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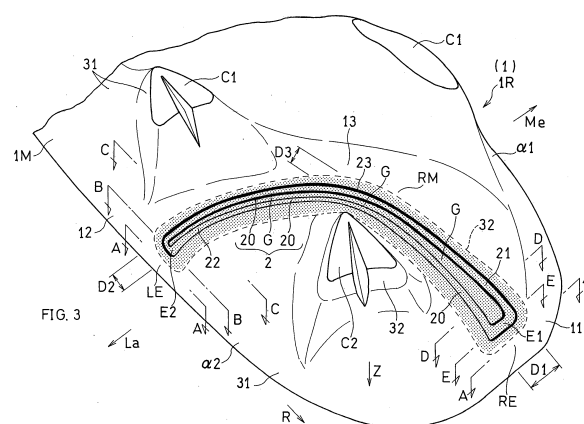
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(54) **SHOE HAVING MOBILE CLEATS**

(57) A shoe including: a plurality of cleats projecting from a bottom surface of an outsole; a first region where a first cleat is arranged; a second region where a second cleat is arranged; a band-shaped portion having a band shape which is arranged between the first region and the second region, wherein: the band-shaped portion extends from a middle region of a rearfoot portion toward a rear edge portion of the rearfoot portion and extends from the middle region of the rearfoot portion toward a lateral edge portion on a lateral side of the rearfoot portion; and at least one of the following elements a) and b) is satisfied: a) a Young's modulus of a soft material forming the band-shaped portion is less than a Young's modulus of a hard material forming the first and second regions; and b) an average value of a thickness of the band-shaped portion is less than an average value of a thickness of portions of the first and second regions in the vicinity of the band-shaped portion.



Description

TECHNICAL FIELD

[0001] The present invention relates to a shoe with movable cleats, and more particularly to a shoe for a field sport such as soccer, rugby and American football.

BACKGROUND ART

[0002] A field sport such as rugby and soccer involves kicking actions as well as running actions, and shoes therefor need to have various functions. For example, during kicking actions which are frequently done in field sports, the pivot foot (the non-kicking foot) is under a force in the horizontal direction that is about three times larger than that during running actions. Therefore, there is a demand for stability. This characteristic is sought for particularly in the heel portion.

[0003] During running actions in field sports mentioned above, loads act upon various parts of the foot. Particularly, if the lateral side of the rearfoot portion first contacts the ground, an impact load referred to as the "1st strike" acts upon the lateral side of the rearfoot portion. Therefore, shoes for field sports need to have a shock-absorbing property in addition to stability mentioned above.

[0004] In order to improve the stability and the shock-absorbing property, it is important to adequately deform the sole upon landing. Many of shoes for field sports have a high-rigidity outsole with protruding/depressing structures referred to as "cleats". Therefore, the amount of deformation of the sole upon landing is small, and the stability and the shock-absorbing property are generally poor.

CITATION LIST

PATENT LITERATURE

[0005]

First Patent Document: US00/5,384,973 A

Second Patent Document: GB 2425706 A

Third Patent Document: US 8,356,428 B2

SUMMARY OF INVENTION

[0006] However, special designs are needed to increase the amount of deformation of the sole upon landing for a high-rigidity outsole with cleats. The stability and the shock-absorbing property are sought for particularly in the heel portion, and it is important to control the sole deformation in the heel portion. However, no shoes have yet been developed with cleats that are designed with sufficient attention to both the stability and the shock-absorbing property needed for the heel portion during running actions and kicking actions. Moreover, even though the deformation of the sole in the heel portion

particularly influences the stability and the shock-absorbing property, the rearfoot portion has not drawn attention, although there are some shoes that have been made with attention to the forefoot portion.

[0007] It is therefore an object of the present invention to provide a shoe with movable cleats having an enhanced stability and shock-absorbing property particularly in the heel portion of the landing foot during a running action or the pivot foot during a kicking action, or the like.

[0008] In one aspect of the present invention, a shoe includes:

a plurality of cleats **C1**, **C2** projecting from a bottom surface **10** of an outer sole **1** formed by a material having a resin component;
a first region $\alpha 1$ where at least one first cleat **C1** of the plurality of cleats **C1**, **C2** is arranged;
a second region $\alpha 2$ where at least one second cleat **C2** of the plurality of cleats **C1**, **C2** is arranged; and
a band-shaped portion **2** having a band shape which is arranged between the first region $\alpha 1$ and the second region $\alpha 2$ so as to allow the second region $\alpha 2$ to be displaced with respect to the first region $\alpha 1$, wherein:

the band-shaped portion **2** extends from a portion of a middle region **RM** of a rear foot portion **1R** toward a rear edge portion **RE** of the rear foot portion **1R** and extends from the portion of the middle region **RM** of the rear foot portion **1R** toward a lateral edge portion **LE** on a lateral side **La** of the rear foot portion **1R** so that the first region $\alpha 1$ includes a medial side **Me** of the rear foot portion **1R** of the outer sole **1** and a middle foot portion **1M**, and the second region $\alpha 2$ forms the lateral side **La** of the rear foot portion **1R** of the outer sole **1**; and
one or both of the following elements a) and b) is satisfied:

a) a Young's modulus of a soft material forming the band-shaped portion **2** is less than a Young's modulus of a hard material forming the first and second regions $\alpha 1$, $\alpha 2$; and

b) an average value of a thickness of the band-shaped portion **2** is less than an average value of a thickness of portions of the first and second regions $\alpha 1$, $\alpha 2$ in the vicinity of the band-shaped portion **2**.

[0009] In this aspect, when the lateral side **La** of the rearfoot portion **1R** lands while running, the second cleat **C2** of the second region $\alpha 2$ first contacts the ground. Then, although the 1st strike acts upon the second cleat **C2**, the band-shaped portion deforms, thereby converting part of the 1st strike energy to the deformation energy. This will reduce the energy of impact acting upon the

foot, thereby increasing the shock-absorbing property.

[0010] That is, when a bending moment acts around an axis extending along the longitudinal direction of a band-shaped portion 2 that satisfies the element a) and/or the element b), the band-shaped portion 2 has a small rigidity against the bending moment, i.e., a small bending rigidity. Therefore, the band-shaped portion 2 exhibits a bending deformation (flexes), whereby the second region $\alpha 2$ deforms with respect to the first region $\alpha 1$, and the second cleat C2 is displaced significantly toward the lateral side with respect to the first cleat C1.

[0011] Upon 1st strike landing, second cleat C2 of the lateral side La of the rearfoot portion 1R often contacts the ground surface at an oblique angle. Then, as the second cleat C2 is displaced together with the second region $\alpha 2$, the second cleat C2 is likely to be vertical to the ground surface, thereby improving the stability while running.

[0012] On the other hand, on the pivot foot during a kicking action, the second cleat C2 of the rearfoot portion 1R is under a significant load toward the lateral side in the horizontal direction. Upon landing of this pivot foot, a bending stress acts on the band-shaped portion 2 via the second region $\alpha 2$ from the second cleat C2, which flexes the band-shaped portion 2 in the foot width direction, thereby moving the second cleat C2 toward the lateral side of the foot, together with the second region $\alpha 2$, with respect to the first region $\alpha 1$. Thus, the distance between the cleats C1, C2 increases, and the support of the pivot foot is likely to become stable. Moreover, it takes time after the second cleat C2 starts contacting the ground before the first cleat C1 starts contacting the ground. Therefore, the sole deformation speed is small, which prevents excessive deformation of the foot, thereby improving the stability.

[0013] Herein, "flex (flexion)" means that the bending stress is produced about an axis extending along the longitudinal direction of the band-shaped portion 2, thereby bending the band-shaped portion.

BRIEF DESCRIPTION OF DRAWINGS

[0014]

FIG. 1 is a lateral side view showing a shoe for the right foot for football according to Embodiment 1 of the present invention.

FIG. 2 is a bottom view showing a shoe sole of the same shoe.

FIG. 3 is an enlarged perspective view showing a rearfoot portion of the same shoe sole as seen from a lateral-posterior diagonal direction.

FIG. 4 is an enlarged perspective view showing a rearfoot portion of the same shoe sole as seen from a lateral-posterior diagonal direction.

FIG. 5 is a back view showing the same shoe sole as seen from the rear side.

FIG. 6A, FIG. 6B, FIG. 6C, FIG. 6D and FIG. 6E are

enlarged cross-sectional views taken along lines A-A, B-B, C-C, D-D and E-E, respectively, of FIG. 3.

FIG. 7 is an enlarged perspective view showing a forefoot portion of the same shoe sole as seen from a medial-anterior diagonal direction.

FIG. 8A, FIG. 8B and FIG. 8C are enlarged cross-sectional views taken along lines A-A, B-B and C-C, respectively, of FIG. 7.

FIG. 9A is a back view showing a shoe not included in the present invention, and FIG. 9B, FIG. 9C and FIG. 9D are back views showing the mechanism by which cleats are movable according to the present invention.

FIG. 10 is an enlarged perspective view showing a rearfoot portion of a shoe sole according to Embodiment 2 as seen from a lateral-posterior diagonal direction.

FIG. 11A, FIG. 11B, FIG. 11C, FIG. 11D and FIG. 11E are enlarged cross-sectional views taken along lines A-A, B-B, C-C, D-D and E-E, respectively, of FIG. 10.

FIG. 12A is a bar graph showing results of a stability test, and FIG. 12B is a bar graph showing results of a shock-absorbing property test.

FIG. 13A, FIG. 13B, FIG. 13C, FIG. 13D, FIG. 13E and FIG. 13F are cross-sectional views each showing an alternative example of a band-shaped portion.

FIG. 14A, FIG. 14B, FIG. 14C, FIG. 14D, FIG. 14E, FIG. 14F, FIG. 14G and FIG. 14H are plan views each showing an alternative example of the arrangement of a band-shaped portion.

DESCRIPTION OF EMBODIMENTS

[0015] Preferably, the band-shaped portion 2 extends from a first end portion E1 of the rear edge portion RE of the rear foot portion 1R toward a second end portion E2 on the lateral side La of the rear foot portion 1R; the first region $\alpha 1$ and the second region $\alpha 2$ are continuous with each other via the hard material and/or a first high-rigidity portion thicker than the band-shaped portion 2 in the rear edge portion RE of the outer sole 2 which is posterior R to the first end portion E1; and the first region $\alpha 1$ and the second region $\alpha 2$ are continuous with each other via the hard material and/or a second high-rigidity portion thicker than the band-shaped portion 2 in the lateral edge portion LE of the outer sole 1 which is on the lateral side La more lateral than the second end portion E2.

[0016] In this case, the first region $\alpha 1$ and the second region $\alpha 2$ are continuous with each other in the rear edge portion RE and the lateral edge portion LE via a hard material and/or a high-rigidity portion. Against a large load acting upon the rearfoot portion 1R, the first region $\alpha 1$ and the second region $\alpha 2$ of the outsole 1 are supported by each other at the opposite ends of the rear edge portion RE and the lateral edge portion LE which are hard and/or high-rigidity.

[0017] Therefore, even though the band-shaped portion 2 is formed by a soft material or the band-shaped portion 2 is thin and has a low rigidity, the durability of the outsole 1 will unlikely lower.

[0018] Preferably, the band-shaped portion 2 extends from a first end portion E1 of the rear edge portion RE of the rear foot portion 1R toward a second end portion E2 on the lateral side La of the rear foot portion 1R;

the outer sole 1 has a first roll-up portion 11 rolled up upwardly in the rear edge portion RE of the rear foot portion 1R;

the outer sole 1 has a second roll-up portion 12 rolled up upwardly in the lateral edge portion LE of the rear foot portion 1R;

the first region $\alpha 1$ and the second region $\alpha 2$ are continuous with each other via the hard material and/or a first high-rigidity portion thicker than the band-shaped portion 2 in the first roll-up portion 11 above the first end portion E1; and

the first region $\alpha 1$ and the second region $\alpha 2$ are continuous with each other via the hard material and/or a second high-rigidity portion thicker than the band-shaped portion 2 in the second roll-up portion 12 above the second end portion E2.

[0019] Also in this case, the durability will unlikely lower as described above.

[0020] Particularly, the first roll-up portion 11 and the second roll-up portion 12 are formed in the rearfoot portion 1R, and the band-shaped portion 2 can be made so long as to reach the rear end of the foot and the lateral edge of the foot. Therefore, the band-shaped portion 2 flexes more easily, and the shock-absorbing property and the stability will be further increased.

[0021] Preferably, where the band-shaped portion 2 is divided in three equal parts in a longitudinal direction thereof, at least one of an average value of a width D1 of a first portion 21 closer to the first end portion E1 and an average value of a width D2 of a second portion 22 closer to the second end portion E2 is greater than an average value of a width D3 of a third portion 23 including the middle region RM.

[0022] In this case, the first portion 21 and/or the second portion 22, which are closer to end portions than the third portion 23 including the middle region RM, have a larger width than that of the third portion 23, and there is a smaller binding force on the band-shaped portion 2 in the end portions 21 and 22 where the width is larger. Therefore, this may make it even easier for the band-shaped portion 2 to flex.

[0023] Preferably, an average value of a width D1 of the band-shaped portion 2 spanning from the portion of the middle region RM of the rear foot portion 1R to the first end portion E1 is greater than an average value of a width D2 of the band-shaped portion 2 spanning from the portion of the middle region RM of the rear foot portion 1R to the second end portion E2.

[0024] The second cleat C2 of the second region $\alpha 2$ of the rearfoot exerts the function described above by

being displaced toward the lateral side La. Therefore, the band-shaped portion 2 needs to flex in the width direction of the foot. Now, where the width D1 of the band-shaped portion 2 extending from a portion of the middle region RM of the rearfoot portion 1R to the first end portion E1 is large, the amount of flexion also increases. Therefore, the shock-absorbing property and the stability will further increase.

[0025] Preferably, an average thickness of the band-shaped portion 2 is less than an average thickness of portions of the first and second regions $\alpha 1$, $\alpha 2$ in the vicinity of the band-shaped portion 2.

[0026] In this case, the band-shaped portion 2 is thin, and the bending rigidity of the band-shaped portion 2 is therefore small, thus making it even easier for the band-shaped portion 2 to flex.

[0027] Preferably, the band-shaped portion 2 defines a groove G extending along the band-shaped portion 2.

[0028] In this case, the band-shaped portion 2 is depressed at the groove G in a cross section of the band-shaped portion 2. This depressed portion deforms due to a bending stress when a bending moment is applied in the transverse direction across the band-shaped portion 2. That is, stress concentration occurs at the depressed portion, and the bending deformation due to a bending stress occurs easily. Therefore, it is easy for the second cleat C2 of the second region $\alpha 2$ to be three-dimensionally displaced with respect to the first cleat C1 of the first region $\alpha 1$.

[0029] Preferably, the band-shaped portion 2 has a thick portion 20 extending along and on both sides of the groove G, and a thickness of the band-shaped portion 2 in the groove G is less than a thickness of the thick portion 20.

[0030] In this case, the bending deformation occurs more easily.

[0031] Preferably, the groove G is not formed with the thick portion 20 being continuous with each other in the first and second end portions E1, E2, and the groove G is formed between the first end portion E1 and the second end portion E2.

[0032] In this case, one can expect flexion because of the groove G, while the strength is high at the first and second end portions E1 and E2, and one can expect it is possible to ensure durability.

[0033] In another aspect of the present invention, a shoe includes:

a plurality of cleats C1, C2 projecting from a bottom surface 10 of an outer sole 1 formed by a material having a resin component;

a first region $\alpha 1$ where at least one first cleat C1 of the plurality of cleats C1, C2 is arranged;

a second region $\alpha 2$ where at least one second cleat C2 of the plurality of cleats C1, C2 is arranged; and

a band-shaped portion 2 having a band shape which is arranged between the first region $\alpha 1$ and the second region $\alpha 2$ and allows the second region $\alpha 2$ to

be displaced with respect to the first region $\alpha 1$, wherein:

at least one of the following elements c) and d) is satisfied:

- c) a Young's modulus of a soft material forming the band-shaped portion **2** is less than a Young's modulus of a hard material forming the first and second regions $\alpha 1$, $\alpha 2$; and
- d) the band-shaped portion **2** defines a groove **G** (depressed portion) extending along the band-shaped portion **2**.

[0034] In this other aspect, the rigidity of the band-shaped portion **2** is small, and a bending deformation is likely to occur in the band-shaped portion **2** due to a bending moment about the axis of the band-shaped portion **2**. Therefore, the stability and the shock-absorbing property will improve in portions where the second cleats **C2** are provided.

[0035] Preferably, both of the elements c) and d) are satisfied. Note that the groove **G** may partially run through a soft resin portion **32** as long as it will not excessively lower the strength when a bending moment is applied in the transverse direction across the band-shaped portion **2**.

[0036] In this case, the band-shaped portion **2** is depressed at the groove **G** in a cross section of the band-shaped portion **2**. This depressed portion deforms due to a bending stress when a bending moment is applied in the transverse direction across the band-shaped portion **2**. That is, stress concentration occurs at the depressed portion, and the bending deformation due to a bending stress occurs easily. Therefore, it is easy for the second cleat **C2** of the second region $\alpha 2$ to be three-dimensionally displaced with respect to the first cleat **C1** of the first region $\alpha 1$. Thus, part of the energy from the load on the second cleat **C2** is converted to a deformation energy, thereby reducing the impact energy acting upon the foot and improving the shock-absorbing property. At the same time, the second cleat **C2** is likely to contact the ground in the vertical direction to the ground surface, and after second cleat **C2** contacts the ground, the sole deformation speed decreases, thereby preventing excessive deformation of the foot and improving the stability. These effects occur not only when cleats and grooves are provided in the rearfoot portion, but they will occur based on a similar mechanism also when cleats and grooves are provided in the forefoot portion and the midfoot portion, etc.

[0037] Preferably, the band-shaped portion **2** has a thick portion **20** extending along and on both sides of the groove **G**, and a thickness of the band-shaped portion **2** in the groove **G** is less than a thickness of the thick portion **20**.

[0038] In this case, the amount of flexion will increase.

[0039] More preferably, the band-shaped portion **2** has one end portion **E1-E3** and another end portion **E1-E3**, and the end portions **E1-E3** each face one of edge portions RE, LE, ME, TE of the outer sole **1**; and the groove **G** is not formed with the thick portion **20** being continuous with each other in the end portions **E1-E3**, and the groove **G** is formed between the one end portion **E1-E3** and the other end portion **E1-E3**.

[0040] In this case, one can expect flexion because of the groove **G**, while the strength is high at the first and second end portions **E1**, **E2**, **E3**, and one can expect it is possible to ensure durability.

[Examples]

[0041] The present invention will be understood more clearly from the following description of preferred embodiments taken in conjunction with the accompanying documents. Note however that the embodiments and the drawings are merely illustrative and should not be taken to define the scope of the present invention. The scope of the present invention shall be defined only by the appended claims. In the accompanying drawings, like reference numerals denote like components throughout the plurality of figures.

[0042] Embodiment 1 of the present invention will now be described.

[0043] FIG. 1 to FIG. 8C show Embodiment 1.

[0044] As shown in FIG. 1, the present shoe for a field sport includes an outsole **1**, and an upper **100** denoted by a two-dot chain line. The outsole **1** is formed by a non-foamed material having a resin component. That is, the outsole **1** includes a thermoplastic or thermosetting resin component, and any other suitable component. The thermoplastic resin component may be, for example, a thermoplastic elastomer or a thermoplastic resin. Such resin components may each be used alone, or two or more of them may be used in combination. Note that a reinforcing material such as a fiber may be used.

[0045] The outsole **1** includes a plurality of first and second cleats **C1**, **C2** projecting from a bottom surface **10** of a plate-shaped base **13**, and a rib **14** arranged in the midfoot portion **1M**, the rib **14** being integral with the cleats **C1**, **C2**. As shown in FIG. 2, the base **13** includes the first region $\alpha 1$, the second regions $\alpha 2$, and the band-shaped portions **2**.

[0046] Note that the top surfaces of the cleats **C1**, **C2** are shaded with large dots in FIG. 2.

[0047] A plurality of first cleats **C1**, of the plurality of cleats **C1**, **C2**, are arranged in the first region $\alpha 1$, whereas one second cleat **C2**, of the plurality of cleats **C1**, **C2**, is arranged in each second region $\alpha 2$.

[0048] The band-shaped portions **2** each have a strip shape and are arranged between the first region $\alpha 1$ and the second regions $\alpha 2$, allowing and facilitating the deformation of the second regions $\alpha 2$ with respect to the first region $\alpha 1$. In the present embodiment, the Young's modulus of the soft material forming the band-shaped

portions 2 is smaller than the Young's modulus of the hard material forming the first and second regions $\alpha 1$, $\alpha 2$. Moreover, in the present embodiment, the average value of thickness of the band-shaped portions 2 is smaller than the average value of thickness of portions in the vicinity of the band-shaped portion 2 in the first and second regions $\alpha 1$, $\alpha 2$, as shown in FIG. 6B to FIG. 6D and FIG. 8A to FIG. 8C.

[0049] As shown in FIG. 2, the band-shaped portions 2 are provided in the forefoot portion 1F and the rearfoot portion 1R. Therefore, the second regions $\alpha 2$ are provided in the forefoot portion 1F and the rearfoot portion 1R. On the other hand, the first region $\alpha 1$ is provided centered around the midfoot portion 1M so as to extend from the medial side Me of the rearfoot portion 1R toward the rear end of the forefoot portion 1F.

[0050] The forefoot portion 1F, the middle foot portion 1M and the rearfoot portion 1R refer to portions that cover the forefoot section, the middle foot section and the rearfoot section of the foot, respectively. The forefoot section includes five metatarsal bones, and fourteen phalanges. The middle foot section includes a navicular bone, a cuboid bone, and three cuneiform bones. The rearfoot section includes a talus bone and a calcaneal bone.

[0051] Next, the band-shaped portion 2, the first region $\alpha 1$ and the second region $\alpha 2$ of the rearfoot portion 1R will be described primarily.

[0052] The band-shaped portion 2 extends from a part of the middle region RM of the rearfoot portion 1R toward the rear edge portion RE of the rearfoot portion 1R, and extends from a part of the middle region RM of the rearfoot portion 1R toward the lateral edge portion LE of the lateral side La of the rearfoot portion 1R. With this arrangement and shape of the band-shaped portion 2, the first region $\alpha 1$ includes the medial side Me of the rearfoot portion 1R and the midfoot portion 1M of the outsole 1, whereas the second region $\alpha 2$ forms the lateral side La of the rearfoot portion 1R of the outsole 1.

[0053] Herein, the middle region RM of the rearfoot portion 1R does not mean it is at the center, but means that it is a portion in the middle between the front portion and the rear portion of the rearfoot portion 1R that is between the medial side Me and the lateral side La of the rearfoot portion 1R; theoretically, it refers to a virtual 1/9 area of the rearfoot portion 1R that is denoted by a two-dot chain line. Thus, a part of the middle region RM of the rearfoot portion 1R and a part of the band-shaped portion 2 overlap with each other.

[0054] As shown in FIG. 5, at the rear edge portion RE of the rearfoot portion 1R, the outsole 1 includes the first roll-up portion 11 rolled up in the upward direction Z. At the lateral edge portion LE of the rearfoot portion 1R, the outsole 1 of FIG. 1 includes the second roll-up portion 12 rolled up in the upward direction Z.

[0055] The band-shaped portion 2 of FIG. 3 extends from the first end portion E1 at the rear edge portion RE of the rearfoot portion 1R toward the second end portion E2 at the lateral side La of the rearfoot portion 1R.

[0056] The first region $\alpha 1$ and the second region $\alpha 2$ are continuous with each other via a high-rigidity portion (RE) of the hard material that is thicker than the band-shaped portion 2 in the first roll-up portion 11 above the first end portion E1. The first region $\alpha 1$ and the second region $\alpha 2$ are also continuous with each other via a high-rigidity portion (LE) of the hard material that is thicker than the band-shaped portion 2 in the second roll-up portion 12 above the second end portion E2.

[0057] In the present embodiment, a hard resin portion 31 and the soft resin portion 32 are laid and attached (bonded or welded) together around the band-shaped portion 2 as shown in FIG. 6B to FIG. 6E (and FIG. 8A to FIG. 8C). That is, the hard resin portion 31, which is the main material forming the first and second regions $\alpha 1$, $\alpha 2$ (FIG. 3), is provided with a through hole H, and the through hole H is filled up with the soft resin portion 32.

[0058] Note that in the actual manufacture, the soft resin portion 32 is formed, by insert molding, in the hard resin portion 31.

[0059] The hard resin portion 31 has a greater Young's modulus and a greater ASTM D2240B hardness than the soft resin portion 32. In the present embodiment, the lateral edge portion LE and the rear edge portion RE of FIG. 3 are formed by the hard resin portion 31 as shown in FIG. 6A, and have a larger average value of thickness than the band-shaped portion 2.

[0060] Note that the tip portion of each cleat C2 of the second region $\alpha 2$ of FIG. 1 may be formed by a soft resin having a smaller hardness than the hard resin portion 31.

[0061] Note that in FIG. 6A to FIG. 6E and FIG. 8A to FIG. 8C, although the accurate cross section is slightly curved, it is drawn to be a straight flat plate for the sake of illustration.

[0062] In FIG. 3 and FIG. 7, the soft resin portion 32 is dotted. Thus, the band-shaped portion 2 is a portion of the dotted region that is delimited by a solid line in FIG. 3 and FIG. 7.

[0063] As described above, the hard resin portion 31 and the soft resin portion 32 of FIG. 6B to FIG. 6E are laid and attached together around the band-shaped portion 2. Therefore, the hard resin portion 31 and the soft resin portion 32 are laid on each other in the vicinity of the band-shaped portion 2.

[0064] In the present embodiment, as shown in FIG. 6B to FIG. 6E (and FIG. 8A to FIG. 8C), the average thickness of the band-shaped portion 2 is smaller than the average thickness of portions of the first and second regions $\alpha 1$, $\alpha 2$ (FIG. 3) in the vicinity of the band-shaped portion 2. Moreover, in the present embodiment, the band-shaped portion 2 is provided with a groove G extending along the band-shaped portion 2, further reducing the average thickness of the band-shaped portion 2.

[0065] As shown in FIG. 6C to FIG. 6D (and FIG. 8B to FIG. 8C), the band-shaped portion 2 of FIG. 3 (and FIG. 7) has thick portions 20 extending along both sides of the groove G. The thickness of the band-shaped portion 2 in the groove G is smaller than the thickness of the

thick portion **20**.

[0066] At the first and second end portions **E1** and **E2**, the groove **G** is absent as shown in **FIG. 6E** and **FIG. 6B**, and the thick portions **20** are continuous with each other as shown in **FIG. 4** and **FIG. 3**.

[0067] Thus, the groove **G** is formed between the first end portion **E1** and the second end portion **E2**. Note that focusing only on the soft resin portion **32**, the thick portion **20** is formed by a bank-shaped and loop-shaped ridge. As shown in **FIG. 6B** to **FIG. 6E**, the thick portion **20** is thinner than the hard resin portion **31** of the first region $\alpha 1$ and the second region $\alpha 2$, thereby forming a stepped groove with two steps, as shown in **FIG. 6C** and **FIG. 6D** in the present embodiment.

[0068] Where the band-shaped portion **2** of **FIG. 3** is divided in three equal parts along the longitudinal direction thereof, it is preferred that at least one of the average value of the width **D1** of the first portion **21** close to the first end portion **E1** and the average value of the width **D2** of the second portion **22** close to the second end portion **E2** is greater than the average value of the width **D3** of the third portion **23** including the middle region **RM** therein. In the present embodiment, the average value of the width **D1** is greater than the average value of the width **D3**.

[0069] In the present embodiment, the average value of the width **D1** of a portion of the band-shaped portion **2** extending from the middle region **RM** of the rearfoot portion **1R** to the first end portion **E1** is greater than the average value of the width **D2** of a portion of the band-shaped portion **2** extending from the middle region **RM** of the rearfoot portion **1R** to the second end portion **E2**.

[0070] Next, the structure of the forefoot portion **1F** of **FIG. 7** will be described.

[0071] In the forefoot portion **1F**, the band-shaped portion **2** is provided so as to reach the lateral edge portion **LE**, the medial edge portion **ME** and the toe edge portion **TE**. Thus, the second regions $\alpha 2$ are separated from one another by the band-shaped portion **2**.

[0072] That is, the band-shaped portion **2** includes one end portion **E3** and another end portion **E3**, with each end portion **E3** facing the toe edge portion **TE**, the lateral edge portion **LE** or the medial edge portion **ME** of the outsole **1**. At each end portion **E3**, the groove **G** is absent with the thick portions **20** being continuous with each other, and the groove **G** is formed between the one end portion **E3** and the other end portion **E3**.

[0073] The phrase "an end portion facing an edge portion" encompasses cases where the end portion of the band-shaped portion **2** of **FIG. 7** arranged so as to extend to an end of the outsole **1**, and cases where the end portion of the band-shaped portion **2** of **FIG. 3** extends to the vicinity of an end of the outsole **1** but does not reach the end of the outsole **1**.

[0074] Next, an improvement to the stability realized by the present structure will be described.

[0075] With non-movable cleats **C** of **FIG. 9A**, a cleat contacts the ground in point contact upon landing. In con-

trast, the second cleat **C2** of **FIG. 9B** is movable as indicated by an arrow, and therefore contacts the ground in surface contact, which is expected to improve the stability.

[0076] It is believed that since the second cleat **C2** is movable upon landing as shown in **FIG. 9C**, a base support surface **10F** increases as shown in **FIG. 9D** and **FIG. 9C**, thereby improving the stability.

[0077] **FIG. 10** to **FIG. 11E** show Embodiment 2.

[0078] As can be seen from these figures, the groove **G** is absent in the band-shaped portion **2** in this example. However, the thickness of the soft resin portion **32** forming the band-shaped portion **2** is smaller than the thickness of the hard resin portion **31**.

[0079] Next, test examples (test ex.) and a comparative example (comp.) will be described in order to clarify the effect of the present invention.

[0080] Test Example 1: A shoe having the groove **G** as shown in **FIG. 1** to **FIG. 8** as prepared as Test Example 1.

[0081] Test Examples 2 and 3: Shoes with no groove **G** as shown in **FIG. 10** and **FIG. 11** were prepared as Test Examples 2 and 3.

[0082] In each of Test Examples 1 to 3, the ASTM D hardness of the hard resin portion **31** was set to 69°. The D hardness of the soft resin portion **32** was set to 64° for Test Examples 1 and 2, and 59° for Test Example 3.

[0083] Test Example 4: A shoe was prepared as Test Example 4, with the structure of **FIG. 10** and **FIG. 11**, in which the soft resin portion **32** was not used for the band-shaped portion **2**, but the hard resin portion **31** was used entirely.

[0084] Comparative Example: A shoe with no band-shaped portion **2** was prepared as Comparative Example.

[0085] For these examples, the stability and the shock-absorbing property of the pivot foot during a kicking action was examined, using a single male subject.

[0086] For the stability, the amount of change β in the angle of the foot with respect to the lower leg in the supination-pronation direction (the angle by which the heel tilts) was measured, and the peak value upon 1st strike was calculated. The value along the vertical axis of **FIG. 12A** represents the peak value of the amount of change β . When the absolute value of the amount of change β is small, it can be evaluated as meaning that the amount of tilt of the heel is small and that the stability is high.

[0087] The loading rate, which is commonly calculated as $Fz/\Delta t$, was used as the index of the shock-absorbing property. That is, the value $Fz/\Delta t$ is calculated by dividing the peak value Fz of the reaction force in the vertical direction from the ground by the amount of time Δt from the start of contacting the ground to the peak, and the results are shown in **FIG. 12B**.

[0088] As can be seen from the test results of **FIG. 12B**, Test Examples 1 to 4 all have a smaller loading rate than that of Comparative Example 1. This indicates that the shock-absorbing property is improved significantly

by providing the band-shaped portion **2** of which the Young's modulus is small or the thickness is small.

[0089] As can be seen from the test results of FIG. 12A, Test Examples 1 to 3 have a small absolute value of the amount of change β than that of Comparative Example 1, indicating that the stability is also improved if the band-shaped portion **2** is formed by the soft resin portion **32**.

[0090] On the other hand, substantially no improvement to the stability is observed for Test Example 4. However, for reasons to be set forth below, it is expected that the stability is also improved if the hardness of the resin forming the outsole **1** is lowered.

[0091] Now, a comparison between Test Example 1 of which the D hardness is 64° and which has a groove **G** and Test Example 3 of which the D hardness of the soft resin portion **32** is 59° indicates that the stability is more improved by lowering the hardness of the soft resin portion **32** than by providing a groove **G**. This indicates that even if the band-shaped portion **2** has the same hardness as the first region $\alpha 1$ and the second region $\alpha 2$, the stability is improved by setting the overall hardness of the outsole **1** to be smaller than the hardness of Test Example 4.

[0092] Then, it is estimated that the hardness is preferably 59° to 67°, and more preferably about 61° to 65°, in terms of the D hardness.

[0093] From the results of Test Examples 1 to 4, it is estimated that the hardness of the soft resin portion **32** is preferably about 59° to 67° in terms of the D hardness, when the band-shaped portion **2** is formed by the soft resin portion **32**. It is estimated that the difference between the hardness of the hard resin portion **31** and the hardness of the soft resin portion **32** is preferably about 2° to 10° in terms of the D hardness.

[0094] Although the above evaluation is obtained for the rearfoot portion **1R**, it is believed that a similar effect will be obtained also for the forefoot portion **1F**. That is, during a kicking action or when landing from the toe, improvements to the stability and the shock-absorbing property of the forefoot portion **1F** can be expected by providing the band-shaped portion **2** and the second cleats **C2** in the forefoot portion **1F**.

[0095] As shown in FIG. 13A to FIG. 13F, the band-shaped portion **2** and the groove **G** may have any of various cross-sectional shapes. Specifically, the depth and the surface area, etc., of the groove **G** may be determined appropriately as long as it does not hinder the deformation when a bending moment is applied in a transverse direction across the band-shaped portion **2**. One or more groove **G** may be provided in one band-shaped portion **2** as long as it does not hinder the deformation when a bending moment is applied in a transverse direction across the band-shaped portion **2**.

[0096] Any of various arrangements may be employed for the arrangement of the band-shaped portion **2**, the first region $\alpha 1$ and the second region $\alpha 2$, as shown in FIG. 14A to FIG. 14H.

[0097] While preferred embodiments have been described above with reference to the drawings, various obvious changes and modifications will readily occur to those skilled in the art upon reading the present specification.

[0098] For example, if the band-shaped portion **2** itself of FIG. 6B, FIG. 6E and FIG. 11B to FIG. 11E is thinner than the hard resin portion **31**, the depressed portion of the band-shaped portion **2** may be provided on the upper surface of the outsole **1**, rather than on the bottom surface thereof.

[0099] The groove **G** of FIG. 6C, FIG. 6D, FIG. 8B and FIG. 8C may be provided on the upper surface, rather than on the bottom surface.

[0100] Moreover, the groove **G** may be filled with a material having a smaller hardness (softer) than that of the soft resin portion **32** forming the band-shaped portion **2**.

[0101] A midsole may be provided on the outsole **1**.

[0102] Thus, such changes and modifications are deemed to fall within the scope of the present invention, which is defined by the appended claims.

INDUSTRIAL APPLICABILITY

[0103] The present invention is applicable to an outsole of a shoe for a field sport such as soccer, rugby and American football.

REFERENCE SIGNS LIST

[0104]

1: Outsole 10: Bottom surface 11: First roll-up portion
12: Second roll-up portion 13: Base 1F: Forefoot portion
1M: Middle foot portion 1R: Rearfoot portion RM: Middle region
100: Upper
2: Band-shaped portion 20: Thick portion 21: First portion
22: Second portion 23: Third portion
31: Hard resin portion 32: Soft resin portion
C1: First cleat C2: Second cleat
E1: First end portion E2: Second end portion E3: Third end portion
G: Groove H: Through hole
F: Front R: Rear
Me: Medial La: Lateral
LE: Lateral edge portion RE: Rear edge portion ME: Medial edge portion TE: Toe edge portion
 $\alpha 1$: First region $\alpha 2$: Second region

Claims

1. A shoe comprising:

a plurality of cleats **C1**, **C2** projecting from a bottom surface 10 of an outer sole **1** formed by a

material having a resin component;
 a first region $\alpha 1$ where at least one first cleat **C1** of the plurality of cleats **C1**, **C2** is arranged;
 a second region $\alpha 2$ where at least one second cleat **C2** of the plurality of cleats **C1**, **C2** is arranged; and
 a band-shaped portion **2** having a band shape which is arranged between the first region $\alpha 1$ and the second region $\alpha 2$ so as to allow the second region $\alpha 2$ to be displaced with respect to the first region $\alpha 1$, wherein:

the band-shaped portion **2** extends from a portion of a middle region **RM** of a rear foot portion **1R** toward a rear edge portion **RE** of the rear foot portion **1R** and extends from the portion of the middle region **RM** of the rear foot portion **1R** toward a lateral edge portion **LE** on a lateral side **La** of the rear foot portion **1R** so that the first region $\alpha 1$ includes a medial side **Me** of the rear foot portion **1R** of the outer sole **1** and a middle foot portion **1M**, and the second region $\alpha 2$ forms the lateral side **La** of the rear foot portion **1R** of the outer sole **1**; and
 one or both of the following elements a) and b) is satisfied:

- a) a Young's modulus of a soft material forming the band-shaped portion **2** is less than a Young's modulus of a hard material forming the first and second regions $\alpha 1$, $\alpha 2$; and
- b) an average value of a thickness of the band-shaped portion **2** is less than an average value of a thickness of portions of the first and second regions $\alpha 1$, $\alpha 2$ in the vicinity of the band-shaped portion **2**.

2. A shoe according to claim 1, wherein:

the band-shaped portion **2** extends from a first end portion **E1** at the rear edge portion **RE** of the rear foot portion **1R** toward a second end portion **E2** at the lateral side **La** of the rear foot portion **1R**;
 the first region $\alpha 1$ and the second region $\alpha 2$ are continuous with each other via the hard material and/or a first high-rigidity portion thicker than the band-shaped portion **2** in the rear edge portion **RE** of the outer sole **2** which is posterior **R** to the first end portion **E1**; and
 the first region $\alpha 1$ and the second region $\alpha 2$ are continuous with each other via the hard material and/or a second high-rigidity portion thicker than the band-shaped portion **2** in the lateral edge portion **LE** of the outer sole **1** which is on the

lateral side **La** more lateral than the second end portion **E2**.

3. A shoe according to claim 1, wherein:

the band-shaped portion **2** extends from a first end portion **E1** of the rear edge portion **RE** of the rear foot portion **1R** toward a second end portion **E2** on the lateral side **La** of the rear foot portion **1R**;
 the outer sole **1** has a first roll-up portion **11** rolled up upwardly in the rear edge portion **RE** of the rear foot portion **1R**;
 the outer sole **1** has a second roll-up portion **12** rolled up upwardly in the lateral edge portion **LE** of the rear foot portion **1R**;
 the first region $\alpha 1$ and the second region $\alpha 2$ are continuous with each other via the hard material and/or a first high-rigidity portion thicker than the band-shaped portion **2** in the first roll-up portion **11** above the first end portion **E1**; and
 the first region $\alpha 1$ and the second region $\alpha 2$ are continuous with each other via the hard material and/or a second high-rigidity portion thicker than the band-shaped portion **2** in the second roll-up portion **12** above the second end portion **E2**.

4. A shoe according to any one of claims 1 to 3, wherein where the band-shaped portion **2** is divided in three equal parts in a longitudinal direction thereof, at least one of an average value of a width **D1** of a first portion **21** closer to the first end portion **E1** and an average value of a width **D2** of a second portion **22** closer to the second end portion **E2** is greater than an average value of a width **D3** of a third portion **23** including the middle region **RM**.

5. A shoe according to any one of claims 1 to 3, wherein an average value of a width **D1** of the band-shaped portion **2** spanning from the portion of the middle region **RM** of the rear foot portion **1R** to the first end portion **E1** is greater than an average value of a width **D2** of the band-shaped portion **2** spanning from the portion of the middle region **RM** of the rear foot portion **1R** to the second end portion **E2**.

6. A shoe according to any one of claims 1 to 5, wherein an average thickness of the band-shaped portion **2** is less than an average thickness of portions of the first and second regions $\alpha 1$, $\alpha 2$ in the vicinity of the band-shaped portion **2**.

7. A shoe according to any one of claims 1 to 6, wherein the band-shaped portion **2** defines a groove **G** extending along the band-shaped portion **2**.

8. A shoe according to claim 7, wherein the band-shaped portion **2** has a thick portion **20** extending

along and on both sides of the groove **G**, and a thickness of the band-shaped portion **2** in the groove **G** is less than a thickness of the thick portion **20**.

9. A shoe according to claim 8, wherein the groove **G** is not formed with the thick portion **20** being continuous with each other in the first and second end portions **E1**, **E2**, and the groove **G** is formed between the first end portion **E1** and the second end portion **E2**.

10. A shoe comprising:

a plurality of cleats **C1**, **C2** projecting from a bottom surface **10** of an outer sole **1** formed by a material having a resin component;
 a first region $\alpha 1$ where at least one first cleat **C1** of the plurality of cleats **C1**, **C2** is arranged;
 a second region $\alpha 2$ where at least one second cleat **C2** of the plurality of cleats **C1**, **C2** is arranged; and
 a band-shaped portion **2** having a band shape which is arranged between the first region $\alpha 1$ and the second region $\alpha 2$ and allows the second region $\alpha 2$ to be displaced with respect to the first region $\alpha 1$, wherein:

at least one of the following elements c) and d) is satisfied:

- c) a Young's modulus of a soft material forming the band-shaped portion **2** is less than a Young's modulus of a hard material forming the first and second regions $\alpha 1$, $\alpha 2$; and
 d) the band-shaped portion **2** defines a groove **G** extending along the band-shaped portion **2**.

11. A shoe according to claim 10, wherein both of the elements c) and d) are satisfied.
 12. A shoe according to claim 10 or 11, wherein the band-shaped portion **2** has a thick portion **20** extending along and on both sides of the groove **G**, and a thickness of the band-shaped portion **2** in the groove **G** is less than a thickness of the thick portion **20**.

13. A shoe according to any one of claims 10 to 12, wherein:

the band-shaped portion **2** has one end portion **E1-E3** and another end portion **E1-E3**, and the end portions **E1-E3** each face an edge portion **RE**, **LE**, **ME**, **TE** of the outer sole **1**; and
 the groove **G** is not formed with the thick portion **20** being continuous with each other in the end portions **E1-E3**, and the groove **G** is formed be-

tween the one end portion **E1-E3** and the other end portion **E1-E3**.

FIG. 1

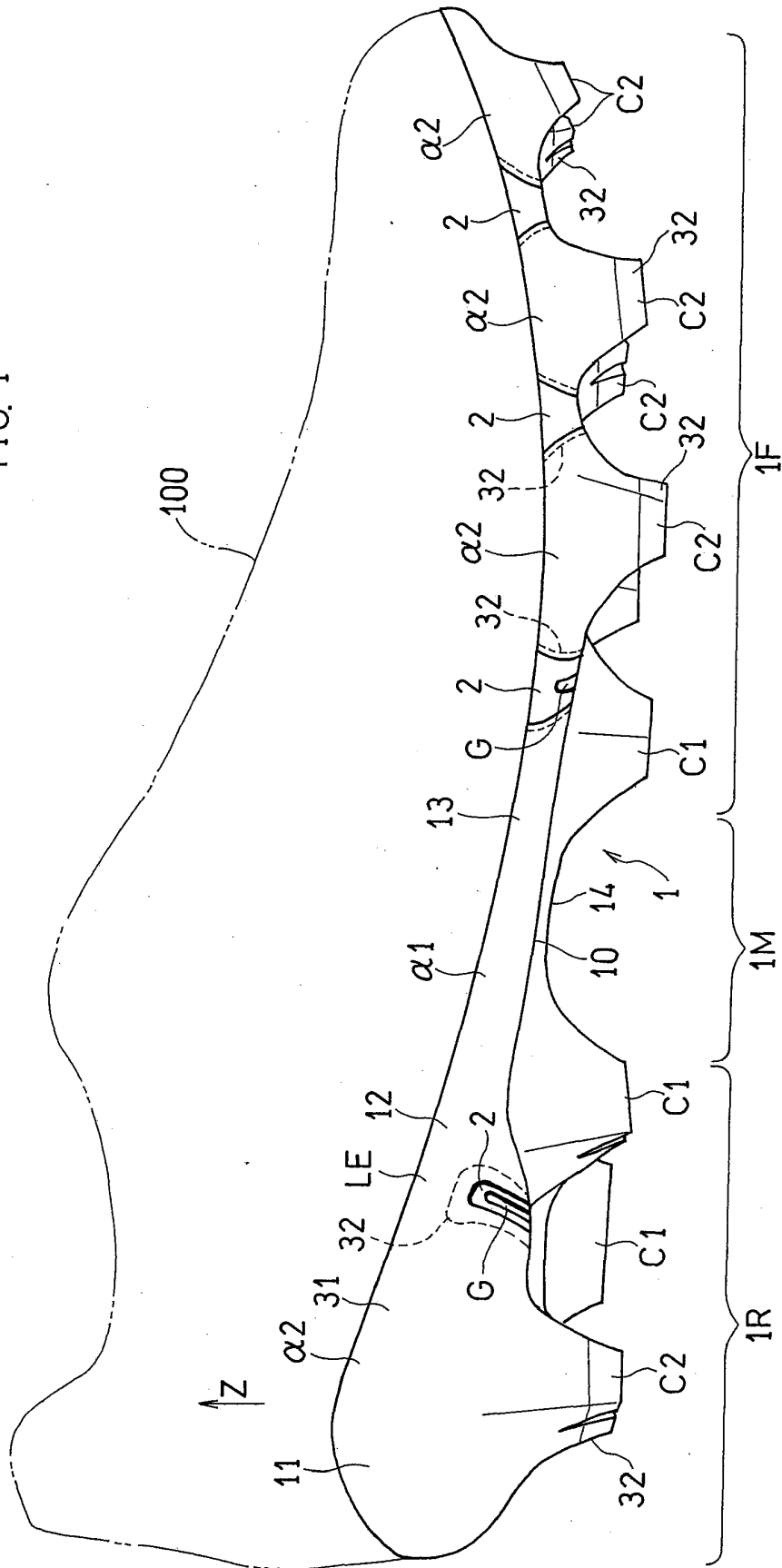
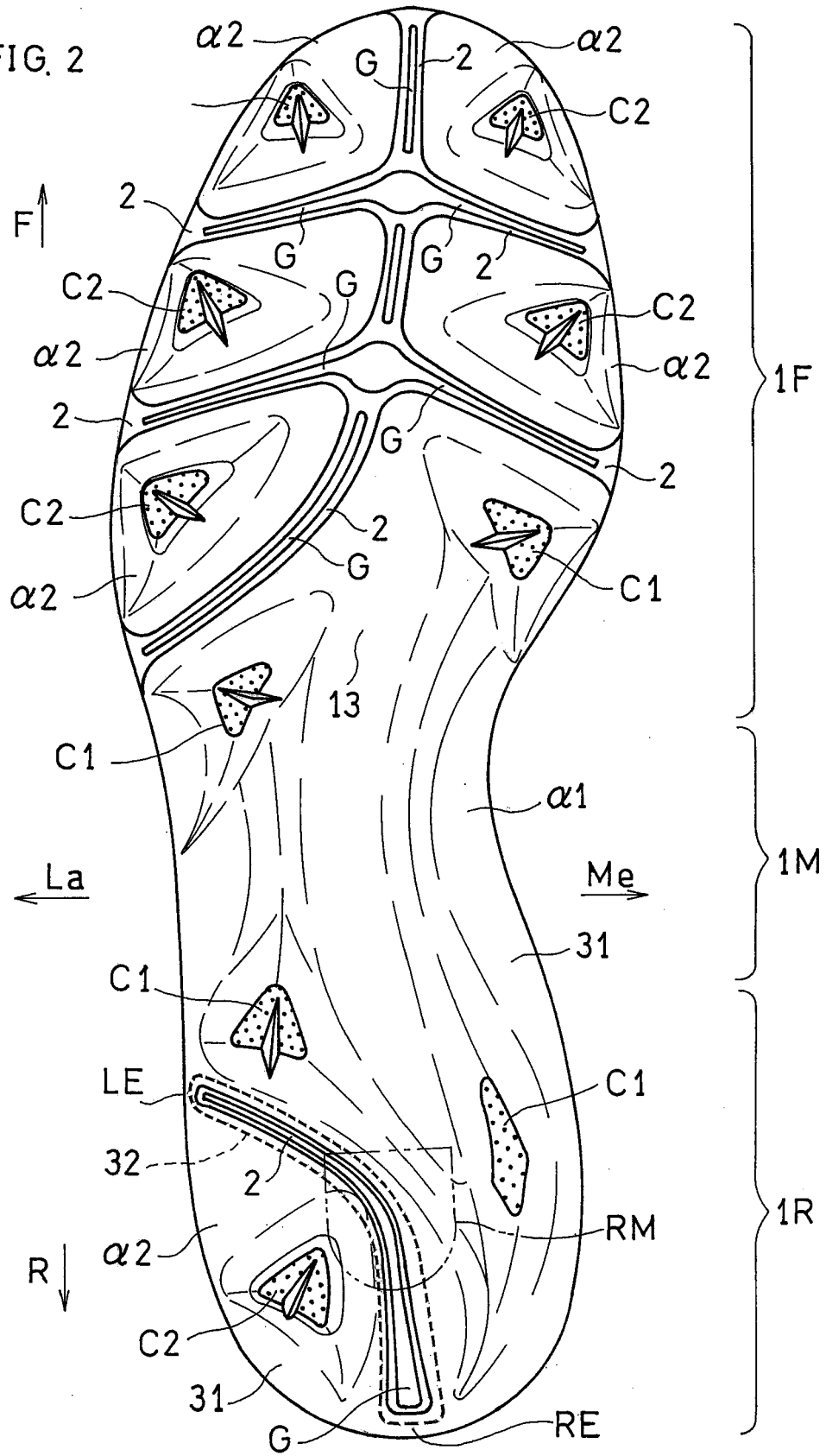


FIG. 2



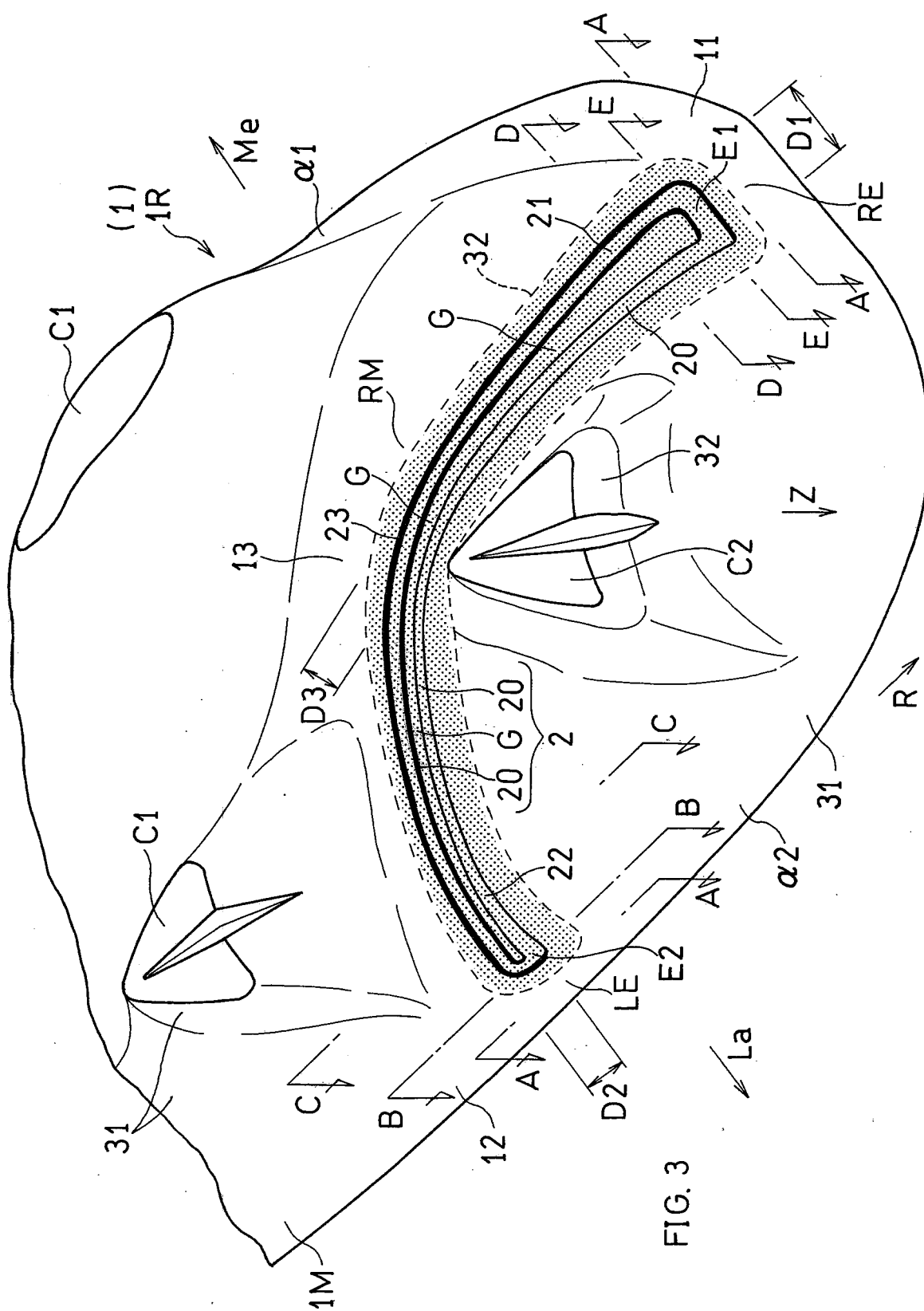


FIG. 3

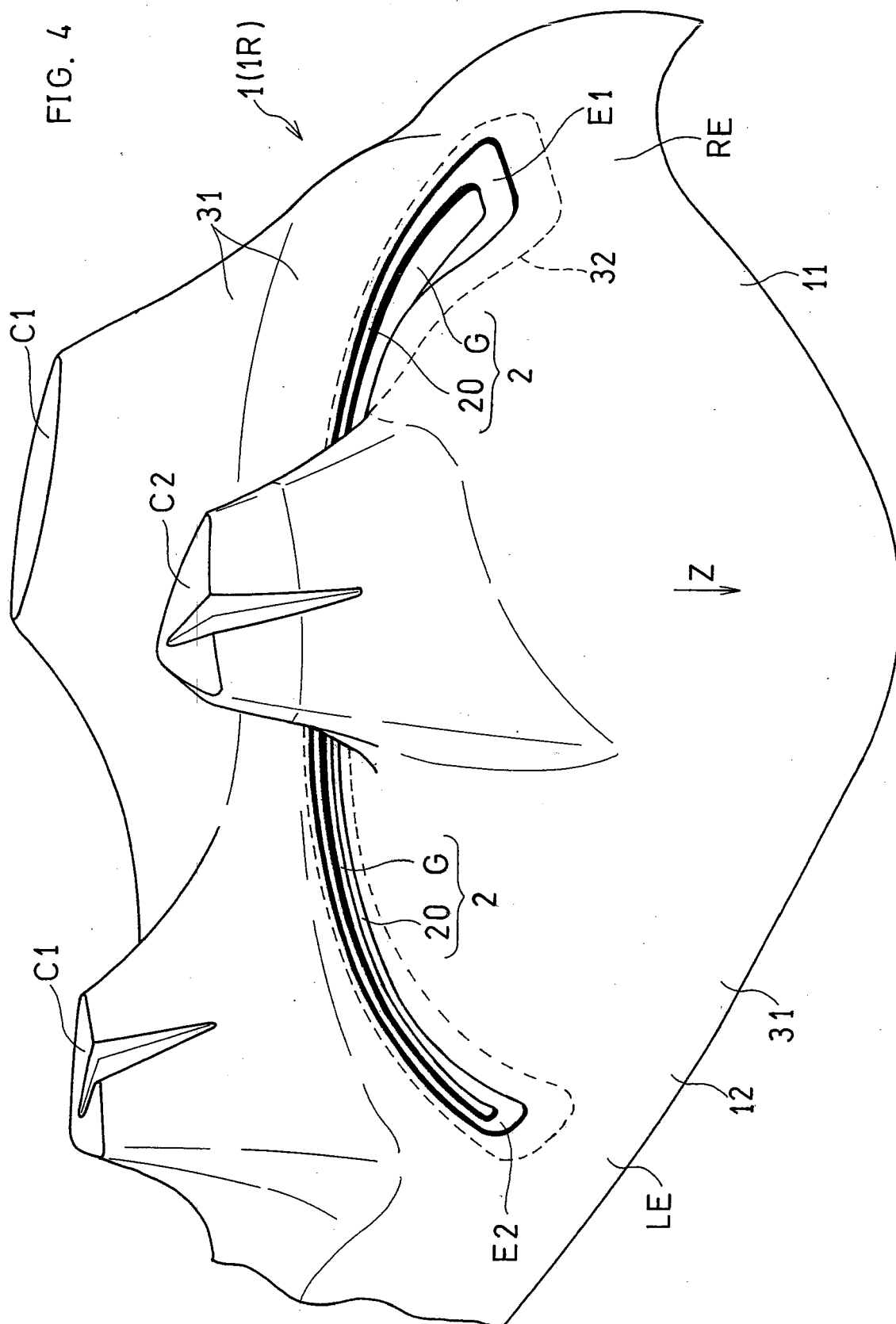
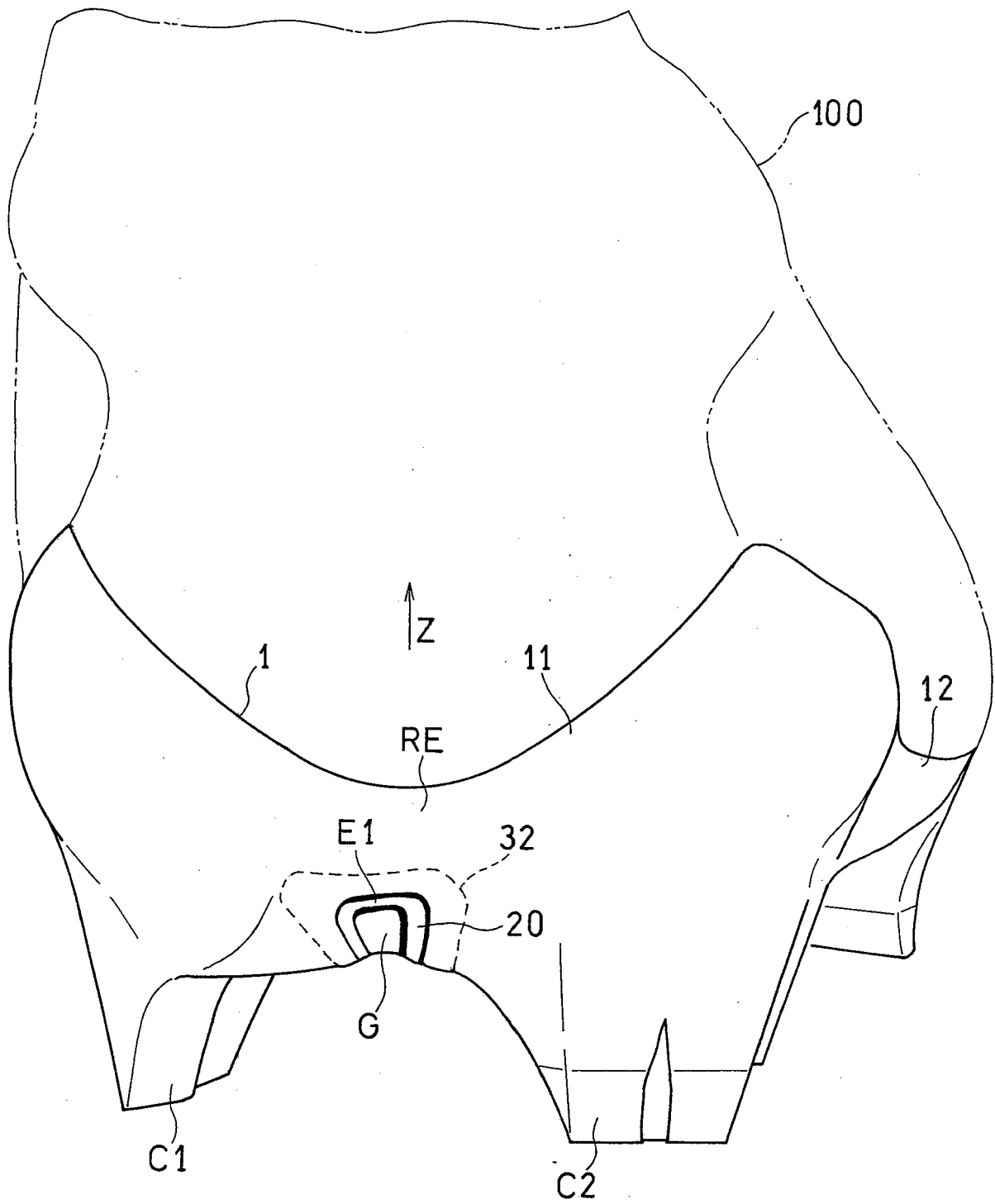


FIG. 5



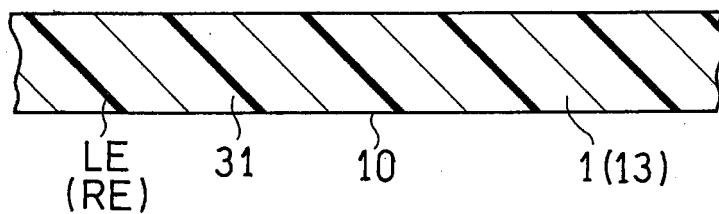


FIG. 6A

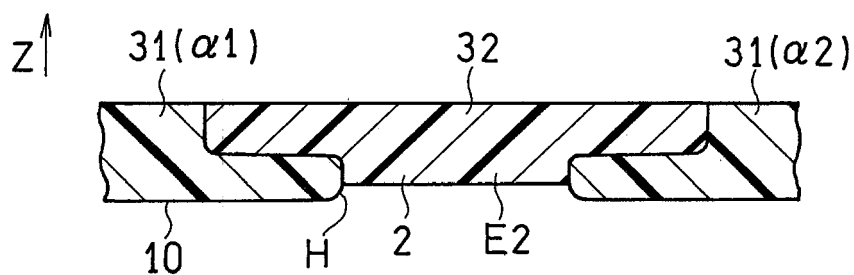


FIG. 6B

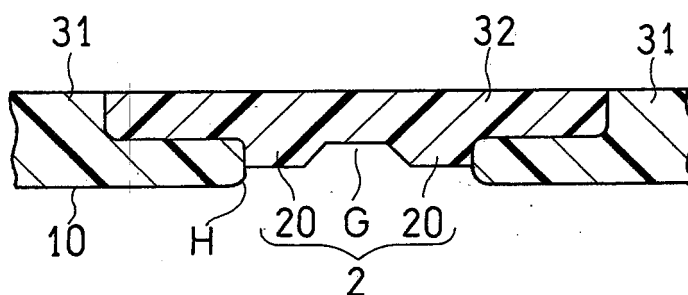


FIG. 6C

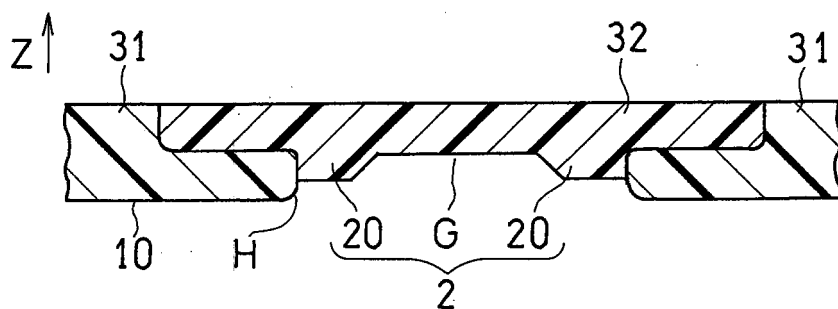


FIG. 6D

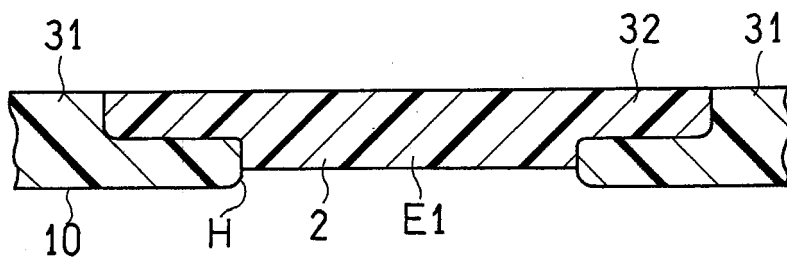


FIG. 6E

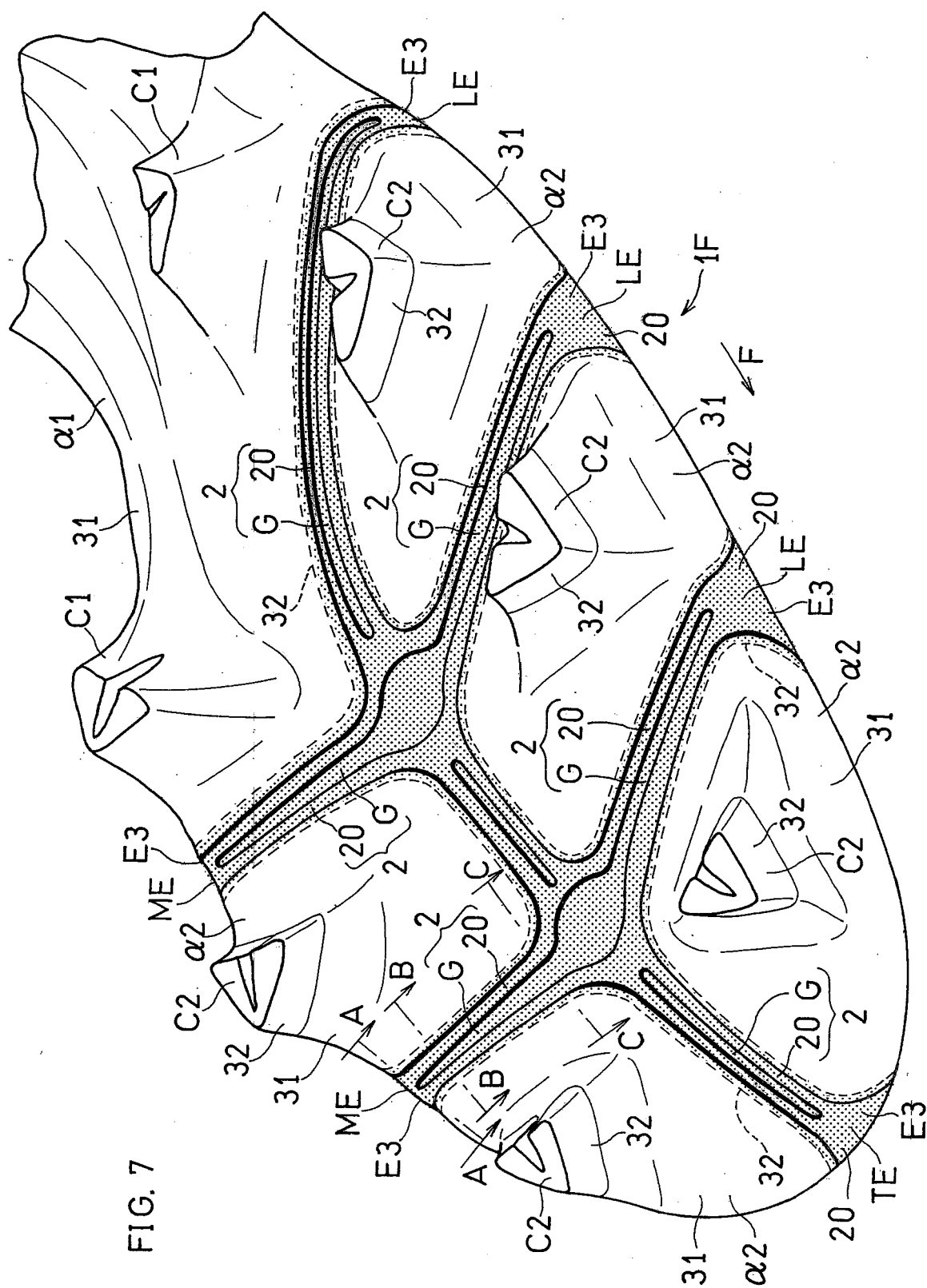


FIG. 7

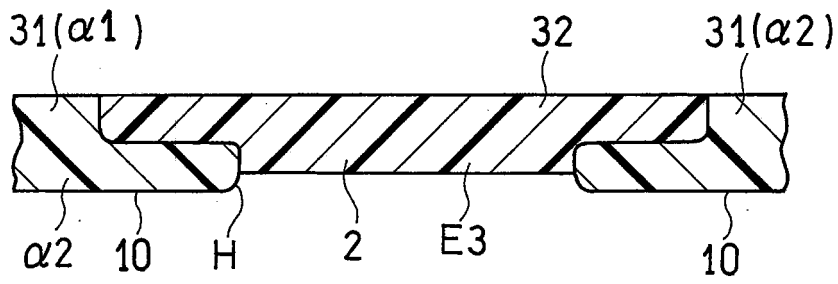


FIG. 8A

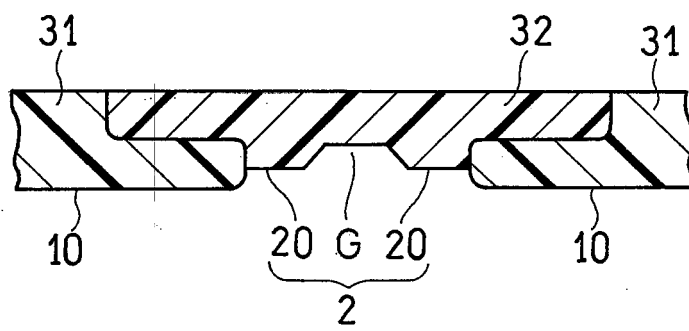


FIG. 8B

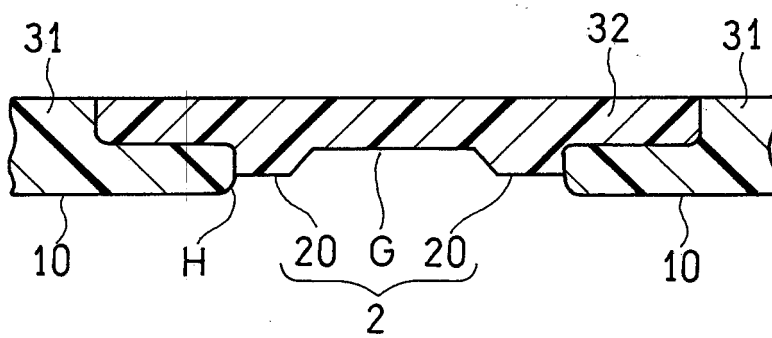


FIG. 8C

FIG. 9A
Prior Art

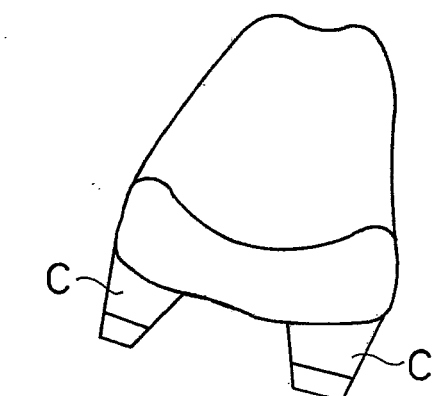


FIG. 9B

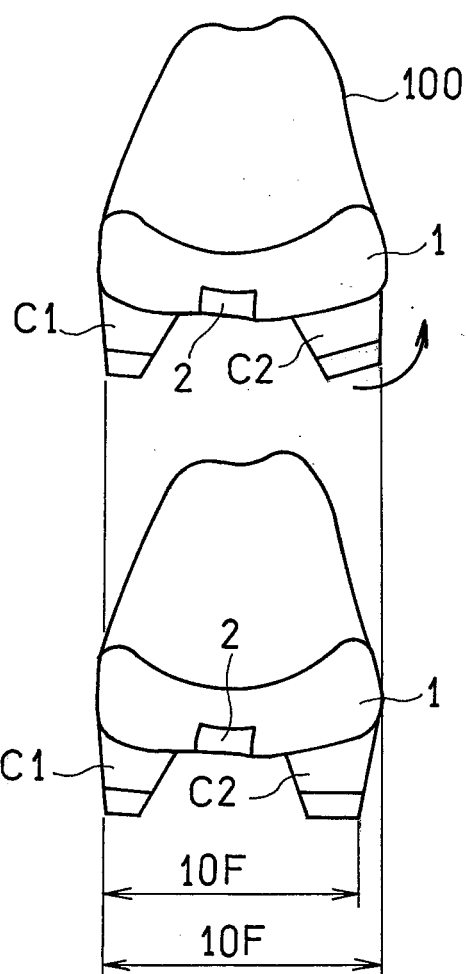
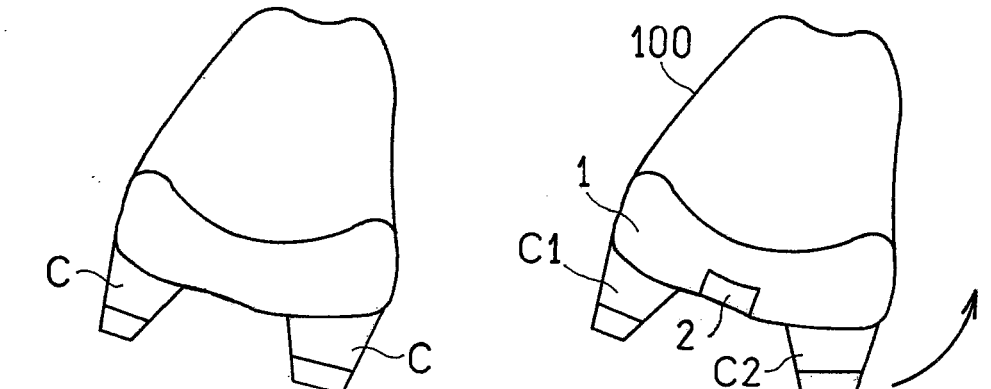


FIG. 9C

FIG. 9D

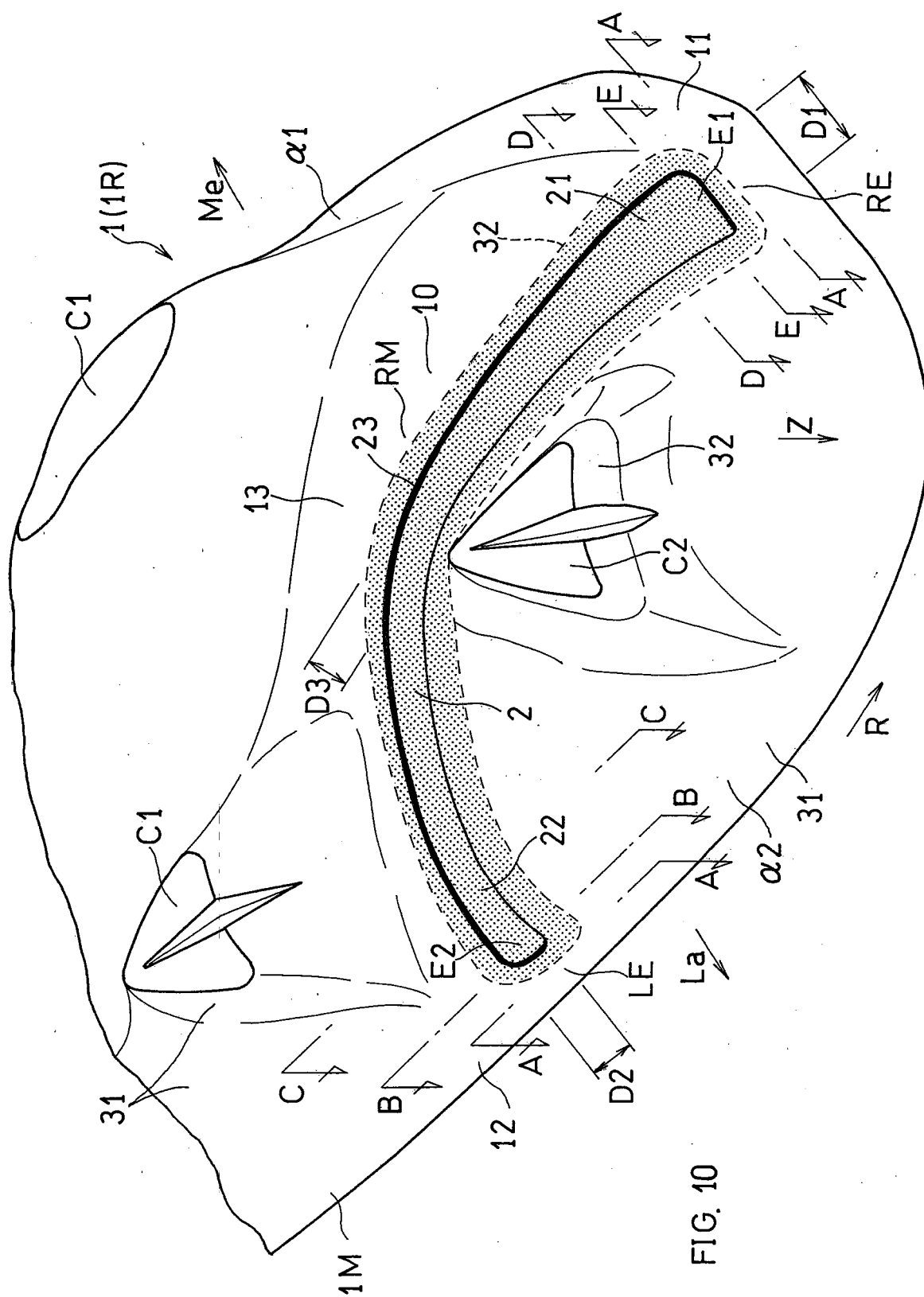


FIG. 10

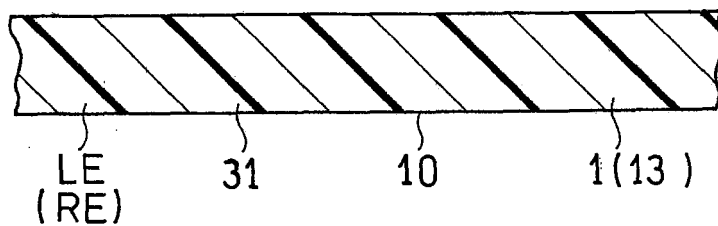


FIG. 11A

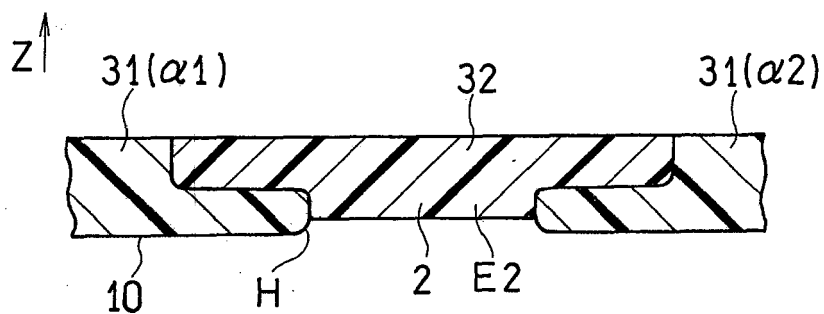


FIG. 11B

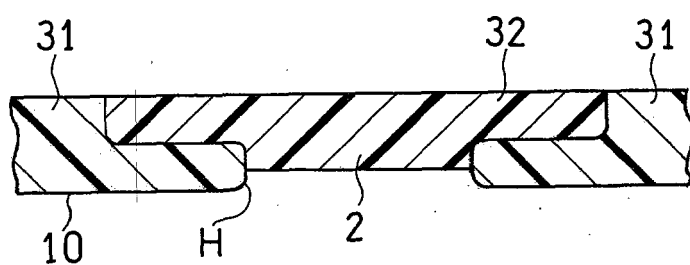


FIG. 11C

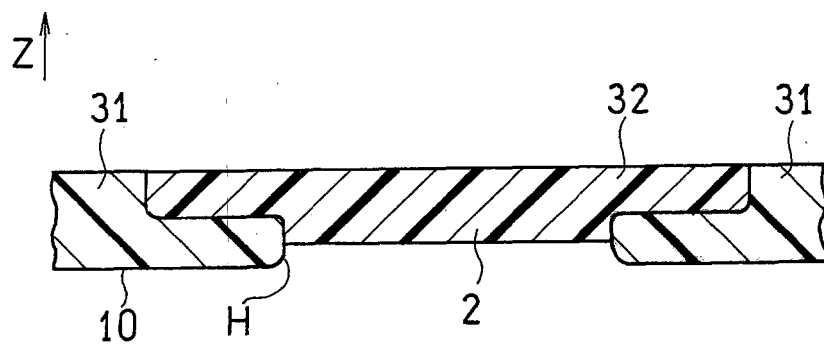


FIG. 11D

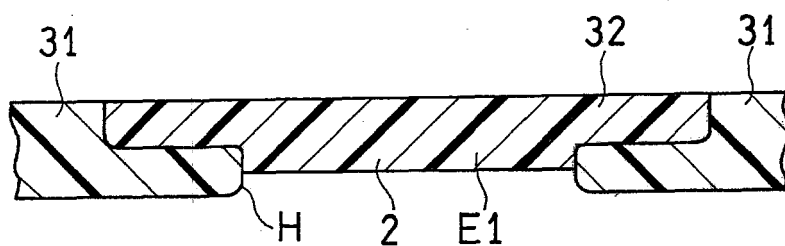


FIG. 11E

FIG. 12 A

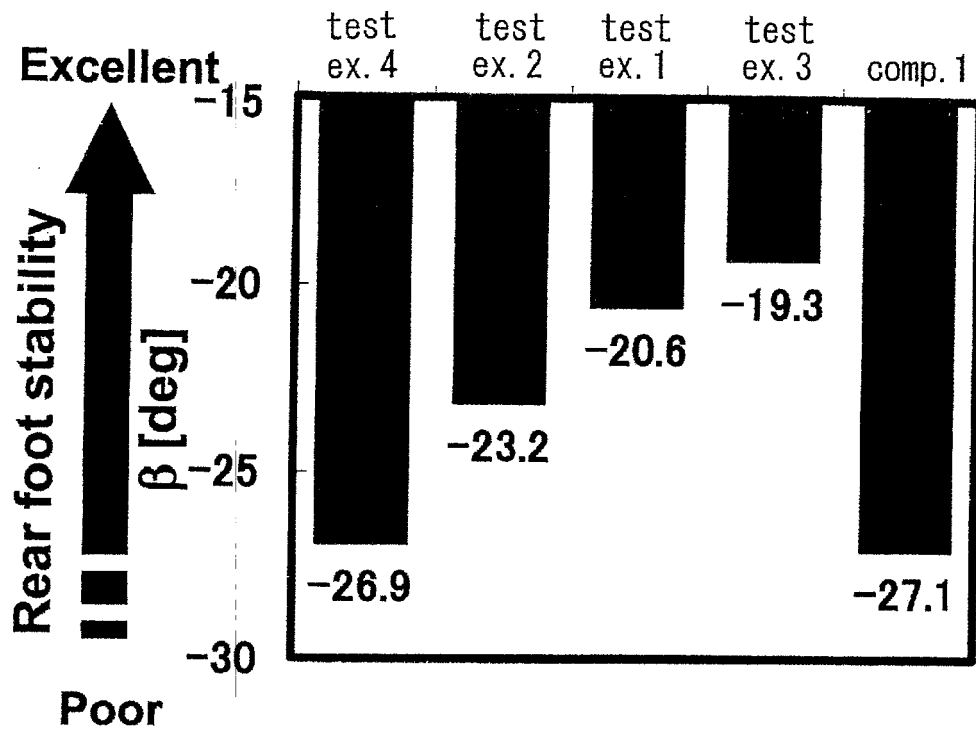
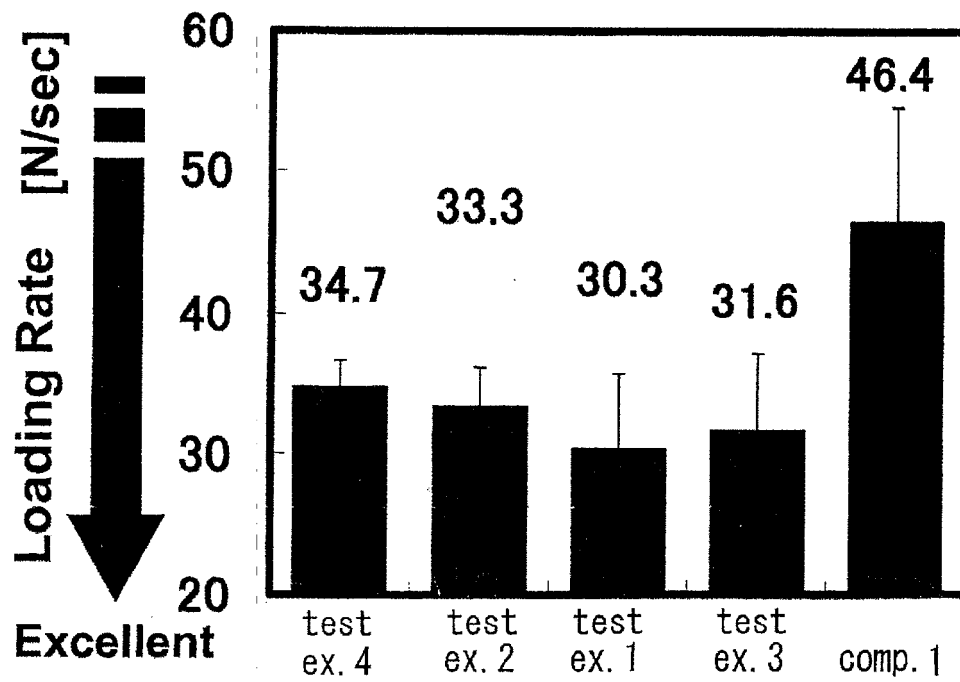


FIG. 12 B



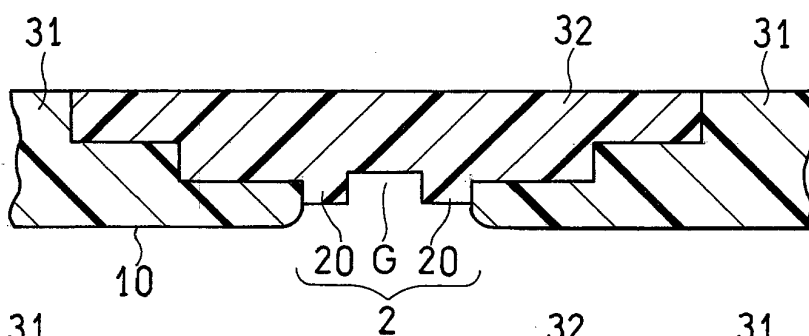


FIG. 13A

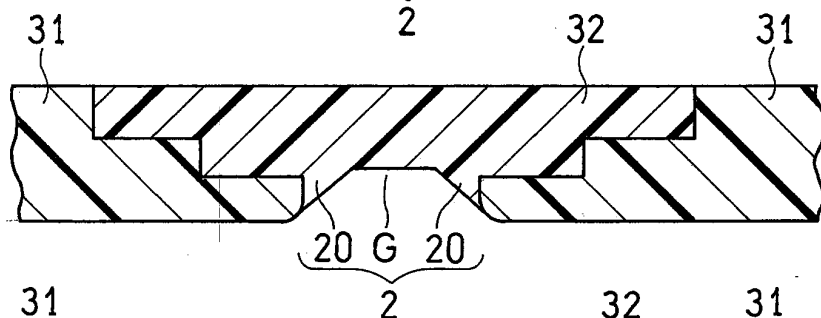


FIG. 13B

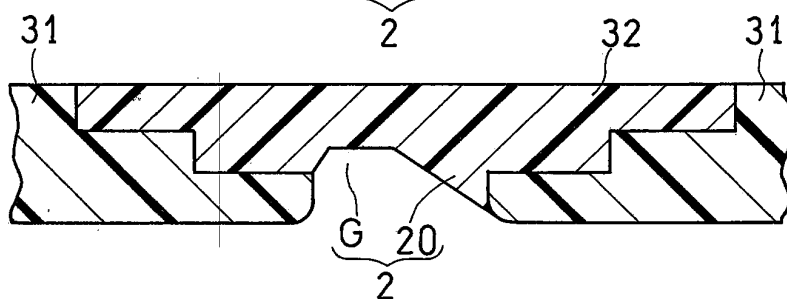


FIG. 13C

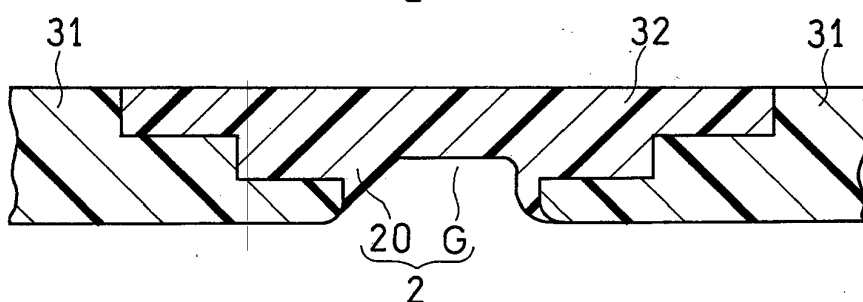


FIG. 13D

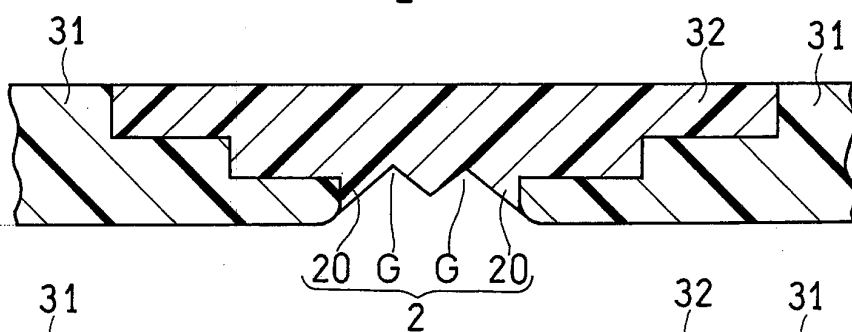


FIG. 13E

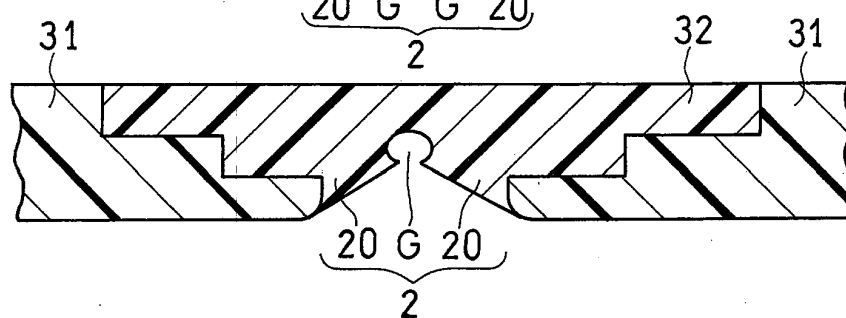


FIG. 13F

FIG.14 A

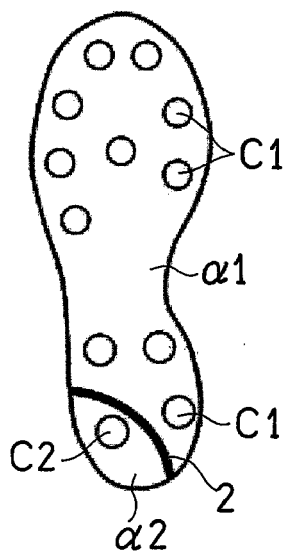


FIG.14B

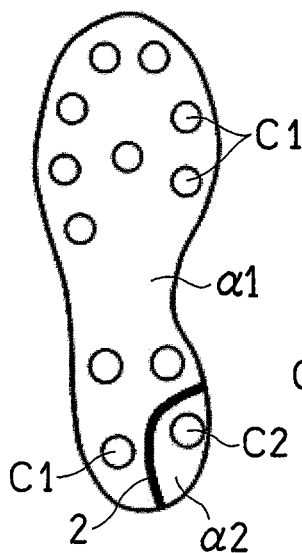


FIG.14C

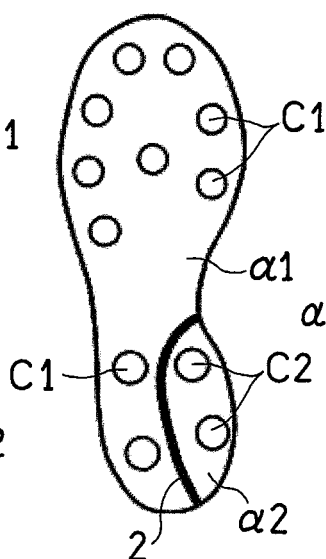


FIG.14D

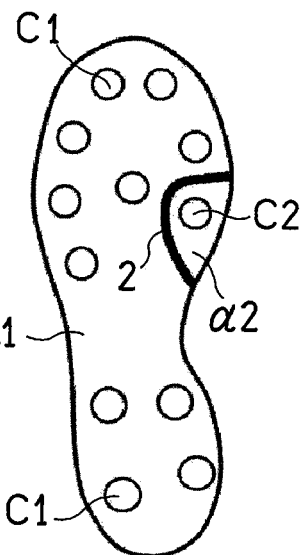


FIG.14 E

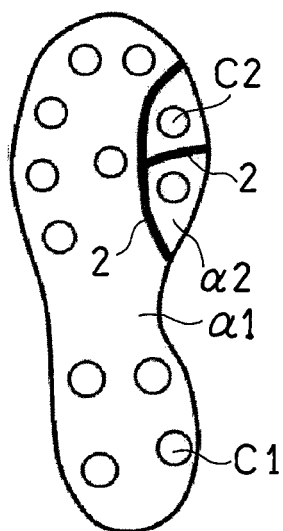


FIG.14F

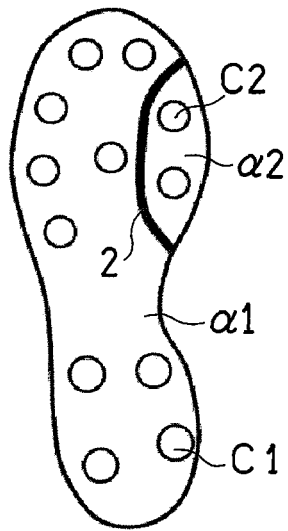


FIG.14G

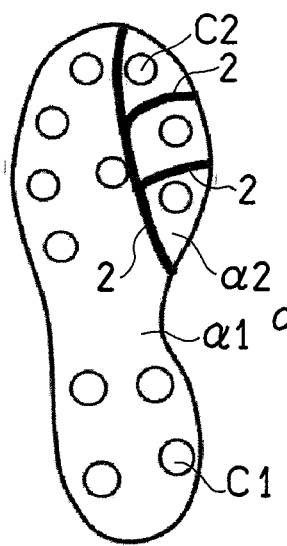
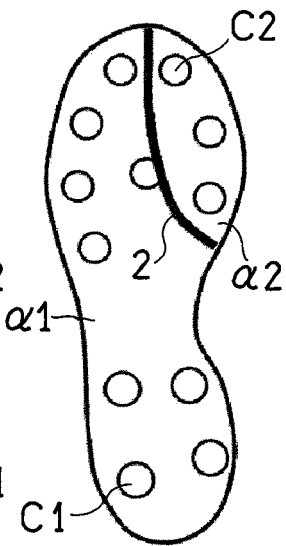


FIG.14H



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/059630

A. CLASSIFICATION OF SUBJECT MATTER

A43B13/26(2006.01) i, A43B5/02(2006.01) i, A43C15/16(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)

A43B13/26, A43B5/02, A43C15/16

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	US 2005/0016029 A1 (Perry W.AUGER), 27 January 2005 (27.01.2005), paragraphs [0023] to [0030]; fig. 1 to 9 & EP 1648253 A & WO 2005/016049 A1	1-13
A	JP 2-295502 A (Salomon S.A.), 06 December 1990 (06.12.1990), specification, page 5, upper right column, line 15 to lower left column, line 7; fig. 5 to 6 & US 5024007 A & EP 395538 A1	1-13
A	US 2011/0203134 A1 (Adriano SARTOR.), 25 August 2011 (25.08.2011), paragraphs [0035] to [0036]; fig. 1 to 6 & EP 2361521 A1 & CN 102166053 A	1-13



Further documents are listed in the continuation of Box C.



See patent family annex.

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document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"

document member of the same patent family

Date of the actual completion of the international search
30 April, 2013 (30.04.13)Date of mailing of the international search report
14 May, 2013 (14.05.13)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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- GB 2425706 A [0005]
- US 8356428 B2 [0005]