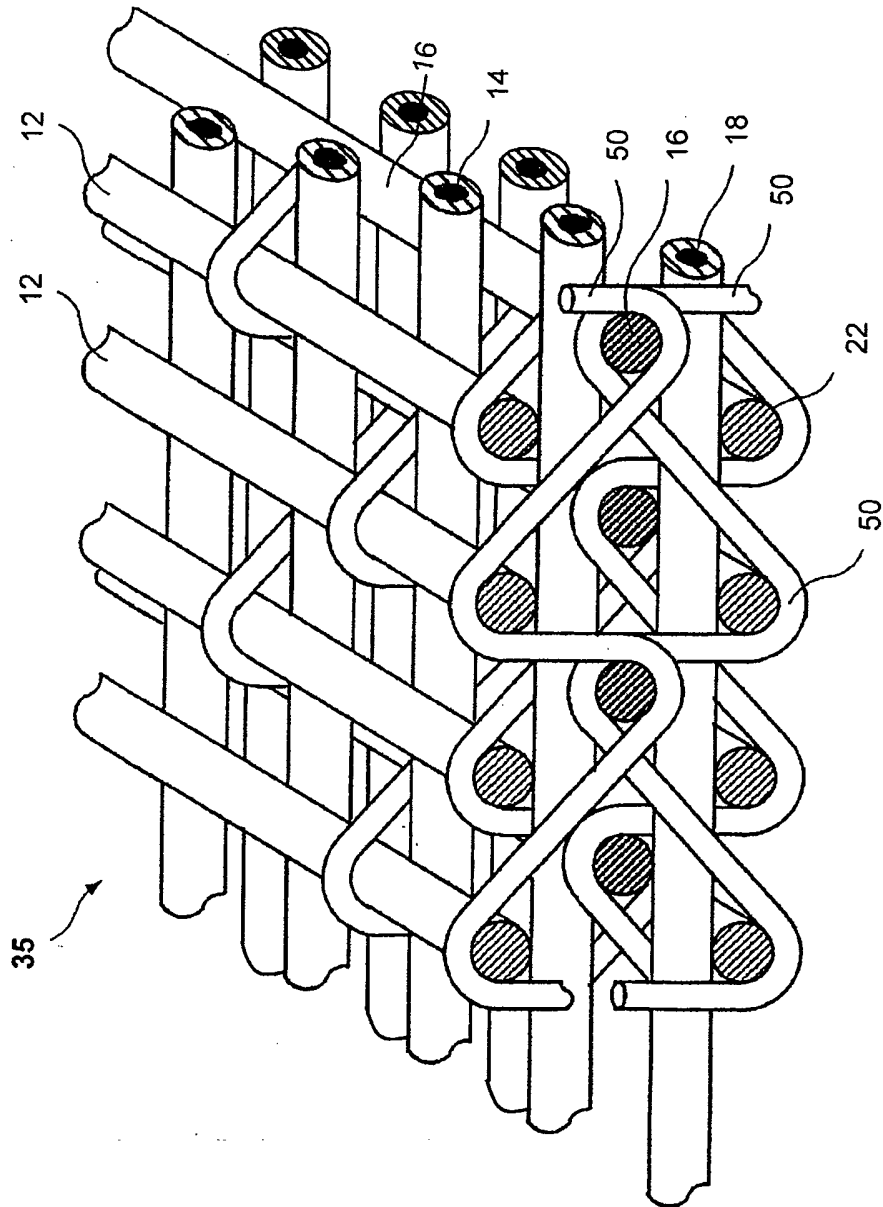
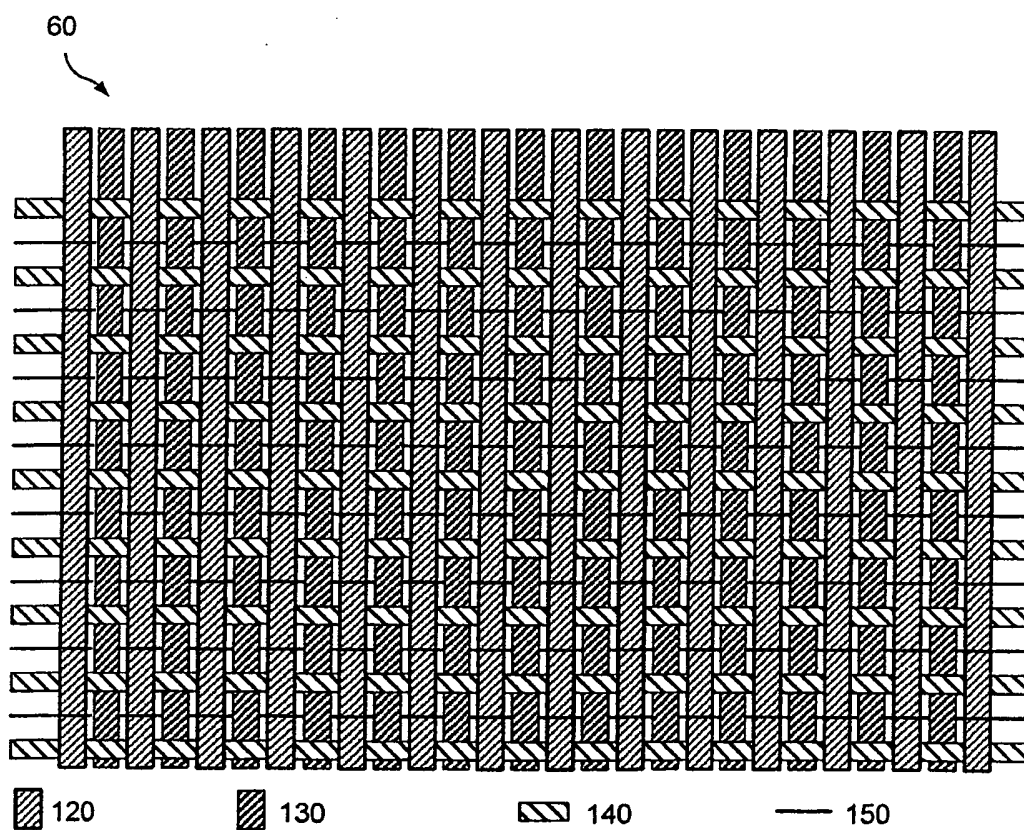
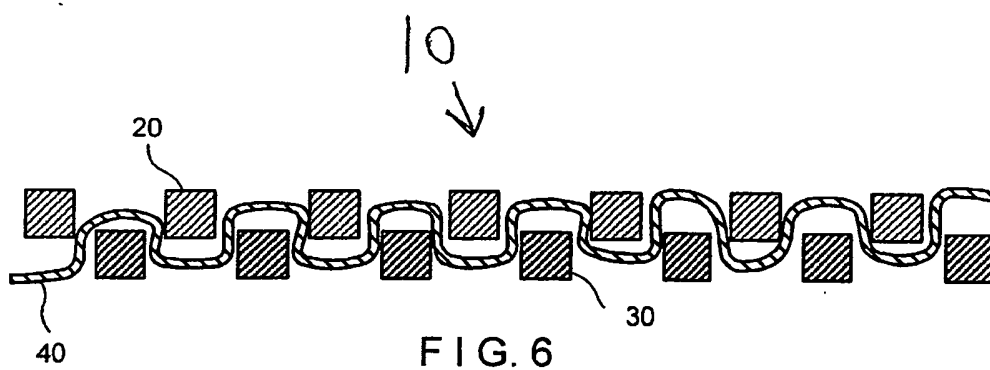


FIG. 5B



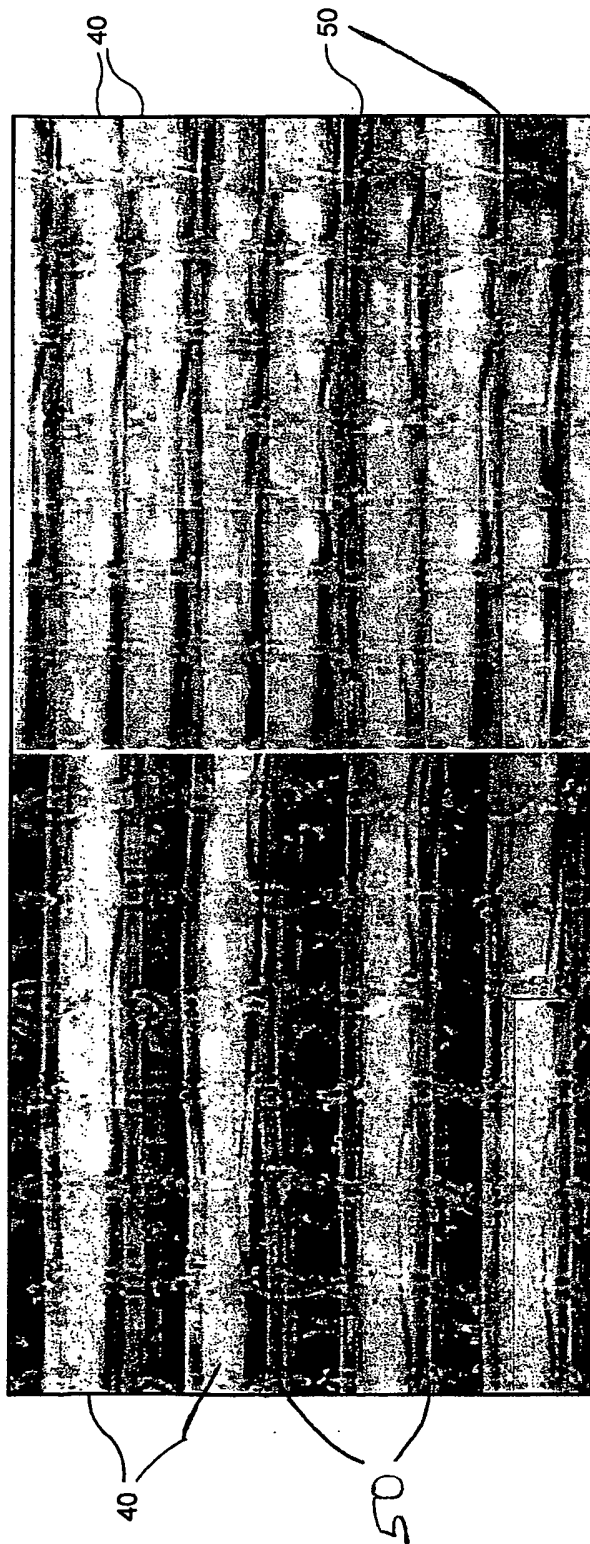


FIG. 8



FIG. 9



FIG. 10A

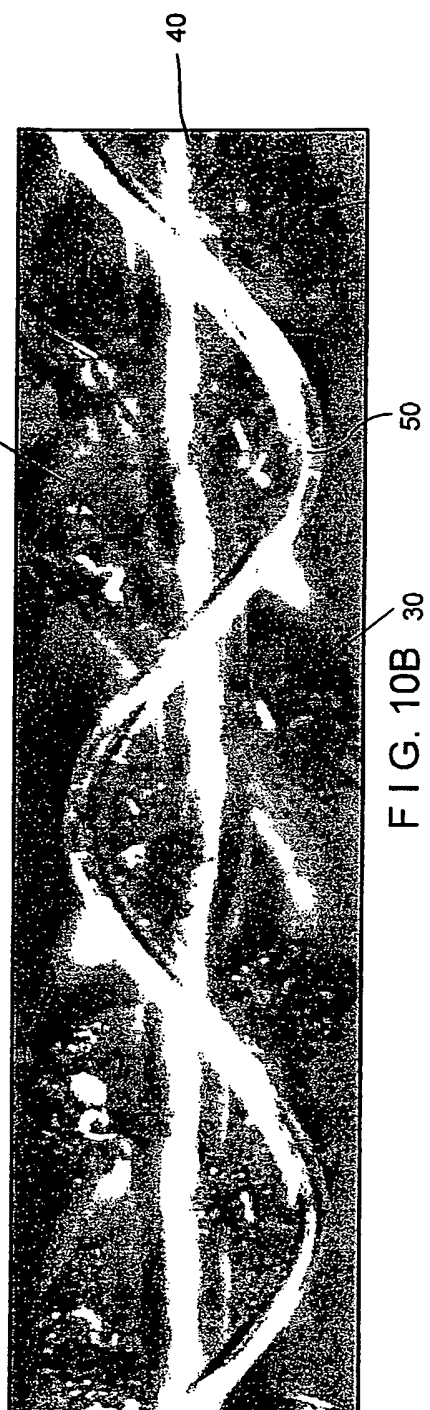


FIG. 10B

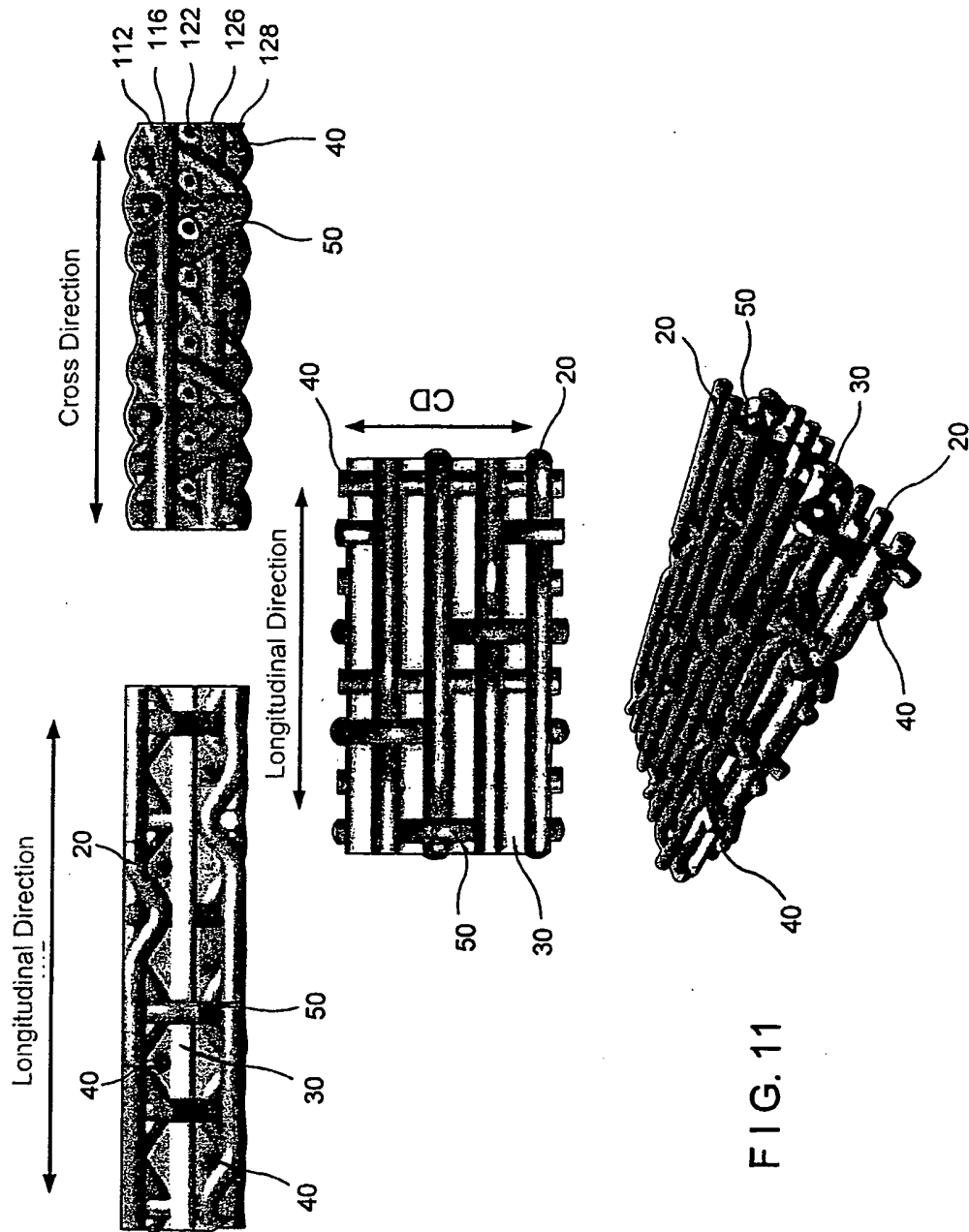


FIG. 11

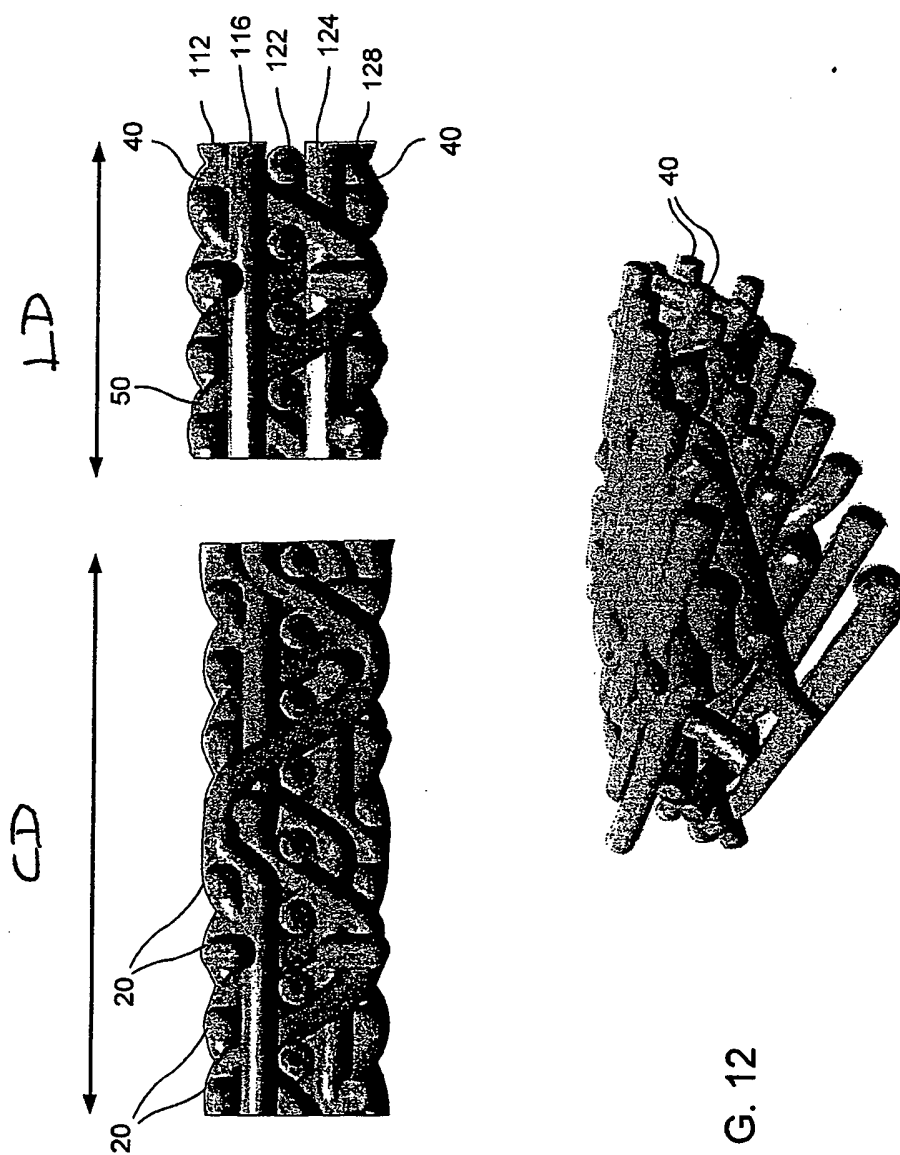
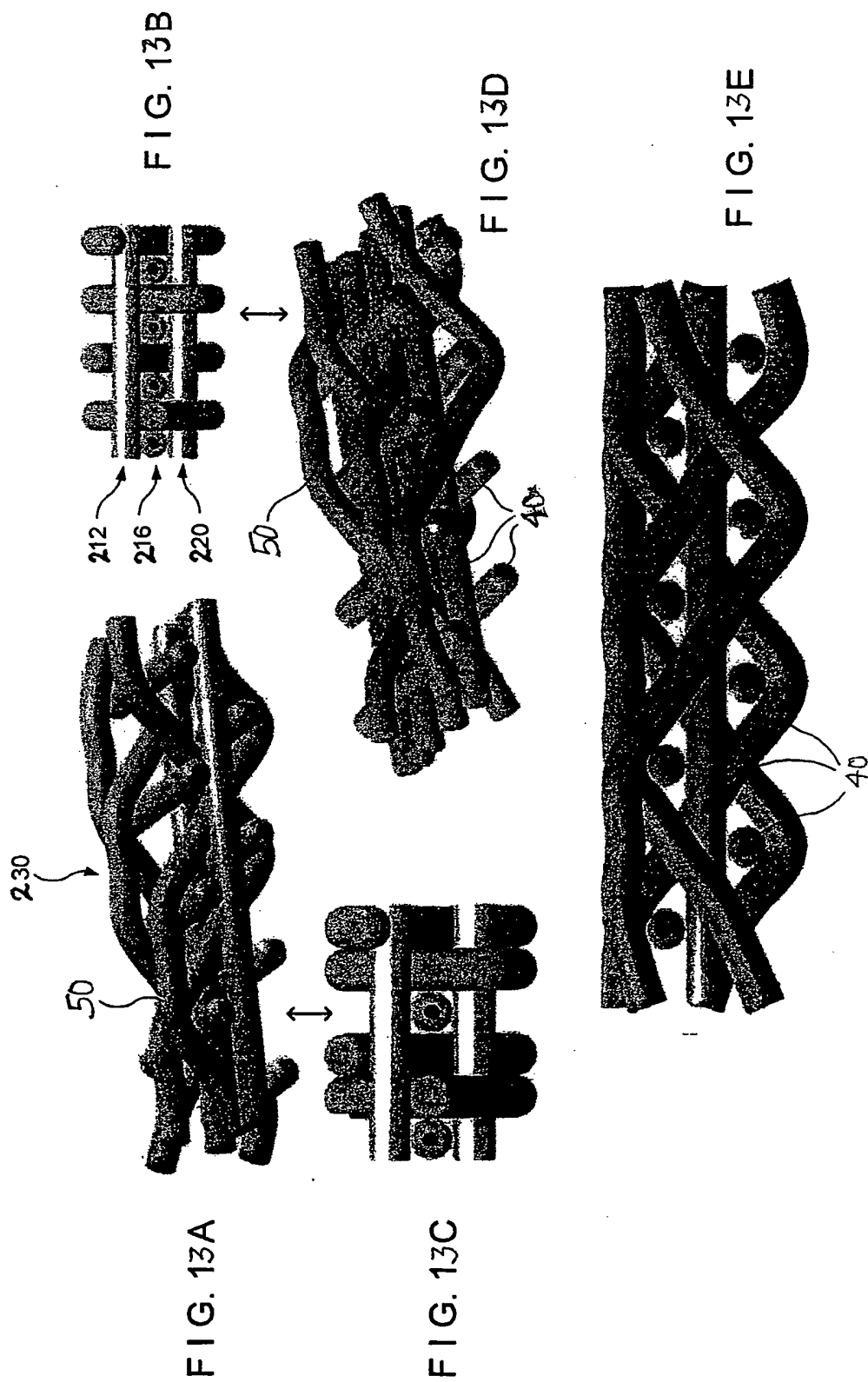


FIG. 12



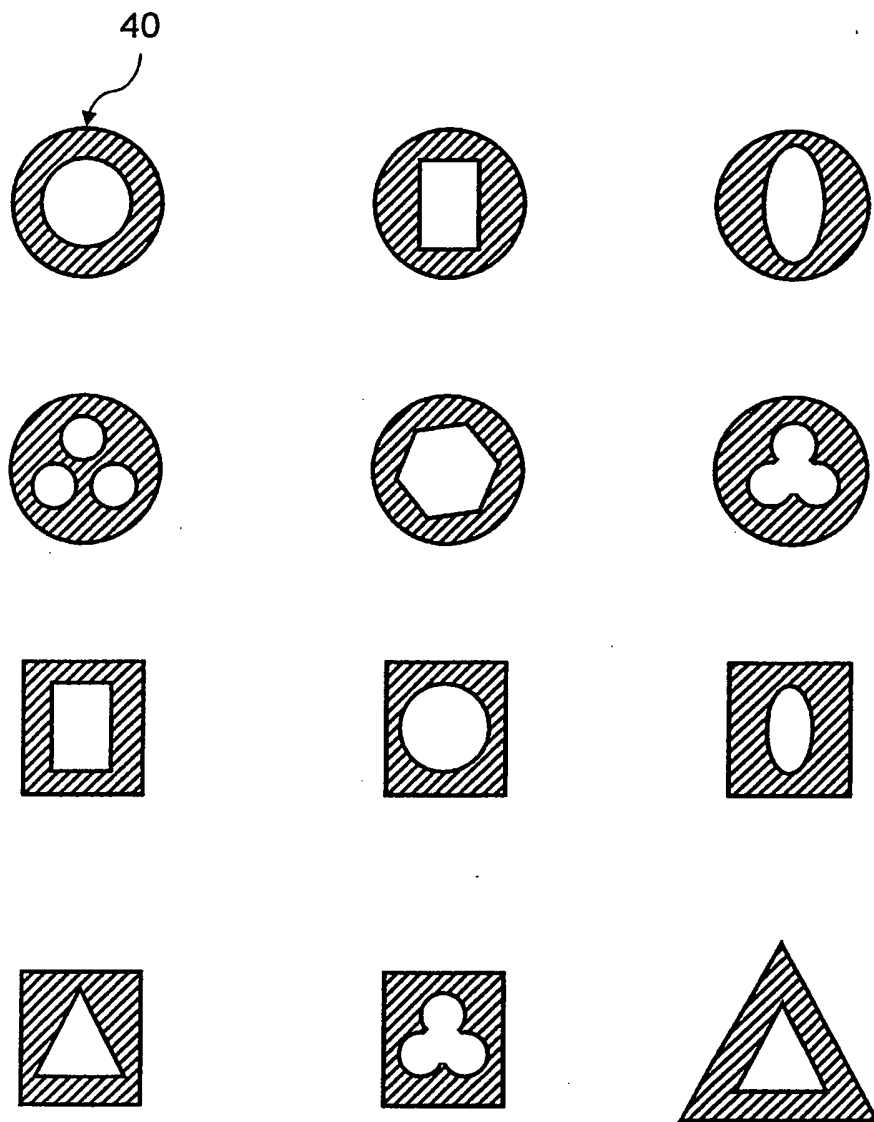


FIG. 14

REFERENCES CITED IN THE DESCRIPTION

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ULTRARUGALMAS PÁRNÁZAT

Szabadalmi igénypontok

1. Összenyomható rugalmas párnázat (10; 35; 60), ahol a párnázat olyan szerkezetet foglal magában, amely tartalmaz

- 5 párhuzamos hosszirányú fonalakat;
 párhuzamos keresztirányú fonalakat;
 párhuzamos üreges elasztikus tagokat, melyek vastagságirányukban vagy radiális irányban és hosszirányukban vagy tengelyirányban olyan módon elasztikusak, hogy az üreges elasztikus tagok úgy nyúlnak meg és nyomódnak össze, hogy a párnázat merőleges terhelés hatására összenyomódik és a terhelés megszűntét követően visszaugrik,

10 **azzal jellemezve, hogy**

a hosszirányban vagy a keresztirányban futó párhuzamos fonalak (20; 120) első rétegét (12; 112; 212) tartalmazza;

15 az első réteg egyik oldalán a párhuzamos üreges elasztikus tagok (40; 140) második rétege (14; 116; 216) van, a második réteg üreges elasztikus tagjai az első réteg hosszirányától vagy keresztirányától különböző hosszirányban vagy keresztirányban futnak; és

a második rétegnek (14; 116; 216) az első réteggel (12; 112; 212) átellenes oldalán a párhuzamos fonalak (30; 130) harmadik rétege (16; 122; 220) van, melynek fonalai az első réteg (12; 112; 212) fonalaival azonos irányban futnak;

20 ahol a harmadik réteg (16; 122; 220) párhuzamos fonalai (30; 130) az első réteg (12; 112; 212) párhuzamos fonalai (20; 120) közötti térközökben elhelyezkedően vannak elrendezve.

2. Az 1. igénypont szerinti párnázat, ahol a szerkezet tartalmaz

összekötőfonal-rendszert, ahol az összekötőfonalak (50; 150) az első (12; 112; 212), a második (14; 116; 216) és a harmadik réteget (16; 122; 220) kapcsolják össze.

25 3. Az 1. igénypont szerinti párnázat, ahol harmadik rétegben (16; 122; 220) lévő fonalak (30; 130) száma kisebb, mint az első rétegben (12; 112; 212) lévő fonalak (20; 120) száma.

4. A 2. igénypont szerinti párnázat, ahol a második réteg üreges elasztikus tagjai (40; 140) az első és harmadik réteg elasztikus tagjaira ortogonálisak, azokkal 90° -nál kisebb szöget vagy 45° -os szöget zárnak be.

5. Az 1. igénypont szerinti párnázat, ahol a szerkezet tartalmazza

30 párhuzamos üreges rugalmas tagok (40; 140) negyedik rétegét (18; 126) a második réteggel azonos irányban; és

párhuzamos fonalak ötödik rétegét (22; 140) az első réteggel azonos irányban, ahol az ötödik réteg fonalai az első réteg fonalaival megegyező függőleges síkba vannak vastagságirányban elrendezve.

6. A 2. igénypont szerinti párnázat, ahol az üreges elasztikus tag (40; 140) és az összekötőfonal (50; 150) iránya a keresztiránynak felel meg.

7. A 6. igénypont szerinti párnázat, ahol a szerkezet magában foglalja az összekötőfonalaknál (50; 150) vastagabb (nagyobb) üreges elasztikus tagokat (40; 140).

8. Az 1. igénypont szerinti párnázat, ahol a párnázat olyan szerkezetet foglal magában, amely tartalmaz:
láncfonalakat;
vetülékfonalakat;
üreges elasztikus tagokat (40; 140);
5 melyben szövött szerkezet képzéséhez tetszőleges számú vetülékfonal, láncfonal és üreges elasztikus tag (40; 140) egybe van szőve.
9. A 8. igénypont szerinti párnázat, ahol a szerkezet tartalmaz továbbá összekötőfonal-rendszert.
10. Az 1. vagy a 8. igénypont szerinti párnázat, ahol az üreges elasztikus tag a monofil szál, multifil szál, cernézott monofil vagy multifil szál, hurkolt tag, kötött tag, sodrott tag, többkomponensű tag és fonott tag alkotta csoportból van választva.
11. Az 1. vagy a 8. igénypont szerinti párnázat, ahol az üreges elasztikus tag a poliuretán, gumi, Lycra® és Estane® alkotta csoportból van választva.
12. Az 1. vagy a 8. igénypont szerinti párnázat, ahol az üreges elasztikus tag különböző geometriai kialakítású keresztmetszettel rendelkező fonalak közül van választva.
- 15 13. A 12. igénypont szerinti párnázat, ahol az üreges elasztikus tag (40; 140) alakja a kör, körtől eltérő, négyzet, téglalap, háromszög, ellipszis, sokszög, trapéz és karéjos („lobate”) alakok alkotta csoportból van választva.
14. Az 1. vagy a 8. igénypont szerinti párnázat, ahol az üreges elasztikus tag (40; 140) hossziránya vagy tengelyiránya mentén futó legalább egy üreggel rendelkezik.
15. A 14. igénypont szerinti párnázat, ahol a legalább egy üreg alakja a kör, körtől eltérő, négyzet, téglalap, háromszög, ellipszis, trapéz, sokszög és karéjos alakok alkotta csoportból van választva.
- 20 16. A 8. igénypont szerinti párnázat, ahol a szerkezet mintaelemében láncfonalanként 2-8 kötésponthoz van.
17. Az 1. vagy a 8. igénypont szerinti párnázat, ahol a szerkezet laminált szerkezetet tartalmaz.
18. A 17. igénypont szerinti párnázat, ahol a szerkezet két szövött réteget és üreges elasztikus tagok képezte közöttük elhelyezett réteget tartalmaz.
- 25 19. A 17. igénypont szerinti párnázat, ahol a szerkezetnek a laminátum rétegei közé beszórt összekötőfonal-rendszere van.
20. A 2. vagy a 19. igénypont szerinti párnázat, ahol az összekötőfonal és az üreges elasztikus tag (40; 140) azonos irányban vannak szőve.
21. A 20. igénypont szerinti párnázat, ahol az üreges elasztikus tag és az összekötőfonal iránya a lánciránnyal
30 egyezik meg, továbbá az üreges elasztikus tag (40; 140) és az összekötőfonal váltakozón vannak elrendezve.
22. A 6. vagy a 21. igénypont szerinti párnázat, ahol az üreges elasztikus tagok (40; 140) rétege kétrétegű szerkezet belsejében van.
23. A 9. igénypont szerinti párnázat, ahol a szerkezet magában foglalja
a vastagabb (nagyobb) láncfonal képezte üreges elasztikus tagokat (40; 140); és
35 az üreges elasztikus tagot képező láncfonalnál vékonyabb láncfonal képezte összekötőfonalat.

24. A 8. igénypont szerinti párnázat, ahol a szerkezet tartalmaz

négy láncfonalat az üreges elasztikus tagok (40; 140) rétege fölé szőve, melyek minden második ismétlődésnél kétrétegű összekötőbe mennek át;

négy láncfonalat az üreges elasztikus tagok (40; 140) rétege alá szőve, melyek minden második ismétlődéskor kétrétegű összekötőbe mennek át.

25. Az 1. vagy a 8. igénypont szerinti párnázat, ahol a párnázat a lábbelik; cipők; edzőcipők; bakancsok; padlók; szőnyegek; szőnyeglapok; sportpadlók; gépjárműalkatrészek; kompozitok; padlóalapok; tornatermi padlóalapok; sportcsarnoki padlóalapok; nyomótagok; ballisztikai ruházat; testpáncél; ablakhoz való hurrikán elleni védőelemek; kipárnázás; sportfelszerelésben alkalmazott kipárnázás; baseball elkapójátékosok által használt mellkasvédők; térd- és könyökvédők; csípővédők; fali védőpárnázás; cipőbetétek és ortézisok; edzőcipőkhöz való sarkak/talpak; fekhelyekhez való párnázóréteg, valamint a járműülések alkotó csoportból választott termékben van benne vagy magát a terméket, illetve annak részét képezi.

26. Az 1. vagy a 8. igénypont szerinti párnázat, ahol a szerkezet felület cserélhetőségét biztosító anyagot tartalmaz.

27. A 26. igénypont szerinti párnázat, ahol az anyagot horgos hurokképző láncfonal képezi.

28. Az 1. vagy a 8. igénypont szerinti párnázat, ahol a szerkezet rétegei üreges elasztikus tagokat tartalmazó szomszédos rétegeket tartalmaznak.

29. A 17. igénypont szerinti párnázat, ahol a laminátum az összenyomható rugalmas párnázathoz kapcsolt legalább egy fonalelrendezést vagy alapkezelést tartalmaz.

30. Az 1. vagy a 8. igénypont szerinti párnázat, melynek egyik vagy mindkét felületén bevonat van.

31. A 30. igénypont szerinti párnázat, ahol a szerkezet a bevonattal részben vagy teljes egészében körül van véve vagy impregnálva van.

32. A 30. igénypont szerinti párnázat, ahol a bevonatot retikulált vagy nem-retikulált hab képezi.

33. Az 1. vagy a 8. igénypont szerinti párnázat, ahol egy sima felület képzéséhez a párnázat szálakkal tűzdelt.