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(71) Applicant: **NISSHIN RUBBER CO., LTD.**
Okayama 700-0975 (JP)

(72) Inventors:
- **Fujikawa, Eiji**
  Okayama-shi, Okayama 70000975 (JP)
- **Nozaki, Tomohiro**
  Okayama-shi, Okayama 70000975 (JP)
- **Harada, Ryuji**
  Okayama-shi, Okayama 70000975 (JP)
- **Watanabe, Ikumasa**
  Okayama-shi, Okayama 70000975 (JP)

(74) Representative: **Jones, Helen M.M.**
Gill Jennings & Every LLP
The Broadgate Tower
20 Primrose Street
London EC2A 2ES (GB)

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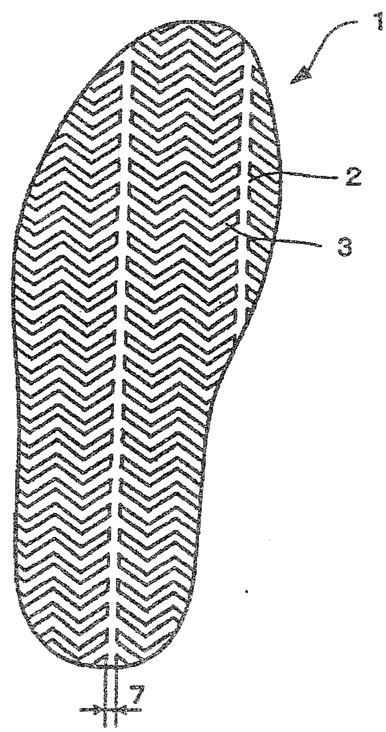
(54) Slip-resistant shoe sole

(57) The slip resistant shoe sole (1) of the invention comprises a plurality of ground contact projections (3) formed on the ground contact side of the sole base (2) with a predetermined gap between adjacent ground contact projections (3) in the longitudinal direction of the base (2), the ground contact projections (3) having a V-shaped horizontal cross section, having inclined reinforcements (5) provided at the roots of the ground contact projections (3) on the base (2), and being formed using an elastomeric polymer with a JIS-A hardness of 45 to 80 as measured at 20°C.

[Fig. 6]



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Description

TECHNICAL FIELD

[0001] The present invention relates to a slip resistant shoe sole that enables relatively stable walking even on smooth- or mirror-finished floor surfaces, floor surfaces that are slippery due to being covered with water, oil, soap, etc., floor surfaces made of stone materials as in buildings, etc., metal surfaces of manhole covers, gutter grates, etc., and the like.

BACKGROUND OF THE INVENTION

[0002] Various proposals have been made to improve the slip resistance of slip resistant shoe soles.

[0003] For example, known is a shoe sole produced by thermal spraying a hard material over projections of an embossed surface formed on the outsole base and then removing the hard material from the ground contact surface of the projections, so that edge effects are imparted to the side surface of the projections (Patent Document 1).

[0004] Also known is a shoe sole having projections containing magnetic microscopic strips, the microscopic strips being oriented upright relative to the ground contact surface of the embossed portion projections and thereby generating a grip due to the hardness difference between the resin body and microscopic strips of the embossed portion, and also reinforcing the cured resin itself as a filler (Patent Document 2).

[0005] Also known is a shoe sole wherein at least one longitudinal flexible groove and at least one transverse flexible groove that intersects the longitudinal grove are formed on at least one of the tread and heel portions of the shoe sole, so that the shoe sole can bend along the flexible grooves when stopping suddenly, and the face of the shoe sole can grip the floor surface, thus increasing the ground contact surface area and achieve excellent stability and slip resistance (Patent Document 3).

[0006] Also known is an indoor sports shoe sole having many concave groves formed parallel to each other on the ground contact side of the shoe sole with a JIS-A hardness of 45 to 85, each groove having a width of 0.2 to 1.0 mm and a depth of 1 to 3 mm, and the gap between adjacent grooves being 2 to 10 mm, thus making it difficult for the edges of the projections to bend (Patent Document 4).

[0007] Rubber soles do not easily start slipping, but once they do, it is difficult to stop the slipping. Known to improve this problem is a slip resistant shoe sole with an improved design pattern on the ground contact surface of the sole (Patent Reference 5) in which the ground contact portion is composed of rubber, polyvinyl chloride, and polyurethane with a hardness of 54 to 62 (JIS-A, 20°C), and has a block design pattern, for example polygons, circles, etc., formed thereon and the thinnest portion has a thickness of 3 to 8 mm. The block design pattern has a design height of 1 to 7 mm, a design gradient of 0 to 3°, and a minimum size of 2 to 8 mm, with the top having no concave-convex design and being flat, so that a layer of water or oil on the floor surface can be cut, thereby suppressing block design deformation.

[0008] Also known is a shoe sole with improved slip resistance, comprising ground contact projections that become gradually wider (inversely tapered) from the base toward the tip thereof (Patent Document 6). Also known is a shoe sole wherein independent block designs, for example, polygons, circles, etc. formed on the ground contact portion of the sole collectively form a pattern over the entire shoe sole, so that the block designs are not easily depressed and the shoe sole has a bending-resistant structure (Patent Document 7).

Patent Document 1: Japanese Unexamined Patent Publication H5-277002
Patent Document 2: Japanese Unexamined Patent Publication H6-154008
Patent Document 3; Japanese Unexamined Patent Publication H7-236503
Patent Document 4: Japanese Unexamined Patent Publication H8-280406
Patent Document 5: Japanese Unexamined Patent Publication 2000-106903
Patent Document 6: Japanese Unexamined Patent Publication 2000-116403
Patent Document 7: Japanese Unexamined Patent Publication 2002-165607

DISCLOSURE OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0009] However, the slip resistant shoe soles described above do not provide fully satisfactory slip resistance because their ground contact projections are not entirely satisfactory in terms of bending resistance, deformation resistance, ground grip, and drainage of liquids present on the ground surface. This will be described below in more detail.

[0010] As shown in Fig. 10(a), when ground contact projections 23 with a rectangular vertical cross section are formed upright on the base 22, the ground contact projections 23 easily bend and deform as shown in Fig. 10(b), resulting in poor bending resistance and deformation resistance and thus providing weak edge effects. To improve the bending resistance and deformation resistance of so configured ground contact projections 23, increasing the hardness thereof may be considered. However, when the ground contact projections 23 are too hard, the grip of the ground contact surface is low and the sole easily slips. Even when a filler, etc., is incorporated into the ground contact projections 23 as in Patent Document 2 to enhance the grip and strength of the ground contact projections 23, sufficient strength to provide fully satisfactory bending resistance and deformation resistance cannot be achieved by ground contact projections having a rectangular vertical cross section. When ground contact projections 23 with a rectangular vertical cross section are formed on the base 22 in such a manner that the projections have a V-shaped horizontal cross section, the bending resistance and deformation resistance of the ground contact projections 23 are somewhat improved, but not to fully satisfactory levels.

[0011] As disclosed in Patent Document 5, satisfactory bending resistance and deformation resistance may be provided by forming ground contact projections 23 with a trapezoidal vertical cross section so that the projections 23 taper from the base 22 toward the tip. In this case, however, due to the acute angle θ between the ground contact projections 23 and the ground surface 100 as shown in Fig. 11, the ground contact projections 23 exhibit poor grip on the ground 100. Another problem is that when the shoe treads on a liquid such as water, oil, etc., present on the ground surface 100, the liquid is likely to enter between the ground contact surface 24 of the ground contact projections 23 and the ground surface 100 because the liquid pressurized by treading is led to the boundary between the ground contact surface 24 and ground surface 100 due to the acute angle θ between the ground contact projections 23 and the ground surface 100 as shown in Fig. 11.

[0012] Thus an object of the present invention is to provide a shoe sole with fully satisfactory slip resistance by enhancing the bending resistance and deformation resistance of the ground contact projections, while maintaining their excellent ground grip and drainage of liquid present on the ground.

MEANS FOR SOLVING THE PROBLEM

[0013] To achieve the above object, the slip resistant shoe sole of the invention comprises a plurality of ground contact projections formed on the ground contact side of the sole base with a predetermined gap between adjacent ground contact projections in the longitudinal direction of the base. The ground contact projections have a V-shaped horizontal cross section. Inclined reinforcements are provided at the roots of the ground contact projections on the base. The ground contact projections are formed using elastomeric polymer(s) with a JIS-A hardness of 45 to 80 as measured at 20°C.

[0014] The ground contact projections formed with a predetermined gap between adjacent ground contact projections in the longitudinal direction of the base are preferably arranged in a plurality of columns, with each column of ground contact projections being spaced apart from adjacent columns thereof by a predetermined gap in the transverse direction of the base.

[0015] Alternatively, the ground contact projections formed with a predetermined gap between adjacent ground contact projections in the longitudinal direction of the base may be arranged in a plurality of columns, with each column of ground contact projections being connected to an adjacent column thereof and being spaced apart from the other adjacent column thereof by a predetermined gap in the transverse direction of the base.

[0016] Alternatively, the ground contact projections formed with a predetermined gap between adjacent ground contact projections in the longitudinal direction of the base may be arranged in a plurality of columns, with each column of ground contact projections being connected to both adjacent columns thereof.

[0017] The slip resistant shoe sole may have first and second group regions separated from each other, the first group region having V-shaped ground contact projections arranged in such a manner that the V shape opens toward the toe end, and the second group region having V-shaped ground contact projections arranged in such a manner that the V shape opens toward the heel end. In this case, the first and second group regions are preferably front and rear regions separated from each other. More preferably, a third region not having any ground contact projections is provided between the first and second group regions.

[0018] Preferably, the opening angle of the V shape of the ground contact projections is in the range of 45 to 140°.

[0019] Preferably, the ground contact projection surface has a surface roughness of not more than 28 μm.

[0020] Preferably, the slip resistant shoe sole is formed of at least one elastomeric polymer selected from the group consisting of synthetic rubbers, natural rubbers, ethylene-vinyl acetate copolymers, polyurethane, and polyvinyl chloride, together with a rubber compounding agent.

EFFECTS OF THE INVENTION

[0021] Since the ground contact projections have a V-shaped horizontal cross section and a JIS-A hardness of 45 to 80 as measured at 20°C and inclined reinforcements are formed at the roots of the ground contact projections on the base, the present invention achieves following effects. First, because of the hardness of the ground contact projections being a JIS-A hardness of 45 to 80 at 20°C, an excellent grip can be maintained while suppressing the deformation of the ground contact projections. Due to the inclined reinforcements provided at the roots of the ground contact projections on the base surface, the desired bending resistance and deformation resistance can be obtained.

[0022] As described above, there is a conventional slip resistant shoe sole comprising tapered ground contact projections with a trapezoidal horizontal cross section to enhance the bending resistance and deformation resistance. However, unlike such a conventional sole, the shoe sole of the present invention has inclined reinforcements formed only at the roots of the ground contact projections. More specifically, the angle between the ground contact projections and the ground surface is 90°. Therefore, the present invention can achieve the desired bending resistance and deformation resistance while maintaining excellent grip and drainage capability, which have not been achieved by conventional ground contact projections with a trapezoidal horizontal cross section.

[0023] The ground contact projections with a V-shaped horizontal cross section can enhance the bending resistance and deformation resistance of the ground contact projections. Drainage capability can also be enhanced by the V-shaped horizontal cross section of the ground projections.

[0024] A shoe sole with the desired slip resistance is thus provided by forming ground contact projections that are satisfactory in terms of all of bending resistance, deformation resistance, grip, and drainage capability.

[0025] Providing a predetermined gap between adjacent columns of ground contact projections in the transverse direction of the base can facilitate the drainage of liquid present on a road or floor surface and thereby enhance slip resistance.

[0026] Slip resistance can also be enhanced by increasing the smoothness of the ground contact projections and thereby increasing the bonding effect of the ground contact projection surface to a smooth or wet floor surface.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

[Fig. 1] Fig. 1 is a bottom plan view illustrating one embodiment of a slip resistant shoe sole of the invention.

[Fig. 2] Fig. 2 is a vertical sectional view illustrating a slip resistant shoe sole of this embodiment.

[Fig. 3] Fig. 3 is a detailed, enlarged view of an arrangement of ground contact projections of this embodiment.

[Fig. 4] Fig. 4 is a graph comparing the dynamic friction coefficients of the slip resistant shoe soles of the invention obtained in Example 1 with that of a conventional slip resistant shoe sole.

[Fig. 5] Fig. 5 is a bottom plan view illustrating another embodiment of a slip resistant shoe sole of the invention.

[Fig. 6] Fig. 6 is a bottom plan view illustrating another embodiment of a slip resistant shoe sole of the invention.

[Fig. 7] Fig. 7 is a bottom plan view illustrating another embodiment of a slip resistant shoe sole of the invention.

[Fig. 8] Fig. 8 is a bottom plan view illustrating another embodiment of the slip resistant shoe sole of the invention.

[Fig. 9] Fig. 9 is a bottom plan view illustrating the conventional slip resistant shoe sole used for comparison.

[Fig. 10] Fig. 10 is a vertical sectional view of the conventional slip resistant shoe sole used for comparison.

[Fig. 11] Fig. 10 is a longitudinal sectional view of another conventional slip resistant shoe sole.

[Fig. 12] Fig. 12 is a graph the dynamic friction coefficient of the slip resistant shoe sole of the invention obtained in Example 2 with that of the conventional slip resistant shoe sole used for comparison.

DESCRIPTION OF REFERENCE NUMERALS

[0028]

1	Slip resistant shoe sole
2	Base
2a	Ground contact side
3	Ground contact projection
4	Ground contact projection surface
5	Inclined reinforcement
7	Gap
8	Gap
α	Inclination angle
β	Opening angle
F	First group region
R	Second group region
C	Third region

BEST MODE FOR CARRYING OUT THE INVENTION

[0029] One embodiment of a slip resistant shoe sole of the invention will be described below with reference to the attached drawings. Fig. 1 is a bottom plan view illustrating the slip resistant shoe sole 1 according to this embodiment. Fig. 2 is a vertical sectional view illustrating the slip resistant shoe sole 1. Fig. 3 is a detailed enlarged view of an arrangement of the ground contact projections 3.

[0030] As shown in Figs. 1 to 3, this slip resistant shoe sole 1 has a base 2 and a plurality of ground contact projections 3. The ground contact projections 3 are provided on the ground contact side 2a of the base 2. The ground contact projections 3 have a V-shaped horizontal cross section in such a manner that the V shape opens toward the toe end at an opening angle β (See Figs. 1 and 3). Inclined reinforcements 5 are formed at an inclination angle α at the roots of the ground contact projections 3 on the base 2 (see Fig. 2).

[0031] The ground contact projections 3 have a hardness of 45 to 80 as measured at 20°C according to JIS-A. The V shape has an opening angle P in the range of 45 to 140°. The ground contact projection surface 4 has a surface roughness of not more than 28 μm, and preferably not more than 22 μm.

[0032] The ground contact projections 3 are provided from the toe end to the heel end with a gap 8 between adjacent ground contact projections 3 in the longitudinal direction of the base 2. The ground contact projections 3 arranged in the longitudinal direction of the base 2 are arranged in a plurality of columns, with each column of ground contact projections being spaced apart from adjacent columns thereof by a predetermined gap 7 in the transverse direction of the base 2 (see Fig. 3). Since the optimal gaps 7, 8 between adjacent ground contact projections 3 vary depending on several factors, such as JIS-A hardness and configuration of the ground contact projections 3, and surface roughness of the ground contact projection surface 4, they are preferably decided after conducting preliminary model tests for confirmation.

[0033] Next, materials for the slip resistant shoe sole 1 thus configured are described.

[0034] Examples of materials for the slip resistant shoe sole 1 include (1) elastomeric polymers selected from: natural rubbers; synthetic rubbers such as polybutadiene rubbers, polyisoprene rubbers, styrene-butadiene rubbers, acrylonitrile butadiene rubbers, nitrile rubbers, chloroprene rubbers, polyvinyl chloride rubbers, ethylene propylene (diene) rubbers, and ethylene-vinyl acetate copolymer rubbers; and thermoplastic elastic materials such as polyamide rubbers; (2) so-called polyurethane rubbers comprising polyether- and/or polyester-polyurethane, or polyurea-urethane; etc. Examples of materials for the slip resistant shoe sole for specific uses include (3) elastic polymers selected from epichlorohydrin rubbers, silicone rubbers, and polysulfide rubbers.

[0035] The material(s) for the slip resistant shoe sole 1 may be a single kind of elastic polymer selected from the above-mentioned materials, according to the use of the shoes, or two or more kinds of compatible or high-affinity elastic polymers selected from the above-mentioned materials to provide shoe sole properties suitable for the environment of use. If necessary, rubber compounding agents, for example, fillers such as carbon black, white carbon, etc., vulcanization accelerators, coloring agents, light resistance (weather resistance) stabilizers, etc. may be added to the elastic polymer(s). The materials are subjected to specific processing to give a shoe sole-forming composition. The obtained composition is used to form the base 2 and ground contact projections 3 of the shoe sole 1.

[0036] To produce a slip resistant shoe sole 1 suitable for a wide range of uses, elastic polymer(s) selected from synthetic rubbers, natural rubbers, ethylene-vinyl acetate copolymers, polyurethane, and polyvinyl chloride are preferably used as material(s) for producing slip resistant shoe sole 1. The use of such materials for producing the slip resistant shoe sole facilitates shoe sole hardness adjustment, and adjustment of other properties such as adhesion of the sole to the upper, processability, wear resistance, etc.

[0037] Slip resistant shoe soles suitable for the shoes as described below can be produced by changing the material(s) of the base 2 and ground contact projections 3, hardness and arrangement of the ground contact projections 3, inclination angle α of the inclined reinforcements 5, opening angle β of the V shape of the ground contact projections 3, etc. More specifically, slip resistant shoe soles 1 adapted to the environment of use of each shoe, for example, soles suitable for indoor sports shoes; outdoor sports shoes; shoes for slippery roads such as wet roads, frozen roads, snowy roads, etc.; shoes for metal surfaces; shoes for polished floors; shoes for dry roads; or work shoes for use in specific work environments can be provided.

[0038] Thus, in the slip resistant shoe sole 1 of the invention, deformation of the ground contact projections 3 is suppressed by providing inclined reinforcements 5 at the roots of the ground contact projections 3 on the base 2. Providing the inclined reinforcements 5 only at the roots of the ground contact projections 3 on the base 2 enables the maintenance of excellent ground grip and liquid drainage capability, while suppressing the deformation of the ground contact projections 3. Although the optimal inclination angle α of the inclined reinforcement 5 is decided considering the use of the shoe, hardness of the ground contact projections 3, opening angle β of the V shape, arrangement of the ground contact projections 3, etc., it is usually preferable that the opening angle be in the range of 10 to 80°.

[0039] Since the horizontal cross section of the ground contact projections 3 has a V shape with an opening angle β, enhanced strength and deformation suppression can be provided. Liquid drainage enhancing effects are also provided. The traction of the shoe can be maximized by setting the opening angle β of the V shape of the ground contact projections 3 to the range of 45 to 140°, although it may vary depending on the hardness of the ground contact projections 3. When the opening angle β is wider than this range, insufficient suppression of deformation of the ground contact projections 3 may result, depending on the direction of the load applied to the slip resistant shoe sole 1, i.e., the ground contact projections 3, during walking/running, and fail to provide sufficient traction when walking/running.

[0040] Furthermore, the JIS-A hardness of 45 to 80 of the ground contact projections can enhance deformation suppression and grip. When the hardness is lower than this range, deformation of the ground contact projections 3 becomes great. When the hardness is higher than the above-mentioned range, poor grip and insufficient traction during walking may result and the shoe tends to easily slip.

[0041] A surface roughness of not more than 28 μm, and more preferably not more than 22 μm, of the ground contact projection surface 4 can provide a slip resistant shoe sole that enables stable walking.

[0042] Further, the gaps 7, 8 in the transverse and longitudinal directions of the base 2, provided between adjacent ground contact projections 3, can enhance liquid drainage capability.

[0043] While the invention has been described in connection with a preferred embodiment, it is not intended to limit the invention to that embodiment. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims. For example, although the V shape of the ground contact projections 3 opens toward the toe end in the above embodiment, opening toward the heel end is also possible. Alternatively, as shown in Fig. 5, a first group region F having V-shaped ground contact projections 3 arranged in such a manner that the V shape opens toward the toe end may be provided in the front portion, and a second group region R having V-shaped ground contact projections arranged in such a manner that the V shape opens toward the heel end may be provided in the rear portion. In this case, a third region 9 having no ground contact projections may be provided between the first group region F and the second group region R. With such a configuration, the shoe sole can exhibit reliable slip resistance, irrespective of the direction of the load applied, i.e., whether the direction is from the toe or heel end.

[0044] As shown in Fig. 6, each column of ground contact projections 3 may be connected to an adjacent column thereof and be spaced apart from the other adjacent column thereof by a gap 7. Alternatively, as shown in Fig. 7, each column of ground contact projections 3 may be connected to both adjacent columns thereof. Alternatively, as shown in Fig. 8, a mixed column arrangement of ground contact projections 3 is also possible in which a column of ground contact projections 3 that is spaced apart from both adjacent columns by a gap 7 and another column of ground contact projections 3 that is connected to an adjacent column thereof and spaced apart from the other adjacent column thereof by a gap 7 are present.

EXAMPLE 1

[0045] A vulcanizing agent, a vulcanization accelerator, an antioxidant, a filler, and a coloring agent were added to a rubber material composition consisting of natural rubber and a styrene butadiene rubber, and roll-mixed to give a composition for forming shoe sole members. Shoe sole member compositions of three different levels of JIS-A hardness in the range of 45 to 80, i.e., low hardness (about 45 to 55), intermediate hardness (about 56 to 65), and high hardness (about 66 to 80) were prepared by changing the proportions of vulcanizing agent, vulcanization accelerator, filler, and like ingredients.

[0046] The shoe sole member compositions of these three levels of hardness were formed into sheets with a thickness of about 10 mm. Each sheet was cut to a predetermined width and length to obtain cut pieces for use as shoe sole-forming members. Subsequently, slip resistant shoe soles 1 as shown in Fig. 1 were formed from the cut pieces. The ground contact projections 3 were provided with inclined reinforcements 5 with an inclination angle α of about 45°. The average opening angle β of the V-shaped projections was about 96°. The ground contact projection surface 4 had a surface roughness of not more than 7 μm. The lengthwise gap 8 was 2.5 mm and the widthwise gap 7 was 2.0 mm.

[0047] To evaluate the slip resistance of the three kinds of slip resistant shoe soles 1 thus provided with different hardnesses of the ground contact projections 3, the kinetic friction coefficient of each shoe sole was determined according to the slip resistance test method "Technical Guidelines for Safe Shoes (RIIS-TR-90, 1991) : Slip Resistance Test Method". For comparison, the kinetic friction coefficient of a conventional slip resistant shoe sole was also determined. Fig. 4 shows the measurement results of kinetic friction coefficients of the soles.

[0048] Figs. 9 and 10 show a bottom plan view and a vertical sectional view of this conventional shoe sole. As shown in Figs. 9 and 10, the ground contact projections 23 do not have any inclined reinforcements at their roots on the ground contact side 22a of the base 22; and the angle between the ground contact projection 23 and the base 22 is 90°. The hardness of the ground contact projections 23 is 45 to 80°. The ground contact projection surface 23 has a surface roughness of 33 μm.

[0049] As is clear from Fig. 4, after the maximum static friction has been reached, smooth transition from static friction to dynamic friction occurs in the slip resistant shoe soles 1 with low, intermediate and high hardnesses obtained in Example 1, and a high dynamic friction state is maintained, thus providing a stable slip resistance. In contrast, in the conventional shoe sole, after the maximum static friction is reached, sudden slippage occurs and results in a low dynamic friction state upon transition from static friction to dynamic friction, thus resulting in loss of stability when walking and a dangerous walking state. The above results clearly show that compared to the conventional slip resistant shoe sole, the slip resistant shoe soles of the invention have highly excellent slip resistance.

EXAMPLE 2

[0050] A vulcanizing agent, a vulcanization accelerator, an antioxidant, a filler, and a coloring agent were added to a composition consisting of a mixture of natural rubber for standard shoe soles and a polybutadiene rubber, and roll-mixed to give a shoe sole material. The slip resistant shoe sole 1 shown in Fig. 7 was formed using this material. The inclination angle α of the inclined reinforcements 5, opening angle β of the V shape of the ground contact projections 3, surface roughness of the ground contact projection surface 4, and lengthwise gap 8 were the same as in Example 1. The JIS-A hardness of the ground contact projections 3 was set to the intermediate hardness (56 to 65°). Fig. 12 shows the measurement results of the kinetic friction coefficient of the thus obtained slip resistant shoe sole measured in the same manner as in Example 1. For comparison, the kinetic friction coefficient of the conventional shoe sole used in Example 1 above is also shown in Fig. 12. Fig. 12 clearly shows that, as with the slip resistant shoe soles of Example 1, the slip resistant shoe sole of Example 2 has highly excellent slip resistance.

INDUSTRIAL APPLICABILITY

[0051] The slip resistant rubber sole structure of the invention is applicable to normal shoes; work shoes for use in particularly slippery work environments; and nursing care shoes and shoes for disabled persons. It is also applicable to mats for placing articles thereon, slip resistant materials for chairs, tables, etc., tires for light vehicles, wheelchairs, etc., conveyor belts, and so on.

Numbered Embodiments:

[0052]

Numbered Embodiment 1. A slip resistant shoe sole comprising a plurality of ground contact projections formed on the ground contact side of the sole base with a predetermined gap between adjacent ground contact projections in the longitudinal direction of the base, the ground contact projections having a V-shaped horizontal cross section, having inclined reinforcements provided at the roots of the ground contact projections on the base, and being formed using an elastomeric polymer with a JIS-A hardness of 45 to 80 as measured at 20°C.

Numbered Embodiment 2. A slip resistant shoe sole according to Numbered Embodiment 1, wherein the ground contact projections formed with a predetermined gap between adjacent ground contact projections in the longitudinal direction of the base are arranged a plurality of columns, with each column of ground contact projections being spaced apart from adjacent columns thereof by a predetermined gap in the transverse direction of the base.

Numbered Embodiment 3. A slip resistant shoe sole according to Numbered Embodiment 1, wherein the ground contact projections formed with a predetermined gap between adjacent ground contact projections in the longitudinal direction of the base are arranged in a plurality of columns, with each column of ground contact projections being connected to an adjacent column thereof and being spaced apart from the other adjacent column thereof by a predetermined gap in the transverse direction of the base.

Numbered Embodiment 4. A slip resistant shoe sole according to Numbered Embodiment 1 wherein the ground contact projections formed with a predetermined gap between adjacent ground contact projections in the longitudinal direction of the base are arranged in a plurality of columns, with each column of ground contact projections being connected to both adjacent columns thereof.

Numbered Embodiment 5. A slip resistant shoe sole according to any one of Numbered Embodiments 1 to 4 comprising first and second group regions separated from each other, the first group region having V-shaped ground contact projections arranged in such a manner that the V shape opens toward the toe end, and the second group region having V-shaped ground contact projections arranged in such a manner that the V shape opens toward the heel end.

Numbered Embodiment 6. A slip resistant shoe sole according to Numbered Embodiment 5, wherein the first and second group regions are front and rear regions separated from each other.

Numbered Embodiment 7. A slip resistant shoe sole according to Numbered Embodiment 6, wherein a third region not having the ground contact projections is provided between the first group region and the second group region.

Numbered Embodiment 8. A slip resistant shoe sole according to Numbered Embodiment 1, wherein the opening angle of the V-shape of the ground contact projections is in the range of 45 to 140°.

Numbered Embodiment 9. A slip resistant shoe sole according to Numbered Embodiment 1, wherein the ground contact projection surface has a surface roughness of not more than 28 μm.

Numbered Embodiment 10. A slip resistant shoe sole according to Numbered Embodiment 1, which is formed of at least one elastomeric polymer selected from the group consisting of synthetic rubbers, natural rubbers, ethylene-vinyl acetate copolymers, polyurethane, and polyvinyl chloride, together with a rubber compounding agent.

Claims

1. A slip resistant shoe sole comprising a plurality of ground contact projections formed on the ground contact side of the sole base with a predetermined gap between adjacent ground contact projections in the longitudinal direction of the base,
the ground contact projections are arranged in a plurality of columns, with each column of ground contact projections being connected to an adjacent column thereof and being spaced apart from the other adjacent column thereof by a predetermined gap in the transverse direction of the base,
the ground contact projections having a V-shaped horizontal cross section, having inclined reinforcements provided at the roots of the ground contact projections on the base, and being formed using an elastomeric polymer with a JIS-A hardness of 45 to 80 as measured at 20°C.

2. A slip resistant shoe sole according to claim 1 comprising first and second group regions separated from each other, the first group region having V-shaped ground contact projections arranged in such a manner that the V shape opens toward the toe end, and the second group region having V-shaped ground contact projections arranged in such a manner that the V shape opens toward the heel end.

3. A slip resistant shoe sole according to claim 2 wherein the first and second group regions are front and rear regions separated from each other.

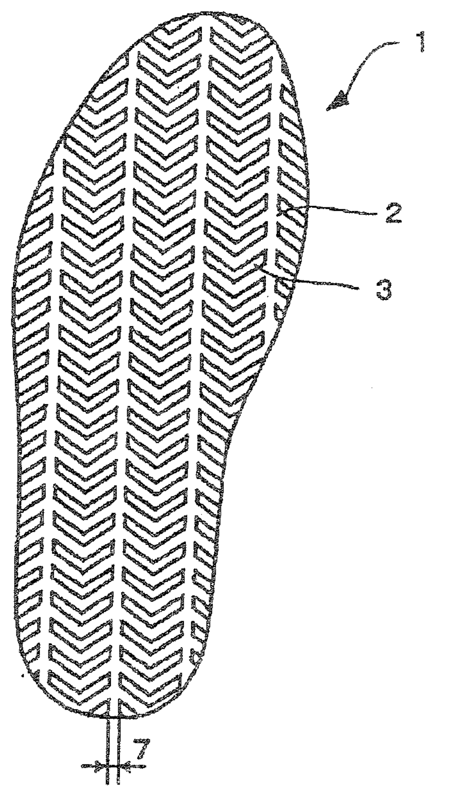
4. A slip resistant shoe sole according to claim 3 wherein a third region not having ground contact projections is provided between the first group region and the second group region.

5. A slip resistant shoe sole according to claim 1 wherein the opening angle of the V-shape of the ground contact projections is in the range of 45 to 140°.

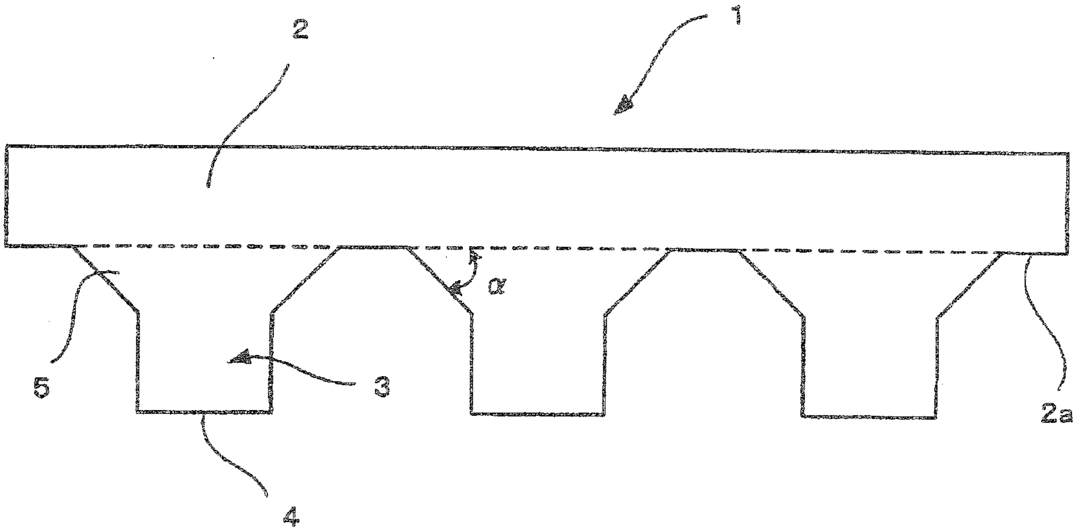
6. A slip resistant shoe sole according to claim 1 wherein the ground contact projection surface has a surface roughness of not more than 28 μm.

7. A slip resistant shoe sole according to claim 1 which is formed of at least one elastomeric polymer selected from the group consisting of synthetic rubbers, natural rubbers, ethylene-vinyl acetate copolymers, polyurethane, and polyvinyl chloride, together with a rubber compounding agent.

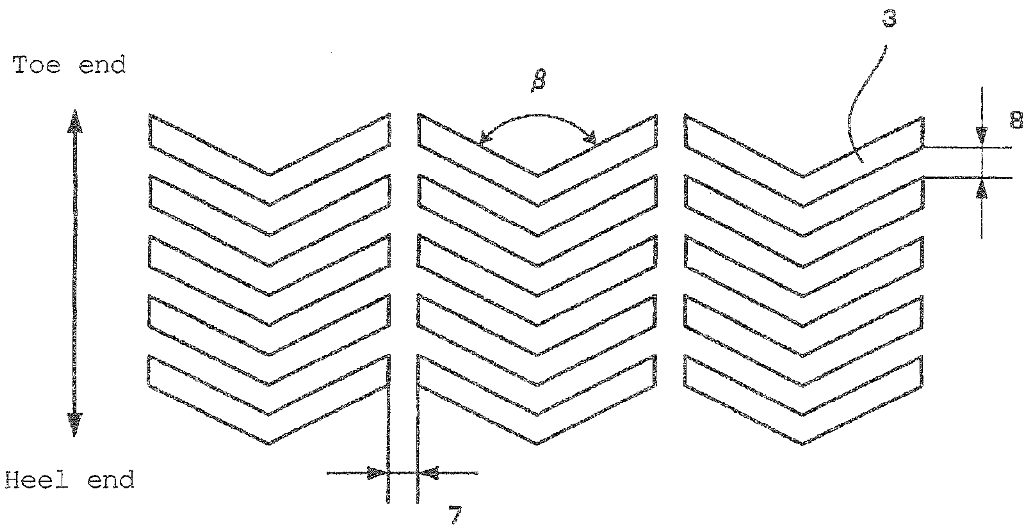
[Fig. 1]



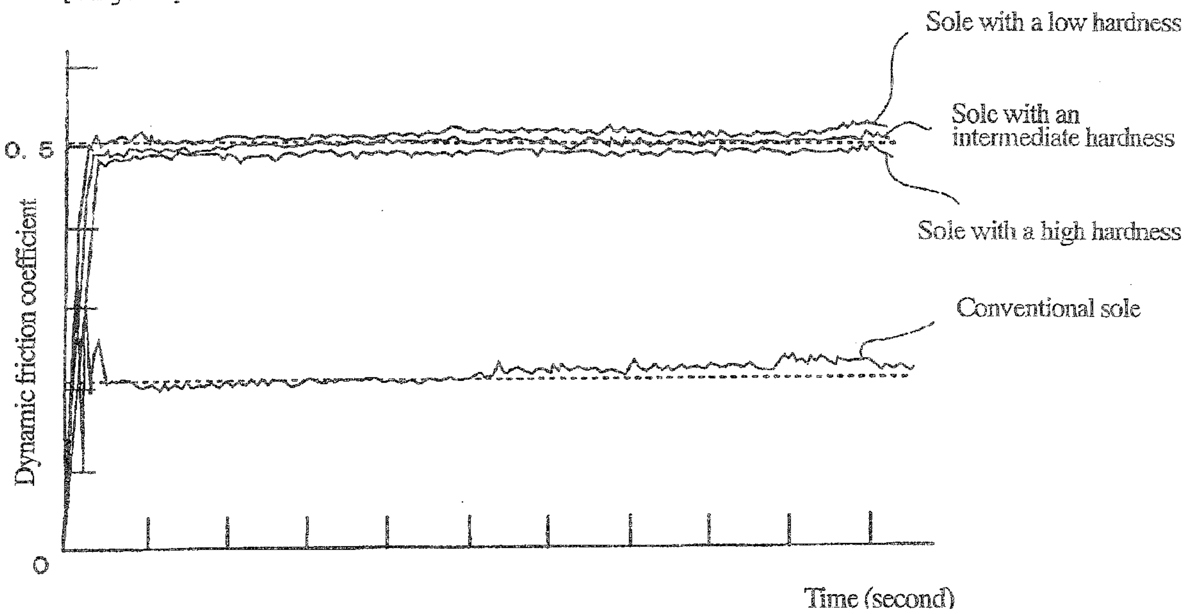
[Fig. 2]



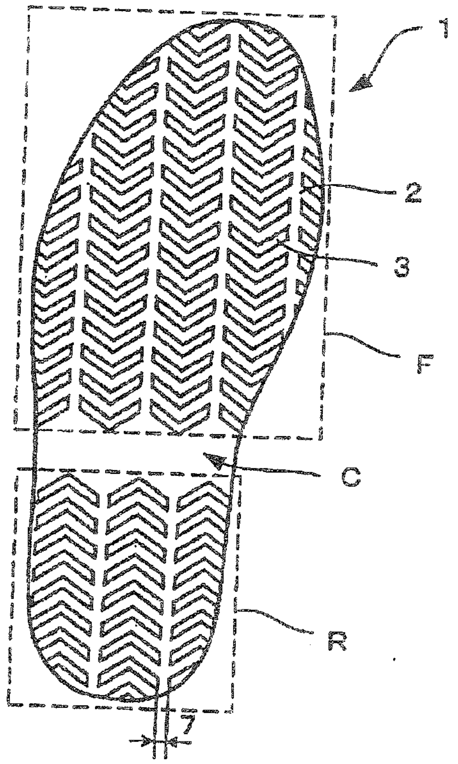
[Fig. 3]


Toe end
Heel end
β
3
8
7

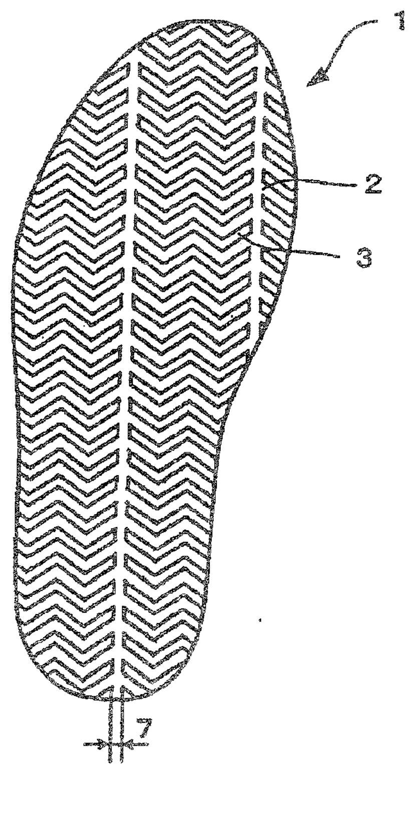
[Fig. 4]


Sole with a low hardness
Sole with an intermediate hardness
Sole with a high hardness
Conventional sole
0. 5
0
Dynamic friction coefficient
Time (second)

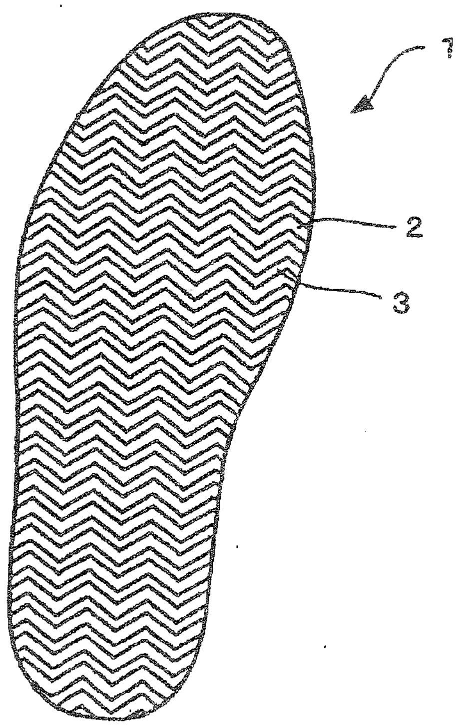
[Fig. 5]



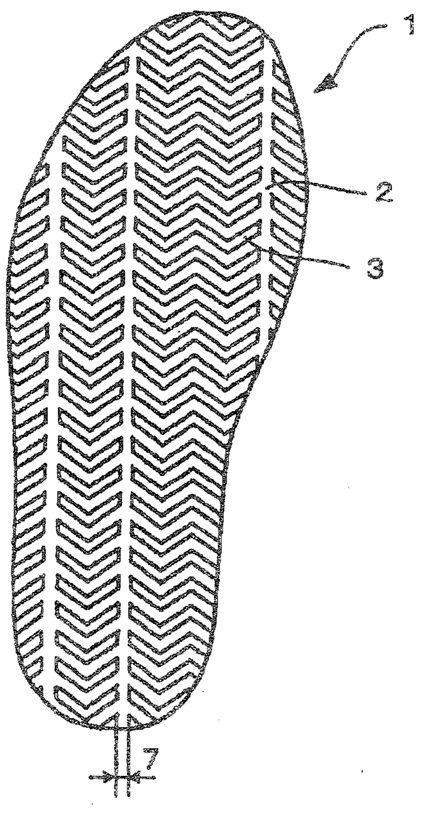
[Fig. 6]



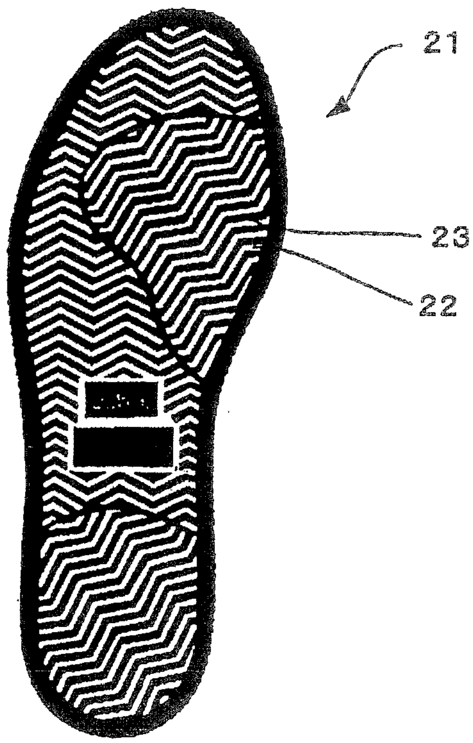
[Fig. 7]



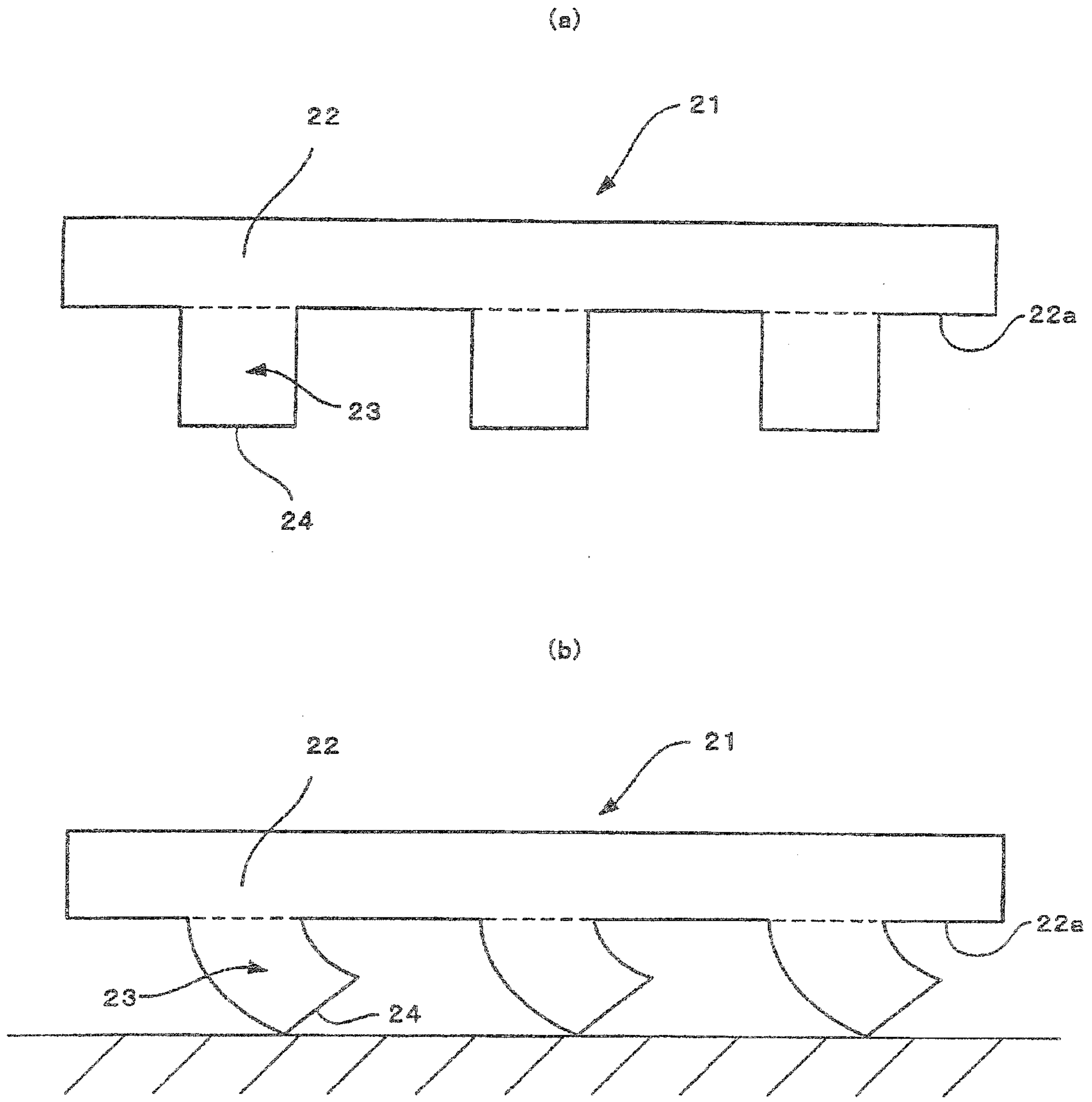
[Fig. 8]



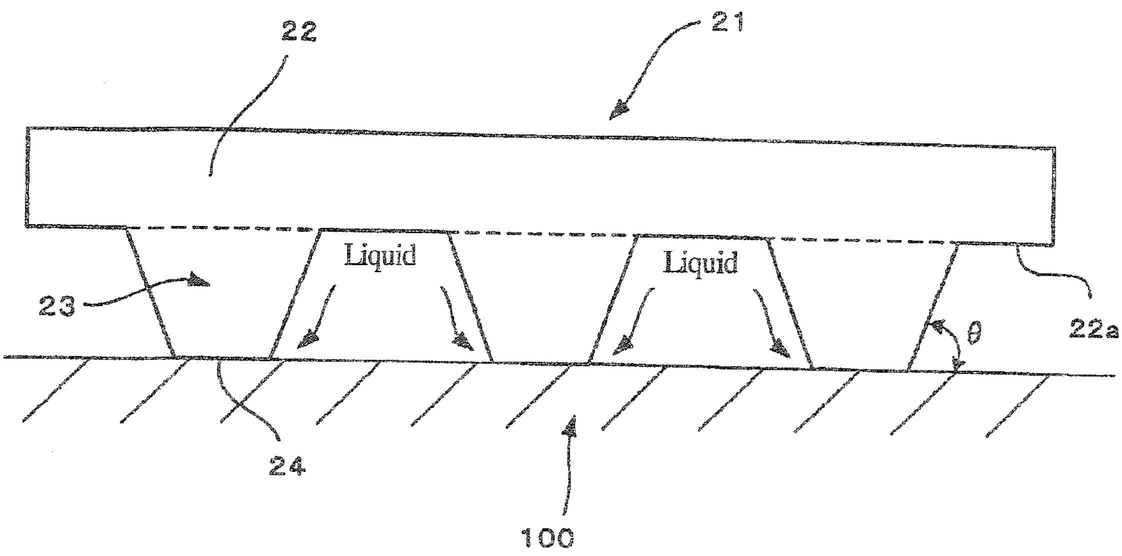
[Fig. 9]



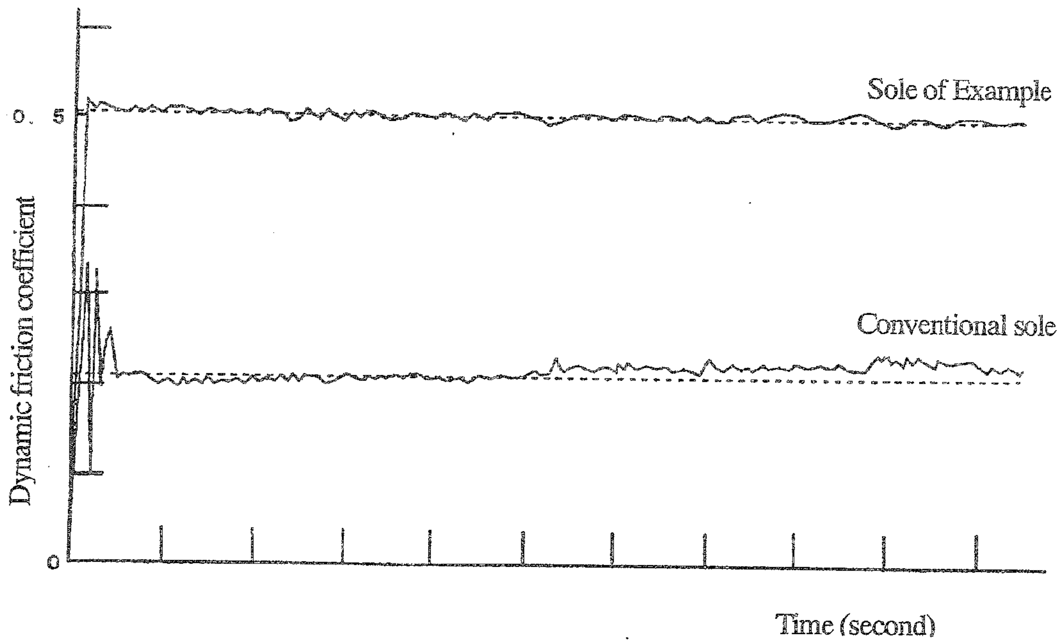
[Fig. 10]



[Fig. 11]


22
21
Liquid
Liquid
23
θ
22a
24
100

[Fig. 12]


0. 5
Sole of Example
Dynamic friction coefficient
Conventional sole
0
Time (second)

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EUROPEAN SEARCH REPORT

Application Number
EP 14 19 6818

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A43B

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	11 March 2015	Herry, Manuel

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