(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 183 290 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
**24.05.2023 Bulletin 2023/21**

(21) Application number: **21846408.9**

(22) Date of filing: **19.07.2021**

(51) International Patent Classification (IPC):
***A43B 17/06*** *(2006.01)* ***A43B 17/04*** *(2006.01)*
***A43B 7/32*** *(2006.01)* ***A43B 7/14*** *(2022.01)*
***A43B 7/30*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
**A43B 7/14; A43B 7/30; A43B 7/32; A43B 17/04; A43B 17/06**

(86) International application number:
**PCT/KR2021/009234**

(87) International publication number:
**WO 2022/019586 (27.01.2022 Gazette 2022/04)**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
**BA ME**
Designated Validation States:
**KH MA MD TN**

(30) Priority: **20.07.2020 KR 20200089322**

(71) Applicant: **Kang, Chunsung**
**Seongnam-si, Gyeonggi-do 13105 (KR)**

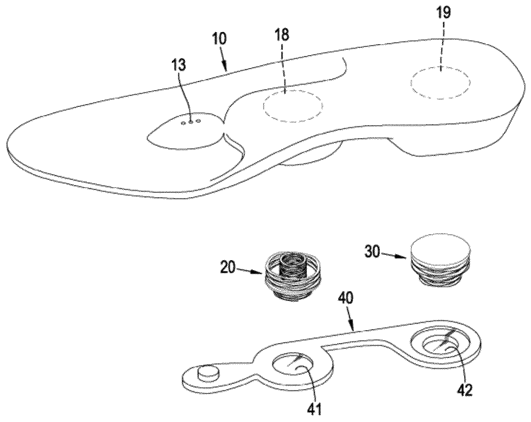
(72) Inventor: **Kang, Chunsung**
**Seongnam-si, Gyeonggi-do 13105 (KR)**

(74) Representative: **Cabinet Chaillot**
**16/20, avenue de l'Agent Sarre**
**B.P. 74**
**92703 Colombes Cedex (FR)**

(54) **SMART INSOLE HAVING SUSPENSION FUNCTION OF AUTOMATICALLY CONTROLLING FOOT ARCH HEIGHT AND BODY WEIGHT AND BALANCING FEET, AND NATURAL TREATMENT SHOE FOR CORRECTING BODY SHAPE AND RELIEVING JOINT PAIN BY USING SAME**

(57) An arch-adaptive smart insole according to the present invention comprises: an insole cushion foam (10) which has a shape corresponding to the shape of the foot and which is made of an elastic foam; and an arch spring module (20) which is loaded in a first loading well (11) of the insole cushion foam (10), and which supports the arch of the foot by means of the interposition of a closing part (18) of the insole cushion foam (10) for closing the upside of the first loading well (11), wherein the arch spring module (20) comprises at least a first coil spring (21) and a second coil spring (22), and the first coil spring (21) having a diameter smaller than that of the second coil spring (22) is positioned inside the second coil spring (22).

【Figure 1】




EP 4 183 290 A1

## Description

[Technical Field]

**[0001]** The present invention relates to a smart insole having a suspension function of automatically controlling a foot arch height and body weight and balancing feet, and a natural treatment shoe for correcting a body shape and relieving joint pain using the same.

[Background Art]

**[0002]** Only human of living things has an arch shape on feet, if there is no arch (arch of foot), the recovery ability of feet considerably decreases, so it is difficult to absorb shock when moving. An arch is a good structure that easily distributes shock of the entire body.

**[0003]** Flatfeet or bowlegs cannot form a normal arch on the feet, so the feet are tired and various foot deformities and foot diseases such as arthritis, hallux valgus, heel pain, interdigital neuroma, plantar fasciitis, etc. may be caused. However, a claw foot is a type that bends more than a normal arch and may be generated innately or postnatally, and when a person wears high-heeled shoes such as a high heel for a long period of time, a claw foot is postnatally generated, and a hardened skin and a corn are generated due to excessive pressure only on the front part of the sole of a foot and the heel, which causes pain.

**[0004]** Meanwhile, since normal shoes employ a flat bottom piece, a load by weight is concentrated on the heels of feet and shock is transmitted to the spine, etc., in walking, so the waist, shoulders, neck, etc. are overloaded, which may cause pain. Depending on the differences in individual arch (arch of foot) such as a flatfoot, a bowleg, and a claw foot, when a normal flat bottom piece (insole) is continuously used, feet, joints, etc. are continuously overloaded, there are various problems such as symptoms get worse, or toes are deformed, and fatigue on the knees, the ankle joints, the toes, etc. increases.

**[0005]** As a related art for supporting an arch, an 'Insole having arch support part self positioning system' has been published in Korean Patent Application Publication No. 10-2011-0017781 (Patent Document 1), but there is inconvenience in that the arch support part has to be replaced and mounted to fit to individual arch heights.

**[0006]** Further, in Korean Patent No. 10-0912910 'Shoe having functionality' (Patent Document 2), there is in convenience that a slider should be adjusted to fit to individual heights of the arch (arch of food) of feet in use.

**[0007]** Further, in Korean Patent No. 10-0928712 'Arch revising possible shoe' (Patent Document 3), a technique of relieving pain by supporting an arch using a spring and an 'arch revision plate' has been disclosed, but there is a problem in that it is limited to the shape of a hard arch revision plate, so it cannot be automatically adapted to various arch shapes.

**[0008]** Further, common insoles are manufactured using elastic cushion foam as a main material, but it is very difficult to couple an elastic member such as a spring to such cushion foam. This is because since both ends of a spring are supported by only the cushion foam, both ends of the spring cut into the cushion foam, so there is a problem in that the pressure of the spring concentrates on a narrow spring contact area and is transmitted to a foot, and accordingly, a hard arch revision plate has to be used as in Patent Document 3.

[Disclosure]

[Technical Problem]

**[0009]** An object of the present invention is to provide an arch adaptive insole that can be automatically adapted to various arch shapes while being able to support arches, and a shoe using the insole.

**[0010]** Further, an object of the present invention is to provide an arch adaptive insole enabling a spring to be directly configured in cushion foam of the insole, and a shoe using the insole.

[Technical Solution]

**[0011]** An arch adaptive smart insole according to an aspect of the present invention includes: an insole cushion foam (10) made of foam having a shape corresponding to the shape of a foot and having elasticity; and an arch spring module (20) seated in a first seat well (11) of the insole cushion foam (10), and supporting an arch of a foot with a closing part (18) of the insole cushion foam (10), which closes the top of the first seat well (11), therebetween, wherein the arch spring module (20) includes at least a first coil spring (21) and a second coil spring (22), and the first coil spring (21) having a smaller diameter than the second coil spring (22) is positioned inside the second coil spring (22).

**[0012]** In the arch adaptive smart insole, the upper end of the second coil spring (22) is configured lower than the upper end of the first coil spring (21) to correspond to the arch of a foot.

**[0013]** In the arch adaptive smart insole, the first coil spring (21) and second coil spring (22) are formed by spirally winding a flat plate material having elasticity and having a band shape of which the width is larger than the thickness, and flat surfaces of the flat plate materials each support the closing part (18) of the insole cushion foam (10) at the upper ends of the first coil spring (21) and second coil spring (22).

**[0014]** In the arch adaptive smart insole, the arch spring module (20) further includes: a disc-shaped moving supporting part (24) supporting the first coil spring (21) and the second coil spring (22) with lower ends of the first coil spring (21) and the second coil spring (22) seated on a first surface thereof; and a third coil spring (23) supporting a load through the disc-shaped moving

supporting part (24) with an upper end thereof seated on a second surface opposite to the first surface of the disc-shaped moving supporting part (24), and the disc-shaped moving supporting part (24) can be moved up and down in the first seat well (11).

**[0015]** The arch adaptive smart insole further includes a rear spring module (30) seated in a second well (11) of the insole cushion foam (10) and supporting the heel of a foot, wherein the rear spring module (30) includes: a fourth coil spring (31) and a fifth coil spring (32) coaxially disposed and different in diameter; and a solid supporting part (33) supporting an upper end of the fourth coil spring (31) and an upper end of the fifth coil spring (32), positioned under a closing part (19) of the second seat well (11), and made of a hard material.

**[0016]** The arch adaptive smart insole may further include a cover (40) supporting lower ends of the arch spring module (20) and the rear spring module (30), closing lower portions of the first seat hole and the second seat hole (12), and bonded to the insole cushion foam (10).

**[0017]** The arch adaptive smart insole has at least one through-hole (13) passing through the top and the bottom of the insole cushion foam (10), and the through-hole (13) may communicate with the first seat hole and the second seat hole (12) using a trench configured in the insole cushion foam (10).

**[0018]** In the arch adaptive smart insole, the height of the inside part of a foot may be smaller than the height of the outside part of a foot at a heel part of the insole cushion foam (10).

**[0019]** The arch adaptive smart insole may be applied to a natural treatment shoe.

[Advantageous Effects]

**[0020]** According to the present invention, there is an advantage that it is possible to configure the upper end of a spring to have a profile corresponding to the profile of a foot arch, it is possible to directly transmit a load to a plurality of springs with a cushion foam therebetween without a hard spring support, and it is possible to apply the present invention to various types of arches because downward movement of the spring may be independent.

**[0021]** Further, according to the present invention there is an effect that since a disc-shaped moving supporting part is configured between the first coil spring and the second coil spring, the problem that a spring falls on its side is greatly reduced, so the arch spring module can entirely maintain a stable posture even when compressed.

**[0022]** Further, according to the present invention, since the arch height is automatically adjusted, the present invention can be applied regardless of arch heights such as a flatfoot, a claw foot, and a normal foot, so it is not required to adjust the height to fit to foot arch heights of individuals and matters required by arch shapes are provided.

**[0023]** Further, according to the present invention, since an arch support is appropriately automatically adjusted in accordance with individually different arch heights, a foot is balanced and the concave on the center of the bottom of a foot is supported by an arch, thereby performing an orthotic function that corrects a body shape straightening a bending musculoskeletal system and distributes and supports the weight and load of a body. Disorders that may be structurally generated in a human body, that is, structural pain of joints is relieved by making the erect joints of a body symmetric by helping correct arrangement of an arch. There is provided a shock absorption effect that can safely protect parts of a human body such as the spine, leg joints, and muscles from shock that may be generated in various activities such as exercise. Further, it is possible to help healthy by relieving joint pain by preventing injuries of a human body and protecting a human body using the shock absorption effect, so knee joints and the spine are protected and pain is relieved.

**[0024]** Further, according to the present invention, it is possible to support and distribute weight and absorb shock through an arch support insole that effectively supports all of a flatfoot with a low arch, a claw foot with a high arch, and a normal foot, so parts of a human body are protected from diseases of the knee joints, the spine, and the leg joints, and plantar fasciitis and an muscular ache due to shock that is generated in various activities such as walking and exercise, which help protect the knees and the waist after a surgery on the knee joints and the waist.

[Description of Drawings]

**[0025]**

FIG. 1 is an exploded perspective view showing an arch adaptive smart insole according to an embodiment of the present invention, that is, an exploded perspective view seen from above.

FIG. 2 is an exploded perspective view showing an arch adaptive smart insole according to an embodiment of the present invention, that is, an exploded perspective view seen from under.

FIG. 3 is an exploded perspective view showing an arch spring module of the arch adaptive smart insole according to an embodiment of the present invention.

FIG. 4 is an exploded perspective view showing a rear spring module of the arch adaptive smart insole according to an embodiment of the present invention.

FIG. 5 is a view showing the shape of a heel part from behind an insole cushion foam.

FIG. 6(a) shows the case in which an arch spring module 20 of the arch adaptive smart insole according to an embodiment of the present invention and the profile F, F of a foot arch are matched and FIG.

6(b) is a comparative example showing the case a spring and a foot arch profile F, F are matched when a common coil spring is applied to an arch part of the insole.

FIG. 7(a) shows the case in which the arch spring module 20 of the arch adaptive smart insole according to an embodiment of the present invention and various types of foot arches are matched and FIG. 7(b) is a plan view showing various types of foot arches.

[Best Mode]

**[0026]** The present invention will be described more fully with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. However, the present disclosure may be modified in various different ways and is not limited to the embodiments described herein. Further, in the accompanying drawings, components irrelevant to the description will be omitted in order to obviously describe the present disclosure, and similar names and reference numerals will be used to describe similar components throughout the specification.

**[0027]** FIG. 1 and FIG. 2 are exploded perspective views showing an arch adaptive smart insole according to an embodiment of the present invention, in which FIG. 1 is an exploded perspective view seen from above and FIG. 2 is an exploded perspective view seen from under. FIG. 3 is an exploded perspective view showing an arch spring module of the arch adaptive smart insole according to an embodiment of the present invention. FIG. 4 is an exploded perspective view showing a rear spring module of the arch adaptive smart insole according to an embodiment of the present invention.

**[0028]** An arch adaptive type smart insole according to an embodiment of the present invention has a function of automatically adapting to various types of arches and supporting arches, and includes an insole cushion foam 10, an arch spring module 10, a rear spring module 30, and a cover 40.

**[0029]** The insole cushion foam 10 is made of foam having a shape corresponding to the shape of a foot when seen from above and having elasticity, has elasticity, restoration ability, formability, etc., and may be made of synthetic resin, polyurethane, latex, memory foam, sponge, etc.

**[0030]** The insole cushion foam 10 has a first seat well 111 in which the arch spring module 20 is seated at a position corresponding to the arch of a foot, and a second seat well 12 in which the rear spring 30 is seated at a position corresponding to the heel of a foot. The first seat well 11 and the second seat well 12 are closed on top and are simultaneously formed using the same material as the insole cushion foam 10 when the insole cushion foam 10 is formed. That is, a first closing part 19 closing the top of the first seat well 11 and a second closing part 19 closing the top of the second seat well 12 are made of the same material as the insole cushion foam 10 simultaneously with when the insole cushion foam 10 is formed. Fabrics or sheets made of various materials may be bonded to the surface of the top of the insole cushion foam 10. A step may be provided inside the first seat well 11, particularly, a step is formed to be able to accommodate the upper end of a first coil spring 21 of the arch spring module 20 and then formed higher (deeper) to fix the upper end of the first coil spring 21.

**[0031]** A groove having a depth and a shape corresponding to the thickness of a cover 40 is formed on the bottom of the insole cushion foam 10 so that the cover 40 can be coupled, and it has a structure for providing air to a foot using air pressure that is generated by variation of the volumes of the first seat well 11 and the second seat well 12 due to walking. At the Yong-cheon (front ball) of a foot, a slightly protruding portion is formed on the insole cushion foam 10 and at least one or more through-holes 13 passing through the top and the bottom of the insole cushion foam 10 are formed. Further, the through-holes 13 communicate with the first seat hole 11 using a buffer well 17 and a first trench 14 of the insole cushion foam 10 and enables the first seat hole 11 to communicate with the second seat hole 12 using a second trench 15. Accordingly, volume variation of the first seat hole 11 and the second seat hole 12 due to walking discharges air toward the Yong-cheon and suctions are through the second trench 15, the first trench 14, the buffer well 17, and the through-hole 13.

**[0032]** The insole cushion foam 10 has a side wall 16 having a partial cylindrical shape surrounding the arch spring module 11 and a space S in which the insole cushion foam is not formed is formed outside the side wall 16 to help expansion and contraction of the arch spring module 11.

**[0033]** The cover 40, which is seated in a groove formed on the insole cushion foam 10 and bonded to the insole cushion foam 10, is made of a hard material. The cover 40 is bonded to the insole cushion foam 10 while supporting the lower ends of the arch spring module 20 and the rear spring module 30 and closing the lower portions of the first seat hole and the second seat hole 12. The cover 40 has a first circular groove 41 supporting and fixing the lower end of a third coil spring 23 of the arch spring module 20 and a second circular groove 42 having a step that accommodates and supports the lower ends of a fourth coil spring 31 and a fifth coil spring 32 of the rear spring module 30.

**[0034]** At the heel portion of the insole cushion foam 10, the height H2 of the inside part of a foot is made smaller than the height H1 of the outside part of a foot. Accordingly, the top of the insole cushion foam 10 is formed such that the top of the insole cushion foam 10 is slightly inclined from the outside part of a foot to the inside part of a foot. A gradient is formed on the insole such that the outer rear ball part is high and the inner rear ball part is low, and as a gradient is formed in this way, when it a bowleg, particularly, an 'O'-shaped leg, a

load concentrates outside, so it is possible to prevent the leg from being further deformed into an 'O'-shape.

**[0035]** Referring to FIG. 3, the rear spring module 30 is configured to be seated in the second seat well 11 of the insole cushion foam 10 and elastically support the heat part of a foot. The rear spring module 30 includes the fourth coil spring 31 and the fifth coil spring 32, which are coaxially disposed and different in diameter, and a solid supporting part 33.

**[0036]** The fourth coil spring 31 and the fifth coil spring 32 are formed by spirally winding a flat plate material having elasticity and having a band shape of which the width is larger than the thickness, in which the band-shaped flat material constructs a curve like a sine wave when seen from a side and may be configured such that the convex portion of a previous turn (N-1-th turn) and a concave portion of a current turn (N-th turn) are in contact with each other. The solid supporting part 33 supports the upper end of the fourth coil spring 31 and the upper end of the fifth coil spring 32, is positioned under the closing part 19 of the second seat well 11, and is made of a hard material, so pressure on a heel in walking is entirely transmitted to the fourth coil spring 31 and the fifth coil spring 32 through the solid supporting part 33.

**[0037]** The solid supporting part 33 has a cylindrical side wall 332 protruding downward and a flange portion 331 outside the cylindrical side wall 332. The upper end of the fifth coil spring 32 is in contact with the flange portion 331 and the inner side of the upper end of the fifth coil spring 32 is inserted outside the cylindrical side wall 332, so position separation of the fifth coil spring 32 is prevented. Further, the upper of the fourth coil spring 31 is inserted inside the cylindrical side wall 332, so position separation of the fourth coil spring 31 is prevented.

**[0038]** Referring to FIG. 4, the arch spring module 20 is seated in the first well 11 and positioned on the insole cushion foam 10 and supports the arch of a fool with the closing part 18 of the insole cushion foam 10, which closes the top of the first seat well 11, therebetween.

**[0039]** The arch spring module 20 includes the first coil spring 21, the second coil spring 22, the third coil spring 23, and a disc-shaped moving supporting part 24. The disc-shaped moving supporting part 24 is made of resin such as plastic, the first coil spring 21 and the second coil spring 22 are positioned on the top thereof, and the third coil spring 23 is positioned on the bottom thereof.

**[0040]** The disc-shaped moving supporting part 24 has a substantially disc shape, but supports the first coil spring 21 and the second coil spring 22 with the lower ends of the first coil spring 21 and the second coil spring 22 seated on the top (first surface) thereof, and supports the third coil spring 23 with the upper end of the third coil spring 23 seated on the bottom (second surface) thereof. A flange portion 242 formed at the edge of the disc-shaped moving supporting part 24 to be smaller than the thickness of the disc-shaped moving supporting part 24 supports the lower end of the second coil spring 22, and the lower end of the first coil spring 21 is supported in a first circular groove 241 formed inside the disc-shaped moving supporting part 24. Further, a second circular groove 243 that supports the upper end of the third coil spring 23 is formed on the bottom of the disc-shaped moving supporting part 24.

**[0041]** The third coil spring 23 supports a load through the disc-shaped moving supporting part 24 with the upper end thereof seated on the second surface (bottom) opposite to the first surface (top) of the disc-shaped moving supporting part 24, and the disc-shaped moving supporting part 24 can be moved up and down while being guided by the inner surface of the first seat well11 in the first weal well 11.

**[0042]** The first coil spring 21, the second coil spring 22, and the third coil spring 23 are formed by spirally winding a flat plate material having elasticity and having a band shape of which the width is larger than the thickness, in which the band-shaped flat material constructs a curve like a sine wave when seen from a side and may be configured such that the convex portion of a previous turn (N-1-th turn) and a concave portion of a current turn (N-th turn) are in contact with each other.

**[0043]** According to a feature of the present invention, flat surfaces of flat plate materials each support the closing part 18 of the insole cushion foam 10 at the upper ends of the first coil spring 21 and the second coil spring 22. The flat plate material of the last turn may also have a flat surface without forming a sine wave at the upper ends of the first coil spring 21 and the second coil spring 22.

**[0044]** FIG. 6(a) shows the case in which an arch spring module 20 of the arch adaptive smart insole according to an embodiment of the present invention and the profile F, F of a foot arch are matched and FIG. 6(b) is a comparative example showing the case a spring and a foot arch profile F, F are matched when a common coil spring is applied to an arch part of the insole.

**[0045]** According to a feature of the present invention, the first coil spring 21 having a smaller diameter than the second coil spring 22 is positioned inside the second coil spring 22 of the arch spring module 20, and the upper end of the second coil spring 22 is configured to be lower than the upper end of the first coil spring 21, so it substantially corresponds to the arch of a foot. As an embodiment, it is preferable that the upper ends of the first coil spring 21 and the second coil spring 22 correspond to the curvature of an arch of a claw foot or a similar curvature in consideration of the step configured in the first well.

**[0046]** The circle of one turn at the uppermost end of a common coil spring supports the arch of a foot, but in the arch spring module 20 according to an embodiment of the present invention, the uppermost one turn of the first coil spring 21 and the uppermost one turn of the second coil spring 22 support the arch of a foot as a smaller circle and a larger circle at different portions and heights, respectively. Further, the first coil spring and the second coil spring formed by winding a flat plate material

less cut into the cushion foam and have a larger area that can support pressure in comparison to common springs formed by winding a narrow rod-shaped material. Common springs easily cut into a cushion foam at the upper end, but the first coil spring and the second coil spring applied to the arch of a foot do not easily cut into a cushion foam, so it is effectively used that it is possible to directly support a cushion foam without configuring a hard support (like the 'arch revision plate' in Patent Document 3) at the middle. Further, as described above, since the uppermost one turn of the first coil spring 21 and the uppermost one turn of the second coil spring 22 support an arch as two circles, respectively, there is an effect that the area supporting the arch of a foot is greatly increased. Two coil springs are used to directly support the cushion form at an arch in an embodiment of the present invention, but it may be possible to achieve a larger supporting area by configuring three or more coil springs.

**[0047]** Meanwhile, as shown in FIG. 6(b), when a single common coil spring is used, the length of the spring has to be relatively large and there may be a problem that the spring falls on its side or laterally bends when compressed in repeated use. In particular, when the material surrounding the outer side of a spring is cushion foam, cushion foam that is a flexible material having elasticity has difficulty in effectively guiding the spring, which makes it possible to directly putting a common coil spring in the cushion foam. However, according to the present invention, since the disc-shaped moving supporting part 24 is configured between the first coil spring, the second coil spring, and the third coil spring, the problem that a spring falls on its side or laterally bends described above is remarkably reduced, so there is an effect that it is possible to keep the entire arch spring module in a stable posture even in compression.

**[0048]** FIG. 7(a) shows the case in which the arch spring module 20 of the arch adaptive smart insole according to an embodiment of the present invention and various types of foot arches are matched and FIG. 7(b) is a plan view showing various types of foot arches.

**[0049]** When an arch of a foot applied a load to the arch spring module 20 with the insole cushion foam 10 therebetween, as for a claw foot (see a profile F1), the first coil spring 21 and the second coil spring 22 are almost simultaneously compressed, and the third coil spring 23 is correspondingly compressed. A claw foot has a small ground contact area, so it easily feels fatigue, pain and inflammation may be generated on the sole of the foot or the toes and knee pain may be generated, and it easily gets sprained in comparison to other people. However, it is supported through wide supporting areas of the first coil spring 21 and the second coil spring 22, so this problem is remarkably reduced.

**[0050]** A normal foot (see a profile F2) compresses the first coil spring 21 first and then the second coil spring 22 is compressed with a short interval. A normal fool feels pressure by the first coil spring 22 under a small load, but is supported simultaneously by the first coil spring 21 and the second coil spring 22 under a load over a predetermined level, and the third coil spring 23 is correspondingly compressed.

**[0051]** A flatfoot (see a profile F3) strongly compresses the first coil spring 21, the second coil spring 22, and the third coil spring 23. Since a flatfoot has a flatter profile, the distance (stroke) of compressing the arch spring module 20 is greatly increased and strong pressure is felt on an arch. A flatfoot feels chronic fatigued due to a large ground contact area, and the arch is fallen at the inside of the foot and the heel inclines outward, but the insole according to an embodiment of the present invention is used, strong pressure is applied to the arch of a flatfoot, and accordingly, a predetermined level of natural correction effect is achieved. In particular, a normal foot becomes a flatfoot due to aging in some cases, but there is an effect of delaying progression to a flatfoot or correcting a flatfoot due to aging.

## Claims

**1.** An arch adaptive smart insole, comprising:

an insole cushion foam (10) made of foam having a shape corresponding to the shape of a foot and having elasticity; and
an arch spring module (20) seated in a first seat well (11) of the insole cushion foam (10), and supporting an arch of a foot with a closing part (18) of the insole cushion foam (10), which closes the top of the first seat well (11), therebetween,
wherein the arch spring module (20) includes at least a first coil spring (21) and a second coil spring (22), and the first coil spring (21) having a smaller diameter than the second coil spring (22) is positioned inside the second coil spring (22).

**2.** The arch adaptive smart insole of claim 1, wherein the upper end of the second coil spring (22) is configured lower than the upper end of the first coil spring (21) to correspond to the arch of a foot.

**3.** The arch adaptive smart insole of claim 2, wherein the first coil spring (21) and second coil spring (22) are formed by spirally winding a flat plate material having elasticity and having a band shape of which the width is larger than the thickness, and
flat surfaces of the flat plate materials each support the closing part (18) of the insole cushion foam (10) at the upper ends of the first coil spring (21) and second coil spring (22).

**4.** The arch adaptive smart insole of claim 3, wherein the arch spring module (20) further includes:

a disc-shaped moving supporting part (24) supporting the first coil spring (21) and the second coil spring (22) with lower ends of the first coil spring (21) and the second coil spring (22) seated on a first surface thereof; and
a third coil spring (23) supporting a load through the disc-shaped moving supporting part (24) with an upper end thereof seated on a second surface opposite to the first surface of the disc-shaped moving supporting part (24), and the disc-shaped moving supporting part (24) can be moved up and down in the first seat well (11).

**5.** The arch adaptive smart insole of claim 4, further comprising a rear spring module (30) seated in a second well (11) of the insole cushion foam (10) and supporting the heel of a foot,
wherein the rear spring module (30) includes:

a fourth coil spring (31) and a fifth coil spring (32) coaxially disposed and different in diameter; and
a solid supporting part (33) supporting an upper end of the fourth coil spring (31) and an upper end of the fifth coil spring (32), positioned under a closing part (19) of the second seat well (11), and made of a hard material.

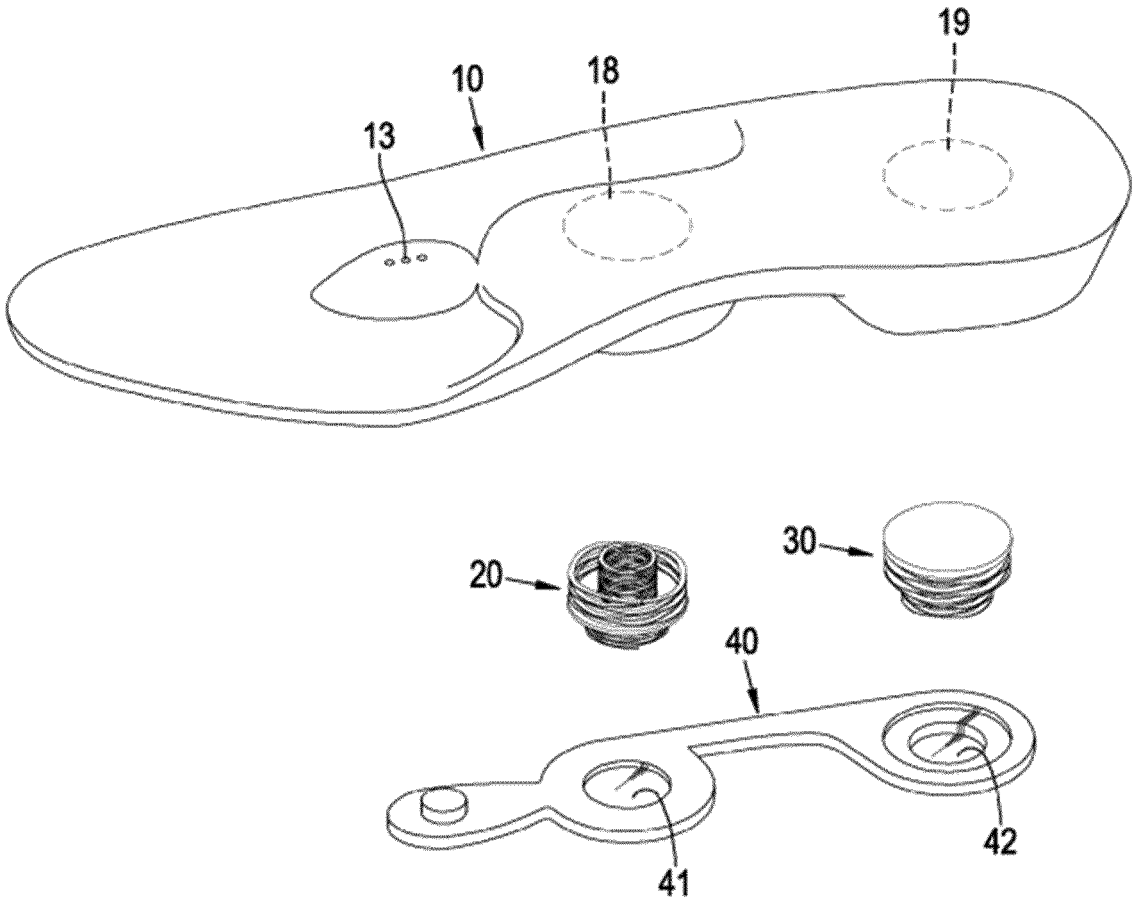
**6.** The arch adaptive smart insole of claim 5, further comprising a cover (40) supporting lower ends of the arch spring module (20) and the rear spring module (30), closing lower portions of the first seat hole and the second seat hole (12), and bonded to the insole cushion foam (10).

**7.** The arch adaptive smart insole of claim 5, having at least one through-hole (13) passing through the top and the bottom of the insole cushion foam (10), and the through-hole (13) communicates with the first seat hole and the second seat hole (12) using a trench configured in the insole cushion foam (10).

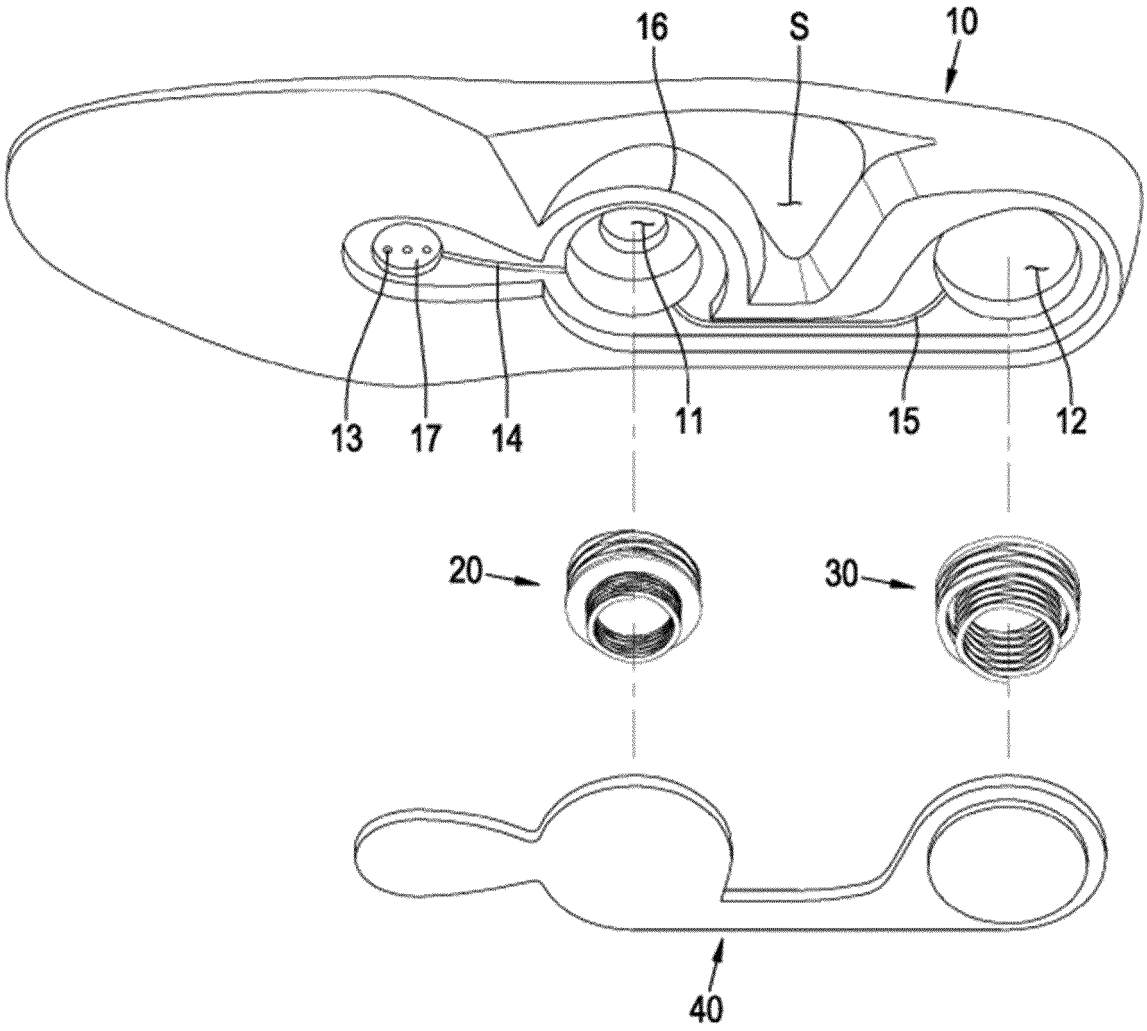
**8.** The arch adaptive smart insole of claim 1, wherein the height of the inside part of a foot is smaller than the height of the outside part of a foot at a heel part of the insole cushion foam (10).

**9.** A natural treatment shoe comprising the arch adaptive smart insole of any one of claims 1 to 7.

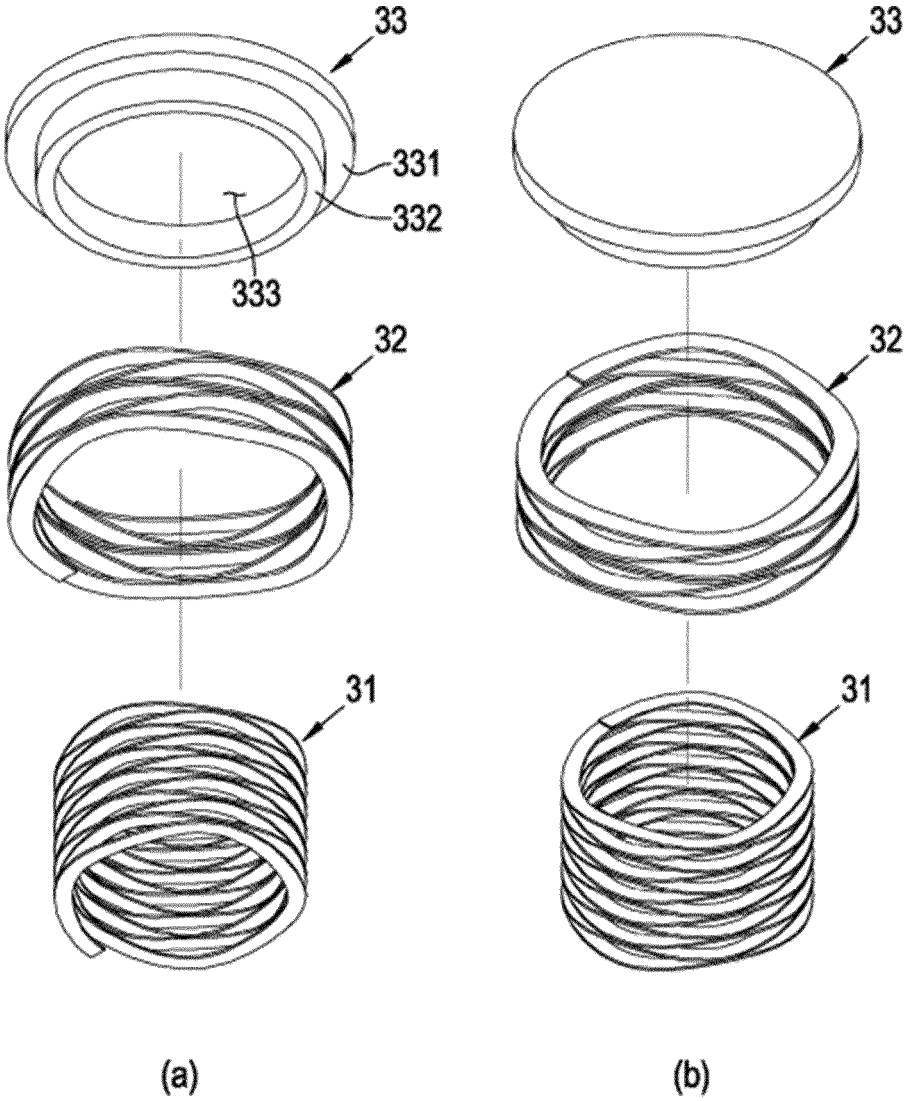
【Figure 1】



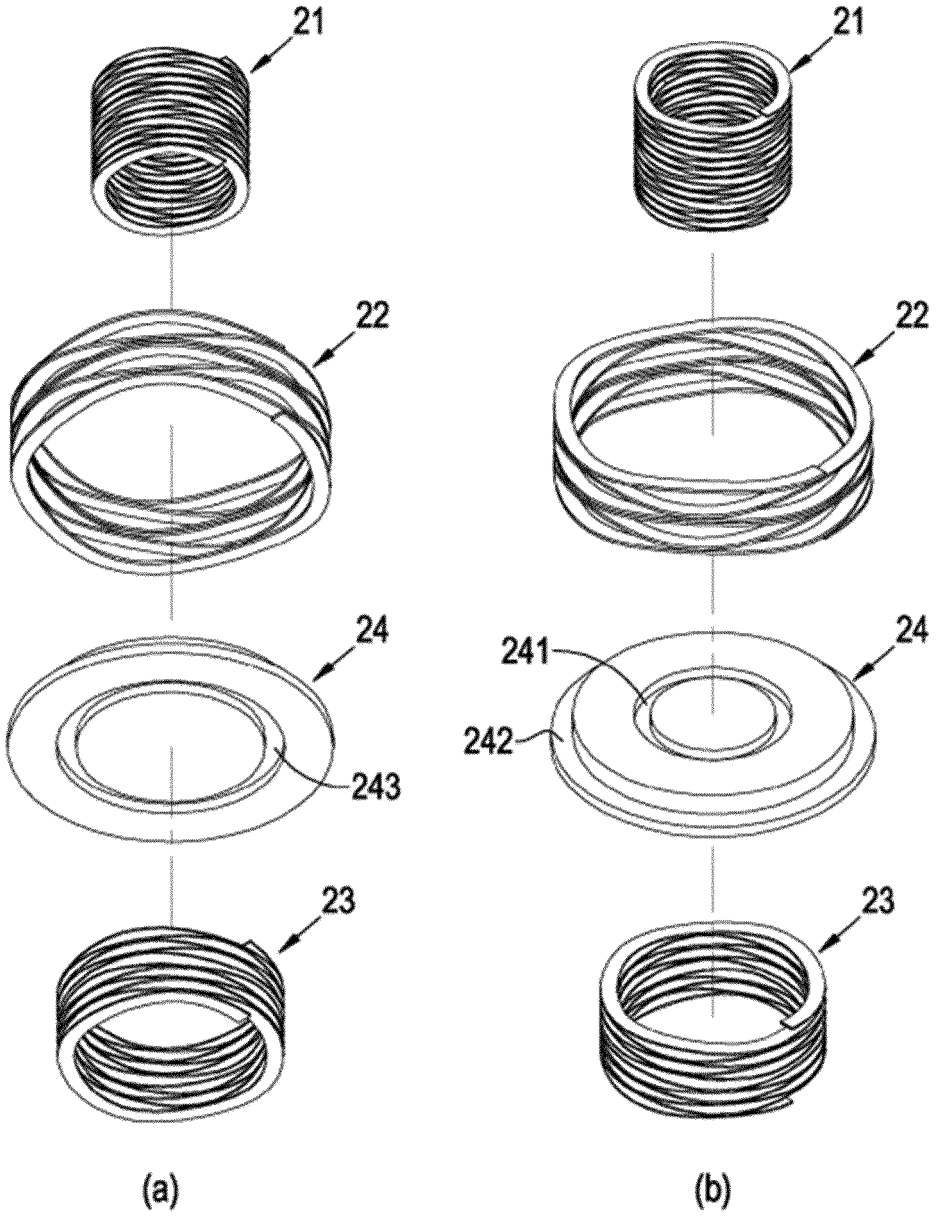
【Figure 2】



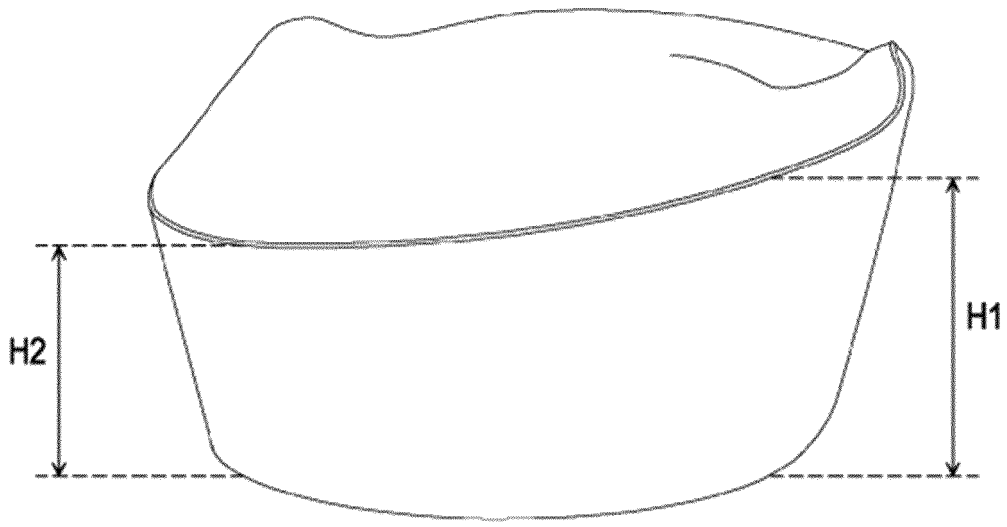
【Figure 3】



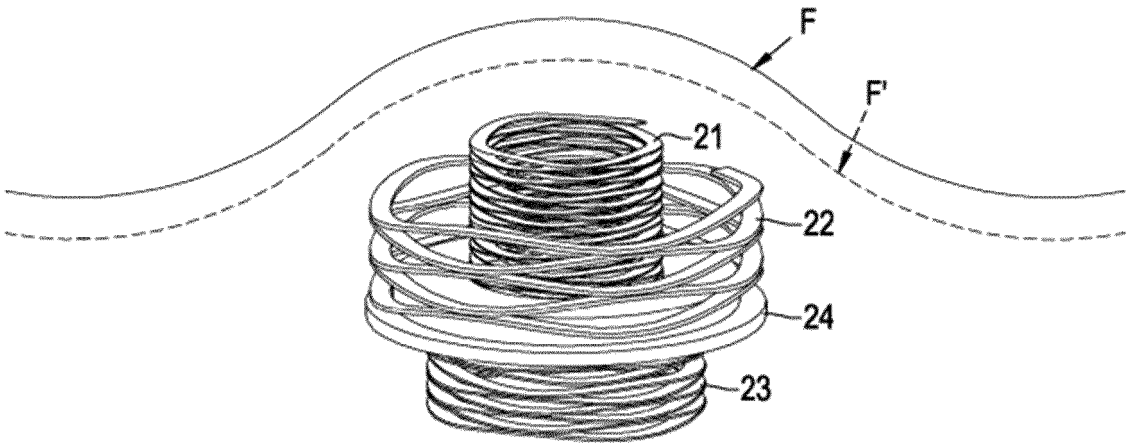
【Figure 4】



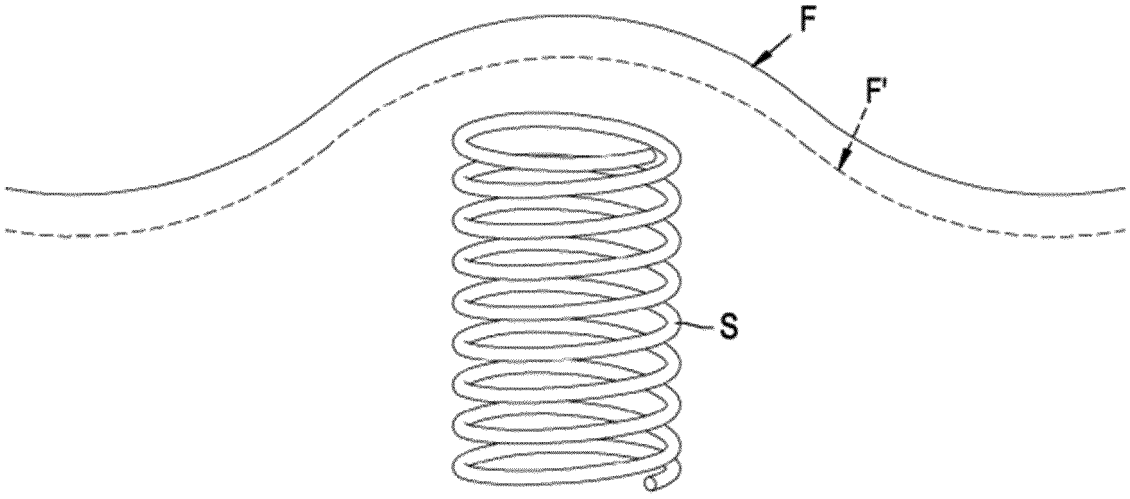
【Figure 5】



【Figure 6】

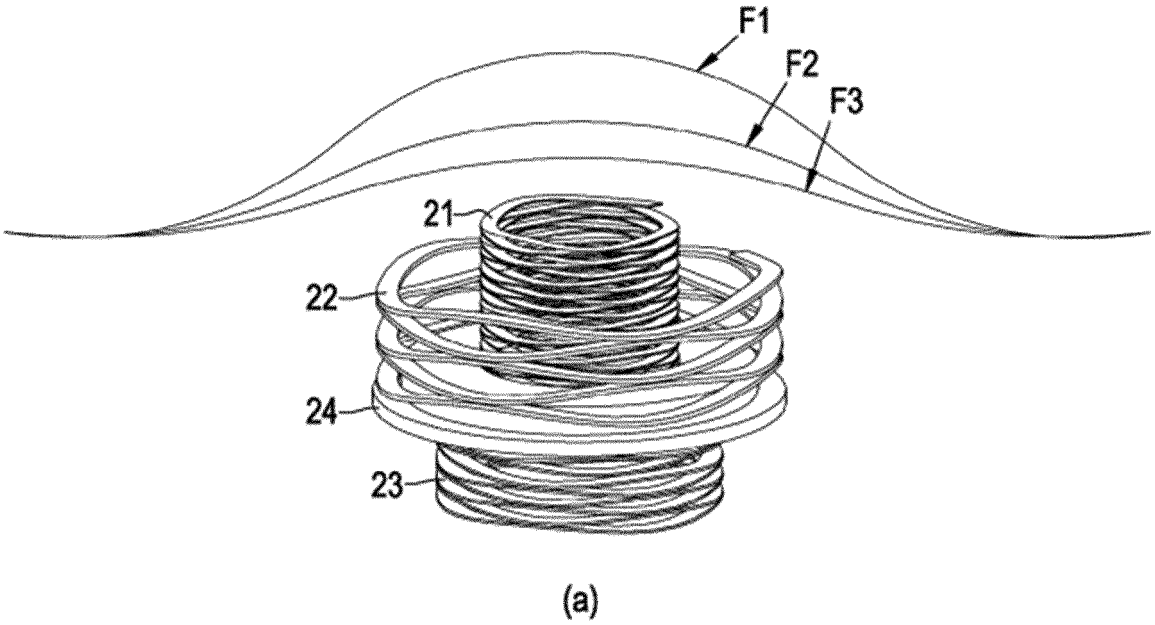



(a)

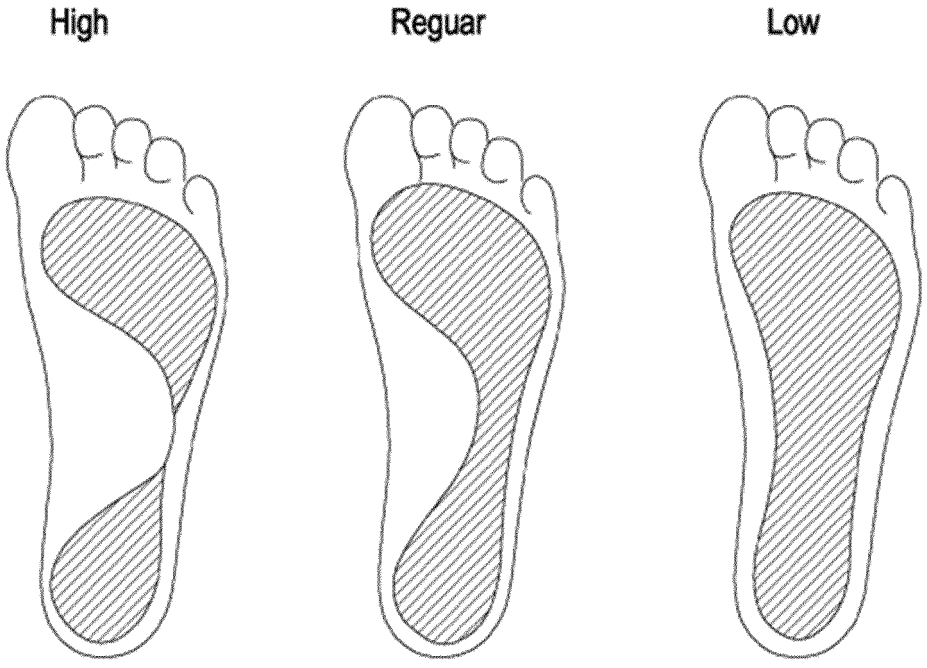



(b)

【Figure 7】




(a)




(b)

## INTERNATIONAL SEARCH REPORT

International application No.
**PCT/KR2021/009234**

**A. CLASSIFICATION OF SUBJECT MATTER**

**A43B 17/06**(2006.01)i; **A43B 17/04**(2006.01)i; **A43B 7/32**(2006.01)i; **A43B 7/14**(2006.01)i; **A43B 7/30**(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)

A43B 17/06(2006.01); A43B 13/14(2006.01); A43B 17/08(2006.01); A43B 7/06(2006.01); A43B 7/14(2006.01); A43B 7/22(2006.01); A43B 7/32(2006.01); B60G 15/06(2006.01); F16F 9/32(2006.01)

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

Korean utility models and applications for utility models: IPC as above
Japanese utility models and applications for utility models: IPC as above

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

eKOMPASS (KIPO internal) & keywords: 인솔(insole), 아치(arch), 쿠션폼(cushion foam), 웰(well) 스프링(spring)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | KR 20-0372085 Y1 (NO, Jin Gu) 14 January 2005 (2005-01-14)<br>See abstract; paragraphs [0009], [0013] and [0033]; claim 1; and figures 1 and 5. | 1-9 |
| Y | KR 10-1018905 B1 (KANG, Min Gu) 02 March 2011 (2011-03-02)<br>See paragraphs [0022], [0024]-[0025], [0030] and [0033]; and figures 1 and 5. | 1-9 |
| Y | JP 2001-227577 A (SAKUGI, Sadao) 24 August 2001 (2001-08-24)<br>See paragraph [0004]; and figure 1. | 4-7 |
| Y | KR 10-0928712 B1 (GREEN STEP CO., LTD.) 30 November 2009 (2009-11-30)<br>See paragraphs [0019]-[0020] and [0022]; and figure 1. | 4-7 |
| Y | JP 08-205904 A (ASICS CORP.) 13 August 1996 (1996-08-13)<br>See claims 1-2; and figure 1. | 8 |

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| **08 November 2021** | **08 November 2021** |
| Name and mailing address of the ISA/KR<br>**Korean Intellectual Property Office**<br>**Government Complex-Daejeon Building 4, 189 Cheongsa-ro, Seo-gu, Daejeon 35208**<br>Facsimile No. **+82-42-481-8578** | Authorized officer<br><br>Telephone No. |

Form PCT/ISA/210 (second sheet) (July 2019)

**INTERNATIONAL SEARCH REPORT**
**Information on patent family members**

International application No.
**PCT/KR2021/009234**

| Patent document cited in search report | Publication date (day/month/year) | Patent family member(s) | Publication date (day/month/year) |
|---|---|---|---|
| KR 20-0372085 Y1 | 14 January 2005 | None | |
| KR 10-1018905 B1 | 02 March 2011 | None | |
| JP 2001-227577 A | 24 August 2001 | None | |
| KR 10-0928712 B1 | 30 November 2009 | KR 10-2009-0076501 A | 13 July 2009 |
| JP 08-205904 A | 13 August 1996 | JP 3140932 B2 | 05 March 2001 |

Form PCT/ISA/210 (patent family annex) (July 2019)

## REFERENCES CITED IN THE DESCRIPTION

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

### Patent documents cited in the description


- KR 1020110017781 **[0005]**
- KR 100912910 **[0006]**
- KR 100928712 **[0007]**