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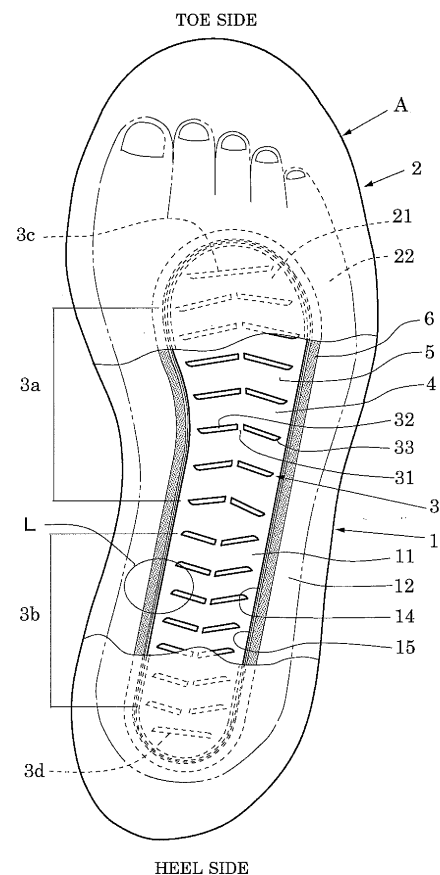
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(54) **FOOTWEAR OUTSOLE MEMBER**

(57) A shoe midsole is composed of a base plate (1), a cover (2), a plurality of blades (3), and liquid (4). The blades (3) are formed in such a manner as to rise within a first region (11) of the base plate (1). The blades (3) are each composed of a plurality of flat-shaped blade elements (32, 33) separated each other by slits (31), and are tilted toward the toe side or the heel side. The flat-shaped blade elements (32, 33) are disposed in such a manner as to be divergent toward the toe side or the heel side. The base plate (1) and the cover (2) are joined together, thereby forming a closed space (5), and the liquid (4) is sealed in the closed space.

FIG. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to a sole member of footwear, and more particularly to a sole member of footwear which absorbs impact during walking while providing feeling of stable, comfortable walking, exhibits a massaging effect through stimulation of the foot sole, and can prevent leakage of liquid sealed therein.

BACKGROUND ART

[0002] When the heel touches down on the ground, impact force imposed on the heel is said to be about 1.25 times the body weight during walking and about three times during jogging. The impact is transmitted to the heel, the ankle, the knee, and then the waist and imposes loads on these regions. Also, it has been known that, as compared with impact applied when the heel touches down on the ground, impact applied when the toes kick the ground is greater.

[0003] Thus, the inventors of the present invention have proposed a shoe insole which disperses and absorbs impact applied to the foot sole when the foot sole lands on the ground during walking and which can exhibit a massaging effect through stimulation of the foot sole (refer to, for example, Patent Document 1).

[0004] Referring to FIG. 17, the configuration of a shoe midsole A described in Patent Document 1 mentioned above is explained. The shoe midsole A described in Patent Document 1 includes a base plate 1 similar in shape to a shoe sole, and a cover 2. Thermoplastic resin is used to form the base plate 1 and the cover 2. The base plate 1 has a first concave portion 11 equivalent to the shape of that portion of the foot sole which comes into contact with the ground, and the cover 2 has a second concave portion 21 which faces the first concave portion.

[0005] The base plate 1 has a plurality of blades 3 formed in the first concave portion 11 in an integrally rising manner. The plurality of blades 3 are disposed substantially orthogonally to the longitudinal direction of the base plate 1 at predetermined intervals and are tilted toward the heel side or the toe side. The base plate 1 has a partition 15 integrally rising therefrom between an inner peripheral wall 14 of the first concave portion 11 of the base plate 1 and the laterally opposite ends of the blades 3.

[0006] As viewed from the heel toward the toes in a direction parallel to the base plate 1, each of the blades 3 has a substantially trapezoidal shape such that its both outer ends are inclined downward, and has two grooves 31 at laterally intermediate positions for allowing movement of liquid 4.

[0007] The base plate 1 and the cover 2 are welded together at a joint 6 which surrounds the outer peripheries of the first and second recesses 11 and 21, and the liquid 4 such as water or propylene glycol is sealed in a closed

space 5 sandwiched between the first concave portion and the second concave portion.

[0008] Next, the function of the shoe midsole A mentioned above will be described. In walking, first, the heel of the foot touches down on the ground. Next, the ground contact area expands toward the outside of the arch; then, the body weight moves to the rounded parts (balls) at the roots of the toes. Upon completion of imposition of the body weight on the balls, the toes spread to right and left so as to restrain shaking right and left and back and forth. Next, while the center of gravity is being moved forward, the foot sole begins to bend at the balls; the heel lifts; and then the entire toes kick the ground.

[0009] In a sequence of walking actions mentioned above, for example, when the heel touches down on the ground, a pressing force derived from the body weight is concentrically applied to that portion of the insole A which is in contact with the heel, and, according to Pascal's principle, the pressing force is equally transmitted to every inner surface of the closed space 5 through the liquid 4 which is sealed in the closed space 5 sandwiched between the first concave portion 11 and the second concave portion 21.

[0010] Meanwhile, when, for example, the heel comes into contact with the closed space 5 in which the liquid 4 is sealed, the contact portion moves downward and presses the liquid 4 at the contact position. Since the liquid 4 such as water or propylene glycol is noncompressible, the liquid 4 does not contract. Therefore, a portion of the liquid 4 corresponding to, for example, the heel contact portion attempts to move to a different location where the pressing force does not act.

[0011] However, in order for such a pressed portion of the liquid 4 to move to a different location where the pressing force does not act, the closed space 5 must be deformed or expanded. In order for the closed space 5 to be deformed or expanded, the sheet-like first and second concave portions 11 and 21 which constitute the closed space must be stretched or deformed; to that end, the pressure of the liquid 4 must be increased.

[0012] That is, when the pressed portion of the liquid 4 moves to a different location where the pressing force does not act, the liquid 4 in the closed space 5 increases in pressure, and the pressed midsole portion receives a reaction force derived from the increased pressure of the liquid 4. Therefore, when, for example, the heel touches down on the ground, the reaction force of the liquid 4 can absorb impact applied to the heel.

[0013] Meanwhile, in the case where the midsole A does not have the blades 3, when, for example, the heel touches down on the ground, since the sealed-in liquid 4 easily moves in every direction within the closed space 5, that portion of the cover 2 which is pressed by the heel easily touches the base plate 1; therefore, impact force derived from the heel's touch down on the ground is hardly mitigated. Also, if the sealed-in liquid 4 easily moves in every direction within the closed space 5, force with which the midsole A supports the foot sole becomes un-

stable, resulting in poor foot comfort.

[0014] In the case where the midsole A has the plurality of blades 3, when, for example, the heel touches down on the ground, the plurality of blades hinder movement of the sealed-in liquid 4. When movement of the liquid 4 is hindered, resistance force is generated against depression of that portion of the cover 2 which is pressed by the heel; accordingly, that portion becomes unlikely to touch the base plate 1, whereby impact force derived from the heel's touch down on the ground can be mitigated.

[0015] Meanwhile, the plurality of blades 3 are tilted toward the heel side or the toe side. In the case where the plurality of blades 3 are tilted toward the heel side, when the heel touches down on the ground, the liquid 4 corresponding to that portion of the midsole A which is pressed by the heel attempts to move toward the toe side within the closed space 5. However, since the blades 3 are tilted in a direction opposite to the moving direction of the liquid 4 directed toward the toe side; i.e., since the blades 3 are tilted toward the heel side, resistance force which hinders the movement of the liquid is enhanced; therefore, impact force derived from the heel's touches down on the ground can be mitigated more effectively.

[0016] In the case where the plurality of blades 3 are tilted toward the toe side, impact force derived from the toes' kick the ground can be mitigated more effectively. Furthermore, in the case where some blades 3 are tilted toward the heel side, and the other blades 3 are tilted toward the toe side, impact forces derived from the heel's and the toes' landings, respectively, on the ground can be mitigated more effectively.

[0017] In addition to the above, the plurality of blades 3 are formed in such a manner as to rise from the base plate 1 and are, as mentioned above, tilted toward the heel side or the toe side. Therefore, when the midsole A is pressed by, for example, the heel, repulsive force is generated from elastic force of the blades 3. Thus, by virtue of repulsive force of the blades 3 in addition to the above-mentioned function of the liquid 4, stronger resistance force is exhibited against depression of the pressed portion of the cover 2.

[0018] Thus, when the midsole A is pressed by, for example, the heel, the cover 2 becomes unlikely to touch the base plate 1, whereby impact force derived from the heel's touch down on the ground can be mitigated further effectively. Also, force to support the foot sole becomes stable, thereby providing good foot comfort.

[0019] Furthermore, in walking, the ridges of the blades 3 sequentially stimulate the foot sole through the cover 2, thereby exhibiting the effect of massaging the foot sole. In the case where the liquid 4 is not sealed in, force with which the ridges of the blades 3 come into contact with the foot sole through the cover 2 becomes strong and excessively stimulates the foot sole, potentially causing pain.

[0020] However, in the case where the liquid 4 is sealed in, resistance force of the liquid appropriately restrains

force generated at the contact portions where the tips of the blades 3 hit the foot sole through the cover 2, thereby yielding a comfortable massaging effect.

[0021] As explained above, during walking, the shoe midsole A described in Patent Document 1 disperses and absorbs impact force applied to the foot sole when the foot sole lands on the ground, and exhibits excellent massaging effect through stimulation of the foot sole, by means of the liquid 4 sealed in the midsole, and the plurality of tilted blades 3 which rise from the bottom plate 1.

[0022] However, in a sequence of walking or jogging actions, when the heel, the outside region of the arch, the balls, and the toes touch down on the ground, a large pressing force is repeatedly applied to the midsole A mentioned above. When a portion of the midsole A is pressed, the liquid 4 corresponding to that portion of the midsole A is also pressed, and the pressing force causes an abrupt increase in pressure of the sealed-in liquid 4. Furthermore, the pressed portion of the liquid 4 quickly moves to a different location where the pressing force does not act, thereby generating impact force.

[0023] That is, in walking or the like, in addition to tensile stress, compressive stress, shearing stress, or bending stress, an abruptly built high pressure of the liquid 4 and impact force induced by quick movement of the liquid are repeatedly generated in the base plate 1 and the cover 2 of the midsole A. Thus, the base plate 1 and the cover 2 have been required to take means to prevent outward leakage of the liquid 4. Particularly, prevention of leakage of the liquid 4 from the joint 6 between the base plate 1 and the cover 2 has been required.

[0024] Thus, the inventors of the present invention have proposed the following means to prevent leakage of the sealed-in liquid 4 in the shoe midsole A.

[0025] An increase has been given to the thickness of the joint portion 6 located at the outer peripheries of the first concave portion 11 of the base plate 1 and the second concave portion 21 of the cover 2 where the base plate 1 and the cover 2 are joined together (see Patent Documents 1 and 2). This is for increasing the strength of the joint 6.

[0026] Also, the width of the joint portion 6 has been rendered uniform along the entire periphery of the joint portion 6 (refer to Patent Documents 1 and 3). This is for rendering the joining strength per unit area of the joint portion 6 uniform along the entire periphery of the joint portion 6, so as to avoid emergence of a portion of weakened joining strength.

[0027] Furthermore, the partition 15 integrally rising from the base plate 1 has been formed between the inner peripheral wall 14 of the first concave portion 11 of the base plate 1 and the both lateral ends of the blades 3, along the entire periphery of the inner peripheral wall 14 (see Patent Document 1). This is for avoiding direct impact against the joint portion 6 which is generated by the liquid 4 that moves quickly as a result of the midsole A being pressed, so as to render leakage of the liquid 4 unlikely to arise.

Patent Document 1: International Publication WO2010/023793

Patent Document 2: Japanese Patent Application Laid-Open (kokai) No. H06-14805

Patent Document 3: Japanese Patent Application Laid-Open (kokai) No. 2000-236908

DISCLOSURE OF THE INVENTION

[0028] However, despite of employment of the above-mentioned means for preventing leakage of liquid, leakage of liquid from the joint between the base plate and the cover has occurred. Thus, it has become clear that, in order to prevent outward leakage of the sealed-in liquid, further improvement is required.

[0029] The inventors of the present invention carried out extensive studies and found that reducing impact force against the joint by restraining rapid movement of the liquid, and restraining increase in pressure locally generated by hindering the liquid flow are effective for prevention of outward leakage of sealed-in liquid; on the basis of the finding, the inventors accomplished the present invention.

[0030] A sole member of footwear according to the present invention comprises a base plate, a cover, a plurality of blades, and liquid. The base plate has a first region having a shape equivalent to a foot sole, and a first horizontal flange portion surrounding the entire periphery of the first region. The cover has a second region having a shape to face the first region, and a second horizontal flange portion having a shape to face the first horizontal flange portion.

[0031] The blades are formed in such a manner as to rise from an upper surface of the first region. The blades are disposed at predetermined intervals substantially orthogonally to a center line extending from a toe side to a heel side of the base plate. The blades each comprise a plurality of flat-shaped blade elements separated each other by slits. The flat-shaped blade elements of each of the blades are tilted toward the toe side or the heel side.

[0032] The flat-shaped blade elements which occupy both outer side portions of each of the blade with respect to a lateral direction of the first region are disposed in such a manner as to be divergent toward the toe side or the heel side as viewed from above. The first horizontal flange portion and the second horizontal flange portion are joined together, thereby forming a space defined by the first region and the second region, and the liquid is sealed in the space.

[0033] No particular limitation is imposed on the material of the "base plate," the "cover," and the "blade;" however, desirably, the material has elasticity. Examples of the material include thermoplastic resin, thermosetting resin, synthetic rubber, and natural rubber. Desirably, the "base plate," the "cover," and the "blades" are formed by injection molding or press molding. Furthermore, desirably, the "base plate" and the "blades" are integrally molded.

[0034] The "shape equivalent to a foot sole" means a shape substantially similar to the shape of that portion of the foot sole which comes into contact with the ground in walking and jogging and in a halt position. Desirably, the shape does not encompass five toes and their roots.

[0035] Desirably, the "first region" and the "second region" are concave region formed on planes where the base plate and the cover face each other; however, may be flat without concave regions. Desirably, the outer peripheral shapes of the "first horizontal flange portion" and the "second horizontal flange portion" are substantially similar to the inner peripheral shape of an outsole; however, more desirably, the outer peripheral shapes are rendered greater so as to match the size of the outsole by trimming off outer peripheries thereof.

[0036] The "slits" desirably extend from the upper ends to the bases of the blades so as to divide the blades; however, the "slits" include those which have a depth of 50% or more of the blade height from the upper ends to the bases.

[0037] The expression "the flat-shaped blade elements which occupy both outer side portions of each of the blades with respect to a lateral direction of the first region are disposed in such a manner as to be divergent toward the toe side or the heel side as viewed from above" means that, for example, in the case where the blade is composed of four flat-shaped blade elements, at least two flat-shaped blade elements which occupy both outer side portions of each of the blades are disposed in such a manner as to be divergent toward the toe side or the heel side as viewed from above. That is, the disposition of the remaining two flat-shaped blade elements includes two dispositions in which the flat-shaped blade elements are divergent, and the flat-shaped blade elements are aligned in a row.

[0038] "Footwear" in "sole member of footwear" includes men's shoes and women's shoes and corresponds to sports shoes, sneakers, sandals with or without straps, business shoes, ski boots, golf shoes, hiking shoes, walking shoes, boots, high boots, indoor shoes, Japanese sandals, slippers, socks, etc. The "sole member" includes so-called midsole and outsoles.

[0039] Next, the functions and effects of the present invention will be described. Similar to the above-mentioned conventional technique, by means of liquid sealed in the insole, and a plurality of tilted blades rising from the bottom plate, the sole member of footwear according to the present invention disperses and absorbs impact applied to the foot sole when the foot sole lands on the ground during walking, and exhibits an excellent massaging effect through stimulation of the foot sole. Additionally, the sole member of footwear according to the present invention more effectively prevents leakage of liquid sealed in the sole member.

[0040] Next will be described the function and effect of preventing leakage of sealed-in liquid when the heel touches down on the ground as an example. The sole member of footwear according to the present invention

is configured as follows: the blades each comprise a plurality of flat-shaped blade elements separated each other by slits, and, as viewed from above, the flat-shaped blade elements which occupy both outer side portions of each of the blade with respect to the lateral direction of the first region are disposed in such a manner as to be divergent toward the toe side or the heel side.

[0041] When the heel, for example, presses a portion of the surface of the cover, the liquid corresponding to the pressed portion is also pressed and moves abruptly to an unpressed portion of the closed space. However, plurality of blades are provided at predetermined intervals in the closed space. Thus, movement of pressed liquid is hindered by the plurality of blades; accordingly, the liquid moves abruptly in the lateral direction of the midsole along gaps between the blades.

[0042] As viewed from above, the flat-shaped blade elements which occupy both outer side portions of each of the blade with respect to the lateral direction of the sole member are disposed in such a manner as to be divergent toward the toe side or the heel side. Therefore, the flat-shaped blade elements which occupy both outer side portions of each of the blade bend the flow path of the liquid which abruptly moves in the lateral direction along the gaps between the blades; thus, the liquid flows out obliquely toward the toe side or the heel side from the both sides of the gaps between the blades.

[0043] Accordingly, the liquid which flows out from the both sides of the gaps between the blades impinges obliquely on the joint between the base plate and the cover which is located externally of the blades. In other words, when the abruptly moving liquid obliquely impinges on the joint between the base plate and the cover, impact force of the moving liquid applied to the impingement portion can be greatly reduced, as compared with orthogonal impingement on the joint.

[0044] Also, when the abruptly moving liquid obliquely impinges on the joint between the base plate and the cover, the flow direction of the moving liquid can be smoothly changed toward the heel side or the toe side, as compared with orthogonal impingement on the joint. In the other words, when the liquid orthogonally impinges on the joint between the base plate and the cover, the impinging liquid becomes unlikely to be released toward the heel side or the toe side and is dammed; as a result, static pressure of the liquid increases at the impingement portion.

[0045] Thus, when the liquid obliquely impinges on the joint between the bottom plate and the cover, the impinging liquid is readily released toward the heel side or the toe side, whereby there can be restrained an increase in static pressure of liquid at the impingement portion.

[0046] Through employment of the configuration in which the blades each comprise a plurality of flat-shaped blade elements separated each other by slits, the following function and effect can be exhibited. In the case of provision of no slits, the flat-shaped blade elements disposed in a divergent arrangement do not easily lean even

when pressed from above, and thus apply excessively strong stimulation to the foot sole and may possibly cause pain. The provision of the slits avoids an excessive increase in bending rigidity of the flat-shaped blade elements and enables application of appropriate stimulation to the foot sole, whereby a comfortable massaging effect can be exhibited.

[0047] The provision of slits between the flat-shaped blade elements allows liquid pressed by the heel or the like to flow toward the heel side or the toe side through the slits. Thus, the velocity of liquid flowing in the lateral direction along the gaps between the blades can be restrained, along with confinement pressure, whereby impact force of liquid applied to the joint can be reduced.

[0048] By using flat plates for forming the blade elements, bending rigidity of the blade elements can be reduced, the appropriate stimulation to the foot sole can be obtained and the comfortable massaging effect can be exhibited.

[0049] Regarding the configuration in which one group of the blades are located on one side and the other group of the blades are located on the other side with respect to the center portion of longitudinal length of the first region of the base plate, when the tilting directions of both groups of the blades are reversed each other, impact force can be effectively mitigated when the heel touches down on the ground and also when the toe kicks the ground.

[0050] Thus, in another sole member of footwear according to the present invention, the plurality of blades are composed of a plurality of toe-side blades located in a toe-side range from a center portion of longitudinal length of the first region to toe side, and composed of a plurality of heel-side blades located in a heel side range from a center portion of longitudinal length of the first region to heel side. A plurality of the flat-shaped blade elements of each of the toe-side blades are tilted toward the toe side or the heel side.

[0051] A plurality of the flat-shaped blade elements of each of the heel-side blades are tilted in a direction opposite to that of the flat-shaped blade elements of toe-side blades. The flat-shaped blade elements which occupy both outer side portions of each of the toe-side blades with respect to the lateral direction of the first region are inclined in such a manner as to be divergent toward the toe side or the heel side as viewed from above. The flat-shaped blade elements which occupy both outer side portions of each of the heel-side blades with respect to the lateral direction of the first region are inclined in such a manner as to be divergent in a direction opposite to that of the flat-shaped blade elements of the toe-side blades as viewed from above.

[0052] Meanwhile, regarding the blade located at nearest position to toe side or heel side, when liquid flows out through a slit which separates the flat-shaped blade elements thereof, impact force of the liquid is directly applied to the joint at a position which faces the slit. Particularly, in the case where the flat-shaped blade elements

which occupy both outer side portions of the toe-side blade located at nearest position to toe side are inclined in such a manner as to be divergent toward the heel side, or in the case where the flat-shaped blade elements which occupy both outer side portions of the heel-side blade located at nearest position to heel side are inclined in such a manner as to be divergent toward the toe side, liquid flows out faster through the slit; accordingly, impact force of liquid becomes stronger.

[0053] Thus, as to the toe-side blade located at nearest position to toe side and heel-side blade located at nearest position to heel side, by forming those blades with a single flat blade element having no slit, there can be prevented generation of impact force of liquid flowing out through the slit.

[0054] Meanwhile, when the heel, for example, presses a portion of sealed-in liquid, the pressed liquid moves in the lateral direction of the base plate along the gaps between the blades, flows out from the both sides of the gaps between the blades, and impinges on the joint between the base plate and the cover which is located externally of the blades. Thus, if liquid flowing out from the both sides of the gaps between the blades does not directly impinge on the joint, leakage of liquid can be effectively prevented. Thus, the inventors of the present invention have employed, as described in Patent Document 1, a means of forming a single partition integrally rising from the base plate between the both sides of the blades and the inner peripheral wall of the first concave portion of the base plate, along the entire periphery of the inner peripheral wall.

[0055] However, it has become clear that the provision of only a single partition fails to prevent leakage of liquid from the joint located externally of the partition. Specifically, when the heel, for example, presses sealed-in liquid, the pressed portion of liquid moves to a different location where the pressing force does not act, and deforms and expands a corresponding portion of the closed space.

[0056] Thus, at the unpressed portion, a contact portion between the upper end of the single partition and the lower surface of the cover opens, and moving liquid flows through a clearance of the opening and impinges directly on the joint located externally of the partition. Therefore, the liquid becomes likely to leak from the joint.

[0057] Thus, in another sole member of footwear according to the present invention, a first partition is formed between an inner peripheral wall of the first region and both lateral ends of the plurality of blades in such a manner as to rise from the upper surface of the first region. Also, a second partition is formed on an inner periphery side or an outer periphery side of the first partition in such a manner as to rise from a lower surface of the second region with a predetermined gap formed between the first partition and the second partition.

[0058] Furthermore, the first partition and the second partition have a plurality of grooves or cuts formed therein. Also, the grooves or cuts formed in the first partition

and the grooves or cuts formed in the second partition are disposed in such a manner as not to overlap each other as viewed from a direction along center lines of the grooves or cuts.

[0059] That is, through employment of dual partition such that one partition is formed in such a manner as to rise from the bottom plate, whereas the other partition is formed in such a manner as to be suspended from the cover, even though, as a result of movement of liquid, a clearance is formed between the upper end of the partition and the lower surface of the cover, liquid which passes through a clearance which opens at the upper end of the inner partition is blocked by the base of the outer partition, so that there can be avoided direct impingement of liquid on the joint located externally of the outer partition.

[0060] Also, by virtue of provision of the grooves or cuts in the first and second partitions, liquid which flows into the gap between the outer partition and the inner periphery of the joint is easily released, through the grooves or cuts, to the inside of the first and second partitions, thereby avoiding confinement of liquid in the gap; thus, an increase in pressure resulting from the confinement can be restrained.

[0061] Furthermore, by means of the grooves or cuts formed in the first partition and the grooves or cuts formed in the second partition being disposed in such a manner as not to overlap each other as viewed from a direction along center lines of the grooves or cuts, there can be avoided an incident in which liquid that flows out from both sides of gaps between the blades as a result of press impinges directly on the joint between the base plate and the cover through the grooves or cuts.

BRIEF DESCRIPTION OF THE DRAWINGS

[0062]

[FIG. 1] Top view showing a shoe midsole with a portion of a cover cut away.

[FIG. 2] Sectional view taken along a longitudinal direction in a state in which a base plate and the cover are separated from each other.

[FIG. 3] Sectional view taken along the longitudinal direction in a state in which the base plate and the cover are joined together.

[FIG. 4] Sectional view taken along a lateral direction in a state in which the base plate and the cover are joined together.

[FIG. 5] Fragmentary, enlarged front views showing a slit which separates flat-shaped blade elements from each other.

[FIG. 6] Fragmentary, enlarged top view showing a first partition and a second partition.

[FIG. 7] Enlarged views showing grooves and cuts formed in the first and second partitions as viewed from a direction along the center lines of the grooves and cuts.

[FIG. 8] Top views showing examples of dispositions of the flat-shaped blade elements.

[FIG. 9] Top views showing other examples of dispositions of the flat-shaped blade elements.

[FIG. 10] Top views showing examples of divergent directions of the flat-shaped blade elements.

[FIG. 11] Top view and sectional view showing a relation between the divergent directions and the tilting directions of the flat-shaped blade elements.

[FIG. 12] Top view and sectional view showing another relation between the divergent directions and the tilting directions of the flat-shaped blade elements.

[FIG. 13] Enlarged sectional views showing examples of the first partition and the second partition.

[FIG. 14] Top view of a shoe midsole showing desirable positions where grooves or cuts are not provided in the first partition and the second partition.

[FIG. 15] Exploded perspective view of a portion of a shoe, showing the position of a midsole.

[FIG. 16] Exploded perspective view of a portion of a shoe, showing the position of an outsole.

[FIG. 17] Top view showing a conventional shoe midsole with a portion of a cover cut away.

DESCRIPTION OF REFERENCE NUMERALS

[0063]

1:	base plate
2:	cover
3, 3c, 3d:	blade
3a:	toe-side blade
3b:	heel-side blade
4:	liquid
5:	closed space
6:	joint
11:	first region
12:	first horizontal flange portion
14:	inner peripheral wall
15:	first partition
21:	second region
22:	second horizontal flange portion
31:	slit
32, 33:	flat-shaped blade element
A:	midsole

BEST MODE FOR CARRYING OUT THE INVENTION

[0064] A sole member of footwear according to the present invention will next be described while referring to a shoe midsole, with reference to FIGS. 1 to 7. As shown in FIG. 1, the shoe midsole A according to the present invention includes a base plate 1, a cover 2, a plurality of blades 3, and liquid 4.

[0065] The base plate 1 has a first region 11 having a shape equivalent to a foot sole, and a first horizontal flange portion 12 surrounding the entire periphery of the

first region. The cover 2 has a second region 21 which faces the first region 11 of the base plate 1, and a second horizontal flange portion 22 which faces the first horizontal flange portion 12. As is apparent from FIG. 1, the first region 11 of the base plate 1 has a length extending from the heel to the portion near to the roots of the toes, and a width of the portion where foot sole contacts with, when foot sole touches down on the ground.

[0066] As shown in FIGS. 2 to 4, the first region 11 has a concave shape which is slightly depressed downward from the upper surface of the first horizontal flange portion 12, and the second region 21 has a concave shape which is slightly depressed upward from the lower surface of the second horizontal flange portion 22. The upper surface of the first region 11 and the lower surface of the second region 21 are connected to each other through inner peripheral walls 14 and 24 which are gently inclined toward a mating surface between the first horizontal flange portion 12 and the second horizontal flange portion 22, thereby avoiding stress concentration.

[0067] As shown in FIGS. 1 to 4, a plurality of the blades 3 are formed in the first region 11 of the bottom plate 1 in such a manner as to integrally rise from the base plate. The plurality of blades 3 are disposed at predetermined intervals substantially orthogonally to a center line extending from the toe side to the heel side of the base plate 1. As shown in FIGS. 1 and 4, each of the blades 3 is composed of two flat-shaped blade elements 32 and 33 separated each other by a slit 31.

[0068] As shown in FIGS. 2 and 3, the blades 3 are tilted in opposite directions with respect to a central portion of longitudinal length of the first region 11.

[0069] Specifically, the blades located in a range from the central portion of longitudinal length of the first region to the toe side (hereinafter called the "toe-side blades 3a") are tilted toward the heel side, whereas the blades located in a range from the central portion to the heel side (hereinafter called the "heel-side blades 3b") are tilted toward the toe side.

[0070] However, all of the blades 3 may be tilted toward the toe side or the heel side; also, the toe-side blades 3a may be tilted toward the toe side, whereas the heel-side blades 3b may be tilted toward the heel side. Furthermore, the boundary between the toe-side blades 3a and the heel-side blades 3b may be moved toward the toe side or the heel side instead of being set at the central portion of longitudinal length.

[0071] As shown in FIG. 1, as viewed from above, the two flat-shaped blade elements 32 and 33 which constitute each of the blades 3 are disposed in such a manner as to be divergent toward the toe side or the heel side.

[0072] Specifically, the flat-shaped blade elements 32 and 33 which constitute the toe-side blades 3a are disposed in such a manner as to be divergent toward the heel side, whereas the flat-shaped blade elements 32 and 33 which constitute the heel-side blades 3b are disposed in such a manner as to be divergent toward the toe side.

[0073] As shown in FIG. 1, the blades 3c, 3d located at the positions nearest to toe side and heel-side are formed of a single flat-shaped blade element having no slit. The blade 3c located at the position nearest to toe side is tilted toward the heel side, whereas the blade 3d located at the positions nearest to heel side is tilted toward the toe side.

[0074] In a certain use mode of shoes, the single flat-shaped blade element having no slit may be eliminated, two or more of such blade elements may be formed being adjacent to one another, and such blade elements may be provided at any position between the heel side and the toe side.

[0075] Desirably, the slit 31 shown in FIG. 4 separates the flat-shaped blades 32 and 33 from each other with a range from their upper ends to their bases as shown in FIG. 5(A). However, as shown in FIG. 5(B), the slit 31 may be formed in such a manner as to separate the blades 32 and 33 from each other with depth of 50% or more of the blade height from their upper ends to their bases so as to leave a connecting portion above their bases.

[0076] As shown in FIGS. 1 to 4, a first partition 15 is formed between an inner peripheral wall 14 of the first region 11 of the base plate 1 and both sides of the blades 3 in such a manner as to rise from the upper surface of the first region. Also, a second partition 25 is formed on an inner periphery side of the first partition 15 in such a manner as to rise from the lower surface of the second region 21 with a predetermined gap formed between the first partition and the second partition. For the purpose of easy understanding of shape and constitution, FIGS. 2 to 4 show the first partition 15 and the second partition 25 in a size greater than an actual size.

[0077] As shown in FIGS. 6 and 7(A), the first partition 15 and the second partition 25 have a plurality of grooves 151 and 251, respectively. The grooves 151 provided in the first partition 15 and the grooves 251 provided in the second partition 25 are disposed in such a manner as not to overlap each other as viewed from a direction along the center lines of the grooves.

[0078] In place of the grooves 151 and 251 provided in the first and second partitions 15 and 25, cuts 151 and 251 may be provided as shown in FIG. 7(B).

[0079] The first partition 15 and the second partition 25 may be reversed in position. Moreover, in addition to the first partition 15 and the second partition 25, a third partition may be provided with a predetermined gap formed between the same and the first or second partition, and a fourth partition may be provided further.

[0080] As shown in FIGS. 1 and 3, the first horizontal flange portion 12 of the base plate 1 and the second horizontal flange portion 22 of the cover 2 are joined together by a belt-like joint 6, thereby forming a closed space 5 sandwiched between the first region 11 and the second region 21. The liquid 4 is injected into the closed space 5 from an inlet (not shown) provided on the heel side; then, the inlet is closed for sealing.

[0081] The belt-like joint 6 is formed at inner peripheral portions of the first and second flange portions 12 and 22 and has uniform width along the entire periphery of the inner peripheral portions. Desirably, the joint 6 is formed through thermal welding by use of a high-temperature press; however, adhesive may be used to bond.

[0082] The bottom plate 1 and the cover 2 are formed through injection molding by use of thermoplastic resin such as vinyl chloride resin. Desirably, the liquid 4 has low water permeability, is less susceptible to evaporation, and does not rot. Furthermore, more desirably, liquid which does not freeze in a cold district, such as propylene glycol, is used as the liquid 4.

[0083] Also, as shown in FIG. 4, both outer sides of the flat-shaped blade elements 32 and 33 are shaped in such a manner as to be gently curved from their upper ends to their bases and are not connected to the inner peripheral surface of the second partition 25. The reason for this is to allow the flat-shaped blade elements 32 and 33 to easily lean when pressed, so as to exhibit a comfortable massaging effect. Also, the reason is to allow the liquid 4 to easily flow in the longitudinal direction through gaps 7 formed between the inner peripheral surface of the second partition 25 and both outer sides of the flat-shaped blade elements 32 and 33, so as to avoid increase in confinement pressure of the liquid 4.

[0084] Desirably, as shown in FIG. 4, in a state in which the liquid 4 is sealed in the closed space 5, the height of the blade 3 is such that the upper end of the blade is in contact with the lower surface of the second region 21; however, the blade height may be higher or lower than the above contact height. Also, desirably, the height of the first and second partitions 15 and 25 is such that the distal ends of the first and second partitions 15 and 25 are in contact with the lower surface of the second region 21 and the upper surface of the first region 11, respectively; however, the partition height may be higher or lower than the above contact height.

[0085] Next, referring to FIGS. 8 to 10, the dispositions of the blades 3 and the flat-shaped blade elements 32 and 33 according to other embodiments will be described. FIG. 8 shows the number and disposition of the flat-shaped blade elements 32 and 33. Specifically, each of the blades 3 shown in FIG. 8(A) is composed of three flat-shaped blade elements 32, 34, and 33 which are separated from one another by the slits 31. The flat-shaped blade elements 32 and 33 are disposed in such a manner as to be divergent toward the heel side, whereas the central flat-shaped blade element 34 is disposed orthogonally to the longitudinal center line of the first region 11.

[0086] Each of the blades 3 shown in FIG. 8(B) is composed of four flat-shaped blade elements 32, 35, 36, and 33 which are separated from one another by the slits 31. The flat-shaped blade elements 32 and 33 are disposed in such a manner as to be divergent toward the heel side, and the central flat blade elements 35 and 36 are also disposed in such a manner as to be divergent toward the heel side. The central flat-shaped blade elements 35 and

36 may be disposed orthogonally to the longitudinal center line of the first region 11.

[0087] Each of the blades 3 shown in FIG. 8(C) is composed of five flat-shaped blade elements 32, 37, 38, 39, and 33 which are separated from one another by the slits 31. The flat-shaped blade elements 32 and 33 are disposed in such a manner as to be divergent toward the heel side, and the inner flat-shaped blade elements 37 and 39 are also disposed in such a manner as to be divergent toward the heel side. The central flat-shaped blade element 38 is disposed orthogonally to the longitudinal center line of the first region 11. The inner flat blade elements 37 and 39 may be disposed orthogonally to the longitudinal center line of the first region 11.

[0088] FIG. 9 shows embodiments in which the slits 31 of the adjacent blades 3 are located at such positions as not to overlap each other as viewed from a direction along the center lines of the slits 31. The reason for this is that, if the slits 31 of the adjacent blades 3 are located at such positions as to overlap each other, the pressed liquid 4 flows excessively easily in the longitudinal direction, therefore, the effect of reducing impact force of the liquid 4 is decreased.

[0089] The divergent angle of the flat-shaped blade elements 32 and 33 is preferably 170 degrees to 120 degrees, more preferably 160 degrees to 140 degrees. At a divergent angle in excess of 170 degrees, the effect of reducing impact force of the liquid 4 which flows out from the both sides of the gaps between the blades 3 and impinges on the joint 6 between the base plate 1 and the cover 2 is decreased, and, at a divergent angle less than 120 degrees, when the foot sole or the like touches down on the ground during walking or the like, a feeling of lateral stability deteriorates. In the present embodiment, the divergent angle is set at about 150 degrees.

[0090] FIG. 10 shows embodiments in which the flat-shaped blade elements 32 and 33 are divergent. Specifically, FIG. 10 (A) shows an embodiment in which the flat-shaped blade elements 32 and 33 of the toe-side blades 3a are disposed in such a manner as to be divergent toward the toe side, whereas the flat-shaped blade elements 32 and 33 of the heel-side blades 3b are disposed in such a manner as to be divergent toward the heel side.

[0091] FIG. 10(B) shows an embodiment in which the flat-shaped blade elements 32 and 33 of the toe-side blades 3a and the heel-side blades 3b are both disposed in such a manner as to be divergent toward the heel side. Furthermore, FIG. 10(C) shows an embodiment in which the flat-shaped blade elements 32 and 33 of the toe-side blades 3a and the heel-side blades 3b are both disposed in such a manner as to be divergent toward the toe side.

[0092] FIGS. 11 and 12 show relations between the divergent direction of the flat-shaped blade elements 32 and 33, and the tilting direction of the flat-shaped blade elements 32 and 33. FIG. 11 (B) and FIG. 12 (B) show a case where the divergent direction and tilting direction of the flat-shaped blade elements 32 and 33 are the

same. Specifically, in FIG. 11(B), the divergent direction and the tilting direction of the flat-shaped blade elements 32 and 33 are toward the toe side. In FIG. 12(B), the divergent direction and the tilting direction of the flat-shaped blade elements 32 and 33 are toward the heel side.

[0093] By contrast, FIGS. 11 (C) and 12 (C) show a case where the divergent direction and the tilting direction of the flat-shaped blade elements 32 and 33 are reversed. Specifically, in FIG. 11(C), the flat-shaped blade elements 32 and 33 are divergent toward the toe side, but are tilted toward the heel side. In FIG. 12(C), the flat-shaped blade elements 32 and 33 are divergent toward the heel side, but are tilted toward the toe side.

[0094] Desirably, the blade 3c located nearest to the toe-side blades 3a shown in FIG. 10 is tilted toward the heel side, and the blade 3d located nearest to the heel-side blades 3b is tilted toward the toe side; however, their tilting directions may be reversed.

[0095] The tilting angle of the flat-shaped blade elements 32 and 33, etc., is desirably 30 degrees to 60 degrees, more desirably 40 degrees to 50 degrees, with respect to a vertical plane. At an tilting angle less than 30 degrees, the flat-shaped blade elements 32 and 33, etc., become unlikely to fall when pressed by the foot sole, so that stimulation to the foot sole becomes excessively strong, and, at an tilting angle in excess of 60 degrees, the flat-shaped blade elements 32 and 33 easily fall, so that stimulation to the foot sole becomes excessively weak. In the present embodiment, the tilting angle is set to about 45 degrees.

[0096] Desirably, the upper ends of the flat-shaped blade elements 32 and 33, etc., have a cross-sectional shape outlined by an arc-shaped curve or the like. The reason for this is that stimulation to the foot sole becomes soft, thereby yielding a comfortable massaging effect.

[0097] FIG. 13 shows examples of cross-sectional shapes of the first partition 15 and the second partition 25. Specifically, FIG. 13(A) shows a cross-sectional shape composed of a rectangular base portion and a semicircular distal end. FIG. 13(B) shows a rectangular cross-sectional shape whose distal end has radiused corners. Furthermore, FIG. 13(C) shows a trapezoidal cross-sectional shape whose distal end has radiused corners. Notably, the cross-sectional shapes of the first partition 15 and the second partition 25 are not limited to the above-mentioned cross-sectional shapes.

[0098] Five positions marked with letter C in FIG. 14 indicate those positions at which, in the conventional shoe midsole A, the liquid 4 is likely to leak from the joint 6 between the base plate 1 and the cover 2. Therefore, desirably, the grooves or cuts 151 of the first partition 15 and the grooves or cuts 251 of the second partition 25 shown in FIGS. 6 and 7 are provided at positions other than the five positions marked with letter C. The reason for this is to prevent the quickly moving liquid 4 from directly hitting the joint 6 at the five positions marked with letter C.

[0099] FIG. 15 shows a case where the sole member of footwear according to the present invention is applied as the shoe midsole A mentioned above. FIG. 16 shows a case where the sole member of footwear according to the present invention is applied as a shoe outsole B.

INDUSTRIAL APPLICABILITY

[0100] The present invention can be utilized widely in the footwear industry, since, during walking or the like, the sole member of footwear of the present invention absorbs impact while providing a feeling of stability, exhibits a massaging effect through stimulation of the foot sole, and can prevent leakage of sealed-in liquid.

Claims

1. A sole member of footwear comprising a base plate, a cover, a plurality of blades and liquid, **characterized in that**
 - the base plate has a first region having a shape equivalent to a foot sole, and a first horizontal flange portion surrounding the entire periphery of the first region;
 - the cover has a second region having a shape to face the first region, and a second horizontal flange portion having a shape to face the first horizontal flange portion;
 - the blades are formed in such a manner as to rise from an upper surface of the first region;
 - the blades are disposed at predetermined intervals substantially orthogonally to a center line extending from a toe side to a heel side of the base plate;
 - the blades each comprise a plurality of flat-shaped blade elements separated each other by slits;
 - the flat-shaped blade elements of each of the blades are tilted toward the toe side or the heel side;
 - the flat-shaped blade elements which occupy both outer side portions of each of the blades with respect to a lateral direction of the first region are disposed in such a manner as to be divergent toward the toe side or the heel side as viewed from above;
 - the first horizontal flange portion and the second horizontal flange portion are joined together, thereby forming a space defined by the first region and the second region; and
 - the liquid is sealed in the space.
2. A sole member of footwear according to claim 1, wherein
 - the plurality of blades are composed of a plurality of toe-side blades located between a center portion of a longitudinal length of the first region and the toe side, and a plurality of heel-side blades located between the center portion of the longitudinal length of the first region and the heel side;
 - a plurality of the flat-shaped blade elements of each

of the toe-side blades are tilted toward the toe side or the heel side;

a plurality of the flat-shaped blade elements of each of the heel-side blades are tilted in a direction opposite to that of flat-shaped blade elements of the toe-side blades;

the flat-shaped blade elements which occupy both outer side portions of each of the toe-side blades with respect to a lateral direction of the first region are disposed in such a manner as to be divergent toward the toe side or the heel side as viewed from above; and

the flat-shaped blade elements which occupy both outer side portions of each of the heel-side blades with respect to a lateral direction of the first region are disposed in such a manner as to be divergent in a direction opposite to that of the flat-shaped blade elements of the toe-side blades as viewed from above

3. A sole member of footwear according to claim 1 or 2, wherein the toe-side blades located at nearest position to the toe side or the heel-side blade located at nearest position to the heel side is formed of a single flat-shaped blade element having no slit.
4. A sole member of footwear according to claim 1 or 2, wherein
 - a first partition is formed between an inner peripheral wall of the first region and both lateral ends of the plurality of blades in such a manner as to rise from the upper surface of the first region;
 - a second partition is formed on an inner periphery side or an outer periphery side of the first partition in such a manner as to rise from a lower surface of the second region with a predetermined gap between the first partition and the second partition;
 - each of the first partition and the second partition has a plurality of grooves or cuts formed therein; and
 - the grooves or cuts formed in the first partition and the grooves or cuts formed in the second partition are disposed in such a manner as not to overlap each other as viewed from a direction along center lines of the grooves or cuts.
5. A sole member of footwear according to claim 3, wherein
 - a first partition is formed between an inner peripheral wall of the first region and both lateral ends of the plurality of blades in such a manner as to rise from the upper surface of the first region;
 - a second partition is formed on an inner periphery side or an outer periphery side of the first partition in such a manner as to rise from a lower surface of the second region with a predetermined gap between the first partition and the second partition;
 - each of the first partition and the second partition has a plurality of grooves or cuts formed therein; and

the grooves or cuts formed in the first partition and the grooves or cuts formed in the second partition are disposed in such a manner as not to overlap each other as viewed from a direction along center lines of the grooves or cuts.

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6. A sole member of footwear according to claim 1 or 2, wherein the sole member of footwear is an insole of the footwear or an outsole of the footwear.

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7. A sole member of footwear according to claim 3, wherein the sole member of footwear is an midsole of the footwear or an outsole of the footwear.

8. A sole member of footwear according to claim 4, wherein the sole member of footwear is an midsole of the footwear or an outsole of the footwear.

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9. A sole member of footwear according to claim 5, wherein the sole member of footwear is an midsole of the footwear or an outsole of the footwear.

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FIG. 1

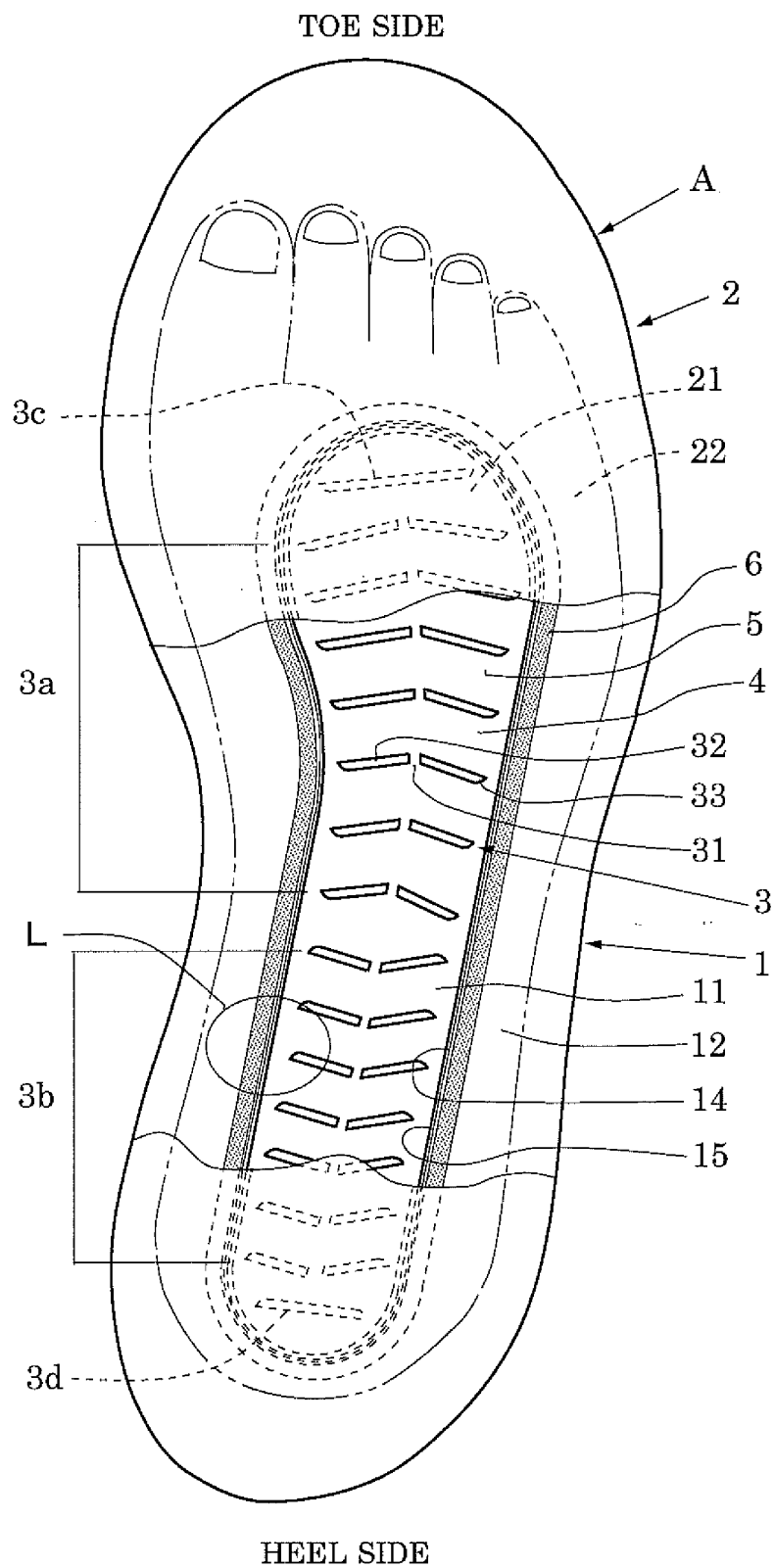


FIG. 2

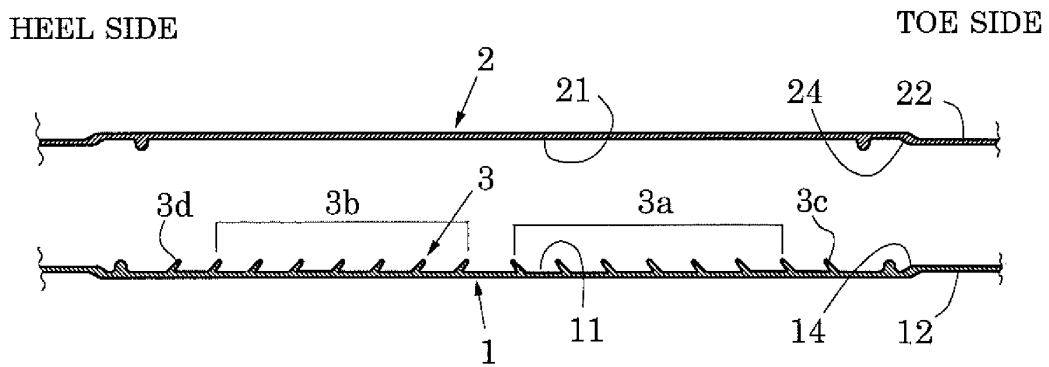


FIG. 3

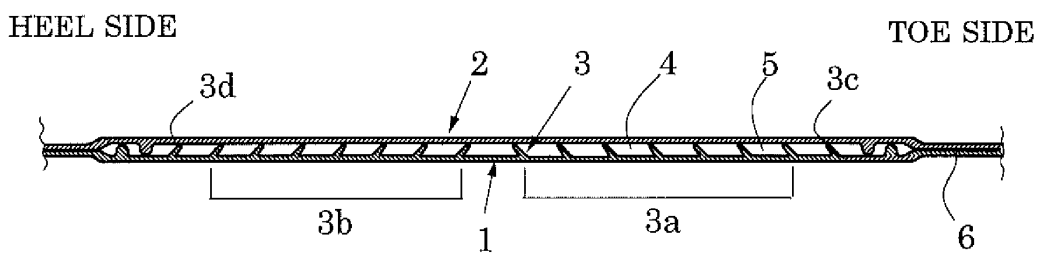


FIG. 4

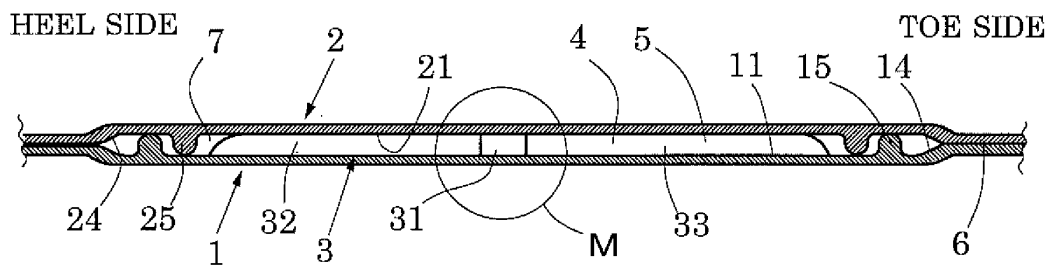
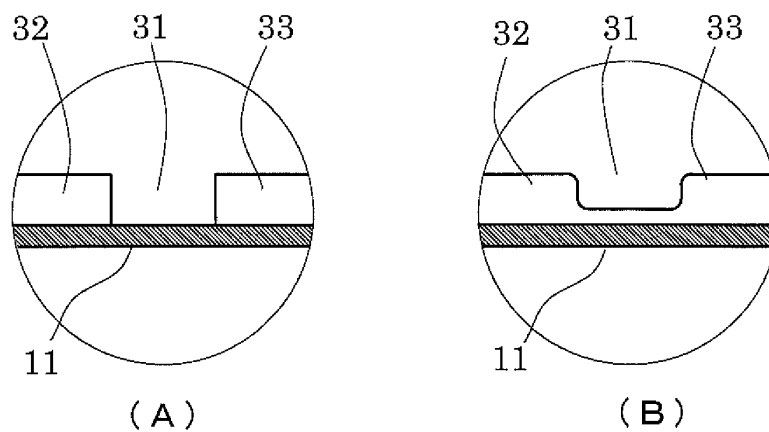
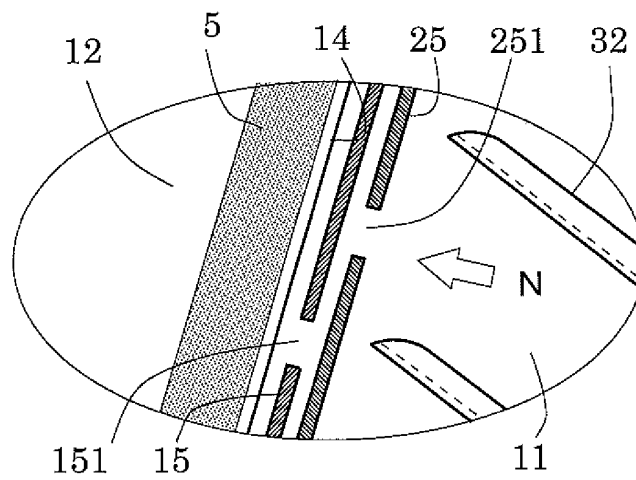


FIG. 5



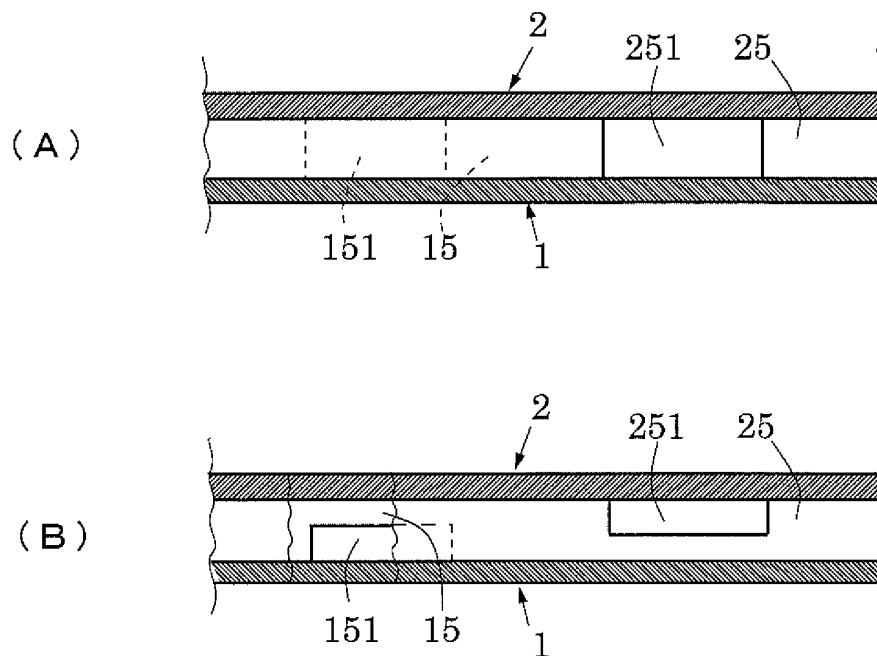
ENLARGED VIEWS OF PORTION M OF FIG. 4

FIG. 6



ENLARGED VIEW OF PORTION L OF FIG. 1

FIG. 7



VIEW AS VIEWED IN DIRECTION N IN FIG. 5

FIG. 8

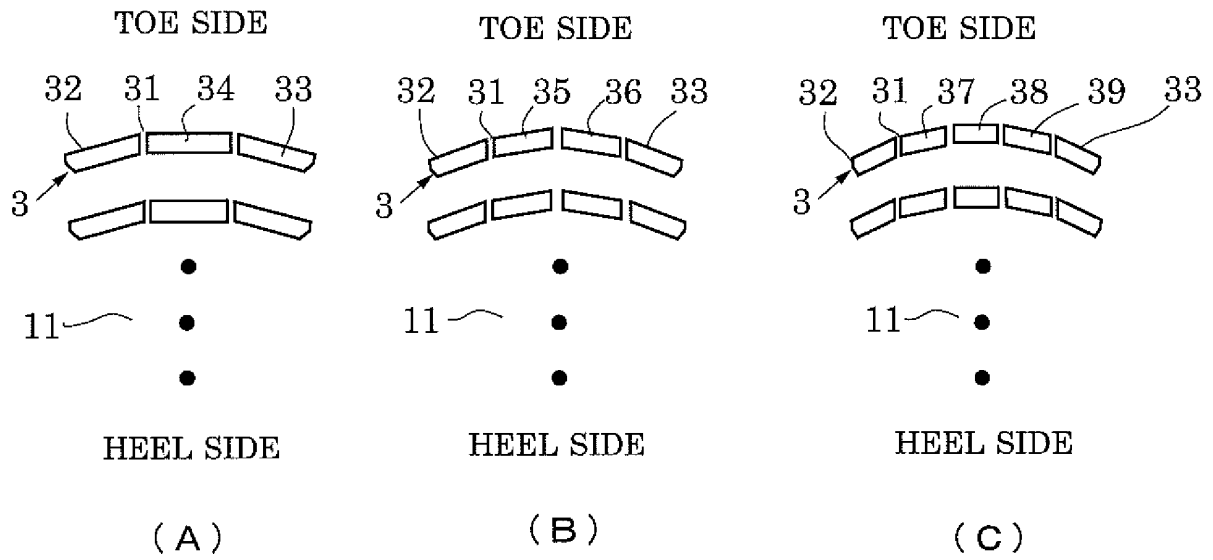


FIG. 9

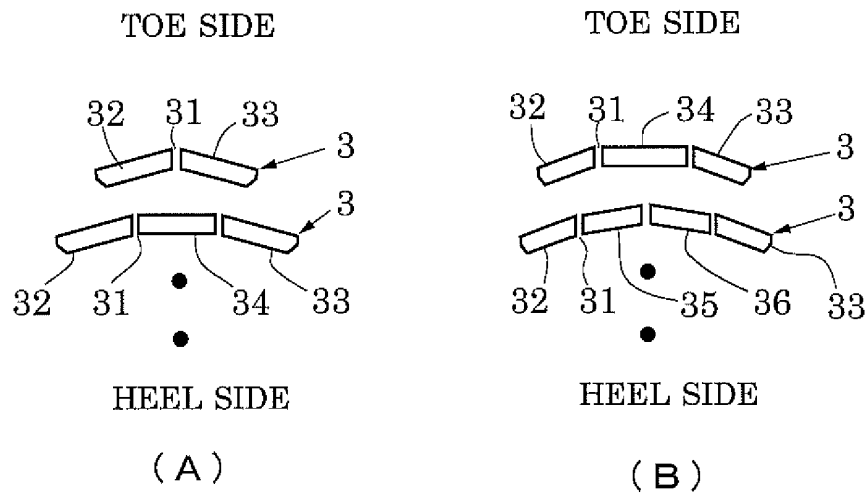


FIG. 10

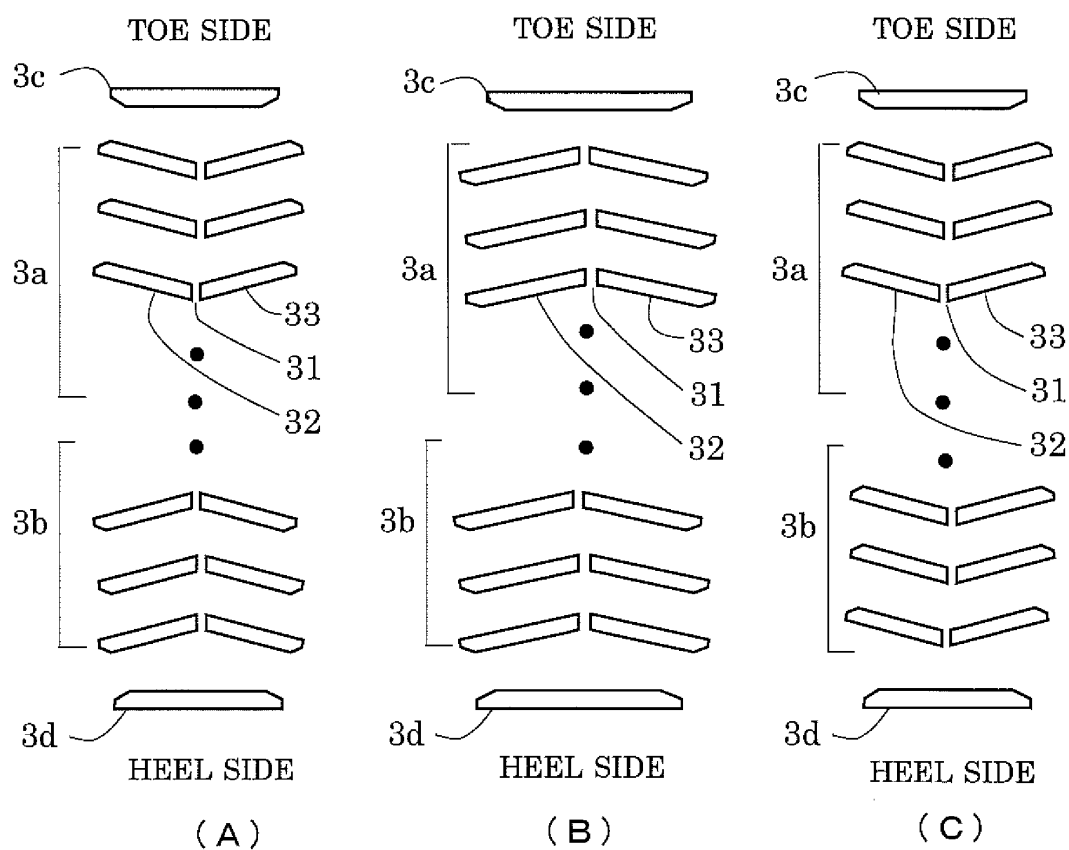


FIG. 11

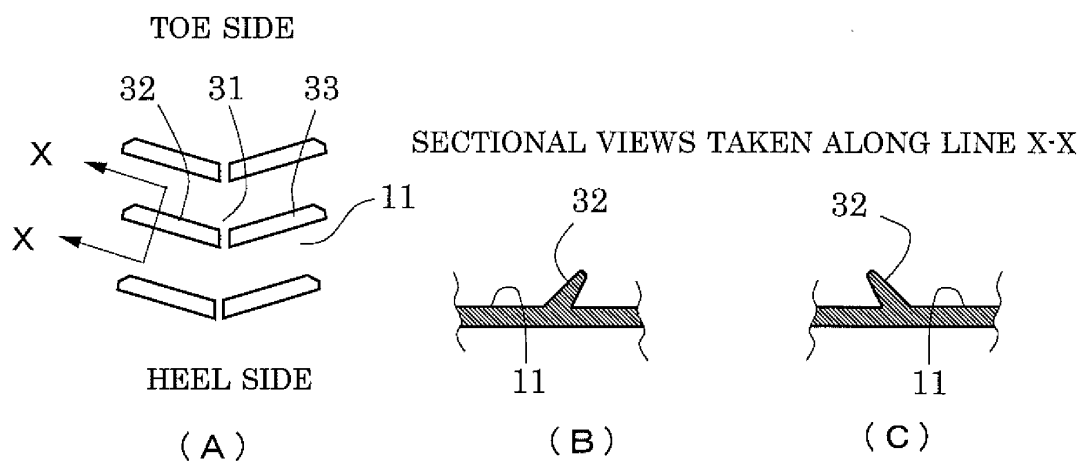


FIG. 12

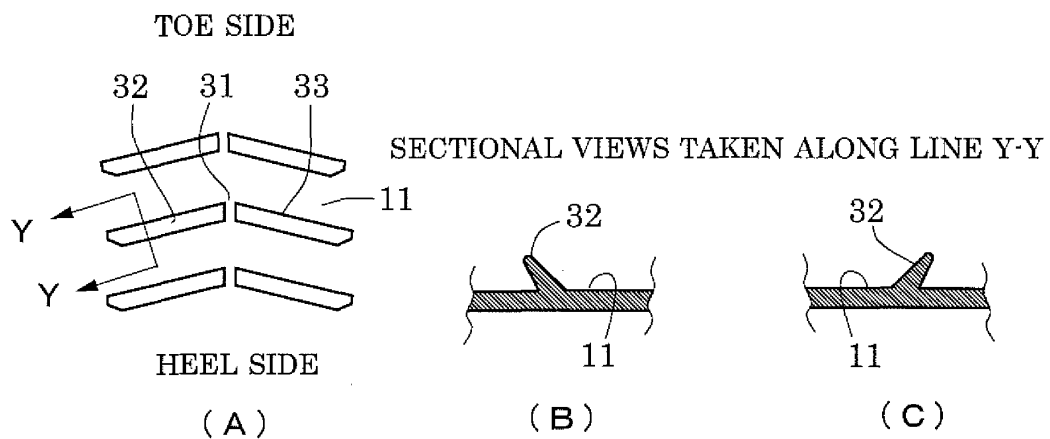


FIG. 13

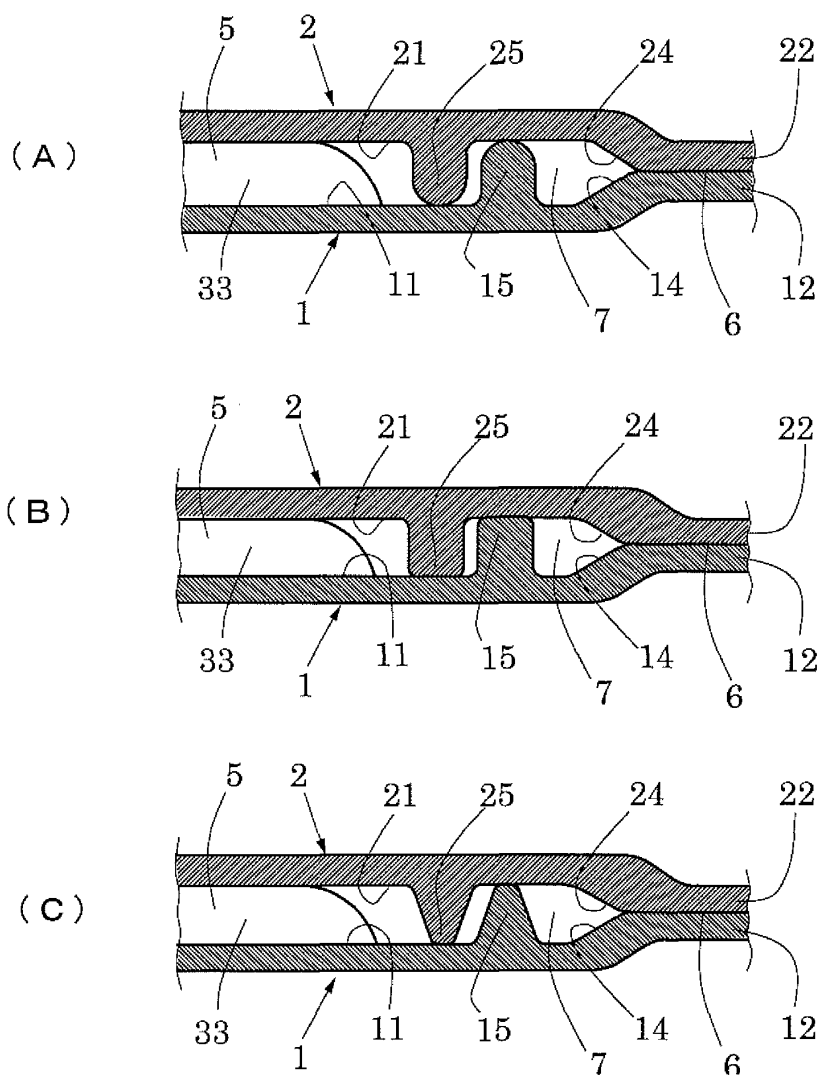
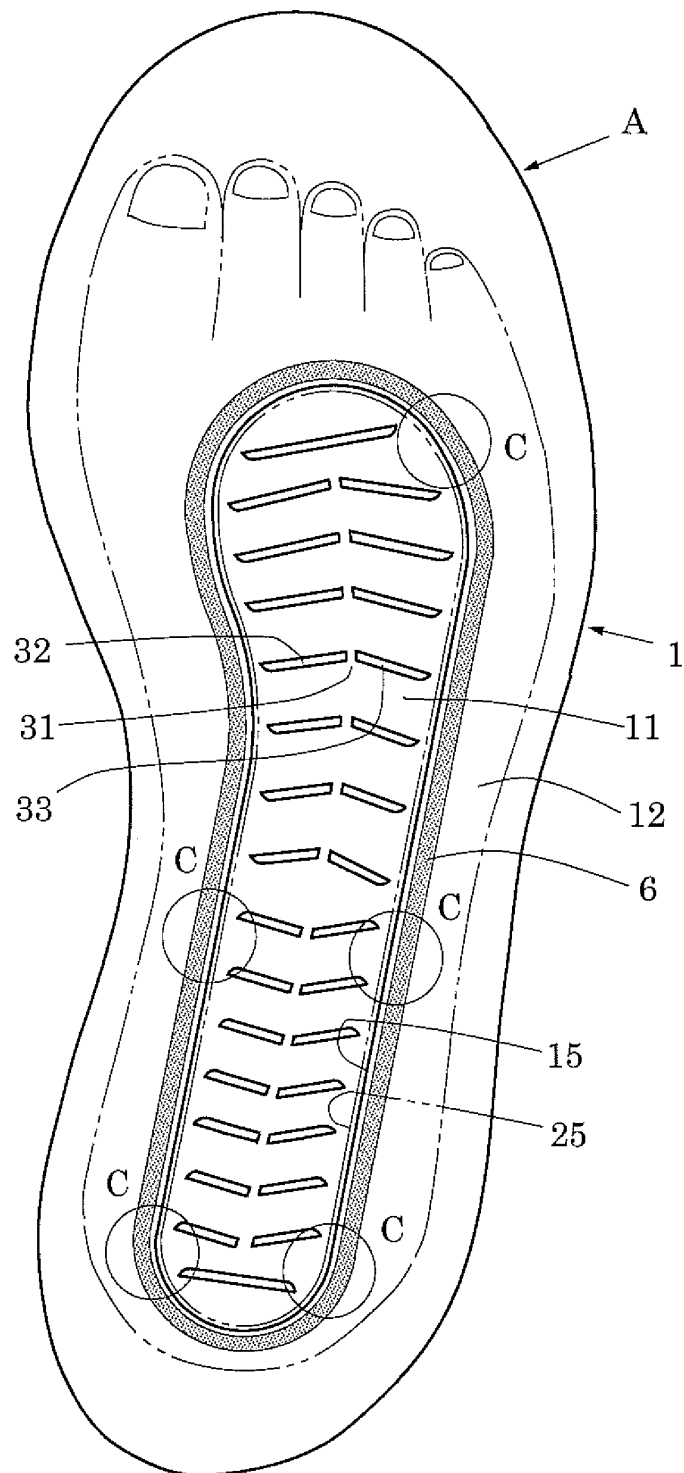


FIG. 14

TOE SIDE



HEEL SIDE

FIG. 15

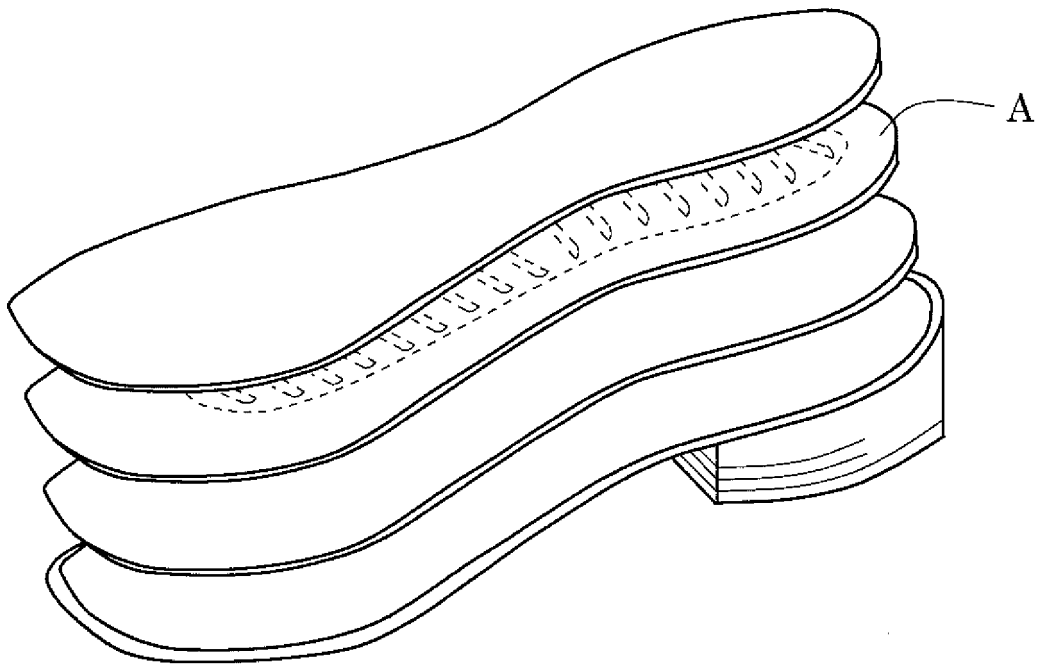


FIG. 16

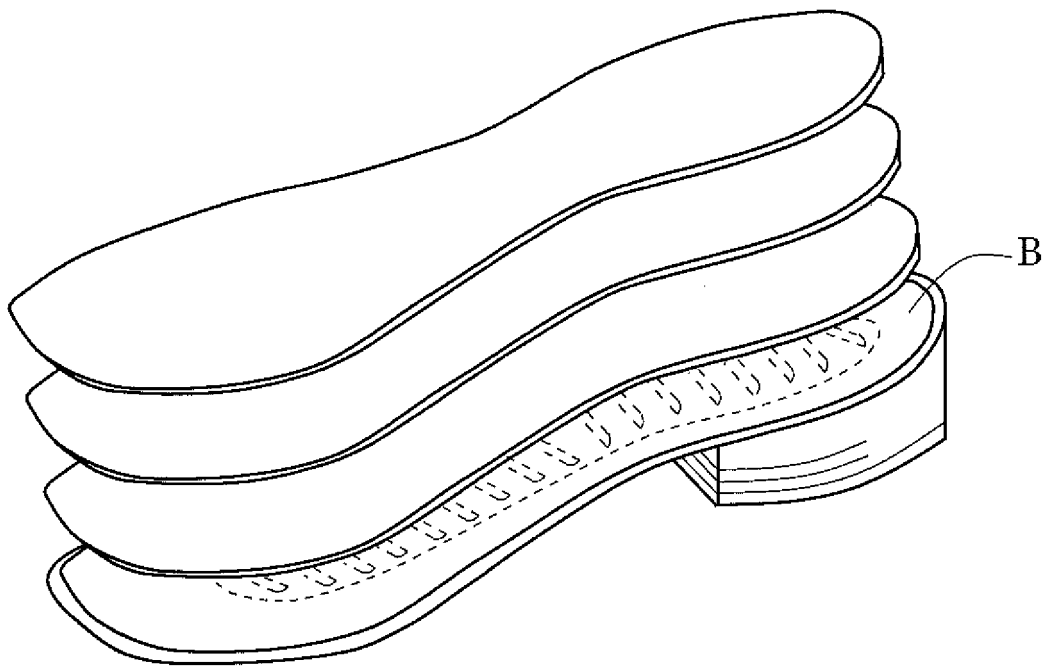
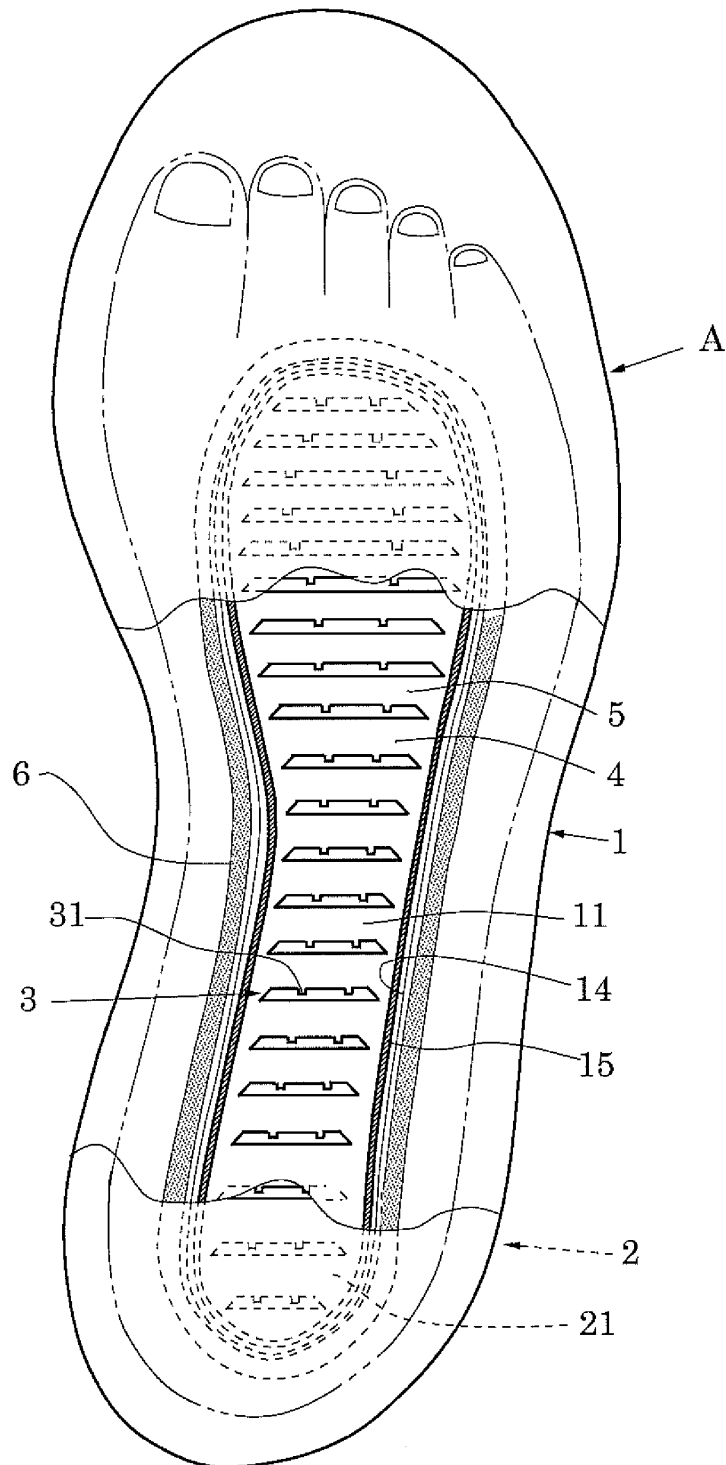


FIG. 17

TOE SIDE



HEEL SIDE

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/064269

A. CLASSIFICATION OF SUBJECT MATTER

A43B13/18(2006.01) i, A43B13/40(2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A43B13/18, A43B13/40

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013

Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2010/023793 A1 (Himiko Co., Ltd.), 04 March 2010 (04.03.2010), & US 2011/0131834 A1 & EP 2316294 A1 & AU 2009286277 A & CN 102131417 A & TW 201023778 A & HK 1155621 A & KR 10-2011-0055553 A	1-9
A	JP 2007-301275 A (Hamamatsu Foundation for Science and Technology Promotion), 22 November 2007 (22.11.2007), & US 2009/0126226 A1 & WO 2007/132567 A1	1-9

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search
13 August, 2013 (13.08.13)Date of mailing of the international search report
27 August, 2013 (27.08.13)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

REFERENCES CITED IN THE DESCRIPTION

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- JP 2000236908 A [0027]