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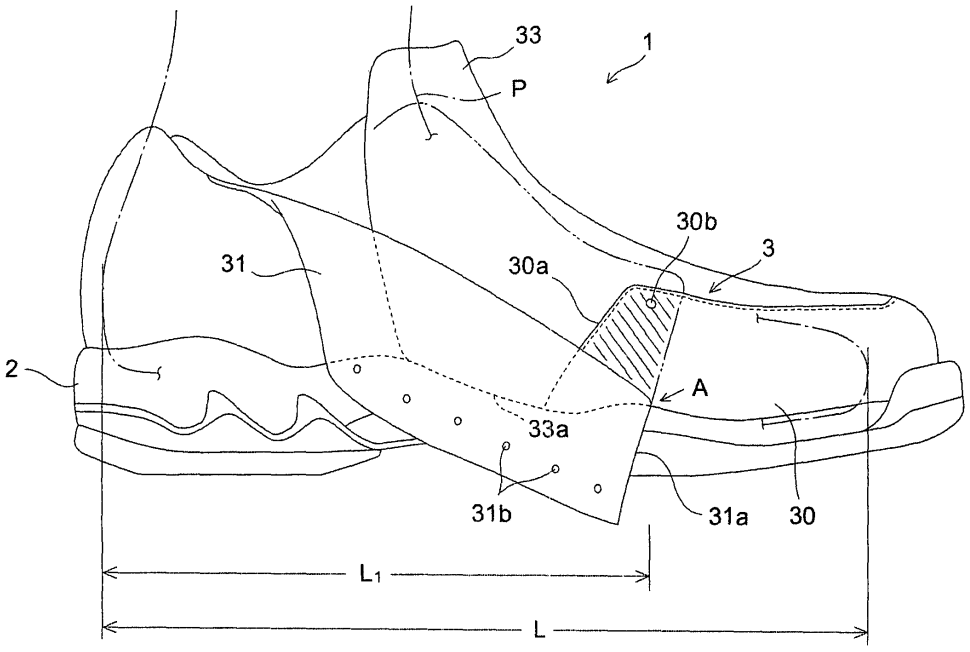
(54) Upper structure for a shoe

(57) An upper structure for a shoe 1 includes a first upper member 30 that is disposed at the forefoot region F on the medial side of the shoe 1, and a second upper member 31 that is disposed at the rear foot region R on the medial side of the shoe 1 and whose front end edge portion 31a overlaps with the rear end edge portion 30a of the first upper member 30. At the time of bending movement of the upper 3 during the push off motion of the foot, the front end edge portion 31a of the second upper member 31 slides on the first upper member 30 in the longitudinal direction and at the same time the rear end edge portion 30a of the first upper member 30 slides under the second upper member 31 in the longitudinal direction. The lowermost point A of the front end edge portion 31a of the second upper member 31 corresponds to the position of the metatarsophalangeal joints MJ of the foot.

FIG. 2



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates generally to an upper structure for a shoe, and more particularly, to an improved upper structure for improving bendability of the upper.

[0002] A shoe is generally composed of a sole and an upper fixedly attached on the sole. Typically, the upper includes an integrally formed upper body that covers an outer circumferential portion having a toe portion, opposite side portions, and a heel portion of a foot of a shoe wearer, and a tongue portion that is disposed at a longitudinal opening formed at an instep portion of the upper body. Also, various kinds of shoes have been proposed whose upper body is composed of a plurality of members.

[0003] For example, Japanese Publication No. 61-501612 of a Japanese translation of PCT international application (JP 61-501612) discloses an upper comprised of a front toe portion (14) integrally formed with a tongue (16), a side portion (20), a lower portion (30), an upper portion (32), and so on. Japanese application publication No. 2-277405 (JP 2-277405) discloses an upper comprised of an upper portion (22), a lower portion (18), opposite side portions (20, 24), a heel portion (26), and a toe portion (27) . JP 2-277405 also describes that the upper portion (22) and the lower portion (18) are separated from each other.

[0004] WO 2004/093587 discloses an upper that is comprised of a front portion (3) disposed in front of a shoe and covering a toe portion of a foot, arearportion (4) disposed at the back of the shoe, separated from the front portion (3), and covering a rear portion of the foot, and expandable and contractable portions (50, 51) disposed between the front portion (3) and the rear portion (4). The expandable and contractable portion (51) on the medial side covers a portion of and the proximity of Lisfranc's joint of the inside of the foot. The expandable and contractable portion (50) on the lateral side covers a head of and the proximity of a fifth metatarsus of the foot.

[0005] WO 2004/093587 pays attention to the fact that at the time of bending of the foot during running the action of the front portion (3) greatly differs from the action of the rear portion (4) between the expandable and contractable portions (50, 51), and is directed to improving fittability of the upper in such a way that the expandable and contractable portions (50, 51) absorb the difference of the actions (i.e. deformations) between the front portion (3) and the rear portion (4).

[0006] However, none of the above-mentioned publications mentions an improvement of bendability of the upper at the time of bending of the upper during a push off motion of the foot of the shoe wearer. Also, neither publication discloses nor would have suggested that the upper be divided or separated so as to improve bendability of the upper.

[0007] The present invention has been made in view of these circumstances and is directed to providing an upper structure for a shoe that can improve bendability of an upper at the time of bending of the upper during a push off motion of a shoe wearer's foot.

[0008] Other objects and advantages of the present invention will be obvious and appear hereinafter.

SUMMARY OF THE INVENTION

[0009] An upper structure for a shoe according to a first aspect of the present invention comprises a first upper member disposed at a forefoot region on a medial side of the shoe, and a second upper member that is disposed at a rear foot region to the forefoot region on the medial side of the shoe and whose front end edge portion overlaps with the outside of a rear end edge portion of the first upper member.

[0010] According the first aspect of the present invention, at the time of bending movement of the upper during a push off motion of a foot of a shoe wearer, the front end edge portion of the second upper member on the medial side of the shoe slides on the first upper member in the longitudinal direction and at the same time the rear end edge portion of the first upper member slides under the second upper member in the longitudinal direction.

[0011] In this way, a mutual slide movement of the upper members can absorb creases or slacks of the upper created at bending regions of the upper medial side during the push off motion of the foot. Thereby, bending of the upper can be conducted in a smooth manner thus improving bendability of the upper.

[0012] Additionally, in the above-mentioned JP 61-501612, the upper portion (32) is provided on the lower portion (30), but FIGS. 1-3 of JP 61-501612 do not clearly show the position of the rear end edge portion of the lower portion (30) and the way of overlapping of the upper portion (32) with the lower portion (30) is not clear. For example, in the event that the lower portion (30) extends to the top of the instep portion of the upper, it merely has bendability similar to the integrally formed upper of prior art. Also, as is clearly seen from FIGS. 1-3 of JP 61-501612, since the front end edge portion of the upper portion (32) is disposed at the midfoot portion of the shoe, the position of the front end edge portion does not essentially influence absorption of bending deformation of the upper during the push off motion of the foot.

[0013] Also, JP 2-277405 is directed to improving fittability of the upper by separating the upper portion (22) from the lower portion (18) so that a shoe lace passing through each portion can adjust each portion independently from the other

portion, but it is not directed to dividing each portion of the upper so as to absorb bending deformation of the upper during the push off motion of the foot.

[0014] Moreover, in the upper shown in WO 2004/093587, it is possible to increase bendability of the upper medial side in a degree by expansion and contraction of the expanding and contracting portion (51). However, in WO 2004/093587, since the front portion (3) of the upper is in proximity to the rear portion (4), a longitudinal length of the upper end of the expanding and contracting portion (51) is short and the upper has thus certain limitations in the volume of contraction (i.e. bendability). On the other hand, if the expanding and contracting portion (51) is enlarged the upper cannot fulfill its fundamental function to protect the foot of the wearer. Therefore, the longitudinal length of the expanding and contracting portion (51) should not be made long. Consequently, the upper shown in WO 2004/093587 has certain limitations in the volume of contraction (i.e. bendability).

[0015] In contrast, according to the first aspect of the present invention, since the first upper member and the second upper member are provided overlapping with each other so as to slide mutually, such mutual slide movement of the upper members can securely absorb creases or slacks of the upper created at bending regions of the upper medial side of the shoe at the time of bending of the upper during the push off motion of the foot. Thereby, bendability of the upper can be improved.

[0016] The lowermost point of the front end edge portion of the second upper member may correspond to the position of the metatarsophalangeal joints on the medial side of the foot.

[0017] At the time of bending of the foot during the push off motion of the foot, the foot is bent at the metatarsophalangeal joints. Therefore, when the lowermost point of the front end edge portion of the second upper member is located at the position of the metatarsophalangeal joints on the medial side of the foot, the upper can bend in a smooth manner in accordance with bending of the foot thus effectively improving bendability of the upper.

[0018] Additionally, in the upper shown in WO 2004/093587, the expandable and contractable region (51) on the medial side covers a portion of and the proximity of the Lisfranc's joints of the inside of the foot, which are located at the rear of the metatarsophalangeal joints.

[0019] The lowermost point of the front end edge portion of the second upper member may be located at the position of (0.74±0.05) XL (L: shoe's size length) from a heel rear end.

[0020] In this case, the lowermost point corresponds to the position of the metatarsophalangeal joints on the medial side of the foot.

[0021] A material of a low coefficient of friction may be provided at an overlapped portion of the first upper member and the second upper member.

[0022] In this case, at the time of bending of the upper during the push off motion of the foot, a mutual slide movement of the first and second upper members can be conducted more smoothly thus further enhancing bendability of the upper. As the material of a low coefficient of friction, synthetic resin such as polyester, nylon, or the like may be used. Also, film can be employed.

[0023] At the overlapped portion of the first and second upper members may be provided a first bag-shaped member, an end of the first bag-shaped member being coupled to the first upper member and the other end of the first bag-shaped member being coupled to the second upper member, and the first bag-shaped member being adapted to permit a mutual slide movement of the first and second upper members.

[0024] In this case, at the time of the push off motion of the foot followed by bending of the upper, when the front end edge portion of the second upper member slides on the first upper member and the rear end edge portion of the first upper member slides under the second upper member, the first bag-shaped member covers a gap at the overlapped portion between the first and second upper members. The first bag-shaped member can prevent sands or small stones from entering the inside of the shoe through the gap between the first and second upper members during activities.

[0025] Also, in this case, since the first bag-shaped member is provided in a bag-form between the first and second upper members and has a slack in itself, the first bag-shaped member follows the movements of the first and second upper members during the bending movement of the upper. Thereby, the first bag-shaped member does not hinder the slide movements of the first and second upper members thus maintaining bendability of the upper.

[0026] The second upper member may be provided with a wear resistant material at the outside of a front endportion.

[0027] In this case, in a shoe such as a tennis shoe, a badminton shoe, or the like in which the medial side of the upper contacts the court surface to wear during activities, wear resistance and bendability of the medial side of the upper can be compatible with each other. Generally, a wear resistant material is formed of a hard material and also when such wear resistant material is bonded to the surface of the upper the upper increases in thickness. Therefore, in an upper-integrated shoe of prior art, when the wear resistant material is provided at the upper, bendability of the upper was hindered. To the contrary, in the present invention, since bendability of the upper can be achieved such that the second upper member slides on the first upper member, provision of the wear resistant material on the second upper member does not hinder the bendability of the upper.

[0028] An upper structure for a shoe according to a second aspect of the present invention comprises a third upper member disposed at a forefoot region on a lateral side of the shoe, and a fourth upper member that is disposed at a

rear foot region to the forefoot region on the lateral side of the shoe and whose front end edge portion overlaps with the outside of a rear end edge portion of the third upper member.

[0029] According to the second aspect of the present invention, at the time of bending movement of the upper during the push off motion of the foot of the shoe wearer, the front end edge portion of the fourth upper member slides on the third upper member in the longitudinal direction and at the same time the rear end edge portion of the third upper member slides under the fourth upper member in the longitudinal direction.

[0030] In this way, a mutual slide movement of the upper members can absorb creases or slacks of the upper created at bending regions of the upper on the lateral side of the shoe during the push off motion of the foot. Thereby, bending of the upper can be conducted in a smooth manner thus improving bendability of the upper.

[0031] Additionally, in the upper shown in WO 2004/093587, it is possible to increase bendability of the upper lateral side in a degree by expansion and contraction of the expanding and contracting portion (50). However, in WO 2004/093587, since the front portion (3) of the upper is in proximity to the rear portion (4), a longitudinal length of the upper end of the expanding and contracting portion (51) is short and the upper has thus certain limitations in the volume of contraction (i.e. bendability). On the other hand, if the expanding and contracting portion (51) is made enlarged the upper cannot fulfill its fundamental function to protect the foot of the wearer. Thus, the longitudinal length of the expanding and contracting portion (51) should not be made long. Consequently, the upper shown in WO 2004/093587 has certain limitations in the volume of contraction (i.e. bendability).

[0032] In contrast, according to the second aspect of the present invention, since the third upper member and the fourth upper member are provided overlapping with each other so as to slide mutually, such mutual slide movement of the upper members can securely absorb creases or slacks of the upper created at bending regions of the upper lateral side of the shoe at the time of bending of the upper during the push off motion of the foot. Thereby, bendability of the upper can be improved.

[0033] The lowermost point of the front end edge portion of the fourth upper member may correspond to the position of the metatarsophalangeal joints on the lateral side of the foot.

[0034] At the time of bending of the foot during the push off motion of the foot, the foot is bent at the metatarsophalangeal joints. Therefore, when the lowermost point of the front end edge portion of the fourth upper member is located at the position of the metatarsophalangeal joints on the lateral side of the foot, the upper can bend in a smooth manner in accordance with bending of the foot thus effectively improving bendability of the upper.

[0035] Additionally, in the upper shown in WO 2004/093587, the expandable and contractable region (50) on the lateral side covers the head of the fifth metatarsus and its vicinity, which are a region including the metatarsophalangeal joints, but as above-mentioned, in this case, the front portion (3) and the rear portion (4) of the upper are not provided overlapping with each other.

[0036] The lowermost point of the front end edge portion of the fourth upper member may be located at the position of $(0.64 \pm 0.05) \times L$ (L: shoe's size length) from a heel rear end.

[0037] In this case, the lowermost point corresponds to the position of the metatarsophalangeal joints on the lateral side of the foot.

[0038] A material of a low coefficient of friction may be provided at the overlapped portion of the third upper member and the fourth upper member.

[0039] In this case, at the time of bending of the upper during the push off motion of the foot, a mutual slide movement of the third and fourth upper members can be conducted more smoothly thus further enhancingbendabilityof the upper.

[0040] At the overlapped portion of the third upper member and the fourth upper member may be provided a second bag-shaped member, an end of the second bag-shaped member being coupled to the third upper member and the other end of the second bag-shaped member being coupled to the fourth upper member, and the second bag-shaped member being adapted to permit a mutual slide movement of the third upper member and the fourth upper member.

[0041] In this case, at the time of the push off motion of the foot followed by bending of the upper, when the front end edge portion of the fourth upper member slides on the third upper member and the rear end edge portion of the third upper member slides under the fourth upper member, the second bag-shaped member covers a gap at the overlapped portion between the third and fourth upper members. The second bag-shaped member can prevent sands or small stones from entering the inside of the shoe through the gap between the third and fourth upper members during activities.

[0042] Also, in this case, since the second bag-shaped member is provided in a bag-form between the third and fourth upper members and has a slack in itself, the second bag-shaped member follows the movements of the third and fourth upper members during the bending movement of the upper. Thereby, the second bag-shaped member does not hinder the slide movements of the third and fourth upper members thus maintaining bendability of the upper.

[0043] An upper structure for a shoe according to a third aspect of the present invention comprises a first upper member disposed at a forefoot region on a medial side of the shoe, a second upper member that is disposed at a rear foot region to the forefoot region on the medial side of the shoe and whose front end edge portion overlaps with the outside of a rear end edge portion of the first upper member, a third upper member disposed at a forefoot region on a lateral side of the shoe, and a fourth upper member that is disposed at a rear foot region to the forefoot region on the

lateral side of the shoe and whose front end edge portion overlaps with the outside of a rear end edge portion of the third upper member.

[0044] According to the third aspect of the present invention, at the time of bending movement of the upper during the push off motion of the foot of the shoe wearer, the front end edge portion of the second upper member slides on the first upper member in the longitudinal direction and the rear end edge portion of the first upper member slides under the second upper member in the longitudinal direction, and also the front end edge portion of the fourth upper member slides on the third upper member in the longitudinal direction and the rear end edge portion of the third upper member slides under the fourth upper member in the longitudinal direction.

[0045] In this way, a mutual slide movement of the first and second upper members can absorb creases or slacks of the upper created at bending regions of the upper medial side during the push off motion of the foot. Also, a mutual slide movement of the third and fourth upper members can absorb creases or slacks of the upper created at bending regions of the upper lateral side during the push off motion of the foot. As a result, bending of the upper can be conducted in a smoother manner thus improving bendability of the upper.

[0046] The lowermost point of the front end edge portion of the second upper member may correspond to the position of the metatarsophalangeal joints on the medial side of the foot, and the lowermost point of the front end edge portion of the fourth upper member may correspond to the position of the metatarsophalangeal joints on the lateral side of the foot.

[0047] At the time of bending of the foot during the push off motion of the foot, the foot is bent at the metatarsophalangeal joints. Therefore, when the lowermost point of the front end edge portion of the second upper member is located at the position of the metatarsophalangeal joints on the medial side of the foot, and the lowermost point of the front end edge portion of the fourth upper member is located at the position of the metatarsophalangeal joints on the lateral side of the foot, the upper can bend in a smoother manner in accordance with bending of the foot thus improving bendability of the upper more effectively.

[0048] The lowermost point of the front end edge portion of the second upper member may be located at the position of $(0.74\pm0.05)\times L$ (L: shoe's size length) from a heel rear end, and the lowermost point of the front end edge portion of the fourth upper member may be located at the position of $(0.64\pm0.05)\times L$ from the heel rear end.

[0049] In this case, the lowermost point of the second upper member corresponds to the position of the metatarsophalangeal joints on the medial side of the foot, and the lowermost point of the fourth upper member corresponds to the position of the metatarsophalangeal joints on the lateral side of the foot.

[0050] A material of a low coefficient of friction may be provided respectively at the overlapped portion of the first and second upper members and at the overlapped portion of the third and fourth upper members.

[0051] In this case, at the time of bending of the upper during the push off motion of the foot, a mutual slide movement of the first and second upper members as well as the third and fourth upper members can be conducted more smoothly thus further enhancing bendability of the upper.

[0052] A first bag-shaped member may be provided at the overlapped portion of the first and second upper members, an end of the first bag-shaped member being coupled to the first upper member and the other end of the first bag-shaped member being coupled to the second upper member, and the first bag-shaped member being adapted to permit a mutual slide movement of the first and second upper members. Also, a second bag-shaped member may be provided at the overlapped portion of the third and fourth upper members, an end of the second bag-shaped member being coupled to the third upper member and the other end of the second bag-shaped member being coupled to the fourth upper member, and the second bag-shaped member being adapted to permit a mutual slide movement of the third and fourth upper members.

[0053] In this case, at the time of the push off motion of the foot followed by bending of the upper, when the front end edge portion of the second upper member slides on the first upper member and the rear end edge portion of the first upper member slides under the second upper member, the first bag-shaped member covers a gap at the overlapped portion between the first and second upper members. The first bag-shaped member can prevent sands or small stones from entering the inside of the shoe through the gap between the first and second upper members during activities. Also, in this case, since the first bag-shaped member is provided in a bag-form between the first and second upper members and has a slack in itself, the first bag-shaped member follows the movements of the first and second upper members during the bending movement of the upper. Thereby, the first bag-shaped member does not hinder the slide movements of the first and second upper members thus maintaining bendability of the upper.

[0054] Moreover, in this case, at the time of the push off motion of the foot followed by bending of the upper, when the front end edge portion of the fourth upper member slides on the third upper member and the rear end edge portion of the third upper member slides under the fourth upper member, the second bag-shaped member covers a gap at the overlapped portion between the third and fourth upper members. The second bag-shaped member can prevent sands or small stones from entering the inside of the shoe through the gap between the third and fourth upper members during activities. Also, in this case, since the second bag-shaped member is provided in a bag-form between the third and fourth upper members and has a slack in itself, the second bag-shaped member follows the movements of the third and fourth upper members during the bending movement of the upper. Thereby, the second bag-shaped member does not

hinder the slide movements of the third and fourth upper members thus maintaining bendability of the upper.

[0055] The second upper member may be provided with a wear resistant material at the outside of the front end portion.

[0056] In this case, in a shoe such as a tennis shoe, a badminton shoe, or the like in which the medial side of the upper contacts the court surface to wear during activities, wear resistance and bendability of the medial side of the upper can be compatible with each other. Also, in this case, since bendability of the upper can be achieved such that the second upper member slides on the first upper member and the fourth upper member slides on the third upper member, provision of the wear resistant material on the second upper member does not hinder bendability of the upper.

BRIEF DESCRIPTION OF THE DRAWINGS

[0057] For a more complete understanding of the invention, reference should be made to the embodiments illustrated in greater detail in the accompanying drawings and described below by way of examples of the invention. In the drawings, which are not to scale:

FIG. 1 is a medial side view of a tennis shoe employing an upper structure according to an embodiment of the present invention;

Fig. 2 is a medial side view of the tennis shoe of FIG. 1 showing an opening state of the second upper member;

FIG. 3 is a top plan schematic view of an upper structure showing the positions of the front end edge portions of the second and fourth upper members;

Fig. 4 is a side view illustrating a change of the bending state of the upper during a push off motion of the foot;

FIG. 5 is a side view illustrating a change of the bending state of the upper during a push off motion of the foot;

Fig. 6 is a front perspective view of a tennis shoe employing an upper structure according to another embodiment of the present invention;

FIG. 7 is a front elevational view of a friction tester;

FIG. 8 is a medial side view of a tennis shoe employing an upper structure according to a still another embodiment of the present invention, showing an opened state of a portion of the second upper member; and

FIG. 9 is a medial side view of a tennis shoe employing an upper structure according to a still another embodiment of the present invention, showing a closed state of the second upper member.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0058] Referring now to the drawings, FIGS. 1 and 5 show an upper structure for a shoe according to an embodiment of the present invention. In these drawings, like reference numbers indicate identical or functionally similar elements.

[0059] As shown in FIGS. 1 and 2, a shoe 1 comprises a sole 2, and an upper 3 that is provided on the sole 2, whose lower portion is fixedly attached to the sole 2, and that covers a foot P of a shoe wearer.

[0060] The upper 3 is composed of a first upper member 30 disposed at a forefoot region F on a medial side of the shoe 1, and a second upper member 31 that is disposed at a rear foot region R to the forefoot region F on the medial side of the shoe 1. A front end edge portion 31a of the second upper member 31 overlaps with the outside of a rear end edge portion 30a of the first upper member 30 (see FIG. 2).

[0061] The first and second upper members 30, 31 are provided such that at the time of bending movement of the upper 3 during a push off motion of the foot of the shoe wearer the front end edge portion 31a of the second upper member 31 slides on the first upper member 30 in the longitudinal direction and at the same time the rear end edge portion 30a of the first upper member 30 slides under the second upper member 31 in the longitudinal direction.

[0062] The lowermost point A of the front end edge portion 31a of the second upper member 31 corresponds to the position of the metatarsophalangeal joints MJ on the medial side of the foot (see FIG. 3). Here, the metatarsophalangeal joints MJ are joints between the bottoms of the proximal phalanxes PP and the heads of the metatarsi MT of the first toe to the fifth toe of the foot. More particularly, the lowermost point A of the front end edge portion 31a of the second upper member 31 is located at the position of $(0.74 \pm 0.05) \times L$ (L: shoe's size length) from a heel rear end. The position of the heel rear end indicates a position of a heel rear end of an inner wall surface 3i of the upper 3. This value is calculated from the data of actual measurements of the bending positions of the feet of athletes more than 500.

[0063] Preferably, a material of a low coefficient of friction is provided at an overlapped portion (or a hatched region in FIG. 2) of the first upper member 30 and the second upper member 31. As such material, fluorocarbon polymers such as PTFE (Polytetrafluoroethylene), polyethylene resin, silicon, boron nitride, or the like may be used. The material may be provided on a surface of the upper by coating, bonding, or doping. Alternatively, the material may be made up into a sheet and the sheet may be sewn on the surface of the upper.

[0064] In the example shown in FIG. 2, a region of a low coefficient of friction is provided on a surface (or the outside) of the first upper member 30, but the region of a low coefficient of friction may be provided on the back surface of the second upper member 31. In the alternative, the region of a low coefficient of friction may be provided both on the surface

(or the outside) of the first upper member 30 and on the back surface of the second upper member 31. In this case, when the first and second upper members 30, 31 slide each other in the longitudinal direction at the time of bending of the upper 3, a slide movement of each of the first and second upper members 30, 31 along the other of the first and second upper members 30, 31 can be conducted in a smoother manner thus improving bendability of the upper 3.

[0065] The second upper member 31 is provided with a wear resistant material 32 at the outside of a front end portion. The wear resistant material 32 may be artificial leather, nylon, rubber, or urethane, whose hardness is greater than or equal to hardness of the second upper member 31. Such a material may be made up into a small sheet piece and the small sheet piece may be bonded or sewn to the front end portion of the second upper member 31. In the alternative, the front end portion of the second upper member 31 may be coated with nylon, rubber, urethane, or the like.

[0066] A tongue portion 33 is provided at a longitudinal opening formed along an instep portion of the shoe 1. A front end of the tongue portion 33 is fixedly attached to a toe portion of the first upper member 30. Also, the second upper member 31 has a plurality of eyelets 31b formed on the upper end edge portion of the second upper member 31. A shoelace 38 is inserted into these eyelets 31b.

[0067] In accordance with a shift from a sole entire surface contact (or foot flat contact) with the ground shown in FIG. 1 to a push off motion of the foot shown in FIG. 4, as the upper bends, the front end edge portion 31a of the second upper member 31 moves forward toward the toe side to increase an overlap with the first upper member 30. As shown in FIG. 5, as the upper 3 further bends, the front end edge portion 31a of the second upper member 31 moves further forward toward the toe side to further increase the overlap with the first upper member 30.

[0068] At the time of bending movement of the upper 3, the front end edge portion 31a of the second upper member 31 slides on the surface of the first upper member 30 in the longitudinal direction and at the same time the rear end edge portion 30a of the first upper member 30 slides under (or on the back surface of) the second upper member 31 in the longitudinal direction.

[0069] Thereby, creases or slacks formed on bending regions of the upper medial side during the push off motion of the foot can be absorbed by a mutual slide movement of the upper members 30, 31. As a result, bending of the upper 3 can be conducted in a smooth manner thus improving bendability of the upper 3.

[0070] Also, in this case, the lowermost point A of the front end edge portion 31a of the second upper member 31 corresponds to the position of the metatarsophalangeal joints MJ on the medial side of the foot. At the time of bending of the foot during the push off motion of the foot, the foot is bent at the metatarsophalangeal joints MJ. Therefore, when the lowermost point A of the front end edge portion 31a of the second upper member 31 is located at the position of the metatarsophalangeal joints MJ on the medial side of the foot, the upper 3 can bend in a smooth manner in accordance with bending of the foot thus effectively improving bendability of the upper 3. The position of the metatarsophalangeal joints MJ on the medial side of the foot can be expressed by the position of $L_1=(0.74\pm0.05)\times L$ (L: shoe's size length) from a heel rear end.

[0071] Moreover, in this case, since the material of a low coefficient of friction is provided at the overlapped portion of the first and second upper members 30, 31, when the first and second upper members 30, 31 slide each other in the longitudinal direction at the time of bending of the upper, a mutual slide movement of the first and second upper members 30, 31 can be conducted more smoothly thus enhancing bendability of the upper.

[0072] Furthermore, in this case, since the second upper member 31 is provided with the wear resistant material 32 on the outside of a front end, wear resistance of the upper medial side can be improved. In a tennis shoe, the medial side of the upper contacts the court surface to wear during activities. A wear resistant material is generally formed of a hard material and also when such wear resistant material is bonded to the surface of the upper the upper increases in thickness. Therefore, in an upper-integrated shoe of prior art, when the wear resistant material is provided at the upper, bendability of the upper was hindered. To the contrary, in the upper structure of the embodiment, since bendability of the upper 3 can be achieved by sliding movement of the second upper member 31 along the first upper member 30, provision of the wear resistant material 32 on the second upper member 31 does not hinder bendability of the upper 3. Thereby, both wear resistance and bendability can be compatible with each other.

[0073] In the above-mentioned embodiment, an embodiment was shown in which the mutually slidable two upper members were provided overlapping with each other on the medial side of the shoe, but the present invention is not limited to such an example.

[0074] As shown in FIG. 3, the upper 3 on the lateral side of the shoe 1 is composed of a third upper member 34 disposed at a forefoot region F on the lateral side of the shoe 1 and a fourth upper member 35 that is disposed at a rear foot region R to the forefoot region F on the lateral side of the shoe 1. A front end edge portion 35a of the fourth upper member 35 overlaps with the outside of a rear end edge portion (not shown) of the third upper member 34.

[0075] In this case, at the time of bending movement of the upper 3 during the push off motion of the foot of the shoe wearer, the front end edge portion 35a of the fourth upper member 35 slides on the third upper member 34 in the longitudinal direction and at the same time the rear end edge portion of the third upper member 34 slides under the fourth upper member 35 in the longitudinal direction.

[0076] The lowermost point B of the front end edge portion 35a of the fourth upper member 35 corresponds to the

position of the metatarsophalangeal joints MJ on the lateral side of the foot. More particularly, the lowermost point B of the front end edge portion 35a of the fourth upper member 35 is located at the position of L_2=(0.64±0.05)XL (L: shoe's size length) from the heel rear end. The position of the heel rear end indicates a position of the heel rear end of the inner wall surface 3i of the upper 3. This value is calculated from the data of actual measurements of the bending positions of the feet of athletes more than 500.

[0077] As with the above-mentioned embodiment, a material of a low coefficient of friction (not shown) is provided at an overlapped portion of the third upper member 34 and the fourth upper member 35. A region of a low coefficient of friction is provided on a surface (or an outside) of the third upper member 34, on a back surface of the fourth upper member 35, or both on the surface of the third upper member 34 and on the back surface of the fourth upper member 35. In this case, when the third and fourth upper members 34, 35 slide each other in the longitudinal direction at the time of bending of the upper 3, a slide movement of each of the third and fourth upper members 34, 35 along the other of the third and fourth upper members 34, 35 can be conducted in a smoother manner thus improving bendability of the upper 3.

[0078] In this case as well, similar to the above-mentioned embodiment, in accordance with a shift from the sole entire surface contact (or foot flat contact) with the ground shown in FIG. 1 to the push off motion of the foot shown in FIGS. 4 and 5, as the upper bends, the front end edge portion 35a of the fourth upper member 35 moves forward toward the toe side to increase an overlap with the third upper member 34.

[0079] At the time of bending movement of the upper 3, the front end edge portion 35a of the fourth upper member 35 slides on the surface of the third upper member 34 in the longitudinal direction and at the same time the rear end edge portion of the third upper member 34 slides under (or on the back surface of) the fourth upper member 35 in the longitudinal direction.

[0080] Thereby, creases or slacks formed on bending regions of the upper lateral side during the push off motion of the foot can be absorbed by a mutual slide movement of the upper members 34, 35. As a result, bending of the upper 3 can be conducted in a smooth manner thus improving bendability of the upper 3.

[0081] Also, in this case, the lowermost point B of the front end edge portion 35a of the fourth upper member 35 corresponds to the position of the metatarsophalangeal joints MJ on the lateral side of the foot. At the time of bending of the foot during the push off motion of the foot, the foot is bent at the metatarsophalangeal joints MJ. Therefore, when the lowermost point B of the front end edge portion 35a of the fourth upper member 35 is located at the position of the metatarsophalangeal joints MJ on the lateral side of the foot, the upper 3 can bend in a smooth manner in accordance with bending of the foot thus effectively improving bendability of the upper 3. The position of the metatarsophalangeal joints MJ on the lateral side of the foot can be expressed by the position of (0.64±0.05)×L (L: shoe's size length) from the heel rear end.

[0082] Moreover, in this case, since the material of a low coefficient of friction is provided at the overlapped portion of the third and fourth upper members 34, 35, when the third and fourth upper members 34, 35 slide each other in the longitudinal direction at the time of bending of the upper, a mutual slide movement of the third and fourth upper members 34, 35 can be conducted more smoothly thus enhancing bendability of the upper.

[0083] In each of the above-mentioned embodiments, mutually slidable two upper members were provided overlapping with each other on either the medial side or the lateral side of the shoe 1. The present invention is applicable to the case in which mutually slidable two upper members were provided overlapping with each other on both the medial side and the lateral side of the shoe 1 (see FIG. 3).

[0084] Additionally, in the example shown in FIG. 3, the third upper member 34 is integrally formed with the first upper member 30 via the toe portion, and the fourth upper member 35 is integrally formed with the second upper member 31 via the heel portion.

[0085] In this case, at the time of bending movement of the upper during the push off motion of the foot, the front end edge portion 31a of the second upper member 31 slides on the first upper member 30 in the longitudinal direction and the rear end edge portion 30a of the first upper member 30 slides under the second upper member 31 in the longitudinal direction. At the same time, the front end edge portion 35a of the fourth upper member 35 slides on the third upper member 34 in the longitudinal direction and the rear end edge portion of the third upper member 34 slides under the fourth upper member 35 in the longitudinal direction.

[0086] In such a manner, a mutual slide movement of the first and second upper members 30, 31 can absorb creases or slacks of the upper created at bending regions of the upper medial side during the push off motion of the foot. Also, a mutual slide movement of the third and fourth upper members 34, 35 can absorb creases or slacks of the upper created at bending regions of the upper lateral side during the push off motion of the foot. As a result, bending of the upper 3 can be conducted in a further smoother manner thus further improving bendability of the upper 3.

[0087] Also, the lowermost point A of the front end edge portion 31a of the second upper member 31 corresponds to the position of the metatarsophalangeal joints MJ on the medial side of the foot, and the lowermost point B of the front end edge portion 35a of the fourth upper member 35 corresponds to the position of the metatarsophalangeal joints MJ on the lateral side of the foot.

[0088] At the time of bending of the foot during the push off motion of the foot, the foot is bent at the metatarsophalangeal joints MJ. Therefore, when the lowermost point A of the front end edge portion 31a of the second upper member 31 is located at the position of the metatarsophalangeal joints MJ on the medial side of the foot, and the lowermost point B of the front end edge portion 35a of the fourth upper member 35 is located at the position of the metatarsophalangeal joints MJ on the lateral side of the foot, the upper 3 can bend in a smoother manner in accordance with bending of the foot thus improving bendability of the upper more effectively.

[0089] The lowermost point A of the front end edge portion 31a of the second upper member 31 is located at the position of $(0.74 \pm 0.05) \times L$ (L: shoe's size length) from the heel rear end, and the lowermost point B of the front end edge portion 35a of the fourth upper member 35 is located at the position of $(0.64 \pm 0.05) \times L$ from the heel rear end. The lowermost point A of the second upper member 31 corresponds to the position of the metatarsophalangeal joints MJ on the medial side of the foot, and the lowermost point B of the fourth upper member 35 corresponds to the position of the metatarsophalangeal joints MJ on the lateral side of the foot.

[0090] A material of a low coefficient of friction is provided respectively at the overlapped portion of the first and second upper members 30, 31 and at the overlapped portion of the third and fourth upper members 34, 35.

[0091] In this case, at the time of bending of the upper during the push off motion of the foot, a mutual slide movement of the first and second upper members 30, 31 as well as the third and fourth upper members 34, 35 can be conducted more smoothly thus further enhancing bendability of the upper.

[0092] The second upper member 33 is provided with a wear resistant material at the outside of the front end portion.

[0093] In this case, in a shoe such as a tennis shoe, a badminton shoe, or the like in which the medial side of the upper contacts the court surface to wear during activities, wear resistance and bendability of the medial side of the upper is compatible with each other. Also, in this case, since bendability of the upper can be achieved by sliding of the second upper member 31 along the first upper member 30 and also by sliding of the fourth upper member 35 along the third upper member 34, provision of the wear resistant material on the second upper member 31 does not hinder bendability of the upper.

[0094] In each of the above-mentioned embodiments, the front end edge portion 31a of the second upper member 31 and the front end edge portion 35a of the fourth upper member 35 are flat in shape and the lowermost points A, B are fixedly attached to the sole 2. However, each of the front end edge portions 31a, 35a may have a small arc at the lowermost points A, B, the center of radius of curvature of the small arc being located at the first or third upper member 30, 34. In this case, stress concentration that occurs at the lowermost point A of the second upper member 31 and the lowermost point B of the fourth upper member 35 during bending of the upper 3 can be relieved, thus preventing the second and fourth upper members 31, 35 from cracking at the lowermost points A, B.

[0095] FIG. 6 shows another embodiment of the present invention. In this embodiment, a first bag-shaped member 4 is provided at the overlapped portion of the first upper member 30 and the second upper member 31 on the medial side of the shoe 1. The first bag-shaped member 4 is, for example, a fan-shaped cloth, fabrics, artificial leather, film, or the like. An end 40 of the first bag-shaped member 4 is fixedly attached to the surface of the first upper member 30 and the other end 41 of the first bag-shaped member 4 is fixedly attached to the back surface of the front end edge portion 31a or its proximity of the second upper member 31. The first bag-shaped member 4 is folded into a bag-form and housed at the overlap portion between the first and second upper members 30, 31. The first bag-shaped member 4 is formed with a hole 42 for inserting the shoelace 38. FIG. 6 illustrates the state in which the second upper member 31 is opened to show the first bag-shaped member 4. At the normal state, as shown in FIG. 1, the first bag-shaped member 4 is covered by the second upper member 31 and is not seen from the outside.

[0096] The first bag-shaped member 4 is preferably formed of a material of a low coefficient of friction. That is for reduction of a frictional resistance during rubbing of the first bag-shaped member 4 relative to each other at the time of bending of the upper. Specifically, in the friction test using the Friction Tester (KES-SE) of KATO TECH CO., LTD., a material of frictional resistance of less than 0.6 is preferable.

[0097] As shown in FIG. 7, the Friction Tester is an apparatus in which the load cell measures the frictional force and the average frictional resistance is calculated when the sensor drags along (i.e. contacts and moves along) the test piece placed on the table. The sensor is supplied with a weight.

[0098] Table 1 shows the results of the friction test using the Friction Tester.

TABLE 1

	Test Piece					
Load(g)	I (surface)	II (surface)	III (surface)	IV (back surface)	V (surface)	VI (back surface)
25	0.511	0.693	0.561	0.431	0.503	0.425

(continued)

	Test Piece					
Load(g)	I (surface)	II (surface)	III (surface)	IV (back surface)	V (surface)	VI (back surface)
50	0.508	0.613	0.578	0.418	0.498	0.430

[0099] In the test, four kinds of materials were arranged and from these materials six kinds of test pieces I to VI were prepared. Compositions of the test pieces I to VI are as follows:

I ...polyester fabric (base material) + polyurethane coating (surface);
II ...artificial leather (base material) + rubber coating (surface);
III ...polyester fabric (surface);
IV ...polyester fabric (back surface);
V ...polyester knitting (surface); and
VI ...polyester knitting (back surface).

[0100] In Table 1, for the test pieces I, II, the frictional resistance of the coating surface is shown; for the test pieces III, V, the frictional resistance of the surface of polyester fabric or polyester knitting is shown; and for the test pieces IV, VI, the frictional resistance of the back surface of polyester fabric or polyester knitting is shown. In the test, the sensor is supplied with a weight of 25 (g) or 50 (g). The frictional resistance of each of the test pieces I to VI is calculated under the load of 25(g) and 50(g).

[0101] Then, as the first bag-shaped member 4, six kinds of members were prepared that have the similar compositions to the above-mentioned test pieces I to VI. These members were respectively fitted to the shoes and thus six kinds of shoes were prepared. Five testees wear each of the shoes and start to dash from a standstill five times for each of the shoes to see if they feel bad at the bending portion of the upper. In such a way, a sensory test was conducted. The result of the test is that the majority of the testees felt bad for the test piece II.

[0102] From Table 1, the frictional resistance of the test piece II is above 0.6, and the frictional resistance of the other test pieces is below 0.6. In view of the results of the sensory test, it is found that the preferable value of the frictional resistance for the first bag-shaped member 4 is below 0.6.

[0103] In this embodiment, at the time of the push off motion of the foot followed by bending of the upper 3, when the front end edge portion 31a of the second upper 31 moves forward the first bag-shaped member 4 disposed at the overlap portion of the first and second upper members 30, 31 rub each other. At this juncture, since the first bag-shaped member 4 is formed of the material of a low coefficient of friction the first bag-shaped member 4 slides each other in a smooth manner, thereby allowing for a smooth forward movement of the front end edge portion 31a of the second upper member 31 to improve bendability of the upper 3.

[0104] Moreover, in this case, since the first bag-shaped member 4 is provided at the overlapped portion of the first and second upper members 30, 31, a gap between the first and second upper members 30, 31 at the overlapped portion is covered by the first bag-shaped member 4. Therefore, the first bag-shaped member 4 can prevent sands or small stones from entering the inside of the shoe 1 through the gap between the first and second upper members 30, 31. Also, since an end 41 of the first bag-shaped member 4 is coupled to the front end edge portion 31a of the second upper member 31, the first bag-shaped member 4 follows the movement of the front end edge portion 31a of the second upper member 31 during bending of the upper 3. Therefore, the first bag-shaped member 4 can prevent sands or small stones from entering the inside of the shoe 1 through the gap between the first and second upper members 30, 31 even at the time of bending of the upper 3 during activities.

[0105] Furthermore, in this case, since the first bag-shaped member 4 is provided in a bag-form between the first and second upper members 30, 31 and has a slack in itself, the first bag-shaped member 4 follows the movements of the first and second upper members 30, 31 during the bending movement of the upper 3. Thereby, the first bag-shaped member 4 does not hinder the slide movements of the first and second upper members 30, 31 thus maintaining bendability of the upper 3.

[0106] In FIG. 6, an example was shown in which the first bag-shaped member 4 is provided only on the medial side of the shoe 1, but the present invention is applicable to an example in which a second bag-shaped member (not shown) similar to the first bag-shaped member 4 is provided only on the lateral side of the shoe 1. In this case, an end of the second bag-shaped member is fixedly attached to the third upper member 34 and the other end of the second bag-shaped member is fixedly attached to the front end edge portion 35a of the fourth upper member 35 (see FIG. 3).

[0107] In this case, at the time of the push off motion of the foot followed by bending of the upper 3, when the front

end edge portion 35a of the fourth upper 35 moves forward the second bag-shaped member disposed at the overlapped portion of the third and fourth upper members 34, 35 rub each other. At this juncture, when the second bag-shaped member is formed of a material of a low coefficient of friction similar to the first bag-shaped member 4, the second bag-shaped member slides each other in a smooth manner, thereby allowing for a smooth forward movement of the front end edge portion 35a of the fourth upper member 35 to improve bendability of the upper 3.

[0108] Moreover, in this case, since the second bag-shaped member is provided at the overlap portion of the third and fourth upper members 34, 35, a gap between the third and fourth upper members 34, 35 at the overlap portion is covered by the second bag-shaped member. Therefore, the second bag-shaped member can prevent sands or small stones from entering the inside of the shoe 1 through the gap between the third and fourth upper members 34, 35. Also, since the end of the second bag-shaped member is coupled to the front end edge portion 35a of the fourth upper member 35, the second bag-shaped member follows the movement of the front end edge portion 35a of the fourth upper member 35 during bending of the upper 3. Therefore, the second bag-shaped member can prevent sands or small stones from entering the inside of the shoe 1 through the gap between the third and fourth upper members 34, 35 even at the time of bending of the upper 3 during activities.

[0109] Furthermore, in this case, since the second bag-shaped member is provided in a bag-form between the third and fourth upper members 34, 35 and has a slack in itself, the second bag-shaped member follows the movements of the third and fourth upper members 34, 35 during the bending movement of the upper 3. Thereby, the secondbag-shapedmember does not hinder the slide movements of the third and fourth upper members 34, 35 thus maintaining bendability of the upper 3.

[0110] The first and second bag-shaped members may be provided on the medial side and the lateral side of the shoe 1, respectively.

[0111] Then, FIGS. 8 and 9 show a still another embodiment of the present invention. In this embodiment, an eyelet 30b' of the first upper member 30 that corresponds to an eyelet 31b of the second upper member 31 on the foremost side is an elongatedaperture that extends substantially along the length of the shoe 1. The shoelace 38 is inserted into the eyelets 31b, 30b'.

[0112] In this case, since the eyelet 30b' is an elongated aperture, the shoelace 38 inserted into the eyelets 30b', 31b can move a small distance in the longitudinal direction between the first upper member 30 and the second upper member 31 after fastening of the shoelace 38. Therefore, when the front end edge portion 31a of the second upper member 31 slides in the forward direction (see a dash-and-dot-line in FIG. 9) at the time of bending of the upper 3 during the push off motion of the foot, the shoelace 38 permits the front end edge portion 31a of the second upper member 31 to slide a small distance, thereby preventing the shoelace 38 from restricting a slide movement of the front end edge portion 31a of the second upper member 31.

[0113] Also, when the front end edge portion 31a of the second upper member 31 slides forward the front end edge portion 31a of the second upper member 31 rotates forward around the lowermost point A (see a dash-and-dot-line in FIG. 9). Therefore, the eyelet 30b' may be formed along an arc m whose center is point A.

[0114] In each of the above-mentioned embodiments, a tennis shoe was taken as an example, but the present invention also has application to the other sports shoe such as a badminton shoe, volleyball shoe, basketball shoe, handball shoe, and the like. Furthermore, the present invention is also applicable to a running shoe, marathon shoe, soccer shoe, or baseball shoe.

Claims

1. An upper structure for a shoe (1) comprising:

a first upper member (30) disposed at a forefoot region (F) on a medial side of the shoe (1); and
a second upper member (31) that is disposed at a rear foot region (R) to the forefoot region (F) on the medial side of the shoe (1) and whose front end edge portion (31a) overlaps with the outside of a rear end edge portion (30a) of the first upper member (30);

wherein at the time of bending movement of the upper (3) during a push off motion of a foot of a shoe wearer, the front end edge portion (31a) of the second upper member (31) slides on the first upper member (30) in the longitudinal direction and at the same time the rear end edge portion (30a) of the first upper member (30) slides under the second upper member (31) in the longitudinal direction.

2. The upper structure according to claim 1,
wherein the lowermost point (A) of the front end edge portion (31a) of the second upper member(31) corresponds to the position of the metatarsophalangeal joints (MJ) on the medial side of the foot.

3. The upper structure according to claim 2,
wherein the lowermost point (A) is located at the position of (0.74±0.05)×L (L: shoe's size length) from a heel rear end.

4. The upper structure according to claim 1,
wherein a material of a low coefficient of friction is provided at an overlapped portion of the first upper member (30) and the second upper member (31).

5. The upper structure according to claim 1,
wherein a first bag-shaped member (4) is provided at an overlapped portion of the first upper member (30) and the second upper member (31), an end (40) of the first bag-shaped member (4) is coupled to the first upper member (30) and the other end (41) of the first bag-shaped member (4) is coupled to the second upper member (31), and the first bag-shaped member (4) is adapted to permit a mutual slide movement of the first upper member (30) and the second upper member (31) .

6. The upper structure according to claim 1,
wherein the second upper member (31) is provided with a wear resistant material (32) at the outside of a front end portion.

7. An upper structure for a shoe (1) comprising:

a third upper member (34) disposed at a forefoot region (F) on a lateral side of the shoe (1); and
a fourth upper member (35) that is disposed at a rear foot region (R) to the forefoot region (F) on the lateral side of the shoe (1) and whose front end edge portion (35a) overlaps with the outside of a rear end edge portion of the third upper member (34);

wherein at the time of bending movement of the upper (3) during a push off motion of a foot of a shoe wearer, the front end edge portion (35a) of the fourth upper member (35) slides on the third upper member (34) in the longitudinal direction and at the same time the rear end edge portion of the third upper member (34) slides under the fourth upper member (35) in the longitudinal direction.

8. The upper structure according to claim 7,
wherein the lowermost point (B) of the front end edge portion (35a) of the fourth upper member(35) corresponds to the position of the metatarsophalangeal joints (MJ) on the lateral side of the foot.

9. The upper structure according to claim 8,
wherein the lowermost point (B) is located at the position of (0.64±0.05)×L (L: shoe's size length) from a heel rear end.

10. The upper structure according to claim 7, wherein a material of a low coefficient of friction is provided at an overlapped portion of the third upper member (34) and the fourth upper member (35).

11. The upper structure according to claim 7, wherein a second bag-shaped member is provided at an overlapped portion of the third upper member (34) and the fourth upper member (35), an end of the second bag-shaped member is coupled to the third upper member (34) and the other end of the second bag-shaped member is coupled to the fourth upper member (35), and the second bag-shaped member is adapted to permit a mutual slide movement of the third upper member (34) and the fourth upper member (35).

12. An upper structure for a shoe (1) comprising:

a first upper member (30) disposed at a forefoot region (F) on a medial side of the shoe (1);
a second upper member (31) that is disposed at a rear foot region (R) to the forefoot region (F) on the medial side of the shoe (1) and whose front end edge portion (31a) overlaps with the outside of a rear end edge portion (30a) of the first upper member (30);
a third upper member (34) disposed at a forefoot region (F) on a lateral side of the shoe (1); and
a fourth upper member (35) that is disposed at a rear foot region (R) to the forefoot region (F) on the lateral side of the shoe (1) and whose front end edge portion (35a) overlaps with the outside of a rear end edge portion of the third upper member (34);

wherein at the time of bending movement of the upper (3) during a push off motion of a foot of a shoe wearer, the

front end edge portion (31a) of the second upper member (31) slides on the first upper member (30) in the longitudinal direction and at the same time the rear end edge portion (30a) of the first upper member (30) slides under the second upper member (31) in the longitudinal direction, and also the front end edge portion (35a) of the fourth upper member (35) slides on the third upper member (34) in the longitudinal direction and at the same time the rear end edge portion of the third upper member (34) slides under the fourth upper member (35) in the longitudinal direction.

13. The upper structure according to claim 12, wherein the lowermost point (A) of the front end edge portion (31a) of the second upper member (31) corresponds to the position of the metatarsophalangeal joints (MJ) on the medial side of the foot, and the lowermost point (B) of the front end edge portion (35a) of the fourth upper member (35) corresponds to the position of the metatarsophalangeal joints (MJ) on the lateral side of the foot.

14. The upper structure according to claim 13, wherein the lowermost point (A) is located at the position of (0.74±0.05) ×L (L: shoe's size length) from a heel rear end, and the lowermost point (B) is located at the position of (0.64±0.05) ×L from the heel rear end.

15. The upper structure according to claim 12, wherein a material of a low coefficient of friction is provided respectively at an overlapped portion of the first upper member (30) and the second upper member (31), and also at an overlapped portion of the third upper member (34) and the fourth upper member (35).

16. The upper structure according to claim 12, wherein a first bag-shaped member (4) is provided at an overlapped portion of the first upper member (30) and the second upper member (31), an end (40) of the first bag-shaped member (4) is coupled to the first upper member (30) and the other end (41) of the first bag-shaped member (4) is coupled to the second upper member (31), and the first bag-shaped member (4) is adapted to permit a mutual slide movement of the first upper member (30) and the second upper member (31); and wherein a second bag-shaped member is provided at an overlapped portion of the third upper member (34) and the fourth upper member (35), an end of the second bag-shaped member is coupled to the third upper member (34) and the other end of the second bag-shaped member is coupled to the fourth upper member, and the second bag-shaped member is adapted to permit a mutual slide movement of the third upper member (34) and the fourth upper member (35).

17. The upper structure according to claim 12, wherein the second upper member (31) is provided with a wear resistant material (32) at the outside of a front end portion.

FIG. 1

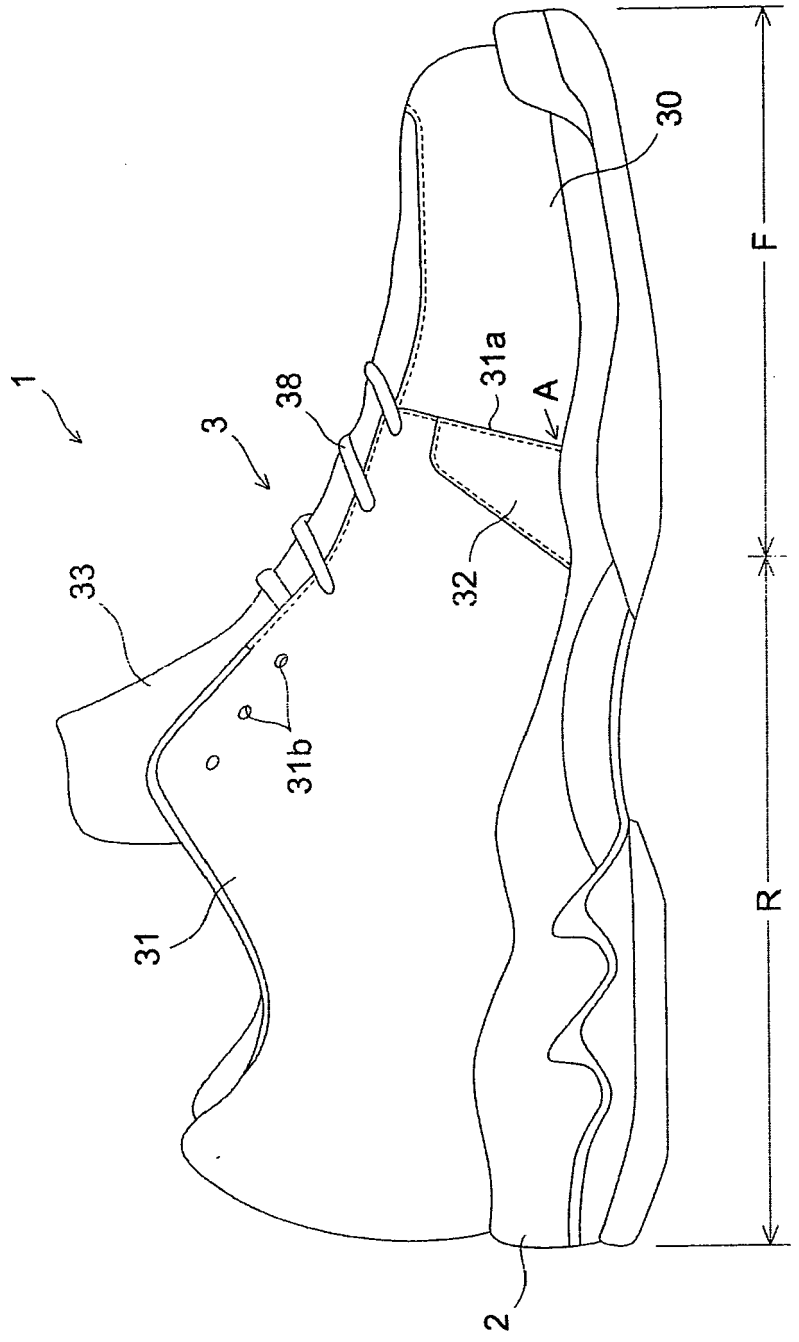


FIG. 2

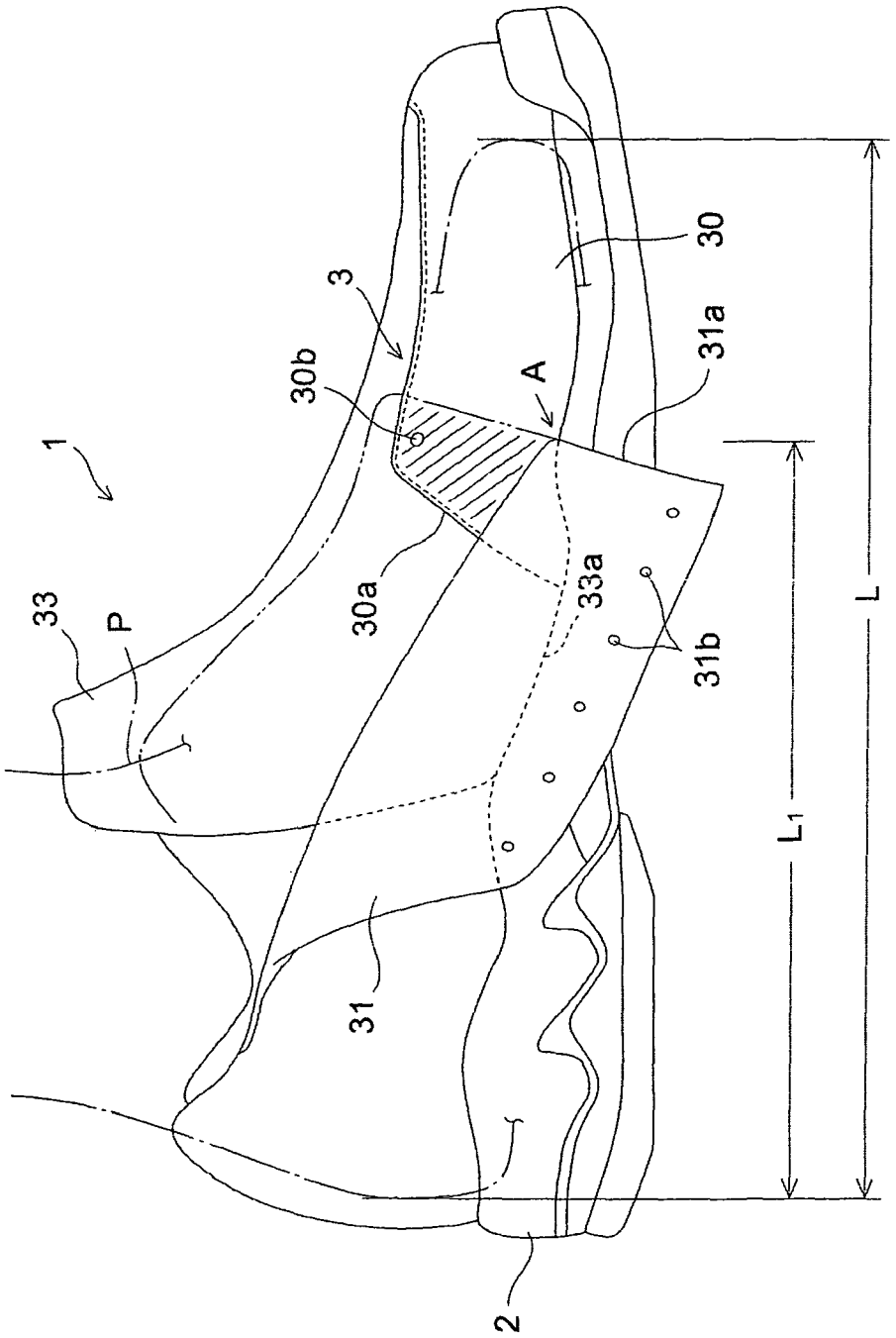


FIG. 3

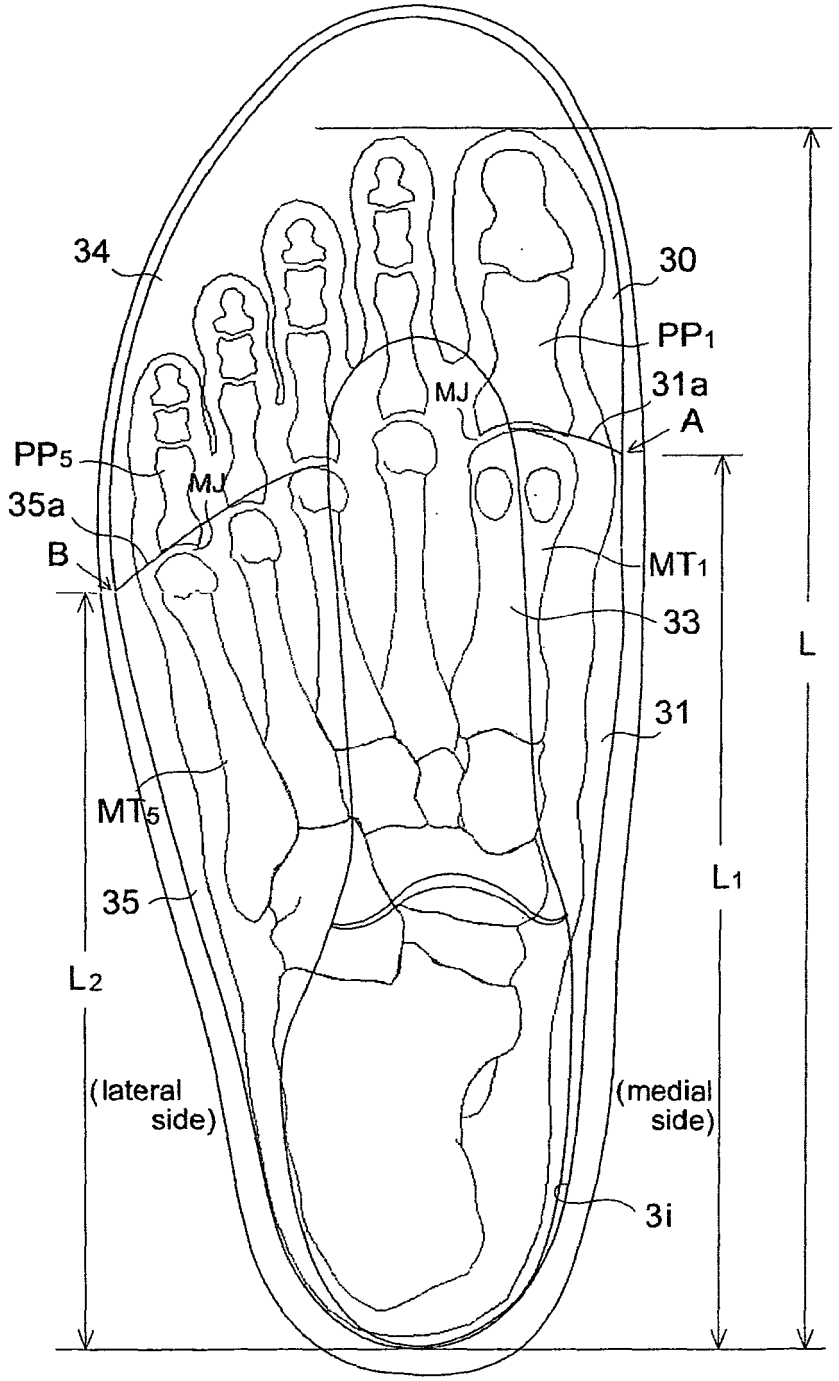

34
30
PP1
MJ
31a
A
PP5
MJ
35a
B
MT1
33
L
31
MT5
35
L1
L2
(lateral side)
(medial side)
3i

FIG. 4

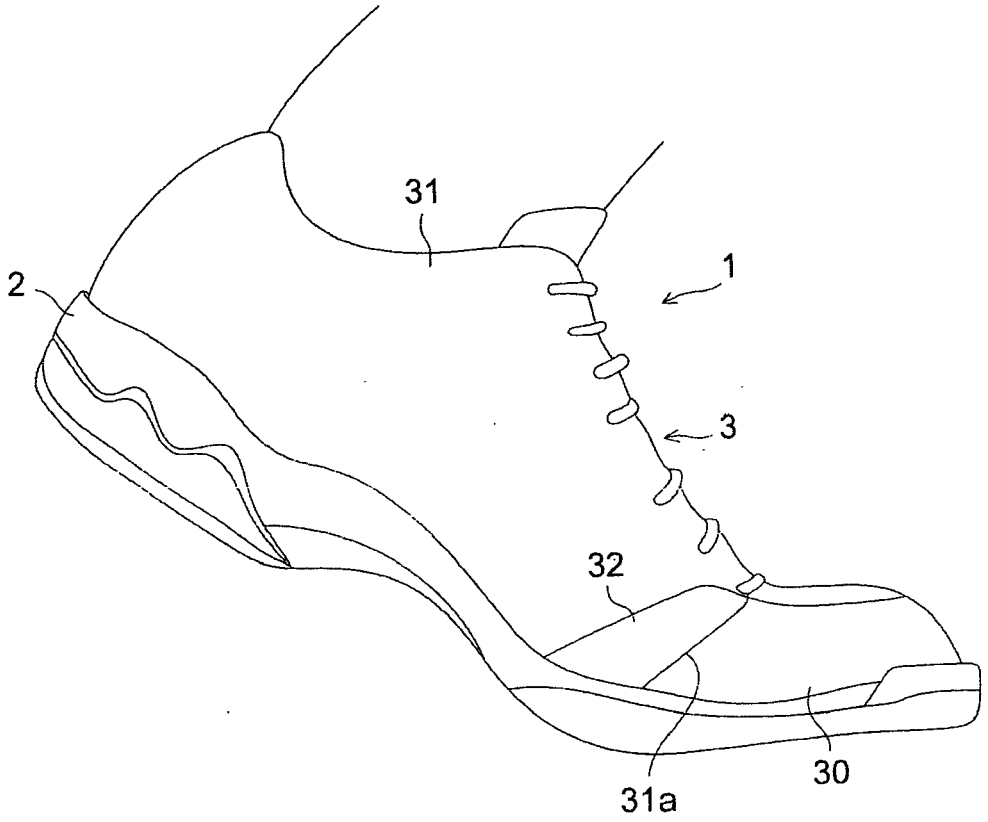


FIG. 5

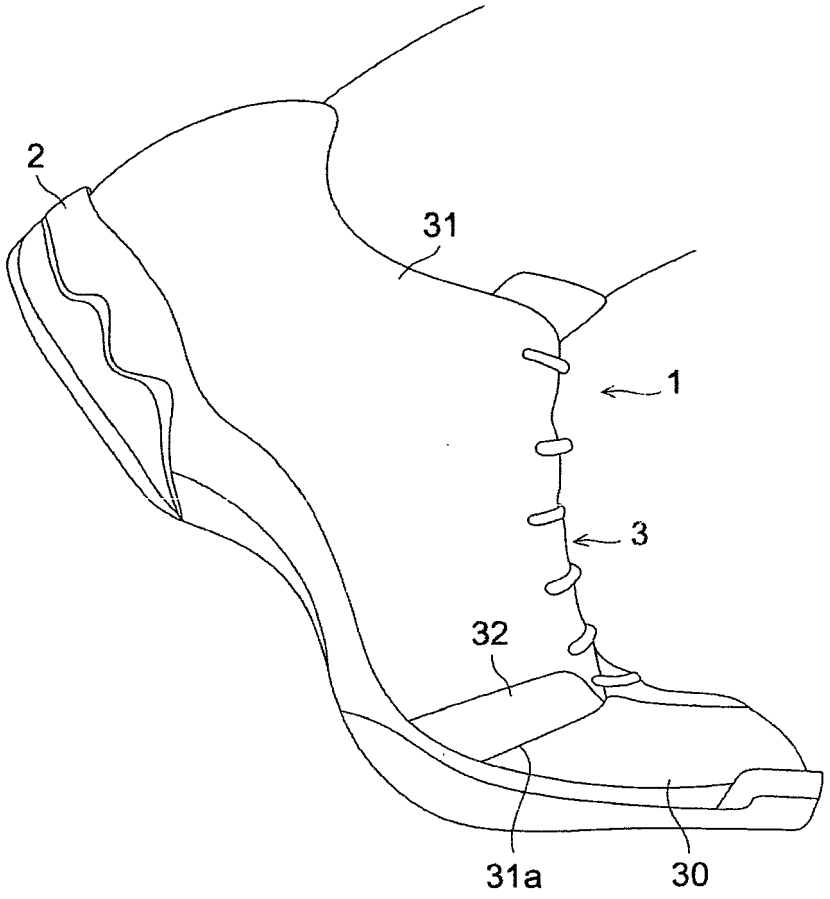


FIG. 6

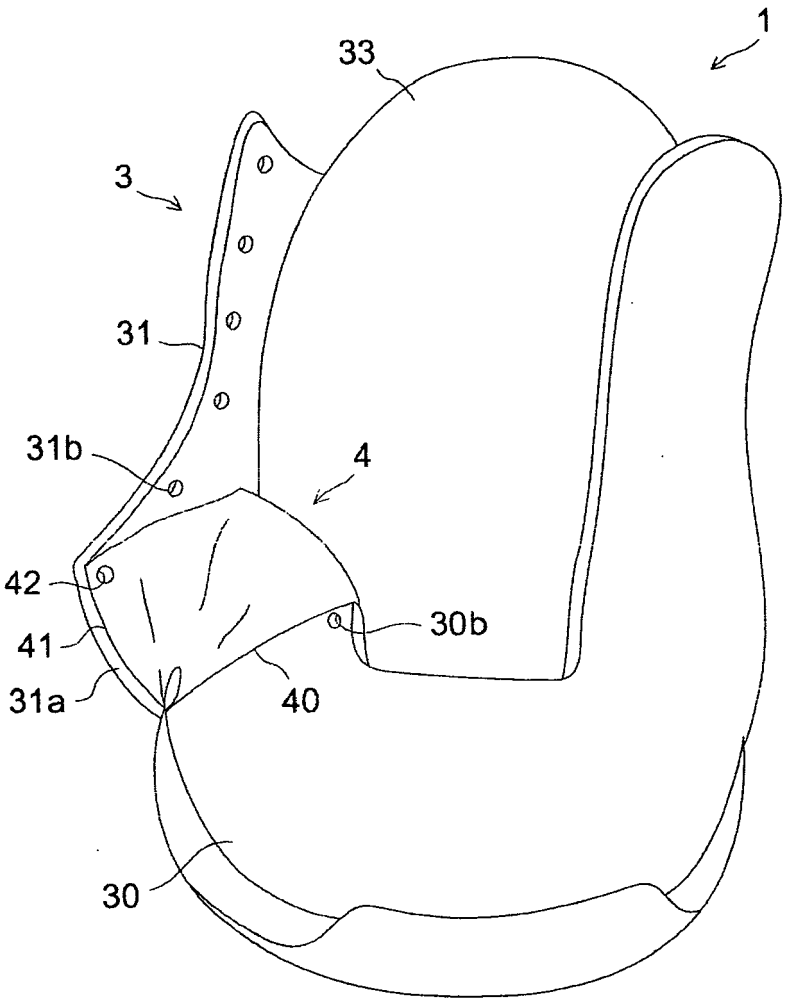


FIG. 7

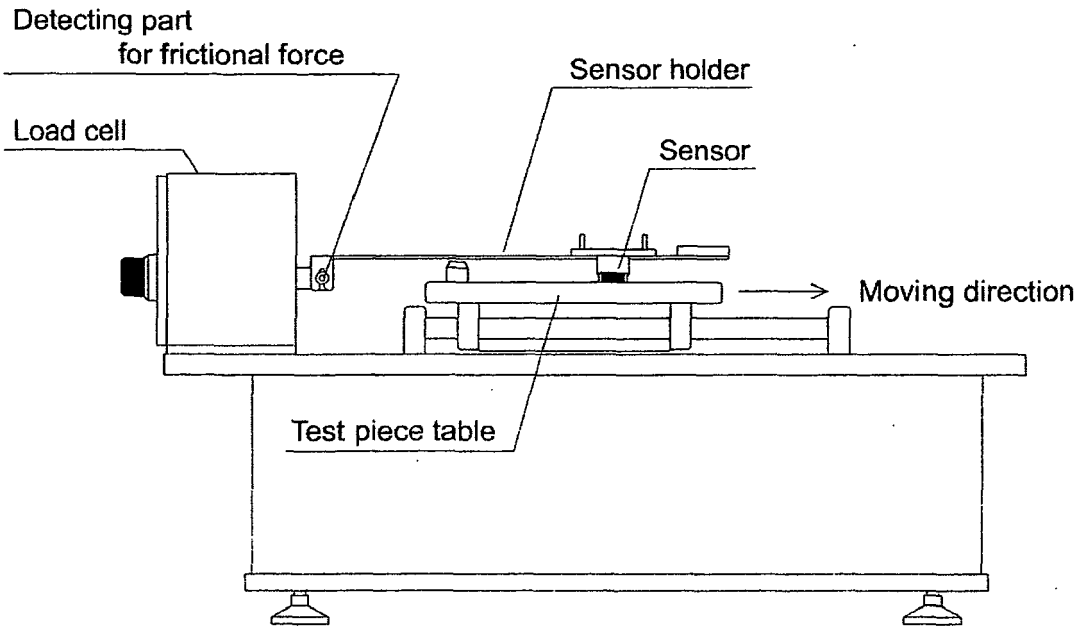

Detecting part
for frictional force
Load cell
Sensor holder
Sensor
Moving direction
Test piece table

FIG. 8

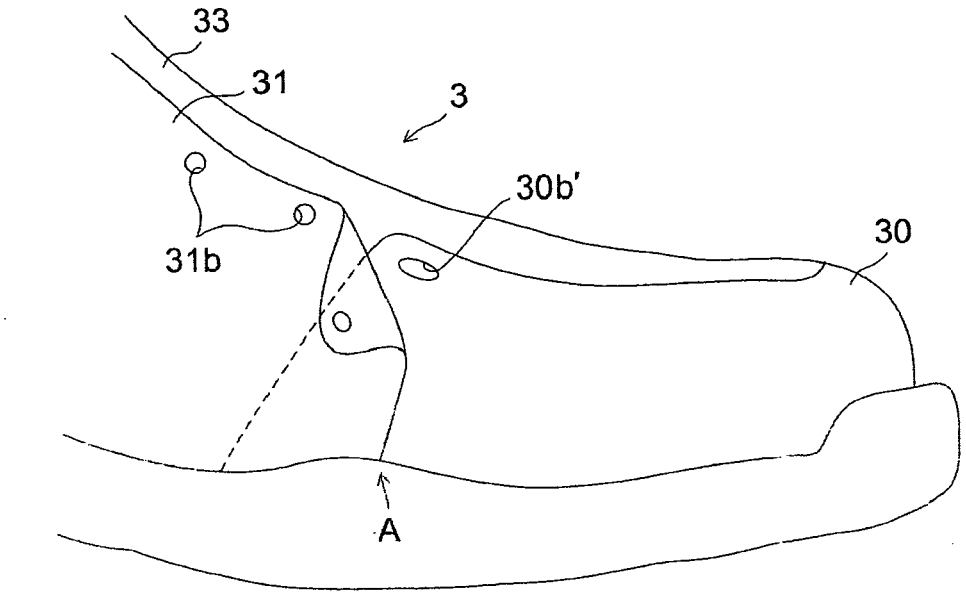
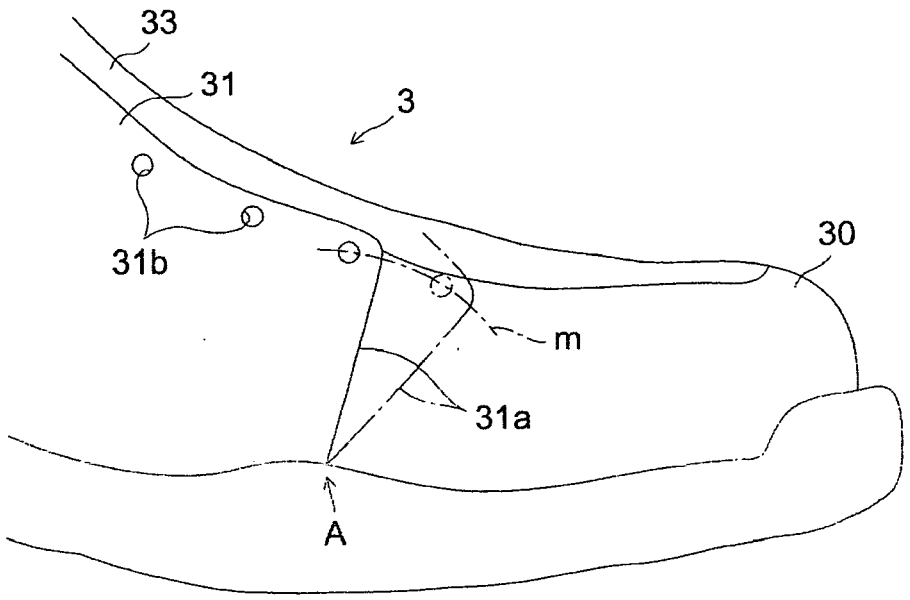


FIG. 9



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EUROPEAN SEARCH REPORT

Application Number
EP 09 25 0867

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A43B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	8 September 2009	Claudel, Benoît

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