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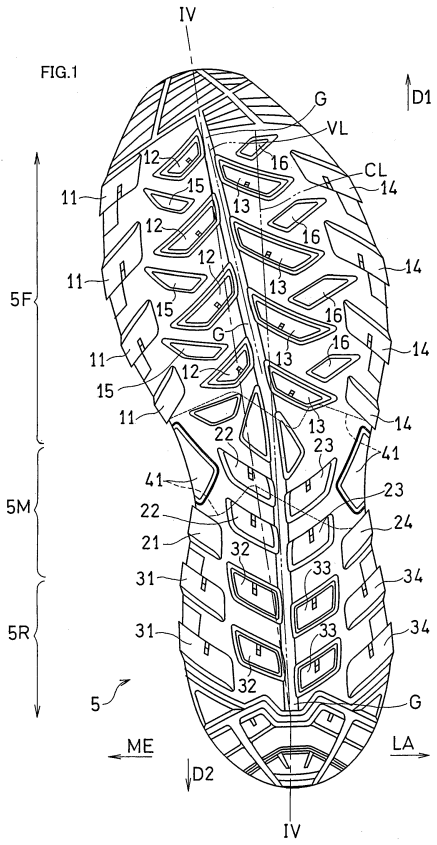
(54) SHOE SOLE SUITABLE FOR UNEVEN TERRAIN ROAD

(57) A shoe sole including a large number of first, second and third cleats projecting from a base surface of an outsole made of rubber, wherein: a medial first cleat arranged on a medial side **ME** of a foot in a forefoot portion has an engaging surface facing toward a posterior-lateral diagonal direction; a lateral first cleat arranged on a lateral side of the foot in the forefoot portion has an engaging surface facing toward a posterior-medial diagonal direction; a medial second cleat arranged on the medial side of the foot in a middle foot portion has an engaging surface facing toward an anterior-lateral diagonal direction; a lateral second cleat arranged on the lateral side of the foot in the middle foot portion has an engaging surface facing toward an anterior-medial diagonal direction; a medial third cleat arranged on the medial side of the foot in a rearfoot portion has an engaging surface facing toward an anterior-lateral diagonal direction; and a lateral third cleat arranged on the lateral side of the foot in the rearfoot portion has an engaging surface facing toward an anterior-medial diagonal direction.

FIG.1



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Description

TECHNICAL FIELD

[0001] The present invention relates to shoe soles for walking shoes, rain shoes and shoes for daily use, as well as shoe soles suitable for uneven (uneven terrain) road surfaces such as for trail running, mountain climbing and cross country. In the present invention, uneven road surfaces include muddy road surfaces, sloped road surfaces, rugged road surfaces, and the like.

BACKGROUND ART

[0002] Generally, in order to improve the grip on uneven road surfaces, it is effective to increase the amount of soil to be scraped off when cleats bite into and grip the road surface. Therefore, it is important to take into consideration the direction, and the projected area, of the load applied on the cleats from the road surface when gripping the road surface. However, conventional techniques do not sufficiently take into consideration the direction of the load within the sole surface when walking on a sloped road surface. Particularly, in the middle foot portion, an arch that does not contact the ground is often provided, and cleats have not been designed while sufficiently taking the grip into consideration.

CITATION LIST

PATENT LITERATURE

[0003]

First Patent Document: JP2011-382A (Abstract)
Second Patent Document: JP2009-233163A (Abstract)
Third Patent Document: JP2007-307377A (Abstract)
Fourth Patent Document: JP2002-034609A (Abstract)
Fifth Patent Document: JP09-075106A (Abstract)
Sixth Patent Document: JP07-136003A (Abstract)

SUMMARY OF INVENTION

[0004] It is therefore an object of the present invention to provide a shoe sole having a desirable grip on sloped road surfaces, particularly on uneven road surfaces.

[0005] Before describing the configuration of the present invention, the direction of the load within the sole surface on a sloped road surface will be described.

[0006] The present inventors first calculated the directions of the primary loads acting within the sole surface when walking (4 km/h) on a sloped road surface. FIG. 11A shows the directions of the loads. In FIG. 11A, one-dot chain lines and solid lines denote the directions of the primary loads acting when walking downhill and when walking uphill, respectively.

[0007] As indicated by one-dot chain lines, when walking downhill, the loads are acting toward posterior-medial **ME** diagonal directions and posterior-lateral **LA** diagonal directions over an area from the rearfoot portion **5R** to the middle foot portion **5M** and the rear end of the forefoot portion **5F.** On the other hand, as indicated by solid lines, it can be seen that when walking uphill, the loads are acting toward anterior-medial **ME** diagonal directions, anterior-lateral **LA** diagonal directions and forward directions over an area that is anterior **D1** to the line **MP,** which connects together the MP (metatarsal phalangeal) joints, of the forefoot portion **5F.**

[0008] The cause for such a load will now be discussed.

[0009] When walking uphill, after the shoe sole contacts the ground and before the shoe sole takes off the ground, the foot is dorsiflexed along the line **MP** connecting together the **MP** joints, and in this dorsiflexed position, a portion of the foot that is anterior to the line **MP** scrapes off the soil of the road surface rearward. Thus, there occurs a load having a vector in the anterior direction **D1**. Moreover, it is speculated that as the forefoot portion rotates about the ball of the big toe in such a direction that the toe moves in the lateral direction, a load toward the anterior **D1**-lateral **LA** diagonal direction is produced on the lateral side **LA** of the foot, and a load toward the anterior **D1**-media **ME** diagonal direction is produced on the medial side **ME** of the foot.

[0010] On the other hand, when walking, generally, a portion of shoe sole that is anterior **D1** to the line **MP** connecting together the MP joints is slightly bent upward off the ground. Therefore, when walking downhill, the area that is posterior **D2** to the line **MP** entirely contacts the ground before the area that is anterior **D1** to the line **MP** contacts the ground.

[0011] Now, the load applied onto the road surface from an outsole **5** in the area that is posterior **D2** to the line **MP** is large along the longitudinal axis **CL** of the foot and in the vicinity of the ball **O1** of the big toe, and is small along the medial and lateral edges of the outsole **5.** That is, regarding the force applied onto the road surface from the outsole when walking downhill, since no force is acting upon the peripheral portion of the sole, the force is a resultant force obtained by adding the force gathering toward the central portion of the sole to the force acting in the foot-slipping direction toward the toe. On the other hand, the direction of the force applied onto the outsole from the road surface when walking downhill is of the opposite direction from that of the resultant force.

[0012] For these reasons, as indicated by one-dot chain lines of FIG. 11A, it is speculated that the load applied onto the outsole **5** from the road surface acts in the posterior **D2**-lateral **LA** diagonal direction on the lateral side **LA** of the foot with respect to the longitudinal axis **CL** and the ball **O1** of the big toe and in the posterior **D2**-medial **ME** diagonal direction on the medial side **ME** of the foot.

[0013] In one aspect of the present invention, a shoe

sole includes an outsole **5** made of rubber and a midsole **4** made of resin, wherein a plurality of first cleats **11** to **14,** second cleats **22** and **23** and third cleats **31** to **34** made of rubber and projecting from a base surface **5S** of the outsole **5** are arranged in a forefoot portion **5F**, a middle foot portion **5M** and a rear foot portion **5R,** respectively, wherein:

of the first cleats **11** to **14,** medial first cleats **11, 12** arranged on a medial side **ME** of a foot have engaging surfaces **11E**, **12E** facing toward a posterior **D2**-lateral **LA** diagonal direction;
of the first cleats **11** to **14,** lateral first cleats **13, 14** arranged on a lateral side **LA** of the foot have engaging surfaces **13E, 14E** facing toward a posterior **D2**-medial **ME** diagonal direction;
of the second cleats **22, 23,** a medial second cleat **22** arranged on the medial side **ME** of the foot has an engaging surface **22E** facing toward an anterior **D1**-lateral **LA** diagonal direction;
of the second cleats **22, 23,** a lateral second cleat **23** arranged on the lateral side **LA** of the foot has an engaging surface **23E** facing toward an anterior **D1**-media **ME** diagonal direction;
of the third cleats **31** to **34,** medial third cleats **31, 32** arranged on the medial side **ME** of the foot have engaging surfaces **31E, 32E** facing toward an anterior **D1**-lateral **LA** diagonal direction; and
of the third cleats **31** to **34,** lateral third cleats **33, 34** arranged on the lateral side **LA** of the foot have engaging surfaces **33E, 34E** facing toward an anterior **D1**-media **ME** diagonal direction.

[0014] Note that "an engaging surface facing toward ..." as used in the present invention refers to "an engaging surface generally perpendicular to ...". Note however that the engaging surface does not need to be perpendicular to the base surface **5S**, as long as it is 70° to 110° with respect to the base surface **5S**.

[0015] In the present invention, the engaging surfaces **11E** and **12E** of the medial first cleats **11** and **12** of the forefoot portion **5F** are facing toward the posterior-lateral **LA** diagonal direction, whereas the engaging surfaces **13E** and **14E** of the lateral first cleats **13** and **14** of the forefoot portion **5F** are facing toward the posterior-medial **ME** diagonal direction. Therefore, the engaging surfaces **11E** to **14E** easily engage facing perpendicular to the directions of the loads described above. Thus, the grip is good and slippage is unlikely when walking uphill.

[0016] Such a grip capacity will also be realized similarly when walking on a flat ground.

[0017] On the other hand, in the middle foot portion **5M** and the rearfoot portion **5R,** the engaging surfaces **22E, 31E** and **32E** of the medial second and third cleats **22, 31** and **32** are facing toward the anterior-lateral **LA** diagonal direction. In the middle foot portion **5M** and the rearfoot portion **5R,** the engaging surfaces **23E, 33E** and **34E** of the lateral second and third cleats **23, 33** and **34** are facing the anterior-medial **ME** diagonal direction. Therefore, the engaging surfaces **22E** and **23E** and **31E** to **34E** easily engage facing perpendicular to the directions of the loads described above. Thus, the grip is good and slippage is unlikely when walking downhill.

[0018] Such a grip capacity will also be realized similarly when walking on a flat ground.

BRIEF DESCRIPTION OF DRAWINGS

[0019]

FIG. **1** is a schematic bottom view showing a shoe sole according to Embodiment 1 of the present invention.
FIG. **2** is a schematic bottom view showing, on an enlarged scale, a forefoot portion of the same shoe sole.
FIG. **3** is a schematic bottom view showing, on an enlarged scale, a middle foot portion and a rearfoot portion of the same shoe sole.
FIG. **4A** is a cross-sectional view taken along line **IV-IV** of FIG. **1**, and FIG. **4B** is an enlarged cross-sectional view showing a part thereof.
FIG. **5A,** FIG. **5B,** FIG. **5C,** FIG. **5D,** FIG. **5E** and FIG. **5F** are cross-sectional views showing the outsole taken along lines A-A, B-B, C-C, D-D, E-E and F-F, respectively, of FIG. **2** or FIG. **3.**
FIG. **6** is a perspective view showing the forefoot portion of the outsole as seen from the medial side.
FIG. **7** is a perspective view showing the forefoot portion of the outsole as seen from the lateral side.
FIG. **8** is a perspective view showing the rearfoot portion of the outsole as seen from the medial side.
FIG. **9** is a perspective view showing the rearfoot portion of the outsole as seen from the lateral side.
FIG. 10A is a bottom view of the shoe sole showing only those of cleats of which the height is 2.8 mm or more, and **FIG. 10B** is a plan view showing the foot bone structure.
FIG. 11A is a plan view showing, in the form of vectors, forces occurring within the sole surface when walking uphill and waking downhill, and **FIG. 11B, FIG. 11C** and **FIG. 11D** are schematic bottom views of the shoe sole each showing an alternative cleat arrangement, etc.

DESCRIPTION OF EMBODIMENTS

[0020] Preferably, an angle α**2** formed between at least one of the engaging surfaces **22E** and **23E** of the second cleats **22** and **23** and the base surface **5S** is equal to an angle ß**2** formed between a back surface **BS** of the second cleats **22** and **23** and the base surface **5S,** or is closer to a right angle than the angle ß**2.**

[0021] If the angle α**2** is closer to the right angle than the angle ß**2**, the engaging surfaces **22E** and **23E** easily engage with the soil, thereby enhancing the grip capacity,

in the middle foot portion **5M,** whereas if the back surface **BS** is inclined with respect to the base surface **5S,** the area of the base surface **5S** over which the second cleats **22** and **23** project becomes larger as compared with the area of the top surface **T** of the second cleats **22** and **23,** which distributes the load acting on the sole of the foot so that one can expect that the upthrust on the sole of the foot will be eased.

[0022] Note that in order to realize a sufficient engaging function, an engaging surface is preferably set to be at 80° to 100° with respect to the base surface **5S**.

[0023] Preferably, an angle α**3** formed between at least one of the engaging surfaces **31E** to **34E** of the third cleats **31** to **34** and the base surface **5S** is equal to an angle ß**3** formed between a back surface **BS** of the third cleats **31** to **34** and the base surface **5S**, or is closer to a right angle than the angle ß**3**.

[0024] Preferably, an angle α**1** formed between at least one of the engaging surfaces **11E** to **14E** of the first cleats **11** to **14** and the base surface **5S** is equal to an angle ß**1** formed between a front surface **FS** of the first cleats **11** to **14** and the base surface **5S**, or is closer to a right angle than the angle ß**1**.

[0025] If the angle α**3** is closer to the right angle than the angle ß**3** and if the angle α**1** is closer to the right angle than the angle ß**1**, one can similarly expect that the grip capacity will improve and the upthrust will be eased in the rearfoot portion **5R** and the forefoot portion **5F.**

[0026] Preferably, the first, second and third cleats **11** to **14, 22, 23** and **31** to **34** are projecting from the base surface **5S** generally by 2 to 10 mm. Note that for cleats other than the first to third cleats, there may be cleats whose height is less than 2 mm.

[0027] In this case, the projection height H from the base surface **5S** being 2 mm (millimeters) or more ensures a certain degree of engaging force. The projection height H being 10 mm or less ensures that the stability and the lightweight property are not hindered.

[0028] For such reasons, the projection height H is preferably about 2.5 to 8 mm, more preferably about 2.8 to 7 mm, and most preferably about 3 to 6 mm.

[0029] Preferably, an area of a top surface **T** of each of the first, second and third cleats **11** to **14, 22, 23** and **31** to **34** contacting the ground is 50 to 500 square millimeters, and is more preferably 50 to 300 square millimeters.

[0030] If the area of the top surface **T** is less than 50 square millimeters, there will unlikely be engaging surfaces of a sufficient length. On the other hand, if the area of the top surface **T** exceeds 300 square millimeters, the cleats will unlikely bite into the ground.

[0031] Preferably, an angle θ22, θ23 formed between a normal **NL** perpendicular to the engaging surface **22E, 23E** of at least one of the second cleats **22** and **23** and a longitudinal axis **CL** of the foot is set to 15° to 45°, and an area of the engaging surface **22E**, **23E** is set to 20 to 500 square millimeters, and is more preferably set to 40 to 200 square millimeters.

[0032] Herein, "an angle formed between a normal perpendicular to an engaging surface and a longitudinal axis of the foot" means the angle between the normal and the longitudinal axis as these lines are projected onto the base surface **5S**, taking into consideration cases where the engaging surface is inclined with respect to the base surface **5S**.

[0033] In this case, in the middle foot portion **5M,** the engaging surfaces **22E** and **23E** will exert the engaging force toward the intended engaging direction.

[0034] If the angles θ22 and θ23 are smaller than 15° or larger than 45°, the engaging directions will deviate, thus failing to exert a sufficient engaging force.

[0035] If the area of engagement is less than 40 square millimeters, they will unlikely to sufficiently engage with the ground, whereas if it exceeds 200 square millimeters, the engaging force of one cleat may increase locally, thereby destroying balance in walking.

[0036] For such reasons, it is more preferred that at least one or more of engaging surfaces **22E** and **23E** whose angles θ22 and θ23 are set to 15° to 45° are formed for each of the medial and lateral second cleats **22** and **23**. More preferably, the angle θ22, θ23 formed between the normal **NL** perpendicular to the engaging surface **22E, 23E** and the longitudinal axis **CL** of the foot is set to 20° to 40°, and most preferably, the area of the engaging surface **22E, 23E** is set to 50 to 160 square millimeters.

[0037] Preferably, an angle θ31-θ34 formed between a normal **NL** perpendicular to the engaging surface **31E-34E** of at least one of the third cleats **31** to **34** and a longitudinal axis **CL** of the foot is set to 15° to 45°, and an area of the engaging surface **31E-34E** is set to 20 to 500 square millimeters, and is more preferably set to 40 to 200 square millimeters.

[0038] In this case, in the rearfoot portion **5R,** as in the middle foot portion **5M** as described above, the engaging surfaces **31E** to **34E** will exert the engaging force toward the intended engaging direction.

[0039] For reasons similar to those described above, it is more preferred that at least one or more of engaging surfaces **31E** to **34E** whose angles θ31 to θ34 are set to 15° to 45° are formed for each of the medial and lateral third cleats **31** to **34.** More preferably, the angle θ31-θ34 formed between the normal **NL** perpendicular to the engaging surface **31E-34E** and the longitudinal axis **CL** of the foot is set to 20° to 40°, and most preferably, the area of the engaging surface **31E-34E** is set to 50 to 160 square millimeters.

[0040] Preferably, an angle θ11-θ14 formed between a normal **NL** perpendicular to an engaging surface **11E-14E** of at least one of the first cleats **11** to **14** and a longitudinal axis **CL** of the foot is set to 20° to 60°, and an area of the engaging surface **11E-14E** is set to 20 to 500 square millimeters, and is more preferably set to 40 to 200 square millimeters.

[0041] In this case, in the forefoot portion **5F**, as in the

middle foot portion **5M** as described above, the engaging surfaces **11E** to **14E** will exert the engaging force toward the intended engaging direction.

[0042] For reasons similar to those described above, it is preferred that at least one or more of engaging surfaces **11E** to **14E** whose angles θ11 to θ14 are set to 20° to 60° are formed for each of the medial and lateral first cleats **11** to **14.** More preferably, the angle θ11-θ14 formed between the normal **NL** perpendicular to the engaging surface **11E-14E** and the longitudinal axis **CL** of the foot is set to 25° to 55°, and most preferably, the area of the engaging surface **11E-14E** is set to 60 to 200 square millimeters.

[0043] Preferably, the midsole **4** includes a midsole body **40** and a reinforcement device **41** having a larger Young's modulus than the midsole body **40,** with at least some of the second cleats **22** and **23** arranged directly under the reinforcement device **41**.

[0044] When the second cleats **22** and **23** of the middle foot portion **5M** contact the ground, the reaction force acts upon a middle foot section **1M** between the Lisfranc joint and the Chopart's joint, and an upthrust is likely to be felt on the sole of the foot. In contrast, in this example, the second cleats **22** and **23** are arranged in a part of the area directly under the reinforcement device **41,** and the upthrust will unlikely be felt.

[0045] Particularly, if the reinforcement device **41** is formed by a foamed resin, it will give the arch of the foot an adequate amount of cushion while suppressing the collapse of the arch of the foot.

[0046] More preferably, there are a plurality of medial second cleats **22** spaced apart from one another in a front-rear direction of the foot, and under no load, a top surface **T** of an anterior medial second cleat **22** has a greater distance from a road surface than a top surface **T** of a posterior **D2** medial second cleat **22**; and

there are a plurality of lateral second cleats **23** spaced apart from one another in the front-rear direction of the foot, and under no load, a top surface **T** of an anterior lateral second cleat **23** has a greater distance from the road surface than a top surface **T** of a posterior **D2** lateral second cleat **23**.

[0047] In the middle foot portion **5M**, the top surface **T** of the anterior second cleats **22** and **23** has a greater distance from a road surface **100** than the top surface **T** of the second cleats **22** and **23**. Therefore, an anterior **D1** portion of the upper surface of the midsole **4** on the outsole **5** is likely to sink in the middle foot portion **5M** at foot flat after landing. Thus, the stagnation of the load, which is likely to occur in the middle foot portion **5M** at foot flat, is less likely to occur, making it easier to walk forward.

[0048] More preferably, the top surfaces **T** of the anterior **D1** second cleats **22** and **23** do not contact the ground under no load, and contact the ground when a load on one foot (a load on one shoe) divided by a size of the foot is 8 kg/cm, more preferably 4 kg/cm, and even more preferably 3 kg/cm.

[0049] The load on one foot acting upon the middle foot portion when walking fast is about 60% of the body weight (about 80% of the body weight when walking slow), meaning a load of 60 kg × 0.6 / 27 cm = 1.33 kg/cm where the body weight is 60 kg and the size of the foot is 27 cm. Therefore, it contacts the ground preferably when this value is at least 2 kg/cm, and most preferably when it is at least 1.3 kg/cm. Note that the load on one foot acting upon the middle foot portion when running fast is about 300% of the body weight, meaning a load of 70kg × 3.0 / 27 cm = 7.78 kg/cm where the body weight is 70 kg and the size of the foot is 27 cm. The load on one foot acting upon the middle foot portion when running slow is about 150% of the body weight, meaning a load of 70 kg × 1.5 / 27 cm = 3.89 kg/cm where the body weight is 70 kg and the size of the foot is 27 cm. The load on one foot acting upon the middle foot portion when walking slow is about 80% of the body weight, meaning a load of 70 kg × 0.8 / 27 cm = 2.07 kg/cm where the body weight is 70 kg and the size of the foot is 27 cm.

[0050] In this case, the anterior **D1** second cleats **22** and **23** can contact the ground when walking, thereby suppressing the collapse of the arch of the foot, and they bite into the ground after contacting the ground, thereby exerting the engaging force.

[0051] In view of suppressing the collapse of the arch, the distance from the top surface **T** of the anterior **D1** second cleats **22** and **23** to the road surface **100** is preferably about 0.5 mm to 2.0 mm. For similar reasons, it is more preferred that the anterior **D1** second cleats **22** and **23** do not contact the ground when the load on one foot divided by the size of the foot is less than or equal to 0.5 kg/cm, and it is particularly preferred that the anterior **D1** second cleats **22** and **23** do not contact the ground when the load on one foot divided by the size of the foot is less than or equal to 1 kg/cm.

[0052] Preferably, the medial third cleats **31** and **32** include a plurality of central cleats **32** spaced apart from one another in a front-rear direction of the foot and arranged closer to a longitudinal axis **CL** of the foot than a medial edge of the outsole 5, and a plurality of medial-edge-side cleats **31** spaced apart from one another in the front-rear direction of the foot and arranged closer to the medial edge than the longitudinal axis **CL**; and

the lateral third cleats **33** and **34** include a plurality of central cleats **33** spaced apart from one another in the front-rear direction of the foot and arranged closer to the longitudinal axis **CL** of the foot than a lateral edge of the outsole **5**, and a plurality of lateral-edge-side cleats **34** spaced apart from one another in the front-rear direction of the foot and arranged closer to the lateral edge than the longitudinal axis **CL**.

[0053] In this case, at least four cleats **31** and **32** are spaced apart from one another in the front-rear direction and the left-right direction on the medial side **ME** of the rearfoot portion 5R, whereas they are arranged similarly also on the lateral side **LA** of the rearfoot portion **5R**. Therefore, for the entire rearfoot portion **5R**, the engaging

force and the supporting force are easily exerted, and the support of the rearfoot portion **5R** is likely stable.

[0054] More preferably, the central cleats **32** and the medial-edge-side cleats **31**, of the medial third cleats **31** and **32**, are offset from, and alternate with, one another in a normal **NL** direction, which is perpendicular to the engaging surfaces **31E** and **32E** of these cleats **31** and **32**; and

the central cleats **33** and the lateral-edge-side cleats **34**, of the lateral third cleats **33** and **34**, are offset from, and alternate with, one another in the normal **NL** direction, which is perpendicular to the engaging surfaces **33E** and **34E** of these cleats **33** and **34**.

[0055] In this case, at least four cleats are offset from, and alternate with, one another in the normal **NL** direction on each of the medial side and the lateral side of the rearfoot portion **5R**. Therefore, one of the cleats is likely to be arranged on any line extended across the rearfoot portion **5R** so that for the entire rearfoot portion **5R**, the engaging force and the supporting force are more easily exerted, and the support of the rearfoot portion **5R** is more likely stable.

[0056] More preferably, the central cleats **32** of the medial third cleats **31** and **32** and the central cleats **33** of the lateral third cleats **33** and **34** are offset from each other in a longitudinal axis **CL** direction.

[0057] In this case, at least eight cleats **31** to **34** of the rearfoot portion **5R** are offset from one another. Therefore, for the entire rearfoot portion **5R**, the engaging force and the supporting force are more easily exerted, and the support of the rearfoot portion **5R** is more likely stable.

[0058] Preferably, the medial first cleats **11** and **12** include a plurality of central cleats **12** spaced apart from one another in a front-rear direction of the foot and arranged closer to a longitudinal axis **CL** of the foot than a medial edge of the outsole **5**, and a plurality of medial-edge-side cleats **11** spaced apart from one another in the front-rear direction of the foot and arranged closer to the medial edge than the longitudinal axis **CL**; and

the lateral first cleats **13** and **14** include a plurality of central cleats **13** spaced apart from one another in the front-rear direction of the foot and arranged closer to the longitudinal axis **CL** of the foot than a lateral edge of the outsole **5**, and a plurality of lateral-edge-side cleats **14** spaced apart from one another in the front-rear direction of the foot and arranged closer to the lateral edge than the longitudinal axis **CL**.

[0059] In this case, at least four cleats **11** and **12** are spaced apart from one another in the front-rear direction and the left-right direction on the medial side **ME** of the forefoot portion **5F**, whereas they are arranged similarly also on the lateral side **LA** of the forefoot portion **5F**. Therefore, for the entire forefoot portion **5F**, the engaging force and the supporting force are more easily exerted, and the support of the forefoot portion **5F** is more likely stable.

[0060] More preferably, the central cleats **12** and the medial-edge-side cleats **11**, of the medial first cleats **11** and **12**, are offset from one another, and alternate with one another, in a normal **NL** direction, which is perpendicular to the engaging surfaces **11E** and **12E** of these cleats **11** and **12**; and

the central cleats **13** and the lateral-edge-side cleats **14**, of the lateral first cleats **13** and **14**, are offset from one another, and alternate with one another, in the normal **NL** direction, which is perpendicular to the engaging surfaces **13E** and **14E** of these cleats **13** and **14**.

[0061] In this case, at least four cleats are offset from, and alternate with, one another in the normal **NL** direction on each of the medial side and the lateral side of the forefoot portion **5F**. Therefore, one of the cleats is likely to be arranged on any line extended across the forefoot portion **5F** so that for the entire forefoot portion **5F**, the engaging force and the supporting force are more easily exerted, and the support of the forefoot portion 5F is more likely stable.

[0062] More preferably, the central cleats **12** of the medial first cleats **11** and **12** and the central cleats **13** of the lateral first cleats **13** and **14** are offset from one another in a longitudinal axis **CL** direction.

[0063] In this case, at least eight cleats **11** to **14** of the forefoot portion **5F** are further offset from one another. Therefore, for the entire forefoot portion **5F**, the engaging force and the supporting force are more easily exerted, and the support of the forefoot portion **5F** is more likely stable.

[0064] Preferably, for the central cleats **12** and **13** of the first cleats **11** to **14**, the engaging surface **13E** of the lateral first cleat **13** arranged on the lateral side **LA** of the foot has a larger area than the engaging surface **12E** of the medial first cleat **12** arranged on the medial side **Me** of the foot.

[0065] When walking, the load distribution across the sole surface is such that the direction of the load varies in a pattern that is centered about the ball of the big toe. Therefore, the boundary line across which the direction of the engaging surface of the cleat varies with respect to the foot width direction is slightly off the longitudinal axis of the foot toward the ball of the big toe on the medial side. Therefore, the area on the lateral side of this line is larger than the area on the medial side of this line. Thus, the engaging force is more easily exerted when the area of the engaging surface **13E** of the lateral first cleat **13** is made larger than that of the medial first cleat **12**.

[0066] Preferably, a medial auxiliary cleat **15** arranged in an area surrounded by two medial-edge-side cleats **11** and **11** and two central cleats **12** and **12** of the medial first cleats **11** and **12**, and having an engaging surface **15E** on a plane crossing the engaging surfaces **11E** and **12E** of the medial first cleats **11** and **12**; and

a lateral auxiliary cleat **16** arranged in an area surrounded by two lateral-edge-side cleats **14** and **14** and two central cleats **13** and **13** of the lateral first cleats **13** and **14**, and having an engaging surface **16E** on a plane crossing the engaging surfaces **13E** and **14E** of the lateral first cleats **13** and **14**,

wherein the auxiliary cleats **15** and **16** are spaced apart from the first cleats **11** to **14**.

[0067] A forefoot section **1F** includes toes arranged therein, and is required to perform various complicated actions, as compared with a rearfoot section **1R**. For example, when changing directions by propelling toward a medial-anterior or lateral-anterior diagonal direction, or when stopping abruptly, engaging forces of various directions will be needed in the forefoot section **1F**.

[0068] In view of this, the auxiliary cleats **15** and **16**, which have the engaging surfaces **15E** and **16E** on planes crossing the engaging surfaces **11E** to **14E** of the first cleats **11** to **14**, will exert the engaging force when changing directions, etc.

[0069] Particularly, because the primary first cleats **11** to **14** and the auxiliary cleats **15** and **16** are spaced apart from one another, it may be less likely that clay-like soil gets stuck between cleats in the forefoot portion **5F**.

[0070] Preferably, a virtual line **VL** is defined extending smoothly in a front-rear direction along a longitudinal axis **CL** of the foot, wherein the medial cleats **11**, **12**, **22**, **31** and **32** are arranged on the medial side **Me** of the virtual line **VL** and the lateral cleats **13**, **14**, **23**, **33** and **34** are arranged on the lateral side **LA** of the virtual line **VL**.

[0071] In this case, along the virtual line **VL**, which is between the medial cleats and the lateral cleats, the midsole **4** is not supported by the cleats but is supported by a thin plate-shaped portion of the outsole **5**. Therefore, the upper surface of the midsole **4** easily sinks downward along the virtual line **VL**, and the foot is guided along the longitudinal axis **CL**, thereby making it unlikely that the foot supinates or pronates. This will increase the efficiency in walking and running.

[0072] More preferably, the cleats **12**, **13**, **32** and **33**, of the first and third cleats **11** to **14** and **31** to **34**, that are arranged in the vicinity of the virtual line **VL**, each have a first groove **G1** on a side thereof extending along its first side **S1**, which is closest to the virtual line **VL**.

[0073] With the provision of the first groove **G1**, the upper surface of the midsole **4** easily sinks downward in the vicinity of the first side **S1**. This will make it even easier for the upper surface of the midsole **4** to sink downward along the virtual line **VL**.

[0074] More preferably, the cleats **12**, **13**, **32** and **33**, arranged in the vicinity of the virtual line **VL**, each have second grooves **G2** which are continuous with the first groove **G1** and extending along a pair of second sides **S2** and **S2** adjacent to the first side **S1**.

[0075] In this case, the midsole **4** more easily sinks downward in the vicinity of the first side **S1**.

[0076] Note that the second groove **G2** does not need to be provided along the entire length of the second side **S2**, as long as the second groove **G2** is provided so as to be continuous with the first groove **G1**.

[0077] More preferably, a long groove **G** extending along the virtual line **VL** from a forefoot portion **5F** to a rearfoot portion **5R** is formed on the base surface **5S**.

[0078] In this case, the long groove **G** is depressed with respect to the base surface **5S**, and the outsole **5** along the long groove **G** is thinner than the base portion (the portion defined by the base surface **5S**). This makes it easier for the upper surface of the midsole **4** to sink downward along the long groove **G**.

[0079] Preferably, the central cleats **12** and **13** of the first cleats **11** to **14**, the second cleats **22** and **23**, and the central cleats **32** and **33** of the third cleats **31** to **34** are each formed in a quadrilateral thick-plate shape.

[0080] As opposed to a cleat of a V-letter shape or a U-letter shape, a cleat of a quadrilateral shape has a linear engaging surface. Therefore, as compared with those of a V-letter shape, it is less likely that clay-like soil gets stuck on the cleat.

[0081] Preferably, a total area of top surfaces **T** of the second cleats **22** and **23** having heights of 2 mm to 10 mm is 20% to 60% of a project area of a middle foot portion **5M** of the shoe sole as projected onto a plane.

[0082] If the total area of the top surfaces **T** is less than 20% in the middle foot portion **5M**, the ground-contact area in the middle foot portion **5M** is small. Therefore, the wearer is likely to feel an upthrust, and the number and size of the second cleats will likely be insufficient, thereby failing to obtain a sufficient engaging force.

[0083] If the total area of the top surfaces **T** exceeds 60% in the middle foot portion **5M**, the ground-contact area in the middle foot portion **5M** will be large. Therefore, the second cleats will unlikely bite into the soil, and the amount of soil to be engaged with the second cleats will be small, thereby failing to obtain a sufficient engaging force.

[0084] In view of this, the total area is more preferably set to 30% to 50% of the project area in the middle foot portion **5M**.

[0085] For similar reasons, preferably, a total area of top surfaces **T** of the cleats **11** to **16** having heights of 2 mm to 10 mm in a region **5FR** of a forefoot portion **5F** that is posterior **D2** to a first metatarsal phalangeal joint **MP1** is 25% to 65% of a project area of the posterior **D2** region **5FR** of the shoe sole as projected onto a plane.

[0086] Such an area proportion in the forefoot portion **5F** is more preferably 35% to 55%.

[0087] Preferably, fourth cleats **42** and **43** are provided in a region **5F2** of a forefoot portion **5F** that is posterior **D2** to a line **MP** connecting together metatarsal phalangeal joints;

the medial fourth cleat **42** arranged on the medial side **Me** of the foot, of the fourth cleats **42** and **43**, has an engaging surface **42E** facing toward an anterior **D1**-lateral **LA** diagonal direction; and

the lateral fourth cleat **43** arranged on the lateral side **LA** of the foot, of the fourth cleats **42** and **43**, has an engaging surface **43E** facing toward an anterior **D1**-media **ME** diagonal direction.

[0088] In the posterior region **5F2** of the forefoot portion **5F** of the outsole **5**, loads are applied toward diagonally posterior directions as indicated by one-dot chain lines of **FIG. 11A** when walking downhill. Therefore, as the

fourth cleats **42** and **43** having the engaging surfaces **42E** and **43E** facing toward diagonally anterior **D1** directions are provided in the posterior region **5F2**, the grip when walking downhill will further improve.

[0089] Preferably, in an area of a forefoot portion **5F** that is anterior **D1** to a ball **O1** of a big toe, the angle θ11 is larger for a more posterior **D2** one of the medial first cleats **11**.

[0090] In this case, the angle θ11 is larger for those medial first cleats **11** that are closer to the ball **O1** of the big toe, and engaging forces are therefore exerted against the loads indicated by solid lines of FIG. **11A**.

[0091] Preferably, the shoe sole further includes a plurality of first to fourth cleats **10**, **11**, **42** and **43** provided around a ball **O1** of a big toe in a forefoot portion **5F**, the first to fourth cleats **10**, **11**, **42** and **43** having engaging surfaces **10E**, **11E**, **42E** and **43E** facing toward the ball **O1** of the big toe.

[0092] In this case, when walking uphill and walking downhill, the cleats efficiently engage with the soil against the loads acting in radial directions centered about the ball **O1** of the big toe.

[0093] Preferably, the shoe sole further includes, in the middle foot portion **5M**:

a medial-edge-side second cleat **21** having an engaging surface **21E** facing toward an anterior **D1**-lateral diagonal direction, and arranged closer to a medial edge than the medial second cleat **22**; and
a lateral-edge-side second cleat **24** having an engaging surface **24E** facing toward an anterior **D1**-media diagonal direction, and arranged closer to a lateral edge than the lateral second cleat **23**.

[0094] In this case, the medial- and lateral-edge-side second cleats **21** and **24** increase the engaging force.

[0095] More preferably, the medial-edge-side second cleat **21** is arranged more posterior to the most posterior one of the medial second cleats **22**; and
the lateral-edge-side second cleat **24** is arranged more posterior to the most posterior one of the lateral second cleats **23**.

[0096] In this case, as the medial- and lateral-edge-side second cleats **21** and **24** are arranged posterior to the medial second cleat **22** and the lateral second cleat **23**, the engaging force and the supporting force can be more easily exerted across the area from the rearfoot portion **5R** to the middle foot portion **5M**, and the support of the area from the rearfoot portion **5R** to the middle foot portion **5M** is more likely stable.

[0097] More preferably, the medial-edge-side second cleat **21** is arranged between the most posterior one of the medial second cleats **22** and the most anterior one of the medial third cleats **32**, while being offset in a normal **NL** direction, which is perpendicular to the engaging surface **21E**, from these cleats **22** and **32**; and
the lateral-edge-side second cleat **24** is arranged between the most posterior one of the lateral second cleats **23** and the most anterior one of the lateral third cleats **33**, while being offset in a normal **NL** direction, which is perpendicular to the engaging surface **24E**, from these cleats **23** and **33**.

[0098] In this case, at least four cleats **21** to **24** are offset from one another in the middle foot portion **5M**. Therefore, for the area from the rearfoot portion **5R** to the middle foot portion **5M**, the engaging force and the supporting force are more easily exerted, thereby making it even more likely that the support of the area from the rearfoot portion **5R** to the middle foot portion **5M** is stable.

[0099] The present invention will be understood more clearly from the following description of preferred embodiments taken in conjunction with the accompanying drawings. 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.

[Embodiment]

[0100] An embodiment of the present invention will now be described with reference to the drawings.

[0101] The present embodiment is, for example, a shoe sole of a shoe for trail running and walking.

[0102] As shown in FIG. 4, the shoe sole includes the outsole **5** made of rubber and the midsole **4** made of resin. Note that an upper (not shown) covering the instep is provided on the shoe sole.

[0103] The midsole **4** includes the midsole body **40** made of a foamed material of EVA, and the reinforcement device **41** made of a foamed material or a non-foamed material of EVA. Note that "made of resin" means that a resin component such as a thermoplastic component is contained, and may include any other suitable component. The midsole **4** may be provided with a low-resilience material, a high-resilience material, a groove, etc.

[0104] The outsole **5** is a tread sole having a higher abrasion resistance than the midsole body **40**, and typically has a higher hardness than the foamed material of the midsole body **40**. Note that "made of rubber" means that it contains a natural rubber component or a synthetic rubber component, and it may contain any other component.

[0105] As shown in FIG. 1, the outsole **5** includes a plurality of first cleats **11** to **14,** second cleats **21** to **24** and third cleats **31** to **34,** which are made of rubber and which are arranged in the forefoot portion **5F,** the middle foot portion **5M** and the rearfoot portion **5R,** respectively.

[0106] The forefoot portion **5F,** the middle foot portion **5M** and the rearfoot portion **5R** refer to areas that cover the forefoot section **1F,** the middle foot section **1M** and the rearfoot section **1R**, respectively, of the foot of **FIG. 10B.** The forefoot section **1F** includes five metatarsal bones and fourteen phalanges. The middle foot section

1M includes a navicular bone, a cuboid bone and three cuneiform bones.

[0107] As shown in FIG. **4** to FIG. **9,** the cleats are projecting downward from the base surface **5S** of the outsole **5** of FIG. **4,** and are formed integral with the outsole **5.** Note that the base surface **5S** refers to the bottom surface of a portion that has a generally constant thickness along the bottom surface of the midsole **4,** and typically includes shallow grooves and small projections/depressions.

[0108] In the forefoot portion **5F** shown on an enlarged scale in FIG. **2,** the medial first cleats **11** and **12** arranged on the medial side **ME** of the foot, of the first cleats **11** to **14,** have the engaging surfaces **11E** and **12E** facing toward the posterior **D2**-lateral **LA** diagonal direction. On the other hand, the lateral first cleats **13** and **14** arranged on the lateral side **LA** of the foot, of the first cleats **11** to **14,** have the engaging surfaces **13E** and **14E** facing toward the posterior **D2**-medial **ME** diagonal direction.

[0109] Note that in the forefoot portion **5F**, the medial auxiliary cleat **15** and the lateral auxiliary cleat **16**, which are made of rubber, are formed integral with the outsole **5**.

[0110] In the middle foot portion **5M** shown on an enlarged scale in FIG. 3, the medial second cleat **22** arranged on the medial side **ME** of the foot, of the second cleats **22** and **23**, has the engaging surface **22E** facing toward the anterior **D1**-lateral **LA** diagonal direction. On the other hand, the lateral second cleat **23** arranged on the lateral side **LA** of the foot, of the second cleats **22** and **23**, has the engaging surface **23E** facing toward the anterior **D1**-media **ME** diagonal direction.

[0111] At the rear end of the middle foot portion **5M** of FIG. 3, the medial-edge-side second cleat **21** and the lateral-edge-side second cleat **24** are provided on the medial side and on the lateral side of the second cleats **22** and **23**. The medial-edge-side second cleat **21** has the engaging surface **21E** facing toward the lateral **LA**-anterior **D1** direction. On the other hand, the lateral-edge-side second cleat **24** has the engaging surface **24E** facing toward the medial **ME**-anterior **D1** direction.

[0112] The medial-edge-side second cleat **21** is offset from, and alternates with, the posterior **D2** one of the medial second cleats **22** and the medial third cleat **32**, in the normal **NL** direction.

[0113] The lateral-edge-side second cleat **24** is offset from, and alternates with, the posterior **D2** one of the lateral second cleats 23 and the lateral third cleat **33**, in the normal **NL** direction.

[0114] That is, the medial-edge-side second cleat **21** is arranged more posterior to the most posterior one of the medial second cleats **22**. On the other hand, the lateral-edge-side second cleat **24** is arranged more posterior to the most posterior one of the lateral second cleats **23**.

[0115] The medial-edge-side second cleat **21** is arranged between the most posterior one of the medial second cleats **22** and the most anterior one of the medial third cleats **32**, while being offset in the normal **NL** direction, which is perpendicular to the engaging surface **21E**, from these cleats **22** and **32**.

[0116] The lateral-edge-side second cleat **24** is arranged between the most posterior one of the lateral second cleats **23** and the most anterior one of the lateral third cleats **33**, while being offset in the normal **NL** direction, which is perpendicular to the engaging surface **24E**, from these cleats **23** and **33**.

[0117] The medial second cleats **22** and the lateral second cleats **23** are offset from one another in the long-axis direction **CL** of the foot.

[0118] At least some of, more preferably a majority of, the second cleats **21** to **24** are arranged in the middle foot portion **5M**. At least some of, more preferably a majority of, the third cleats **31** to **34** are arranged in the rearfoot portion **5R**.

[0119] Note that a majority means equal to or more than a half.

[0120] The medial- and lateral-edge-side second cleats **21** and **24** may contact the ground with no load thereon, or may contact the ground under a load, rather than contacting the ground with no load thereon, as are the medial and lateral second cleats **22** and **23**.

[0121] In the rearfoot portion **5R** of FIG. **3**, the medial third cleats **31** and **32**, which are arranged on the medial side **ME** of the foot, of the third cleats **31** to **34** have the engaging surfaces **31E** and **32E** facing toward the anterior **D1**-lateral **LA** diagonal direction. On the other hand, the lateral third cleats **33** and **34**, which are arranged on the lateral side **LA** of the foot, of the third cleats **31** to **34** have the engaging surfaces **33E** and **34E** facing toward the anterior **D1**-media **ME** diagonal direction.

[0122] In FIG. **3**, the medial third cleats **31** and **32** include a plurality of medial-edge-side cleats **31** and a plurality of central cleats **32**. The plurality of central cleats **32** are spaced apart from one another in the front-rear direction of the foot, and are arranged closer to the longitudinal axis **CL** of the foot than to the medial edge of the outsole **5**. The plurality of medial-edge-side cleats **31** are spaced apart from one another in the front-rear direction of the foot, and are arranged closer to the medial edge than to the longitudinal axis **CL**.

[0123] The lateral third cleats **33** and **34** include a plurality of central cleats **33** and a plurality of lateral-edge-side cleats **34**. The plurality of central cleats **33** are spaced apart from one another in the front-rear direction of the foot, and are arranged closer to the longitudinal axis **CL** of the foot than to the lateral edge of the outsole **5**. The plurality of lateral-edge-side cleats **34** are spaced apart from one another in the front-rear direction of the foot, and are arranged closer to the lateral edge than to the longitudinal axis **CL**.

[0124] One central cleat **32** and one medial-edge-side cleat **31** adjacent to each other, of the medial third cleats **31** and **32**, are offset from, and alternate with, one another in the normal **NL** direction, which is perpendicular to the engaging surfaces **31E** and **32E** of these cleats **31** and **32**.

[0125] One central cleat **33** and one lateral-edge-side cleat **34** adjacent to each other, of the lateral third cleats **33** and **34**, are offset from, and alternate with, one another in the normal **NL** direction, which is perpendicular to the engaging surfaces **33E** and **34E** of these cleats **33** and **34**.

[0126] In the present invention, "to be offset from, and alternate with, one another in the normal **NL** direction" means that not only are they offset from one another, but also the lateral-edge-side cleat **34 (31)** is arranged at a position between one central cleat **33 (32)** and another central cleat **33 (32)** in the normal **NL** direction, while the central cleat **33 (32)** is arranged at a position between one lateral-edge-side cleat **34** (**31**) and another lateral-edge-side cleat **34** (**31**) in the normal **NL** direction.

[0127] The central cleat **32** of the medial third cleats **31** and **32** and the central cleat **33** of the lateral third cleats **33** and **34** are slightly offset from one another in the longitudinal axis **CL**.

[0128] In FIG. **2,** the medial first cleats **11** and **12** include a plurality of medial-edge-side cleats **11** and a plurality of central cleats **12**. The plurality of central cleats **12** are spaced apart from one another in the front-rear direction of the foot, and are arranged closer to the longitudinal axis **CL** of the foot than to the medial edge of the outsole **5**. The plurality of medial-edge-side cleats **11** are spaced apart from one another in the front-rear direction of the foot, and are arranged closer to the medial edge than to the longitudinal axis **CL**.

[0129] The lateral first cleats **13** and **14** include a plurality of central cleats **13** and a plurality of lateral-edge-side cleats **14**. The plurality of central cleats **13** are spaced apart from one another in the front-rear direction of the foot, and are arranged closer to the longitudinal axis **CL** of the foot than to the lateral edge of the outsole **5**. The plurality of lateral-edge-side cleats **14** are spaced apart from one another in the front-rear direction of the foot, and are arranged closer to the lateral edge than to the longitudinal axis **CL**.

[0130] Of the medial first cleats **11** and **12**, the central cleats **12** and the medial-edge-side cleats **11** are offset from, and alternate with, one another in the normal **NL** direction, which is perpendicular to the engaging surfaces **11E** and **12E** of these cleats **11** and **12**.

[0131] Of the lateral first cleats **13** and **14**, the central cleats **13** and the lateral-edge-side cleats **14** are offset from, and alternate with, one another in the normal **NL** direction, which is perpendicular to the engaging surfaces **13E** and **14E** of these cleats **13** and **14**.

[0132] Note that the meaning of "to be offset from, and alternate with, one another in the normal **NL** direction" is as set forth above.

[0133] The central cleats **12**, of the medial first cleats **11** and **12**, and the central cleats **13**, of the lateral first cleats **13** and **14**, are offset from one another in the longitudinal axis **CL** direction. Note that at least some of, more preferably a majority of, the first cleats **11** to **14** are arranged in the forefoot portion **5F**.

[0134] The forefoot portion **5F** further includes the medial auxiliary cleats **15** and the lateral auxiliary cleats **16**. The auxiliary cleats **15** and **16** are spaced apart from the first cleats **11** to **14**.

[0135] Each medial auxiliary cleat **15** is arranged in an area surrounded by two adjacent medial-edge-side cleats **11** and **11** and two adjacent central cleats **12** and **12** of the medial first cleats **11** and **12**, and has the engaging surface **15E** on a plane crossing the engaging surfaces **11E** and **12E** of the medial first cleats **11** and **12**.

[0136] Each lateral auxiliary cleat **16** is arranged in an area surrounded by two adjacent lateral-edge-side cleats **14** and **14** and two adjacent central cleats **13** and **13** of the lateral first cleats **13** and **14**, and has the engaging surface **16E** on a plane crossing the engaging surfaces **13E** and **14E** of the lateral first cleats **13** and **14**.

[0137] As shown in FIG. **5A** and FIG. **5B**, the angle α**1** formed between the engaging surfaces **11E** to **14E** of the first cleats **11** to **14** and the base surface **5S** is equal to the angle ß**1** formed between the front surfaces **FS** of the first cleats **11** to **14** and the base surface **5S**, or is closer to the right angle than the angle ß**1**.

[0138] More specifically, the engaging surfaces **12E** and **13E** of the central cleats **12** and **13** have the angle α**1** which is closer to the right angle than the front surface **FS** but which is not the right angle. On the other hand, the engaging surfaces **11E** and **14E** of the medial- and lateral-edge-side cleats **11** and **14** have the angle α**1**, which is the right angle.

[0139] Note that the angle α**1** of the engaging surfaces **11E** to **14E** and the angle ß**1** of the front surface **FS** may be equal to each other.

[0140] As shown in FIG. **5C**, the engaging surfaces **15E** and **16E** of the auxiliary cleats **15** and **16** are formed by a sloped surface.

[0141] The angle α**2** formed between the engaging surfaces **22E** and **23E** of four second cleats **22** and **23** of FIG. **3** and the base surface **5S** of FIG. **5D** is closer to the right angle than the angle ß**2** formed between the back surface **BS** of the second cleats **22** and **23** and the base surface **5S.** In the present embodiment, the angle α**2** is the right angle, and the angle ß**2** is inclined with respect to the base surface **5S**. Note that the angles α**2** and ß**2** may both be the right angle, or may both be inclined with respect to the base surface **5S.**

[0142] As shown in FIG. **5E** and FIG. **5F,** the angle α**3** formed between the engaging surfaces **31E** to **34E** of the third cleats **31** to **34** and the base surface **5S** is equal to the angle ß**3** formed between the back surface **BS** of the third cleats **31** to **34** and the base surface **5S,** or is closer to the right angle than the angle ß**3**.

[0143] More specifically, the angle α**3** of the engaging surfaces **32E** and **33E** of the central cleats **32** and **33** is equal to the angle ß**3** of the back surface **BS** and is not the right angle. On the other hand, the engaging surfaces **31E** and **34E** of the medial-and lateral-edge-side cleats **31** and **34** have the angle α**3**, which is the right angle. Note that the angle α**3** of the engaging surfaces **31E** and

34E may be equal to the angle ß**3** of the back surface **BS.**

[0144] In FIG. 3, the angles θ22 and θ23 formed between the normals **NL** perpendicular to the engaging surfaces **22E** and **23E** of the second cleats **22** and **23** and the longitudinal axis **CL** of the foot are each set to 15° to 45°. The areas of the engaging surfaces **22E** and **23E** are each set to 40 to 200 square millimeters.

[0145] The angles θ31 to θ34 formed between the normals **NL** perpendicular to the engaging surfaces **31E** to **34E** of the third cleats **31** to **34** and the longitudinal axis **CL** of the foot are each set to 15° to 45°. The areas of the engaging surfaces **31E** to **34E** are each set to 40 to 200 square millimeters.

[0146] In FIG. **2,** the angles θ11 to θ14 formed between the normals **NL** perpendicular to the engaging surfaces **11E** to **14E** of the first cleats **11** to **14** and the longitudinal axis **CL** of the foot are each set to 20° to 60°. The areas of the engaging surfaces **11E** to **14E** are each set to 40 to 200 square millimeters.

[0147] Of the central cleats **12** and **13** of the first cleats **11** to **14**, the area of the engaging surface **13E** of the lateral first cleat **13** arranged on the lateral side **LA** is larger than the area of the engaging surface **12E** of the medial first cleat **12** arranged on the medial side **ME** of the foot.

[0148] In FIG. **5A** to FIG. **5F**, the projection heights **H**, from the base surface **5S**, of the first, medial auxiliary, lateral auxiliary, second and third cleats **11** to **16**, **22**, **23** and **31** to **34** are each set to 2.8 mm to 4.2 mm, for example.

[0149] In FIG. **4B**, the Young's modulus of the reinforcement device **41** is greater than that of the midsole body **40**, and is preferably greater than those of the midsole body **40** and the outsole **5**. At least a part of the most anterior **D1** ones of the second cleats **22** and **23** is arranged directly under the reinforcement device **41** indicated by a dotted line in FIG. 1.

[0150] There are a plurality of medial second cleats **22** spaced apart from one another in the front-rear direction of the foot, and under no load, the top surface **T** of the anterior medial second cleat **22** has a greater distance from the road surface **100** than a distance between the road surface and the top surface **T** of the posterior **D2** medial second cleat **22**, as shown in FIG. **4A** and FIG. **4B**.

[0151] There are a plurality of lateral second cleats **23** of FIG. **3** spaced apart from one another in the front-rear direction of the foot, and under no load as shown in FIG. **4A** and FIG. **4B**, the top surface **T** of the anterior lateral second cleat **23** has a greater distance from the road surface than a distance between the road surface and the top surface **T** of the posterior **D2** lateral second cleat **23**.

[0152] That is, the top surfaces **T** of the anterior **D1** second cleats **22** and **23** do not contact the road surface **100** under no load as described above, but contact the ground when the load on one foot divided by the size of the foot is 1.3 kg/cm or more, for example. Note that such a load occurs when a wearer of an ordinary body size walks or runs.

[0153] As shown in FIG. **2** and FIG. **3**, a long groove **G** extending along the virtual line **VL** from the rearfoot portion **5R** to the forefoot portion **5F** of FIG. **2** is formed on the base surface **5S**. Note that the long groove **G** extends smoothly in the front-rear direction along the longitudinal axis **CL** of the foot. More specifically, in the middle foot portion **5M** and the rearfoot portion **5R** of FIG. **3**, the virtual line **VL** is set at generally the same position as the longitudinal axis **CL** of the foot (the long groove **G** is aligned with the longitudinal axis **CL**), while extending forward inclined toward the medial side **ME** off the longitudinal axis **CL** in the forefoot portion **5F** of FIG. **2**.

[0154] In FIG. **1**, the medial cleats **11**, **12**, **22**, **31** and **32** are arranged on the medial side **ME** of the virtual line **VL**. The lateral cleats **13**, **14**, **23**, **33** and **34** are arranged on the lateral side **LA** of the virtual line **VL**.

[0155] The cleats **12**, **13**, **32** and **33**, of the first and third cleats **11** to **14** and **31** to **34** of FIG. **1**, that are arranged in the vicinity of the long groove **G**, each have a first groove **G1** on the side thereof extending along its first side **S1** of FIG. **2** and **FIG. 3**, which is closest to the virtual line **VL**.

[0156] As shown in FIG. **6** to FIG. **9**, these cleats **12**, **13**, **32** and **33** each have second grooves **G2** which are continuous with the first groove **G1** and extending along a pair of second sides **S2** and **S2** adjacent to the first side **S1**.

[0157] Moreover, these cleats **12**, **13**, **32** and **33** each have a third groove **G3** which is continuous with the second grooves **G2** and extending along a third side **S3** on the opposite side from the first side **S1**.

[0158] As shown in FIG. **6** to FIG. **9**, the central cleats **12** and **13** of the first cleats **11** to **14**, the second cleats **22** and **23**, and the central cleats **32** and **33** of the third cleats **31** to **34** are each formed in a quadrilateral thick-plate shape.

[0159] In the present embodiment, the quadrilateral first cleats **12** and **13** of FIG. **1** are each formed in a trapezoidal thick-plate shape. The quadrilateral second and third cleats **22**, **23**, **32** and **33** are each formed in a parallelogram thick-plate shape.

[0160] As can be seen from FIG. **6** to FIG. **9** and FIG. **4A**, the outsole **5** is rolled up along the midsole **4** above the outsole **5** at the medial and lateral edges and the front and rear ends, i.e., along the periphery of the outsole **5**. The base surface **5S** of the outsole **5** being rounded makes it easier to run or walk.

[0161] Note that the cleats **51** and **52** at the front and rear ends are projecting from the base surface **5S** by about 2.8 mm to 4.5 mm.

[0162] In FIG. **1,** the area of the top surface **T** of each of the first, second and third cleats **11** to **14**, **22**, **23** and **31** to **34** is set to 50 to 300 square millimeters.

[0163] In FIG. **10A**, the area of the top surface **T** of each of the cleats **11** to **16**, **21** to **24** and **31** to **34** of which the projection height H is 2.8 mm to 4.2 mm is shaded with dots.

[0164] The total area of the top surfaces **T** of the second cleats **22** and **23** having heights of 2.8 mm to 4.2 mm in the middle foot portion **5M** of FIG. **10A** is 30% to 50% of the project area of the middle foot portion **5M** of the shoe sole as projected onto a plane.

[0165] On the other hand, the total area of the top surfaces **T** of the cleats **11** to **16** having heights of 2.8 mm to 4.2 mm in the region **5FR** of the forefoot portion **5F** that is posterior **D2** to the first metatarsal phalangeal joint **MP1** is 35% to 55% of the project area of the posterior **D2** region **5FR** of the shoe sole as projected onto a plane, and it is preferably greater than that of the middle foot portion **5M.** That is because in the middle foot portion **5,** clay is likely to stay between cleats, and it is therefore preferred to have a smaller cleat ratio.

[0166] Next, examples of FIG. **11B** to FIG. **11D** will be described.

[0167] In these figures, the top surface **T** of each cleat is shaded with dots. Surfaces that are at the right angle or nearly at the right angle with respect to the base surface **5S**, i.e., the engaging surfaces **11E**, **14E, 22E, 23E, 32E**, **33E**, **42E** and **43E**, are drawn with thicker lines than lines representing other surfaces.

[0168] In the example of FIG. **11B**, the fourth cleats **42** and **43** are provided in the region **5F2** of the forefoot portion **5F** that is posterior **D2** to the line **MP** connecting together the **MP** joints. The medial fourth cleat **42** arranged on the medial side **ME** of the foot, of the fourth cleats **42** and **43**, has the engaging surface **42E** facing toward the anterior **D1**-lateral **LA** diagonal direction. The lateral fourth cleat **43** arranged closer to the lateral side **LA** of the foot than the medial fourth cleat **42**, of the fourth cleats **42** and **43**, has the engaging surface **43E** facing toward the anterior **D1**-media **ME** diagonal direction.

[0169] In an area of the forefoot portion **5F** that is anterior **D1** to the line **MP** connecting together the MP joints, the central first cleats **10** and **10** are arranged in the middle between the medial side and the lateral side. The engaging surface **10E** of the central first cleat **10** extends generally in the width direction. The engaging surface **10E** is facing toward the posterior **D2** direction.

[0170] In an area of the forefoot portion **5F** that is anterior **D1** to the ball **O1** of the big toe, the angle $\theta 11$ is larger for a more posterior **D2** one of the medial first cleats **11** (see FIG. **2**). Some of the first cleats **10** and **11** and the fourth cleats **42** and **43** of FIG. **11B** are arranged around the ball **O1** of the big toe in the forefoot portion **5F**, and have the engaging surfaces **10E**, **11E**, **42E** and **43E** facing toward the ball **O1** of the big toe or the line **MP** connecting together the MP joints.

[0171] In the example of FIG. 11C, cleats are formed in a V-letter shape. In the example of FIG. 11D, cleats are formed in a shape other than the quadrilateral shape and the V-letter shape. There may be cleats of two or more different shapes.

[0172] 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.

[0173] For example, the grooves **G**, **G1** to **G3** may be absent. Grooves may be provided around the second cleats **22** and **23**.

[0174] 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

[0175] The present invention is applicable to shoe soles for walking shoes, rain shoes, and shoes for daily use, as well as shoes for trail running, mountain climbing, and cross country.

REFERENCE SIGNS LIST

[0176]

1F: Forefoot 1M: Middle foot 1R: Rearfoot
4: Midsole 40: Midsole body 41: Reinforcement device
5: Outsole
5F: Forefoot portion 5FR: Region posterior to MP1 5F2: Region posterior to MP 5M: Middle foot portion 5R: Rearfoot portion 5S: Base surface
10: Central first cleat 11,12: Medial first cleat 13,14: Lateral first cleat 10E-14E: Engaging surface
15: Medial auxiliary cleat 16: Lateral auxiliary cleat 15E,16E: Engaging surface
21: Medial-edge-side second cleat 22: Medial second cleat 23: Lateral second cleat 24: Lateral-edge-side second cleat 21E-24E: Engaging surface
31, 32: Medial third cleat 33, 34: Lateral third cleat 31E-34E: Engaging surface
42: Medial fourth cleat 43: Lateral fourth cleat 42E, 43E: Engaging surface
100: Road surface
BS: Back surface FS: Front surface T: Top surface
CL: Longitudinal axis NL: Normal VL: Virtual line
D1: Anterior D2: Posterior
G: Groove G1: First groove G2: Second groove G3: Third groove
H: Projection height
S1: First side S2: Second side S3: Third side
ME: Medial side LA: Lateral side
MP: Line connecting together metatarsal phalangeal joints MP1: First metatarsal phalangeal joint O1: Ball of big toe
$\alpha 1$-$\alpha 3$, $\beta 1$-$\beta 3$: Angle $\theta 11$-$\theta 14$, $\theta 22$, $\theta 23$, $\theta 31$-$\theta 34$: Angle

Claims

1. A shoe sole comprising an outsole **5** made of rubber and a midsole **4** made of resin, wherein a plurality

of first cleats **11** to **14,** second cleats **22** and **23** and third cleats **31** to **34** made of rubber and projecting from a base surface **5S** of the outsole **5** are arranged in a forefoot portion **5F,** a middle foot portion **5M** and a rear foot portion **5R,** respectively, wherein:

of the first cleats **11** to **14,** medial first cleats **11, 12** arranged on a medial side **ME** of a foot have engaging surfaces **11E**, **12E** facing toward a posterior **D2**-lateral **LA** diagonal direction;
of the first cleats **11** to **14**, lateral first cleats **13**, **14** arranged on a lateral side **LA** of the foot have engaging surfaces **13E**, **14E** facing toward a posterior **D2**-medial **ME** diagonal direction;
of the second cleats **22**, **23**, a medial second cleat **22** arranged on the medial side **ME** of the foot has an engaging surface **22E** facing toward an anterior **D1**-lateral **LA** diagonal direction;
of the second cleats **22**, **23**, a lateral second cleat **23** arranged on the lateral side **LA** of the foot has an engaging surface **23E** facing toward an anterior **D1**-medial **ME** diagonal direction;
of the third cleats **31** to **34**, medial third cleats **31**, **32** arranged on the medial side **ME** of the foot have engaging surfaces **31E**, **32E** facing toward an anterior **D1**-lateral **LA** diagonal direction; and
of the third cleats **31** to **34**, lateral third cleats **33**, **34** arranged on the lateral side **LA** of the foot have engaging surfaces **33E**, **34E** facing toward an anterior **D1**-medial **ME** diagonal direction.

2. The shoe sole according to claim 1, wherein an angle α**2** formed between at least one of the engaging surfaces **22E** and **23E** of the second cleats **22** and **23** and the base surface **5S** is equal to an angle β**2** formed between a back surface **BS** of the second cleats **22** and **23** and the base surface **5S**, or is closer to a right angle than the angle β**2**.

3. The shoe sole according to claim 1 or 2, wherein an angle α**3** formed between at least one of the engaging surfaces **31E** to **34E** of the third cleats **31** to **34** and the base surface **5S** is equal to an angle ß**3** formed between a back surface **BS** of the third cleats **31** to **34** and the base surface **5S**, or is closer to a right angle than the angle ß**3.**

4. The shoe sole according to any one of claims 1 to 3, wherein an angle α**1** formed between at least one of the engaging surfaces **11E** to **14E** of the first cleats **11** to **14** and the base surface **5S** is equal to an angle ß**1** formed between a front surface **FS** of the first cleats 11 to 14 and the base surface **5S**, or is closer to a right angle than the angle ß**1**.

5. The shoe sole according to any one of claims 1 to 4, wherein the first, second and third cleats 11 to **14, 22, 23** and **31** to **34** are projecting from the base surface **5S** by 2 to 10 mm.

6. The shoe sole according to any one of claims 1 to 5, wherein an area of a top surface **T** of each of the first, second and third cleats **11** to **14, 22, 23** and **31** to **34** contacting the ground is 50 to 500 square millimeters.

7. The shoe sole according to any one of claims 1 to 6, wherein an angle θ22, θ23 formed between a normal **NL** perpendicular to the engaging surface **22E, 23E** of at least one of the second cleats **22** and **23** and a longitudinal axis **CL** of the foot is set to 15° to 45°, and an area of the engaging surface **22E**, **23E** is set to 20 to 500 square millimeters.

8. The shoe sole according to any one of claims 1 to 7, wherein an angle θ31-θ34 formed between a normal **NL** perpendicular to the engaging surface **31E-34E** of at least one of the third cleats **31** to **34** and a longitudinal axis **CL** of the foot is set to 15° to 45°, and an area of the engaging surface **31E-34E** is set to 20 to 500 square millimeters.

9. The shoe sole according to any one of claims 1 to 8, wherein an angle θ11-θ14 formed between a normal **NL** perpendicular to the engaging surface **11E-14E** of at least one of the first cleats **11** to **14** and a longitudinal axis **CL** of the foot is set to 20° to 60°, and an area of the engaging surface **11E-14E** is set to 20 to 500 square millimeters.

10. The shoe sole according to any one of claims 1 to 9, wherein the midsole **4** includes a midsole body **40** and a reinforcement device **41** having a larger Young's modulus than the midsole body **40**, with at least some of the second cleats **22** and **23** arranged directly under the reinforcement device **41**.

11. The shoe sole according to claim 10, wherein:

there are a plurality of medial second cleats **22** spaced apart from one another in a front-rear direction of the foot, and under no load, a top surface **T** of an anterior medial second cleat **22** has a greater distance from a road surface than a top surface **T** of a posterior **D2** medial second cleat **22**; and
there are a plurality of lateral second cleats **23** spaced apart from one another in the front-rear direction of the foot, and under no load, a top surface **T** of an anterior lateral second cleat **23** has a greater distance from the road surface than a top surface **T** of a posterior **D2** lateral second cleat **23**.

12. The shoe sole according to claim 11, wherein the

top surfaces **T** of the anterior **D1** second cleats **22** and **23** do not contact the ground under no load, and contact the ground when a load on one foot divided by a size of the foot is 3 kg/cm.

13. The shoe sole according to any one of claims 1 to 12, wherein:

the medial third cleats **31** and **32** include a plurality of central cleats **32** spaced apart from one another in a front-rear direction of the foot and arranged closer to a longitudinal axis **CL** of the foot than a medial edge of the outsole **5**, and a plurality of medial-edge-side cleats **31** spaced apart from one another in the front-rear direction of the foot and arranged closer to the medial edge than the longitudinal axis **CL**; and
the lateral third cleats **33** and **34** include a plurality of central cleats **33** spaced apart from one another in the front-rear direction of the foot and arranged closer to the longitudinal axis **CL** of the foot than a lateral edge of the outsole **5**, and a plurality of lateral-edge-side cleats **34** spaced apart from one another in the front-rear direction of the foot and arranged closer to the lateral edge than the longitudinal axis **CL**.

14. The shoe sole according to claim 13, wherein:

the central cleats **32** and the medial-edge-side cleats **31**, of the medial third cleats **31** and **32**, are offset from, and alternate with, one another in a normal **NL** direction, which is perpendicular to the engaging surfaces **31E** and **32E** of these cleats **31** and **32**; and
the central cleats **33** and the lateral-edge-side cleats **34**, of the lateral third cleats **33** and **34**, are offset from, and alternate with, one another in the normal **NL** direction, which is perpendicular to the engaging surfaces **33E** and **34E** of these cleats **33** and **34**.

15. The shoe sole according to claim 14, wherein the central cleats **32** of the medial third cleats **31** and **32** and the central cleats **33** of the lateral third cleats **33** and **34** are offset from one another in the longitudinal axis **CL** direction.

16. The shoe sole according to any one of claims 1 to 15, wherein:

the medial first cleats **11** and **12** include a plurality of central cleats **12** spaced apart from one another in a front-rear direction of the foot and arranged closer to a longitudinal axis **CL** of the foot than a medial edge of the outsole **5**, and a plurality of medial-edge-side cleats **11** spaced apart from one another in the front-rear direction of the foot and arranged closer to the medial edge than the longitudinal axis **CL**; and
the lateral first cleats **13** and **14** include a plurality of central cleats **13** spaced apart from one another in the front-rear direction of the foot and arranged closer to the longitudinal axis **CL** of the foot than a lateral edge of the outsole **5**, and a plurality of lateral-edge-side cleats **14** spaced apart from one another in the front-rear direction of the foot and arranged closer to the lateral edge than the longitudinal axis **CL**.

17. The shoe sole according to claim 16, wherein:

the central cleats **12** and the medial-edge-side cleats **11**, of the medial first cleats **11** and **12**, are offset from, and alternate with, one another in a normal **NL** direction, which is perpendicular to the engaging surfaces **11E** and **12E** of these cleats **11** and **12**; and
the central cleats **13** and the lateral-edge-side cleats **14**, of the lateral first cleats **13** and **14**, are offset from, and alternate with, one another in the normal **NL** direction, which is perpendicular to the engaging surfaces **13E** and **14E** of these cleats **13** and **14**.

18. The shoe sole according to claim 17, wherein the central cleats **12** of the medial first cleats **11** and **12** and the central cleats **13** of the lateral first cleats **13** and **14** are offset from one another in the longitudinal axis **CL** direction.

19. The shoe sole according to any one of claims 16 to 18, wherein for the central cleats **12** and **13** of the first cleats **11** to **14,** the engaging surface **13E** of the lateral first cleat **13** arranged on the lateral side **LA** of the foot has a larger area than the engaging surface **12E** of the medial first cleat **12** arranged on the medial side **ME** of the foot.

20. The shoe sole according to any one of claims 16 to 19, comprising:

a medial auxiliary cleat **15** arranged in an area surrounded by two medial-edge-side cleats **11** and **11** and two central cleats **12** and **12** of the medial first cleats **11** and **12**, and having an engaging surface **15E** on a plane crossing the engaging surfaces **11E** and **12E** of the medial first cleats **11** and **12**; and
a lateral auxiliary cleat **16** arranged in an area surrounded by two lateral-edge-side cleats **14** and **14** and two central cleats **13** and **13** of the lateral first cleats **13** and **14**, and having an engaging surface **16E** on a plane crossing the engaging surfaces **13E** and **14E** of the lateral first cleats **13** and **14**,

wherein the auxiliary cleats **15** and **16** are spaced apart from the first cleats **11** to **14**.

21. The shoe sole according to any one of claims 1 to 20, wherein a virtual line **VL** is defined extending smoothly in a front-rear direction along a longitudinal axis **CL** of the foot, wherein the medial cleats **11**, **12**, **22**, **31** and **32** are arranged on the medial side **ME** of the virtual line **VL** and the lateral cleats **13**, **14**, **23**, **33** and **34** are arranged on the lateral side **LA** of the virtual line **VL**.

22. The shoe sole according to claim 21, wherein the cleats **12**, **13**, **32** and **33**, of the first and third cleats **11** to **14** and **31** to 34, that are arranged in the vicinity of the virtual line **VL**, each have a first groove **G1** on a side thereof extending along its first side **S1**, which is closest to the virtual line **VL**.

23. The shoe sole according to claim 22, wherein the cleats **12**, **13**, **32** and **33**, arranged in the vicinity of the virtual line **VL**, each have second grooves **G2** which are continuous with the first groove **G1** and extending along a pair of second sides **S2** and **S2** adjacent to the first side **S1**.

24. The shoe sole according to any one of claims 20 to 23, wherein a long groove **G** extending along the virtual line **VL** from the forefoot portion **5F** to the rearfoot portion **5R** is formed on the base surface **5S**.

25. The shoe sole according to any one of claims 1 to 24, wherein the central cleats **12** and **13** of the first cleats **11** to **14**, the second cleats **22** and **23**, and the central cleats **32** and **33** of the third cleats **31** to **34** are each formed in a quadrilateral thick-plate shape.

26. The shoe sole according to any one of claims 1 to 25, wherein a total area of top surfaces **T** of the second cleats **22** and **23** having heights of 2 mm to 10 mm is 20% to 60% of a project area of a middle foot portion **5M** of the shoe sole as projected onto a plane.

27. The shoe sole according to any one of claims 1 to 26, wherein a total area of top surfaces **T** of the cleats **11** to **16** having heights of 2 mm to 10 mm in a region **5FR** of the forefoot portion **5F** that is posterior **D2** to a first metatarsal phalangeal joint **MP1** is 25% to 65% of a project area of the posterior **D2** region **5FR** of the shoe sole as projected onto a plane.

28. The shoe sole according to any one of claims 1 to 27, wherein:

fourth cleats **42** and **43** are provided in a region **5F2** of the forefoot portion **5F** that is posterior **D2** to a line **MP** connecting together metatarsal phalangeal joints;
the medial fourth cleat **42** arranged on the medial side **ME** of the foot, of the fourth cleats **42** and **43**, has an engaging surface **42E** facing toward an anterior **D1**-lateral **LA** diagonal direction; and
the lateral fourth cleat **43** arranged on the lateral side **LA** of the foot, of the fourth cleats **42** and **43**, has an engaging surface **43E** facing toward an anterior **D1**-medial **ME** diagonal direction.

29. The shoe sole according to any one of claims 9 to 28, wherein in an area of the forefoot portion **5F** that is anterior **D1** to a ball **O1** of a big toe, the angle $\theta 11$ is larger for a more posterior **D2** one of the medial first cleats **11**.

30. The shoe sole according to any one of claims 1 to 29, wherein further comprising a plurality of first to fourth cleats **10**, **11**, **42** and **43** provided around a ball **O1** of a big toe in the forefoot portion **5F**, the first to fourth cleats **10**, **11**, **42** and **43** having engaging surfaces **10E**, **11E**, **42E** and **43E** facing toward the ball **O1** of the big toe.

31. The shoe sole according to any one of claims 1 to 30, further comprising, in the middle foot portion **5M**:

a medial-edge-side second cleat **21** having an engaging surface **21E** facing toward an anterior **D1**-lateral diagonal direction, and arranged closer to a medial edge than the medial second cleat **22**; and
a lateral-edge-side second cleat **24** having an engaging surface **24E** facing toward an anterior **D1**-medial diagonal direction, and arranged closer to a lateral edge than the lateral second cleat **23**.

32. The shoe sole according to claim 31, wherein:

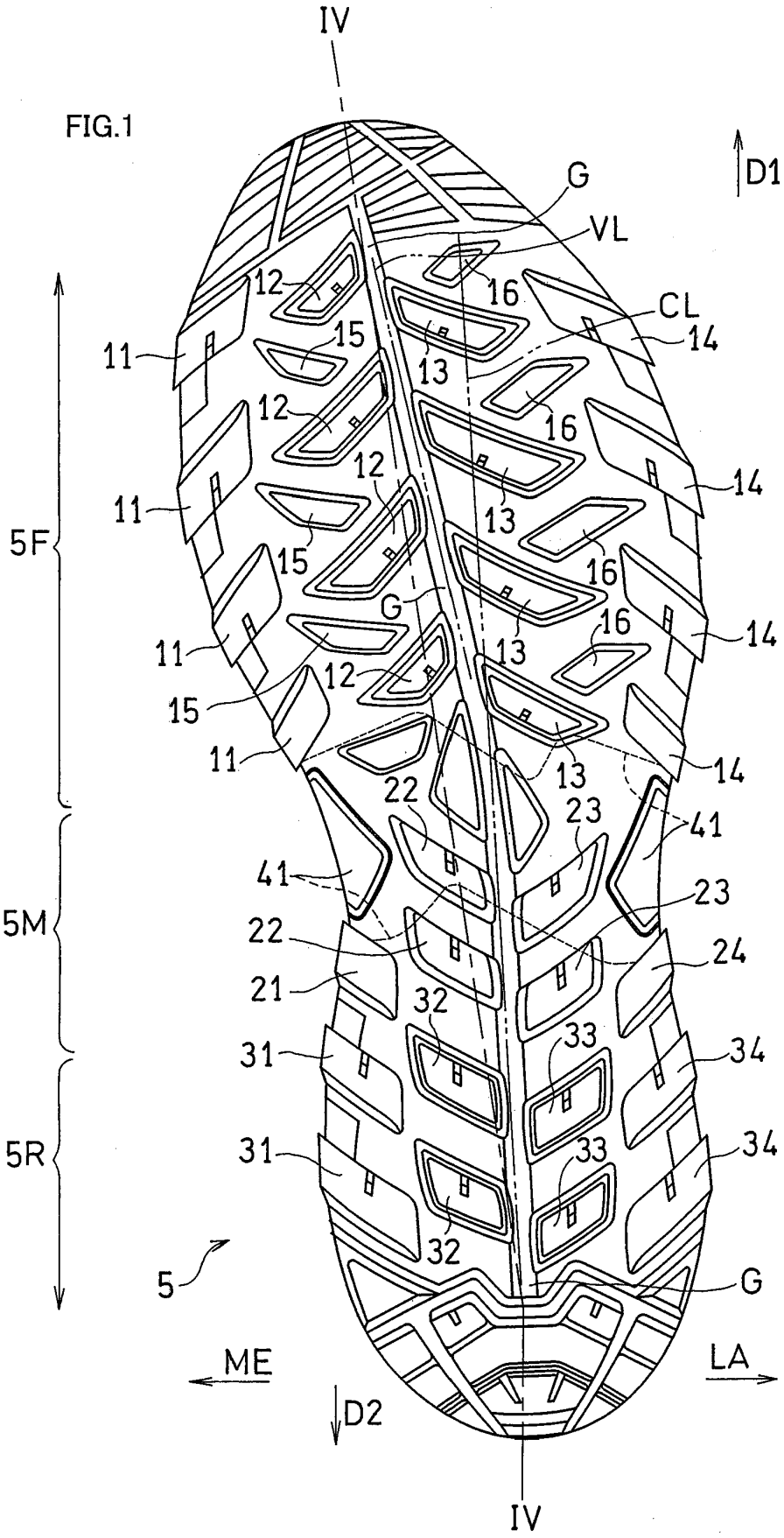
the medial-edge-side second cleat **21** is arranged more posterior to the most posterior one of the medial second cleats **22**; and
the lateral-edge-side second cleat **24** is arranged more posterior to the most posterior one of the lateral second cleats **23**.

33. The shoe sole according to claim 31 or 32, wherein the medial-edge-side second cleat **21** is arranged between the most posterior one of the medial second cleats **22** and the most anterior one of the medial third cleats **32**, while being offset in a normal **NL** direction, which is perpendicular to the engaging surface **21E**, from these cleats **22** and **32**; and
the lateral-edge-side second cleat **24** is arranged between the most posterior one of the lateral second cleats **23** and the most anterior one of the lateral

third cleats **33**, while being offset in a normal **NL** direction, which is perpendicular to the engaging surface **24E**, from these cleats **23** and **33**.

34. The shoe sole according to any one of claims 1 to 33, wherein the medial second cleats **22** and the lateral second cleats **23** are offset from one another in a long-axis direction **CL** of the foot.

FIG.1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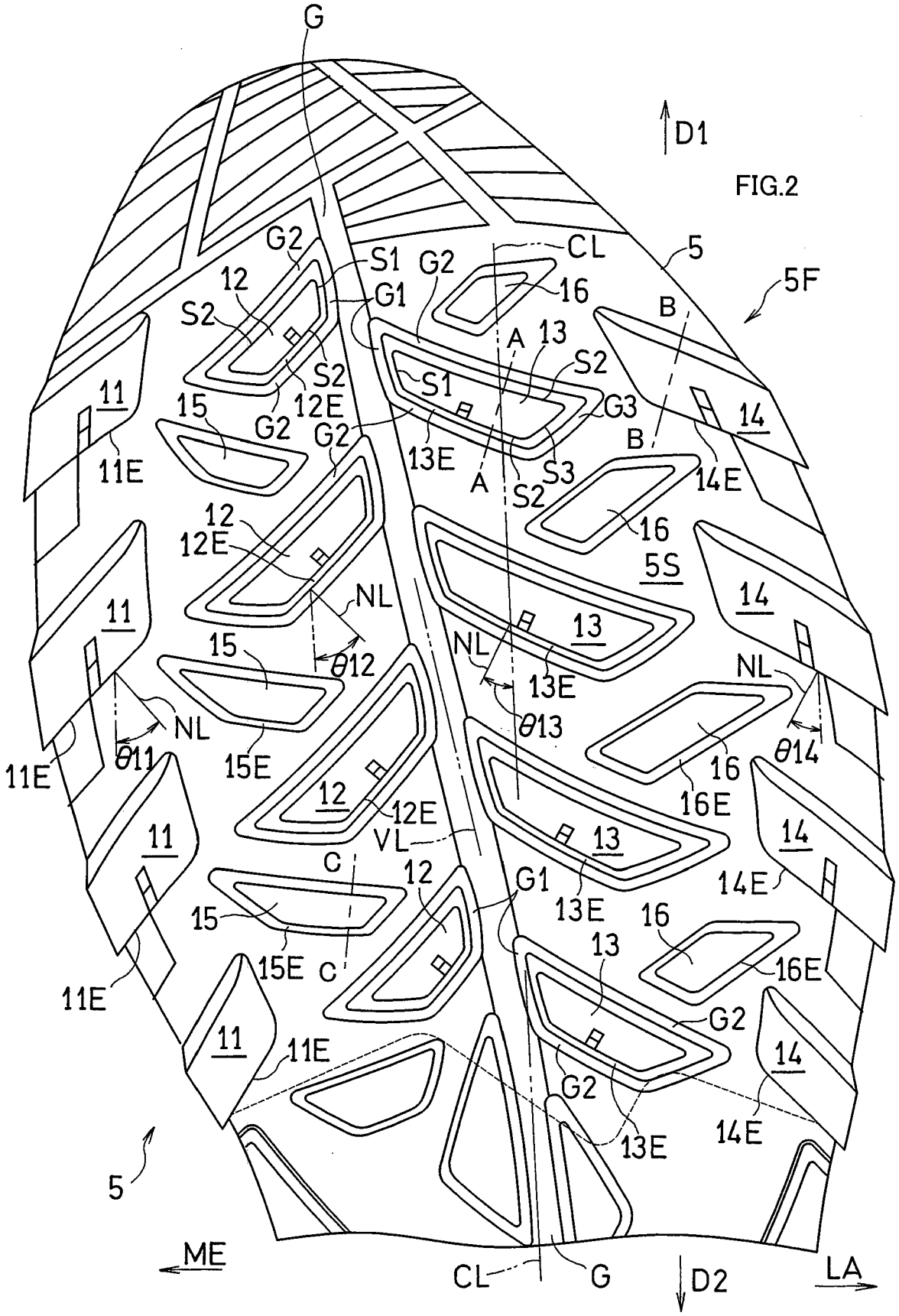
D1
G
VL
CL
12
16
15
14
11
13
5F
5M
5R
22
23
41
24
21
32
31
33
34
5
ME
LA
D2
IV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D1
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16
B
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15
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G2
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12E
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NL
NL
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11E
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13
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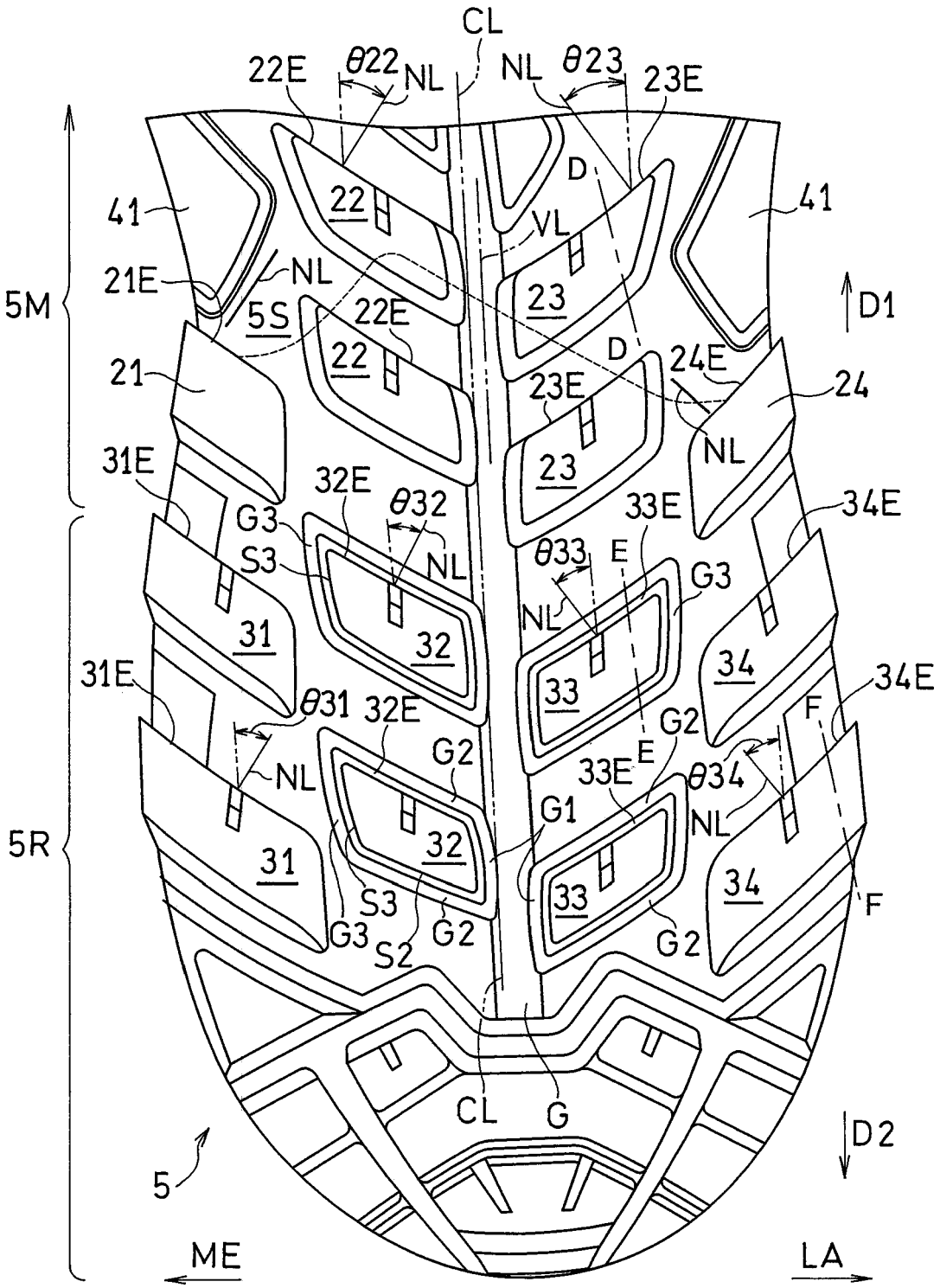
CL
G
D2
LA

FIG.2

FIG.3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24
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32E
θ32
34E
G3
33E
θ33
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S3
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33
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32E
F
G2
G2
E
NL
33E
θ34
G1
NL
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S3
G3
S2
G2
G2
CL
G
D2
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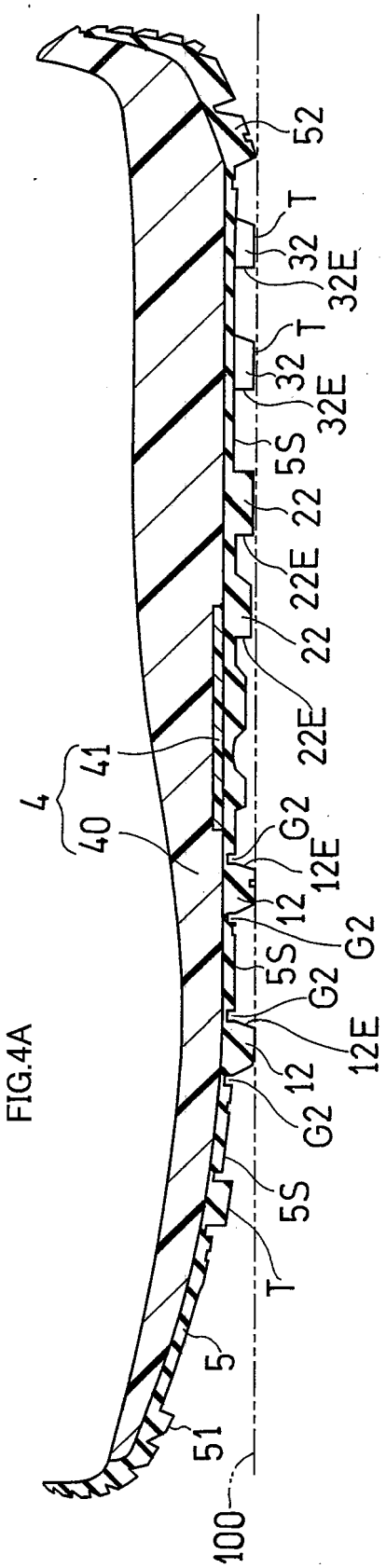
ME
LA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T
32
32E
T
32
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5S
22
22E
22
22E
4
41
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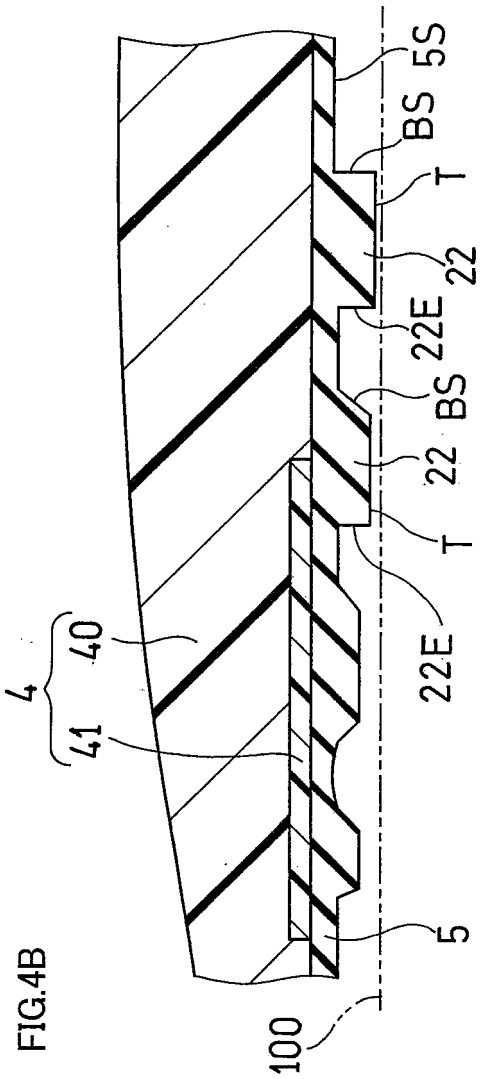
12
5S
G2
G2
12E
12
G2
5S
T
5
51
100

FIG.4A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22E
BS
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T
22E
4
40
41
5
100

FIG.4B

FIG.5A

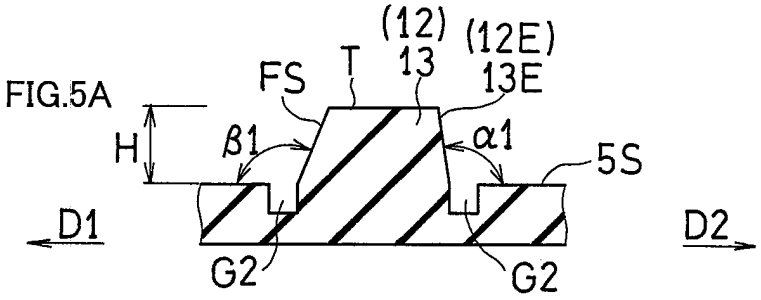


FIG.5B

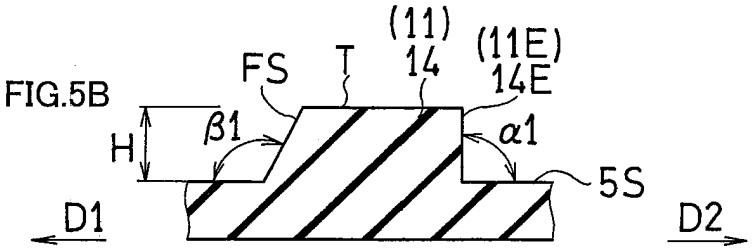


FIG.5C

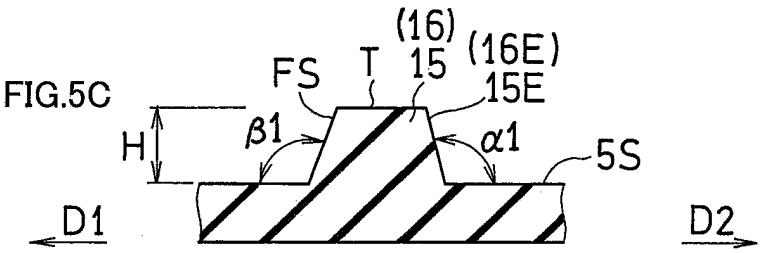


FIG.5D

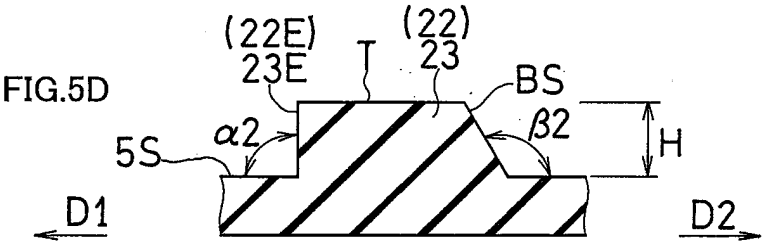


FIG.5E

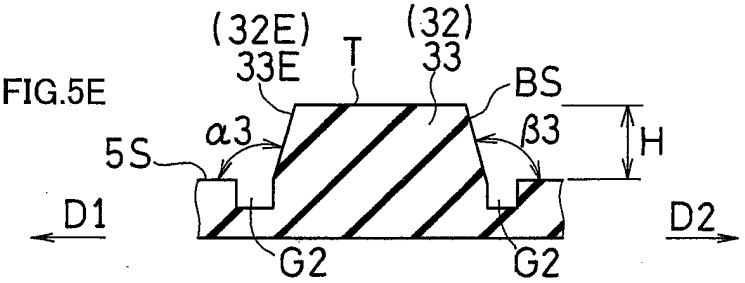


FIG.5F

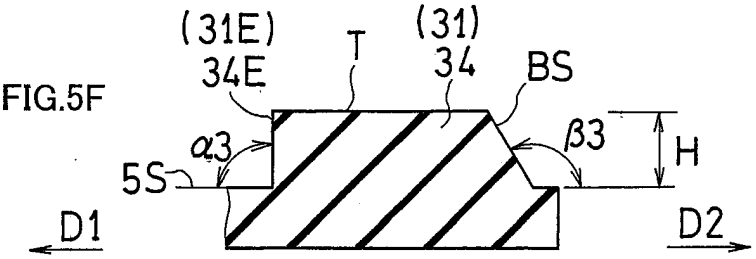
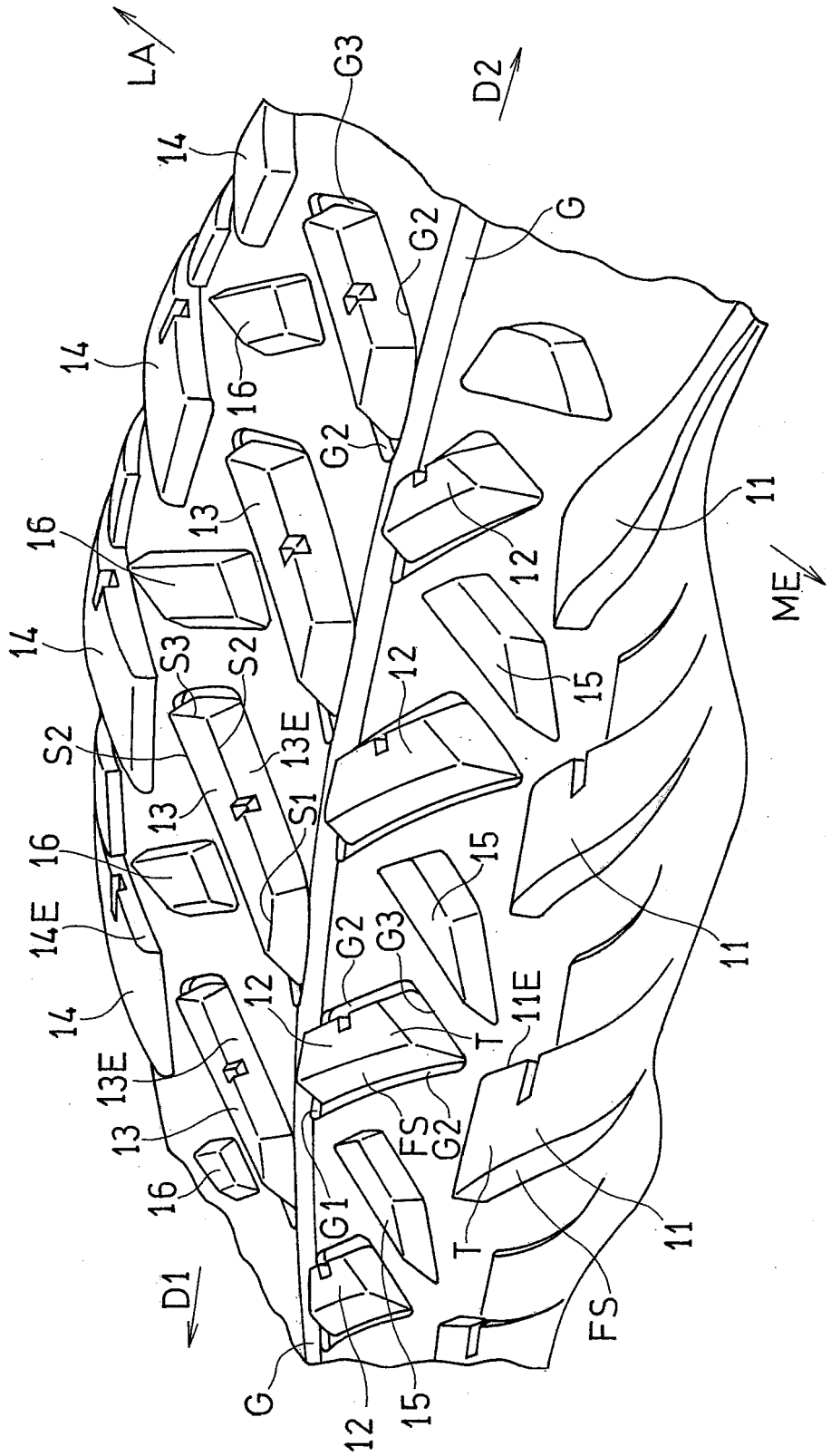


FIG 6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G2
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ME
S3
S2
13E
S1
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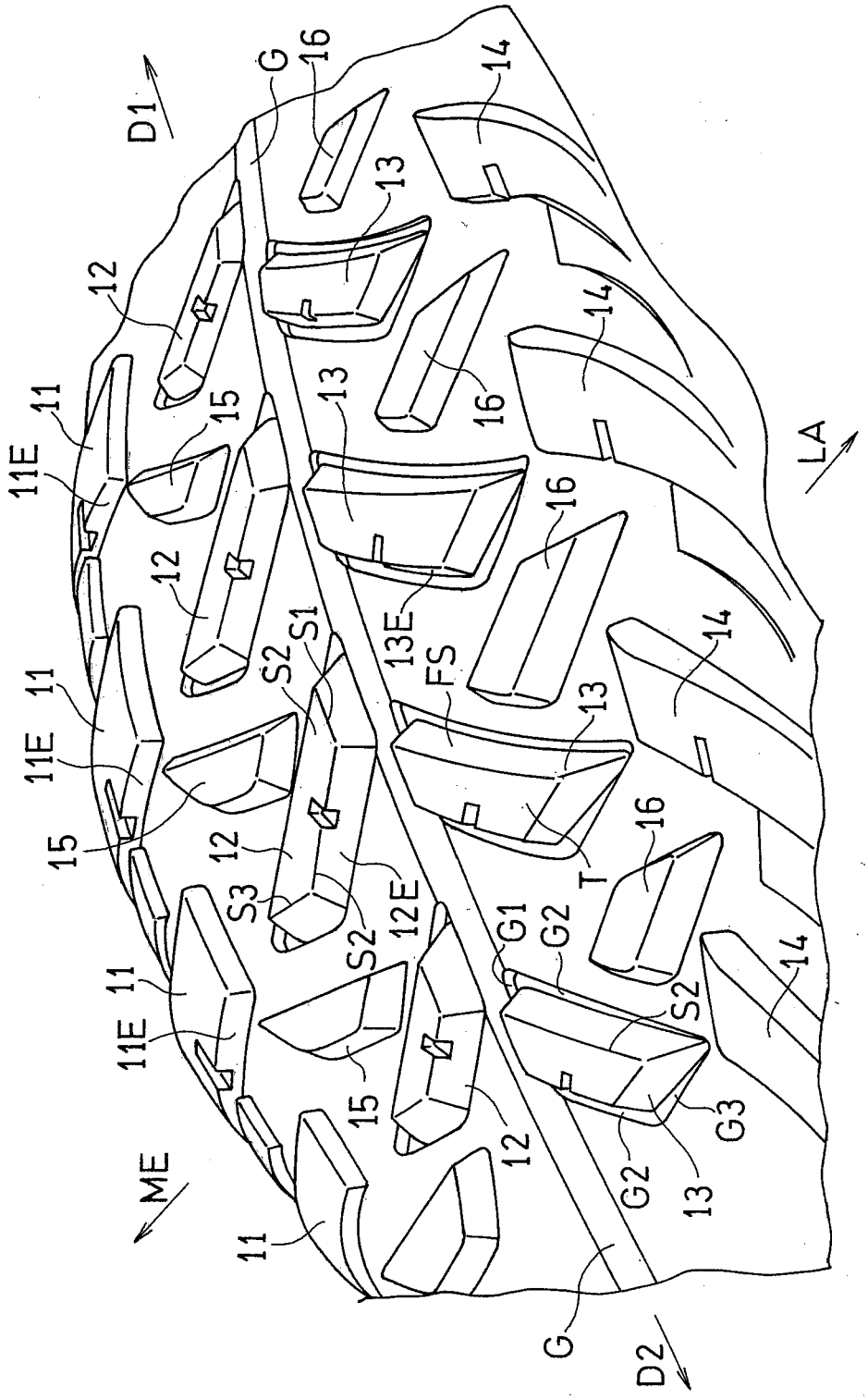
14E
G2
G3
11E
T
FS
G1
D1
12
15

FIG 7


D1
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11E
15
LA
S1
S2
13E
FS
S3
12E
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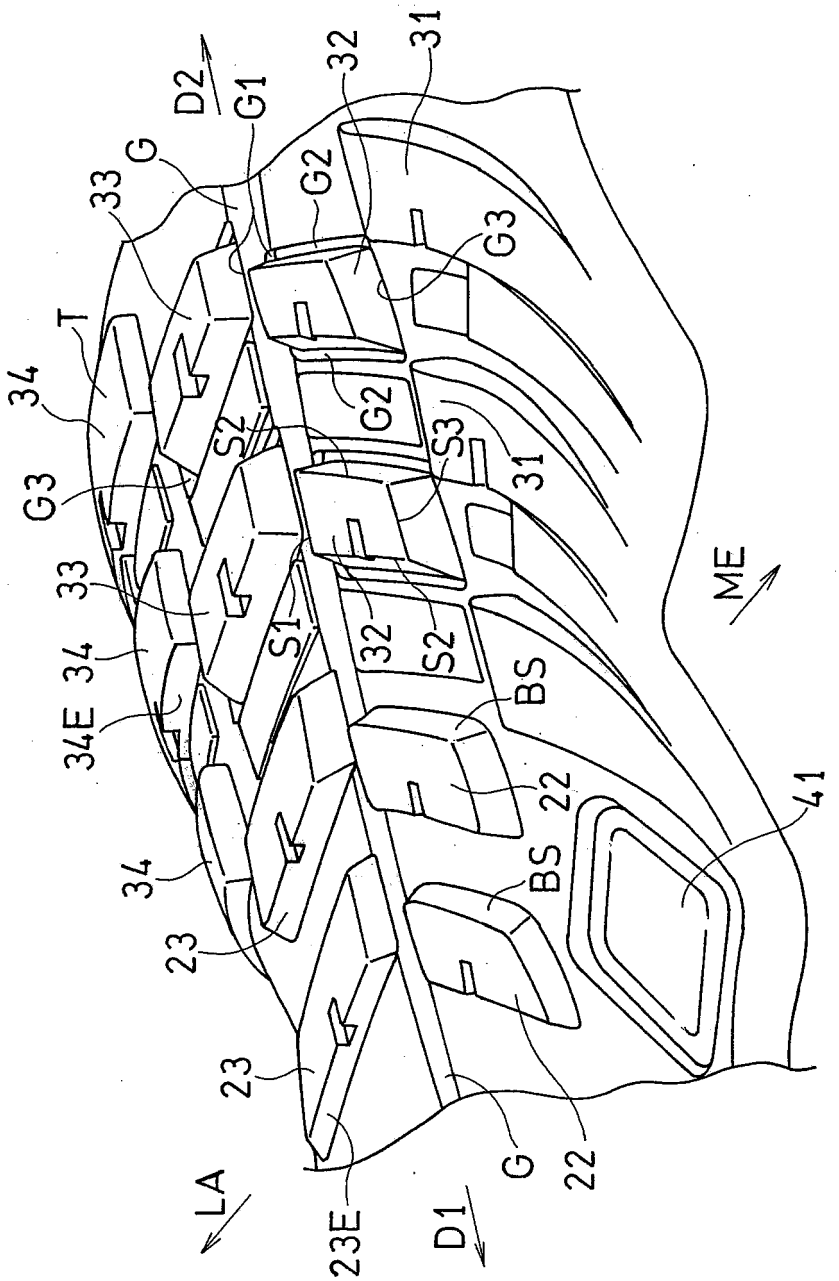
G1
G2
S2
G3
G2
13
G
D2
ME

FIG 8


D2
G1
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G2
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G2
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S3
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G3
33
S1
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S2
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34E
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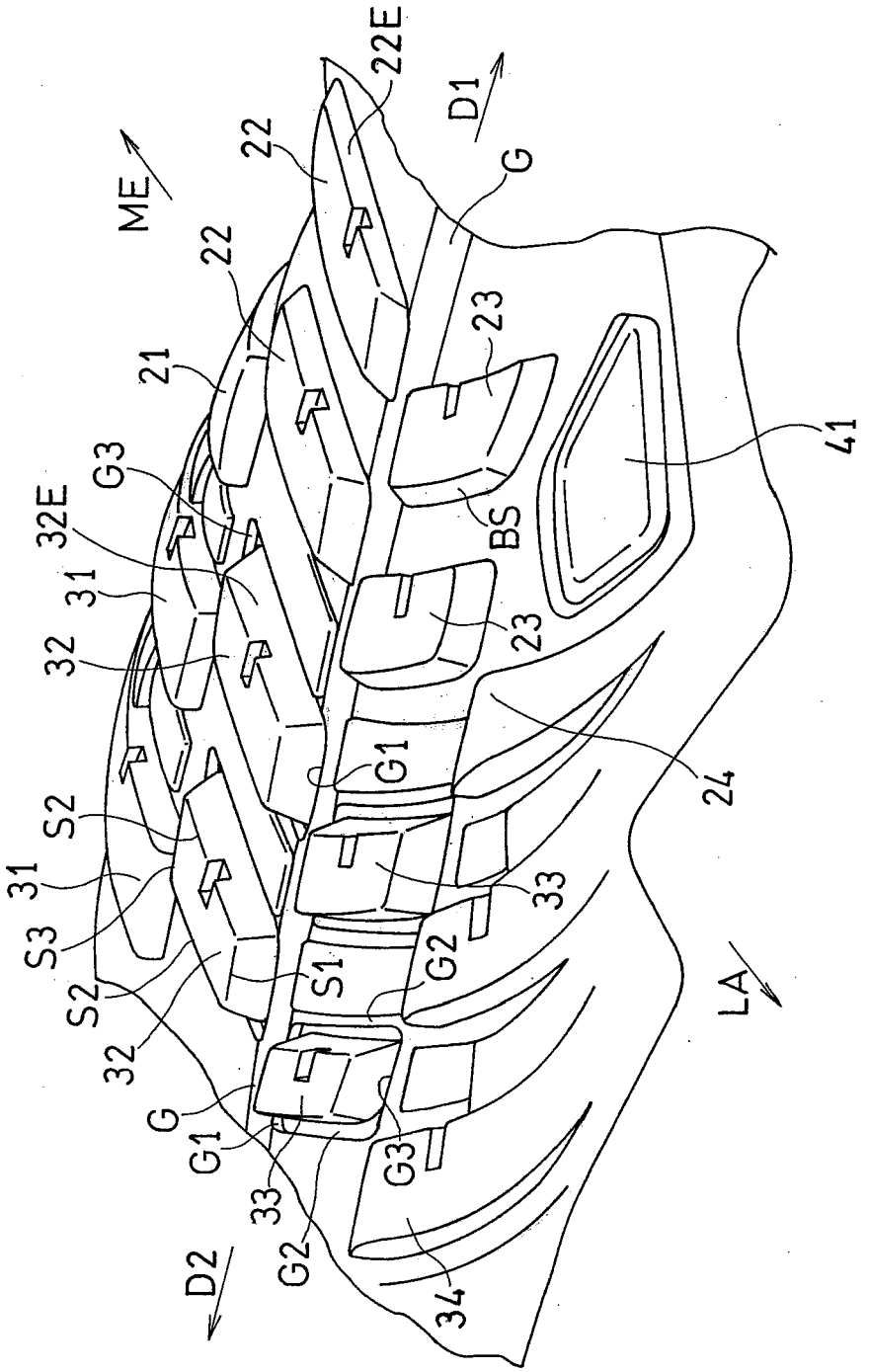
BS
22
41
34
BS
23
23
G
22
LA
23E
D1

FIG 9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G2
D2
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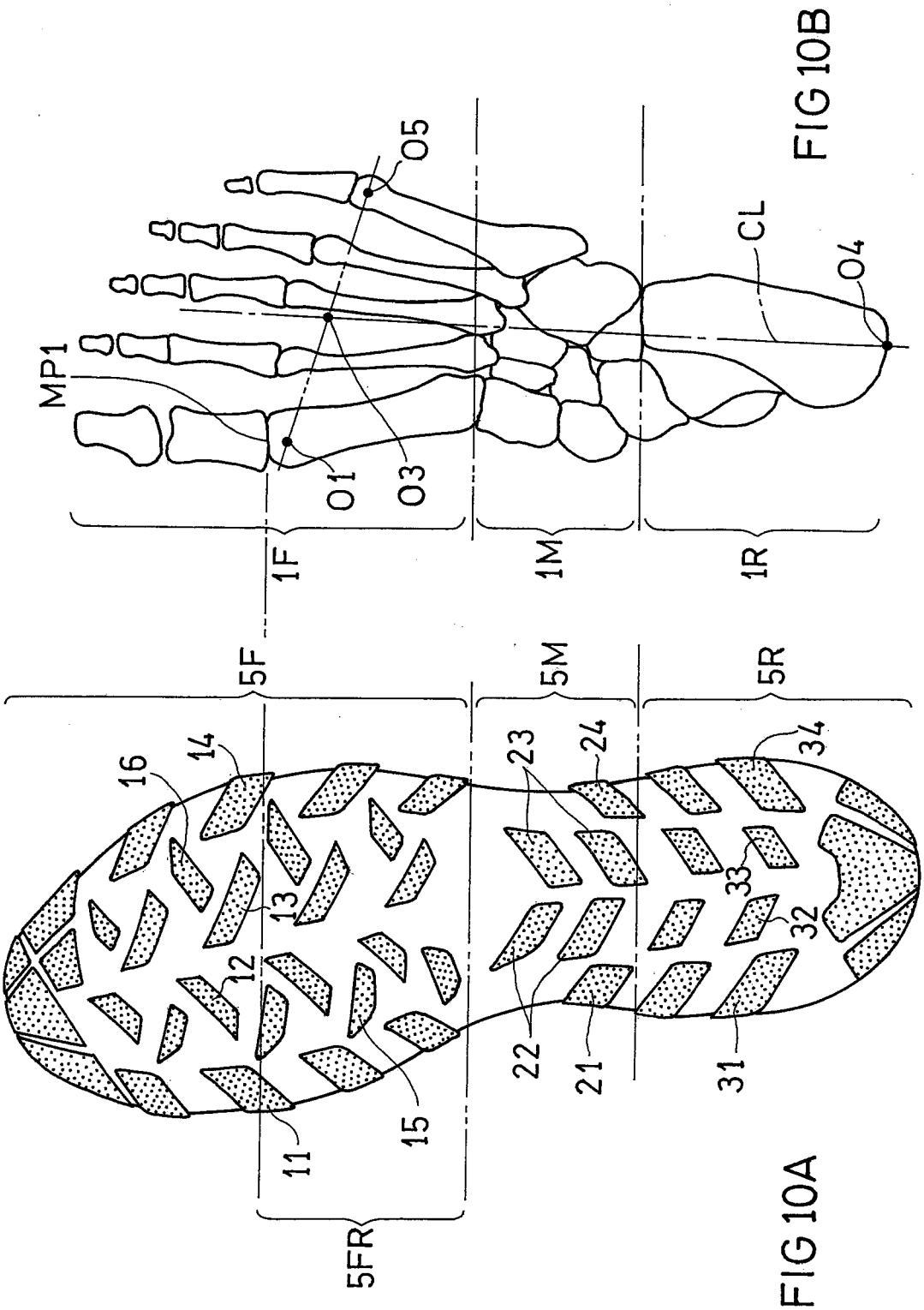


FIG 10B

FIG 10A

FIG11A

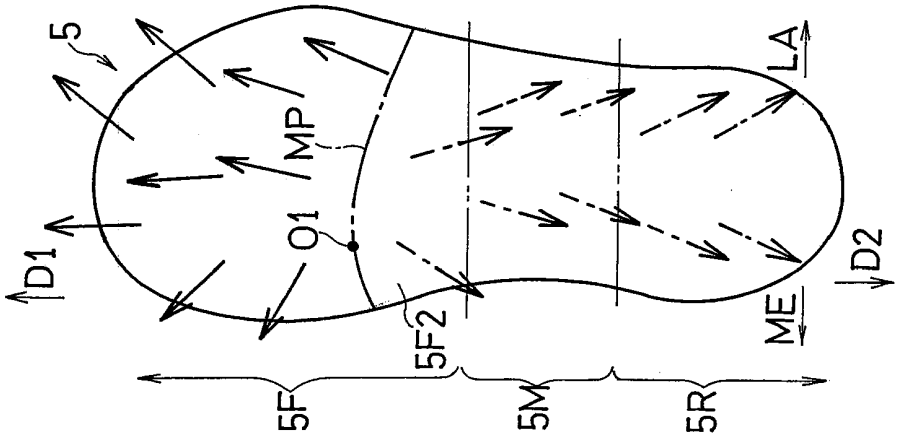


FIG11B

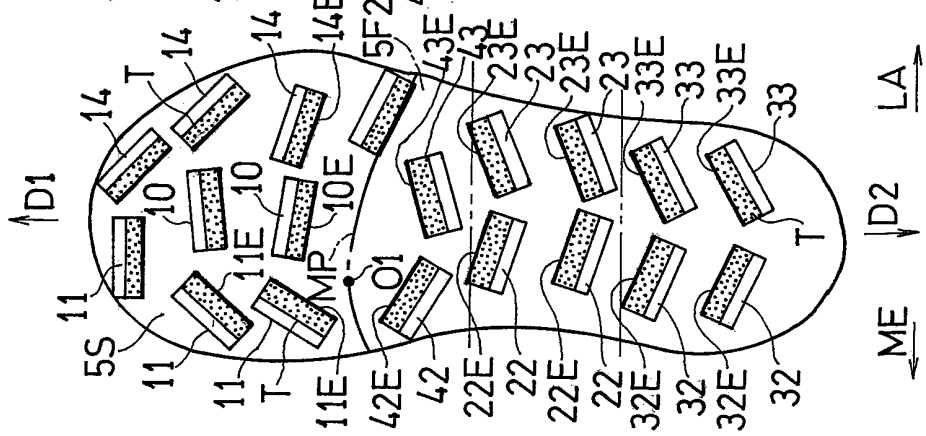


FIG11C

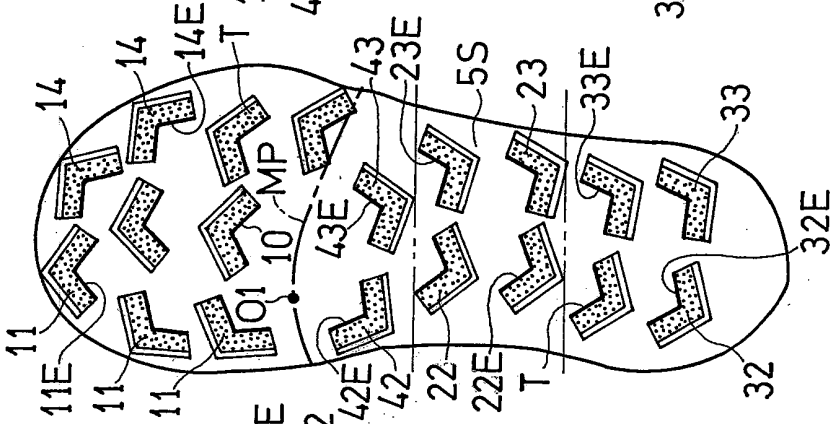
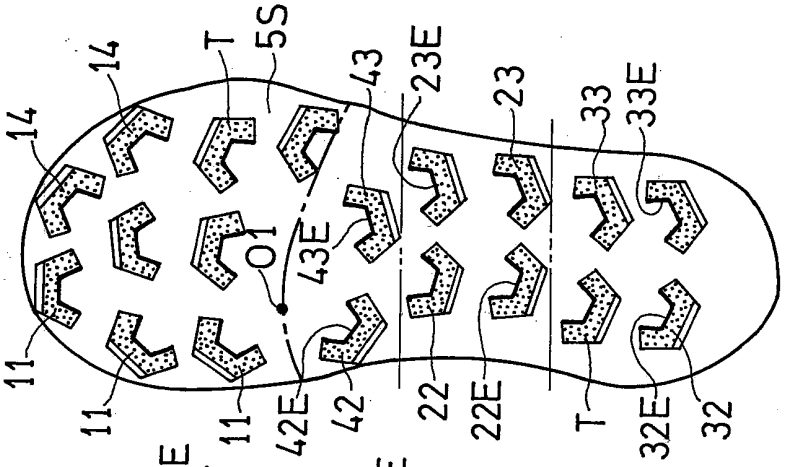


FIG11D



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/061074

A. CLASSIFICATION OF SUBJECT MATTER
A43B13/14(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)
A43B13/12, 13/14, 13/22, 13/26

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	JP 07-136003 A (Simon Corp.), 30 May 1995 (30.05.1995), (Family: none)	1-34
A	US 6205683 B1 (Clark et al.), 27 March 2001 (27.03.2001), (Family: none)	1-34

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
09 July, 2013 (09.07.13)	16 July, 2013 (16.07.13)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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

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- JP 2002034609 A **[0003]**
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- JP 7136003 A **[0003]**