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(54) **WATERPROOF BREATHABLE SOLE**

(57) The present invention provides a waterproof breathable sole, comprising: an outsole (10) provided with ventilation eyeholes (140) in communication with the outer environment; and a waterproof breathable element (40) comprising a waterproof breathable membrane (420) covering the ventilation eyeholes (140); the waterproof breathable element (40) further comprises a connecting ring (440); the connecting ring (440) is provided around a periphery of the waterproof breathable membrane (420) and engaged with the waterproof breathable membrane (420). The outsole (10) may be further provided with an inserting groove (102); the inserting groove (102) corresponds to a position of the ventilation eyeholes (140). The waterproof breathable element (40) is received and sealed in the inserting groove (102); or the top of the outsole (10) is flat, the waterproof breathable element (40) is engaged with and sealed to the outsole via the connecting ring (440). The waterproof breathable sole further comprises a forced-suction and forced-discharge element (60) correspondingly provided over the waterproof breathable element (40). The provision of the waterproof breathable element (40) with the connecting ring (440) simplifies the provision process of the prior art waterproof breathable membrane and improves the adaptability for the various types of soles; the provision of the forced-suction and forced-discharge element (60) greatly improves the air circulation.

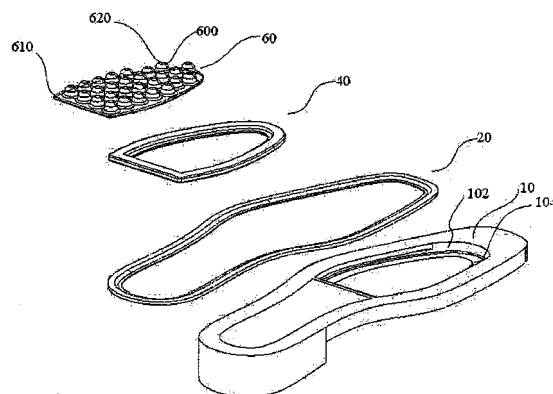


FIG. 1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to footwear, and more particularly to a waterproof breathable sole.

BACKGROUND

[0002] In footwear manufacturing industry, the breathability and waterproofness of a sole is always one of key problems in design. The breathability and waterproofness of a sole not only affects comfortability during wear but also the health status of the feet.

[0003] In order to enhance the breathability of the sole, a Chinese patent application of CN200580002558.2 in the name of Italian Geox SPA company discloses a footwear with breathable and waterproof sole and upper, in which the sole comprises: a breathable and waterproof sole and an assembly that is associated with the sole in an upward region; the assembly is constituted by an external breathable upper, an internal lining, and a breathable and waterproof membrane between them; and an at least partially perforated or breathable insole which is joined at least to the upper and to the breathable and waterproof membrane. The sole of this structure mainly enhances the breathability of the sole by holes in the insole at the same time, in order to function as waterproofness property, the sole of this structure is provided with the breathable and waterproof membrane. Although the sole of this structure may function as a breathable waterproof effect, in this patent application, the breathable and waterproof membrane is adhered to the sole via one layer by one layer, however in the manufacturing process; soles will be processed in a manner of production line. Therefore, in order to apply the breathable and waterproof membranes with respect to different sizes of soles in the same production line, a large quantity of breathable and waterproof membranes are required, it will take more time and more resources to adhere breathable and waterproof membranes on soles, and thus production efficiency is very low. Moreover, in the sole of this structure in this patent, the traditional breathable and waterproof membranes are employed in an aspect of enhancing a breathable waterproof property, and the sole of the footwear is limited in air circulation.

[0004] Moreover, in order to enhance air recirculation in sole, a Chinese patent application of CN91221733.2 discloses a breathable sole. The breathable sole is composed of a footwear sole body, which is made of rubber or plastic, and a cloth pad which are bonded together; cross grooves and longitudinal grooves are arranged above the footwear sole body between the footwear sole body and the cloth pad. During the period when people wears the footwears with the sole of this structure and walks, as upward and downward movement of the soles, the through grooves between the feet and the sole may consequently generate negative pressure and positive

pressure so that the air is made to enter into and come out, and thus the ventilating function can be obtained. However, such a design in through grooves is only an expansion of cross grooves and longitudinal grooves in heel piece in the traditional manufacturing industry. When a force is applied to these through grooves by feet, since the cross grooves and longitudinal grooves are integrally connected in the whole sole, there are many restrictions when the cross grooves and longitudinal grooves deform due to the external force. Therefore, there is still insufficiency for the sole of this structure to enhance ventilation, and thus it is necessary to make a further improvement.

SUMMARY

[0005] In view of the technical problems in the prior art stated above, a technical problem to be resolved by the present invention is to provide a breathable waterproof sole capable of simplifying provision process of a breathable waterproof membrane on a sole.

[0006] In view of the technical problems in the prior art stated above, another technical problem to be resolved by the present invention is to provide a breathable waterproof sole that may realize better air circulation function.

[0007] In view of the technical problems in the prior art stated above, a further technical problem to be resolved by the present invention is to provide a breathable waterproof sole that adapts to human body dynamics.

[0008] In view of the above problems to be resolved by the present invention, there is a waterproof breathable sole provided by the invention, comprising: an outsole provided with ventilation eyeholes in communication with the outer environment; and a waterproof breathable element comprising a waterproof breathable membrane covering the ventilation eyeholes; wherein the waterproof breathable element further comprises a connecting ring, the connecting ring is provided around a periphery of the waterproof breathable membrane and engaged with the waterproof breathable membrane. Therefore, an inserting type waterproof breathable sole of the present invention is formed.

[0009] In the waterproof breathable sole according to the present invention, preferably, the outsole is further provided with an inserting groove; the inserting groove corresponds to a position of the ventilation eyeholes; the waterproof breathable element is received and sealed in the inserting groove; the inserting groove is recessed from a top of the outsole toward an interior of the outsole; the ventilation holes penetrate from a bottom of the inserting groove to a bottom of the outsole; accordingly a semi-inserting type waterproof breathable sole of the present invention is formed.

[0010] In the waterproof breathable sole according to the present invention, preferably, the outsole is further provided with an inserting groove; the inserting groove corresponds to a position of the ventilation eyeholes; the waterproof breathable element is received and sealed in

the inserting groove; the inserting groove penetrates from a top of the outsole to a bottom of the outsole; the outsole further comprises an inserting element inserted and sealed in the inserting groove; and the ventilation eye-holes are provided in the inserting element and penetrate from a top of the inserting element to a bottom of the inserting element; the waterproof breathable element is over the inserting element; accordingly a full-inserting type waterproof breathable sole of the present invention is formed.

[0011] In the waterproof breathable sole according to the present invention, with respect to the semi-inserting type waterproof breathable sole, the inserting groove is further provided with a recess therein; the connecting ring is received and sealed in the recess.

[0012] In the waterproof breathable sole according to the present invention, with respect to the full-inserting type waterproof breathable sole, preferably, the bottom of the outsole is further provided with a bottom groove; a periphery of the bottom groove is larger than a periphery of the inserting groove; the inserting element comprises a flange and a base portion formed on the base portion; an outer profile of the flange is matched with and sealed to the periphery of the inserting groove; the periphery of the base portion is matched with and sealed to the periphery of the bottom groove; the ventilation eye-holes are provided in a part of the base portion locating within the flange and penetrate from a top of the part to a bottom of the part.

[0013] In the waterproof breathable sole according to the present invention, with respect to the full-inserting type waterproof breathable sole, preferably, a recess is provided within the flange of the inserting element; the connecting ring is received and sealed in the recess.

[0014] In the waterproof breathable sole according to the present invention, alternatively, the top of the outsole is flat; the waterproof breathable element is engaged with and sealed to the outsole via the connecting ring; and accordingly a non-inserting type waterproof breathable sole is formed. Or alternatively, a ring-shape recess is provided on a top of the outsole so as to match with the connecting ring; the connecting ring is received in and sealed to the ring-shaped recess.

[0015] In the waterproof breathable sole according to the present invention, whether it is the semi-inserting type sole, the full-inserting type sole or the non-inserting sole, preferably, an inner circumference of the connecting ring is protruded with a protruding loop, and the waterproof breathable membrane is engaged with a surface of the protruding loop.

[0016] In the waterproof breathable sole according to the present invention, whether it is the semi-inserting type sole, the full-inserting type sole or the non-inserting sole, preferably, the waterproof breathable element further comprises a cloth layer; the cloth layer is provided under the waterproof breathable membrane and engaged with the connecting ring along with the waterproof breathable membrane.

[0017] In the waterproof breathable sole according to the present invention, whether it is the semi-inserting type sole, the full-inserting type sole or the non-inserting sole, preferably, the waterproof breathable sole further comprises: a forced-suction and forced-discharge element correspondingly provided over the waterproof breathable element and comprising a base plate and a plurality of forced-suction and forced-discharge units provided on the base plate. Each forced-suction and forced-discharge unit comprises: a top opening provided in a top of the forced-suction and forced-discharge unit; an interior cavity provided inside the forced-suction and forced-discharge unit and in gas communication with the top opening; a bottom opening provided in a bottom of the forced-suction and forced-discharge unit and in gas communication with the interior cavity and the waterproof breathable element.

[0018] In the waterproof breathable sole according to the present invention, whether it is the semi-inserting type sole, the full-inserting type sole or the non-inserting sole, preferably, the plurality of the forced-suction and forced-discharge units is provided to integrally connect with each other, provided to separate from each other, or a part of the plurality of the forced-suction and forced-discharge units is provided to connect with each other. Also the other part of the plurality of the forced-suction and forced-discharge units is provided to separate from each other.

[0019] In comparison with the prior art, the present invention has advantageous effects mainly as follow:

[0020] (1) In the configuration employing the breathable waterproof sole of the present invention, because the waterproof breathable element comprises the waterproof breathable membrane and the connecting ring, the connecting ring is provided around the periphery of the waterproof breathable membrane and engaged with the waterproof breathable membrane, and the inserting groove is provided in the outsole, the waterproof breathable element may be independently configured and individually manufactured, which simplifies the provision process of the prior art waterproof breathable membrane and improves the adaptability for the various type of soles.

[0021] (2) In the configuration employing the breathable waterproof sole of the present invention, the provision of the forced-suction and forced-discharge element greatly improves the air circulation.

[0022] (3) In the configuration employing the breathable waterproof sole of the present invention, because the ventilation eye-holes, the waterproof breathable element and the forced suction and forced discharge structure is distributed on the sole according to the human dynamics, the air circulation is further improved and the design is more accurate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The accompanying drawings, which are included to provide a further understanding of the invention are incorporated and constitute a unit of this application doc-

ument. The drawings illustrate embodiments of the present invention and together with the description serve to explain the principles of the present invention. In the whole drawings, the same reference number will be used as much as possible to indicate the same or similar element. In the drawings:

[0024] FIG. 1 is an explosive perspective view of a semi-inserting type waterproof breathable sole according to the present invention;

[0025] FIG. 2 is a top explosive perspective view of a waterproof breathable element of the semi-inserting type waterproof breathable sole according to the present invention;

[0026] FIG. 3 is a bottom explosive perspective view of the waterproof breathable element of the semi-inserting type waterproof breathable sole according to the present invention;

[0027] FIG. 4 is a bottom perspective view of a forced suction and forced discharge element of the semi-inserting type waterproof breathable sole according to the present invention;

[0028] FIG. 5 is an assembled perspective view of the semi-inserting type waterproof breathable sole according to the present invention;

[0029] FIG. 6 is a top explosive perspective view of a full-inserting type waterproof breathable sole according to the present invention;

[0030] FIG. 7 is a bottom explosive perspective view of the full-inserting type waterproof breathable sole according to the present invention;

[0031] FIG. 8 is an assembled perspective view of the full-inserting type waterproof breathable sole according to the present invention;

[0032] FIG. 9 is a plan view of provision of a pattern and ventilation eyeholes in the waterproof breathable sole according to the present invention;

[0033] FIG. 10 is a schematic diagram of regions receiving forces in the waterproof breathable sole according to the present invention.

DETAILED DESCRIPTION

[0034] The preferred embodiments of the present invention will be now described in details, and the structures of the examples of the preferred embodiments are shown in the corresponding accompanying drawings.

[0035] The present invention includes three specific embodiments, i.e., a structure of a semi-inserting type waterproof breathable sole, a structure of a full-inserting type waterproof breathable sole, and a structure of a non-inserting type waterproof breathable sole, but is not limited to these three embodiments. Herein, FIGs. 1-5 show a structure of a semi-inserting type waterproof breathable sole; FIGs. 6-8 show a structure of a full-inserting type waterproof breathable sole. It should be explained that the semi-inserting type waterproof breathable sole and the full-inserting type waterproof breathable sole as referred in the present invention are distinguished based

on provision manners of an inserting groove and a waterproof breathable element on an outsole; it will be a full-inserting type when the inserting groove penetrates through the outsole, and a semi-inserting type when the inserting groove does not penetrate through the outsole. Moreover, based on design routines in footwear manufacturing industry, because ventilation holes are usually made by perforation after a sole has been completed, the ventilation holes provided in the sole are not shown in FIG. 1, FIG. 6 and FIG. 7, but schematically shown in FIG. 9. Furthermore, "top" as referred in the present invention refers to a side of a sole for contacting with a human foot, "bottom" as referred in the present invention refers to a side of a sole for contacting with a ground; term of "longitudinal" refers to a direction from foot palm to the ground.

[0036] Hereinafter in connection with the accompanying drawings, the specific embodiments of the present invention will be described in detail.

[0037] A structure of a semi-inserting type waterproof breathable sole of the present invention will be now described with reference to FIGs. 1-5 and FIG. 9.

[0038] As shown in FIG. 1, a semi-inserting type waterproof breathable sole of the present invention comprises an outsole 10 and a waterproof breathable element 40, wherein the outsole 10 is provided with ventilation eyeholes 140, as shown in FIG. 9, in communication with the outer environment in order to enhance breathability of the sole. At the same time, the waterproof breathable element 40 comprises a waterproof breathable membrane 420 covering the ventilation eyeholes 140. In order to simplify the provision process of the waterproof breathable element 40 on the sole, as shown in FIG. 2, the waterproof breathable element 40 may further comprise a connecting ring 440 which is provided around a periphery of the waterproof breathable membrane 420 and engaged with the waterproof breathable membrane 420. The outsole 10 is further provided with an inserting groove 102 corresponding to a position of the ventilation eyeholes 140, and the waterproof breathable element 40 is received and sealed in the inserting groove 102.

[0039] In this embodiment, the inserting groove 102 is recessed from a top of the outsole 10 toward an interior of the outsole 10 by a certain depth. The ventilation holes 140 penetrate from a bottom of the inserting groove 102 to a corresponding bottom of the outsole 10, that is, the ventilation eyeholes 140 penetrate through the outsole 10 from the bottom of the inserting groove 102. Under this structure, a bottom of the waterproof breathable membrane 420 is inserted in the inserting groove 102 and engaged with a bottom surface of the inserting groove 102; alternatively, the bottom of the waterproof breathable membrane 420 is directly inserted in the inserting groove 102, and the periphery of waterproof breathable membrane 420 may be engaged with a longitudinal circumferential surface of the inserting groove 102.

[0040] In FIG. 1, the semi-inserting waterproof breath-

able sole further comprises an outsole sidewall 20. In practical manufacturing process, the outsole sidewall 20 may be integrally formed with the outsole 10, and so in the present invention, "outsole" as referred may only refer to the outsole 10 as shown in FIG. 1, and also may refer to a combination of the outsole 10 and the outsole sidewall 20.

[0041] A structure of a full-inserting type waterproof breathable sole of the present invention will be now described with reference to FIGs. 6-8 and FIG. 9.

[0042] As shown in FIG. 6, FIG. 7, and FIG. 8, a full-inserting type waterproof breathable sole of the present invention comprises an outsole 10 and a waterproof breathable element 40, wherein the outsole 10 is provided with ventilation eyeholes 140, as shown in FIG. 9, in communication with the outer environment in order to enhance breathability of the sole. At the same time, the waterproof breathable element 40 comprises a waterproof breathable membrane 420 covering the ventilation eyeholes 140. In order to simplify the provision process of the waterproof breathable element 40 on the sole, as shown in FIG. 2, the waterproof breathable element 40 may further comprise a connecting ring 440 which is provided around a periphery of the waterproof breathable membrane 420 and engaged with the waterproof breathable membrane 420; the outsole 10 is further provided with an inserting groove 102 corresponding to a position of the ventilation eyeholes 140, and the waterproof breathable element 40 is received and sealed in the inserting groove 102.

[0043] In this embodiment, the inserting groove 102 penetrates from the top of the outsole 10 to the bottom of the outsole 10. The outsole 10 further comprises an inserting element 120 inserted and sealed in the inserting groove 102. Also the ventilation eyeholes 140 are provided in the inserting element 120 and penetrate from a top of the inserting element 120 to a bottom of the inserting element 120. The waterproof breathable element 40 is over the inserting element 120. With this structure, the bottom of the waterproof breathable membrane 420 may be directly inserted in the inserting element 120 and engaged with a top surface of the inserting element 120; or the bottom of the waterproof breathable membrane 420 is directly insert in the inserting groove 102, and the periphery of the waterproof breathable membrane 420 is engaged with the longitudinal circumferential surface of the inserting groove 102.

[0044] In order to realize that the inserting element 120 is more closely engaged with the inserting groove 102, as shown in FIG. 6 and FIG. 7, a bottom of the inserting groove 102 is further provided with a bottom groove 1020. A periphery of the bottom groove 1020 is larger than a periphery of the inserting groove 102 so that the bottom groove 1020 is connected to the inserting groove 102 to form a step-shaped groove. Under this structure, the inserting element 120 is correspondingly formed as a step shape, that is, the inserting element 120 may comprise a flange 1200 and a base portion 1220, the flange 1200

is formed on the base portion 1220; an outer profile of the flange 1200 is matched with and sealed to the periphery of the inserting groove 102; the periphery of the base portion 1220 is matched with and sealed to the periphery of the bottom groove 1020. Before the inserting element 120 is assembled into the inserting groove 102 of the outsole 10, the outer profile of the flange 1200 of the inserting element 120 is matched with the periphery of the inserting groove 102; the periphery of the base portion 1220 of the inserting element 120 is matched with the periphery of the bottom groove 1020, the waterproof breathable element 40 may be received in the flange 1200 of the inserting element 120, and a periphery of the waterproof breathable element 40 is matched with an inner circumference of the flange 1200.

[0045] Certainly, the flange 1200 may be omitted from the structure of the inserting element 120. Hereby the periphery of the bottom groove 1020 is consistent with the periphery of the inserting groove 102, and thereby the periphery of the inserting element 120 is directly matched with the periphery of the inserting groove 102, thus, the structure is simplified. Moreover, for the inserting element 120, various forms may be used, for example, the flange of the inserting element 120 is changed into a multi-step shape and at the same time the bottom groove 1020 is correspondingly provided as a multi-step shape.

[0046] In the waterproof breathable sole according to the present invention as above, whether it is the semi-inserting type or the full-inserting type, when the waterproof breathable element 40 comprises the connecting ring 440, since the connecting ring 440 has a certain thickness, as shown in FIG. 1, in order to make the connecting ring 440 to be more closely engaged with the inserting groove 102 (for the semi-inserting type) or with the inserting groove 102 and the inserting element 120 (for the full-inserting type), with respect to the semi-inserting type, a recess 104 may be further provided within the inserting groove 102 in the outsole so that the connecting ring 440 is placed in the recess 104 and thus a good engagement relationship is generated. However with respect to the full-inserting type, a recess 1240 may be provided within the flange 1200 of the inserting element 120 so that the connecting ring 440 is placed in the recess 1240 and thus a good engagement relationship is generated. At this time, a gap between the recess 104 or 1240 and the corresponding connecting ring 440 is sealed to prevent water entering into the sole via the ventilation eyeholes 140 and entering into the interior of the sole via the gap.

[0047] It should be noted that, in view of the matching relationship between the inserting groove and the waterproof breathable element in the case of the semi-inserting type and in view of the matching relationship among the inserting groove, the waterproof breathable element, the bottom groove and the inserting element in the case of the full-inserting type, since there is a complementary relationship in structure, these matching structures may

be provided in a reversed manner, which belongs to an equivalently changed embodiment of the present invention.

[0048] In the specific embodiments of the present invention, alternatively, any provision of the inserting groove on the outsole may be cancelled, that is, non-inserting waterproof breathable sole (not shown). In other words, the top of the outsole is flat and no grooves need to be provided, the waterproof breathable element is engaged with and sealed to the outsole via the connecting ring.

[0049] Alternatively, in the semi-inserting type waterproof breathable sole, the inserting groove 102 is cancelled, so that only the recess 104 is provided on the top of the outsole of the waterproof breathable sole so as to match with and receive the connecting ring (herein this recess may be referred to as a ring-shaped recess), the connecting ring is received in and sealed to the ring-shaped recess, so that a snap-in connection is realized in a concave-convex matching manner between the waterproof breathable element and the outsole.

[0050] In the above waterproof breathable sole of the present invention, whether it is a sole of the semi-inserting type structure, the full-inserting type structure and the non-inserting type structure, the waterproof breathable membrane 420 is used to prevent water from infiltration and realize the breathable function, and has at least one layer.

[0051] Moreover, in order to make the waterproof breathable membrane 420 to be more closely engaged with the connecting ring 440, as shown in FIG. 2, an inner circumference of the connecting ring 440 is protruded with a protruding loop 4402, and the waterproof breathable membrane 420 is directly engaged with a surface of the protruding loop 4420.

[0052] In the above waterproof breathable sole according to the present invention, whether it is the semi-inserting type structure, the full-inserting type structure and the non-inserting type structure, the waterproof breathable element 40 may further comprise a cloth layer (not shown in figures), the cloth layer is provided under the waterproof breathable membrane 420 and engaged with the connecting ring 440 along with the waterproof breathable membrane 420. The cloth layer is used to increase the strength and toughness of the waterproof breathable element, so as to prevent the waterproof breathable membrane from tearing out during subjected to a force; at the same time, the cloth layer is further used to function as filtering dirt from external water entering via ventilation eyeholes 140 and removing corresponding bad odor. The cloth layer is preferably non-woven cloth. The cloth layer may be at least one layer.

[0053] In the above waterproof breathable sole according to the present invention, whether it is the semi-inserting type structure, the full-inserting type structure and the non-inserting type structure, the waterproof breathable sole may further comprise a forced-suction and forced-discharge element 60, the forced-suction and forced-dis-

charge element 60 is correspondingly provided over the waterproof breathable element 40. The forced-suction and forced-discharge element 60 comprises a base plate 610 and a plurality of forced-suction and forced-discharge units 600 provided on the base plate 610. Each forced-suction and forced-discharge unit 600 comprises: a top opening 620 provided in a top of the forced-suction and forced-discharge unit; an interior cavity (not shown in figures) provided inside the forced-suction and forced-discharge unit 600 and in gas communication with the top opening 620; a bottom opening 660 provided in a bottom of the forced-suction and forced-discharge unit and in gas communication with the interior cavity and the waterproof breathable element 40.

[0054] The provision of the forced-suction and forced-discharge element 60 will help to enhance the breathability of the sole. When forced-suction and forced-discharge units 600 are subjected to a pressure from a human foot palm, a volume of the interior cavity is compressed, and a gas is forcibly discharged to the outer environment via a gas passage formed by the top opening 620, the interior cavity, the bottom opening 660, passages of the waterproof breathable membrane 40 and the ventilation eyeholes 140. When the foot palm is lifted up, air is forcibly sucked from the outer environment by the forced-suction and forced-discharge unit 600 due to a negative pressure, and thus good ventilation is realized.

[0055] Each forced-suction and forced-discharge unit 620 may be cylindrical shape, spherical shape, conical shape or any combination thereof as long as the above forced-suction and forced-discharge function is realized. Material of each forced-suction and forced-discharge unit may be made from a deformable material, such as rubber.

[0056] Moreover, the plurality of the forced-suction and forced-discharge units 620 is provided to integrally connect with each other, of course, plurality may be also provided to separate from each other; or a part of the plurality of the forced-suction and forced-discharge units 620 is provided to connect with each other and the other part of the plurality of the forced-suction and forced-discharge units 620 is provided to separate from each other. Herein, the connection does not refer that the plurality of the forced-suction and forced-discharge units are connected via the base plate 610 but that two forced-suction and forced-discharge units 620 are connected via side walls thereof.

[0057] In the embodiments shown in FIGs. 1-9, the waterproof breathable element, the forced-suction and forced-discharge element, and ventilation eyehole are provided only on a front foot palm location. They may, of course, be provided on a rear heel location or in a combination manner of these two locations. For a flat foot, the waterproof breathable element, the forced-suction and forced-discharge element, and ventilation eyeholes may be also provided on the whole outsole.

[0058] However, in order to make the provision of the waterproof breathable element, the forced-suction and

forced-discharge element and the ventilation eye-holes in agreement with the human dynamics, as shown in FIG. 10, generally receiving force locations are shown based on the human dynamics. In FIG. 10, reference numeral F indicates a front toe location of a person, reference numeral FO indicates an outer waist side location of the front foot palm, reference numeral FI indicates an inner side location of the front foot palm, and reference numeral B indicates the rear heel location. Therefore, the ventilation eye-holes 140 may be provided on locations of the outsole respectively corresponding to the toe location, the inner side location of the front foot palm, the outer waist side location of the front foot palm and the rear heel location.

[0059] It will be obvious for a person skilled in the art that the present invention may be embodied in several forms without departing from the spirit and essential features thereof. Therefore, in various aspects the above-described embodiments will be considered as exemplary rather limitative. The scope of the present invention should be determined by reasonable explanation of the appended claims, and all changes that fall within equivalent bounds of the present invention will be embraced within the scope of the present invention.

Claims

1. A waterproof breathable sole, comprising:

an outsole (10) provided with ventilation eye-holes (140) in communication with the outer environment; and

a waterproof breathable element (40) comprising a waterproof breathable membrane (420) covering the ventilation eye-holes (140);

characterized in that the waterproof breathable element (40) further comprises a connecting ring (440), the connecting ring (440) is provided around a periphery of the waterproof breathable membrane (420) and engaged with the waterproof breathable membrane (420).

2. The waterproof breathable sole according to claim 1, **characterized in that** the outsole (10) is further provided with an inserting groove (102), the inserting groove (102) corresponds to a position of the ventilation eye-holes (140); the waterproof breathable element (40) is received and sealed in the inserting groove (102); the inserting groove (102) is recessed from a top of the outsole (10) toward an interior of the outsole (10); the ventilation holes (140) penetrate from a bottom of the inserting groove (102) to a bottom of the outsole (10).

3. The waterproof breathable sole according to claim 1, **characterized in that** the outsole (10) is further provided with an inserting groove (102), the inserting

groove (102) corresponds to a position of the ventilation eye-holes (140); the waterproof breathable element (40) is received and sealed in the inserting groove (102); the inserting groove (102) penetrates from a top of the outsole (10) to a bottom of the outsole (10); the outsole (10) further comprises an inserting element (120) inserted and sealed in the inserting groove (102), and the ventilation eye-holes (140) are provided in the inserting element (120) and penetrate from a top of the inserting element (120) to a bottom of the inserting element (120), the waterproof breathable element (40) is over the inserting element (120).

4. The waterproof breathable sole according to claim 2, **characterized in that** the inserting groove (102) is further provided with a recess (104, 1240) therein, the connecting ring (440) is received and sealed in the recess (104, 1240).

5. The waterproof breathable sole according to claim 3, **characterized in that** the bottom of the outsole (10) is further provided with a bottom groove (1020), a periphery of the bottom groove (1020) is larger than a periphery of the inserting groove (102); the inserting element (120) comprises a flange (1200) and a base portion (1220) formed on the base portion (1220); an outer profile of the flange (1200) is matched with and sealed to the periphery of the inserting groove (102); the periphery of the base portion (1220) is matched with and sealed to the periphery of the bottom groove (1020); the ventilation eye-holes (140) are provided in a part of the base portion (1220) locating within the flange (1200) and penetrate from a top of the part to a bottom of the part.

6. The waterproof breathable sole according to claim 4, **characterized in that** a recess is provided within the flange (1200) of the inserting element (120), the connecting ring (440) is received and sealed in the recess (104, 1240).

7. The waterproof breathable sole according to claim 1, **characterized in that** the top of the outsole (10) is flat, the waterproof breathable element (40) is engaged with and sealed to the outsole (10) via the connecting ring (440); or a ring-shape recess is provided on a top of the outsole (10) so as to match with the connecting ring (440), the connecting ring (440) is received in and sealed to the ring-shaped recess.

8. The waterproof breathable sole according to claim 1, **characterized in that** an inner circumference of the connecting ring (440) is protruded with a protruding loop (4402), and the waterproof breathable membrane (420) is engaged with a surface of the protruding loop (4402).

9. The waterproof breathable sole according to claim 1, **characterized in that** the waterproof breathable element (40) further comprises a cloth layer, the cloth layer is provided under the waterproof breathable membrane (420) and engaged with the connecting ring (440) along with the waterproof breathable membrane (420). 5

10. The waterproof breathable sole according to claim 1, **characterized in that** the waterproof breathable sole further comprises: 10

a forced-suction and forced-discharge element (60) correspondingly provided over the waterproof breathable element (40) and comprising a base plate (610) and a plurality of forced-suction and forced-discharge units (600) provided on the base plate (610), each forced-suction and forced-discharge unit (600) comprises: 15

a top opening (620) provided in a top of the forced-suction and forced-discharge unit (600); 20

an interior cavity provided inside the forced-suction and forced-discharge unit (600) and in gas communication with the top opening (620); 25

a bottom opening (660) provided in a bottom of the forced-suction and forced-discharge unit (600) and in gas communication with the interior cavity and the waterproof breathable element (40); 30

wherein the plurality of the forced-suction and forced-discharge units (600) is provided to integrally connect with each other or provided to separate from each other, or a part of the plurality of the forced-suction and forced-discharge units (600) is provided to connect with each other and the other part of the plurality of the forced-suction and forced-discharge units (600) is provided to separate from each other. 35 40

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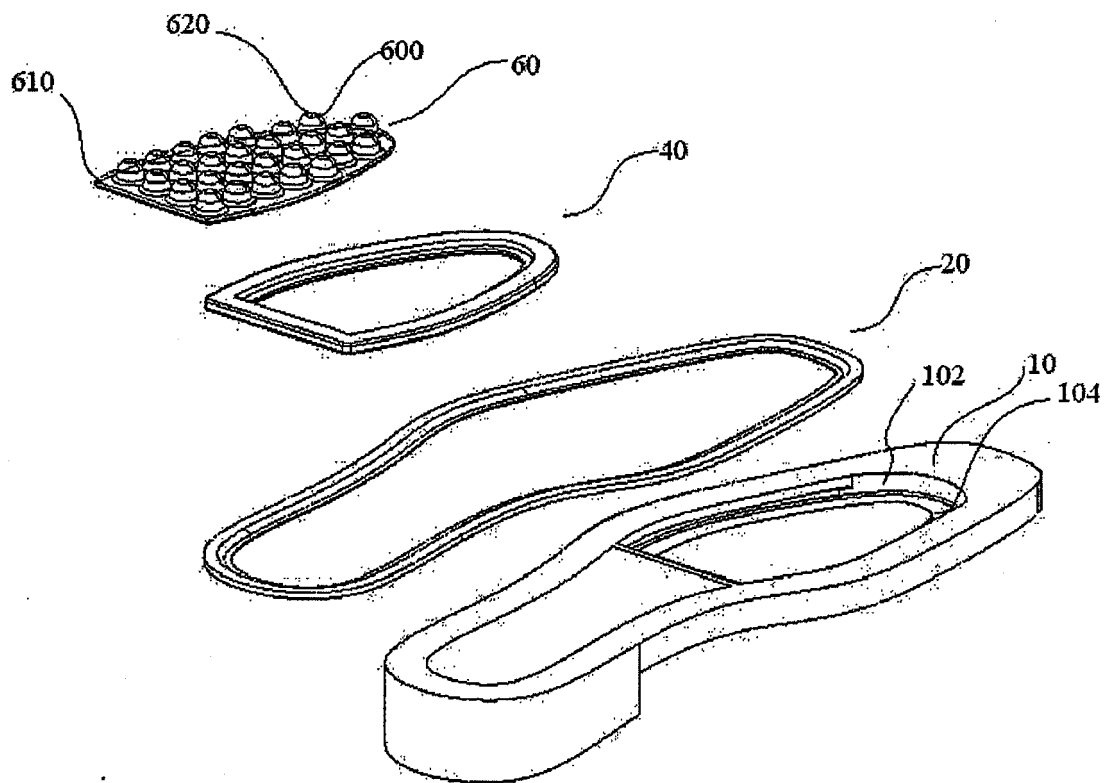


FIG. 1

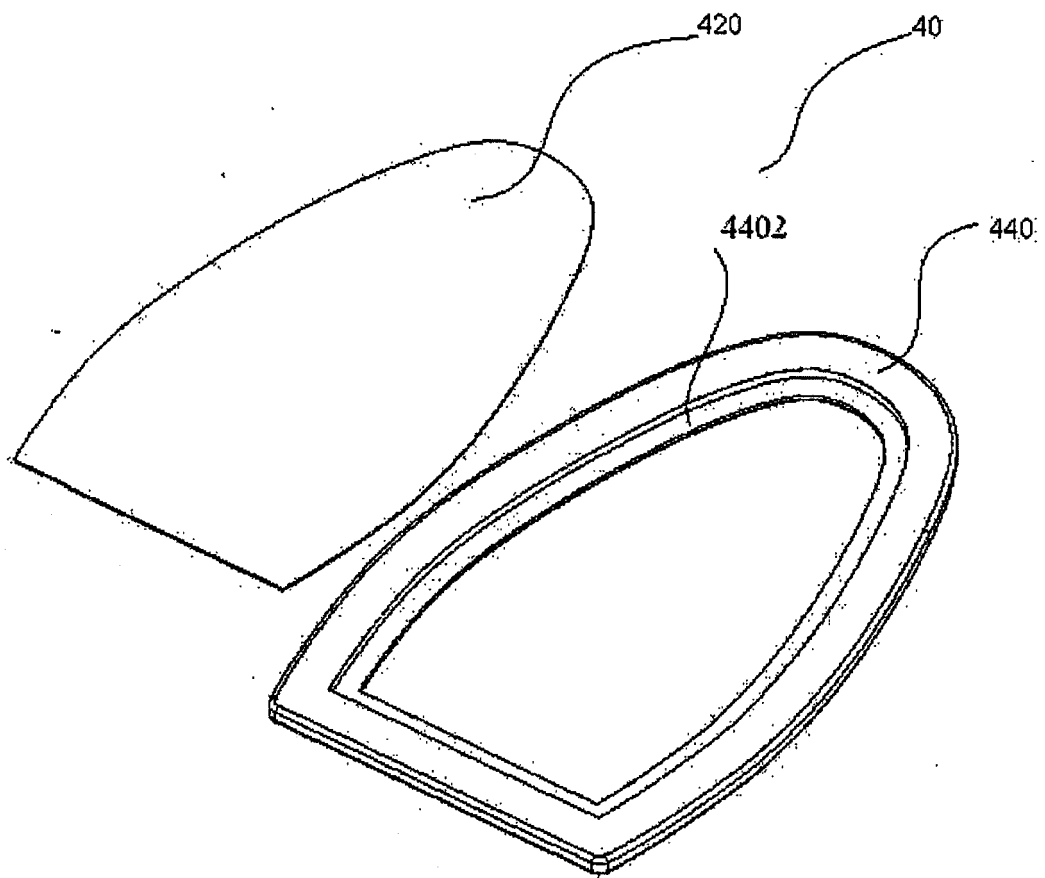


FIG. 2

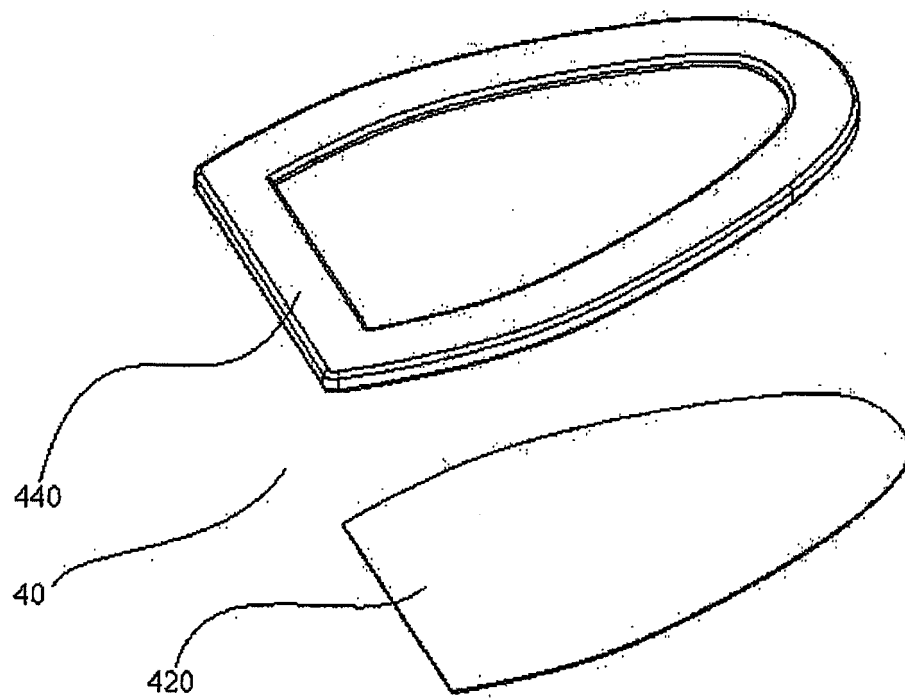


FIG. 3

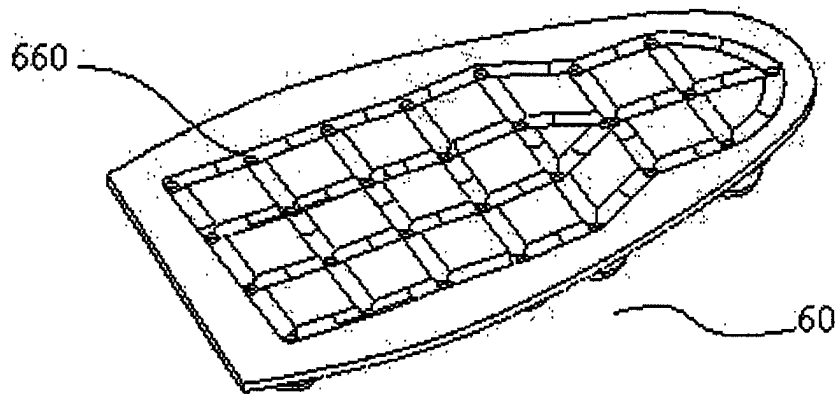


FIG. 4

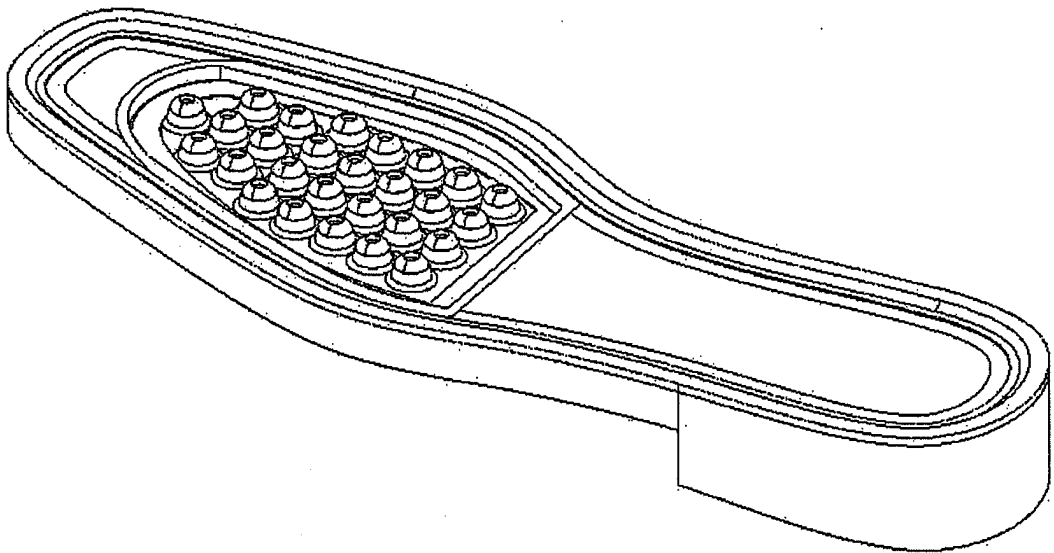


FIG. 5

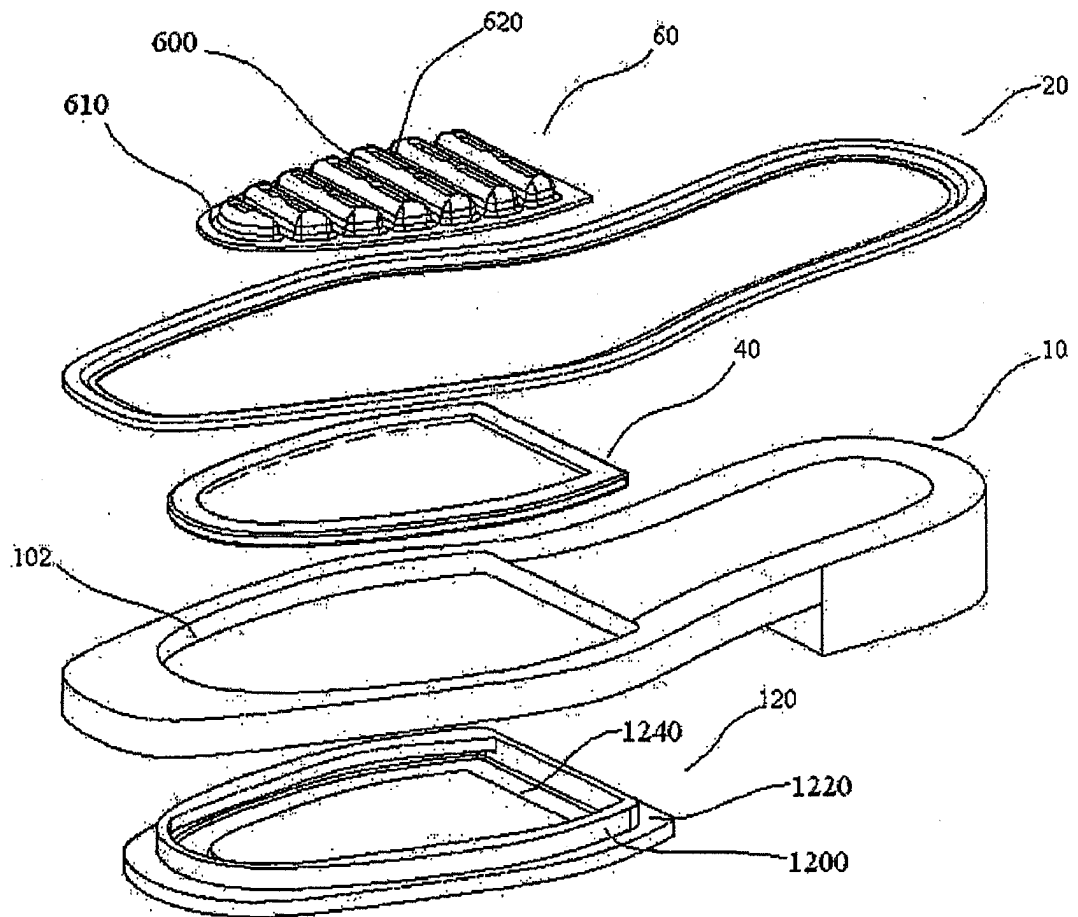


FIG. 6

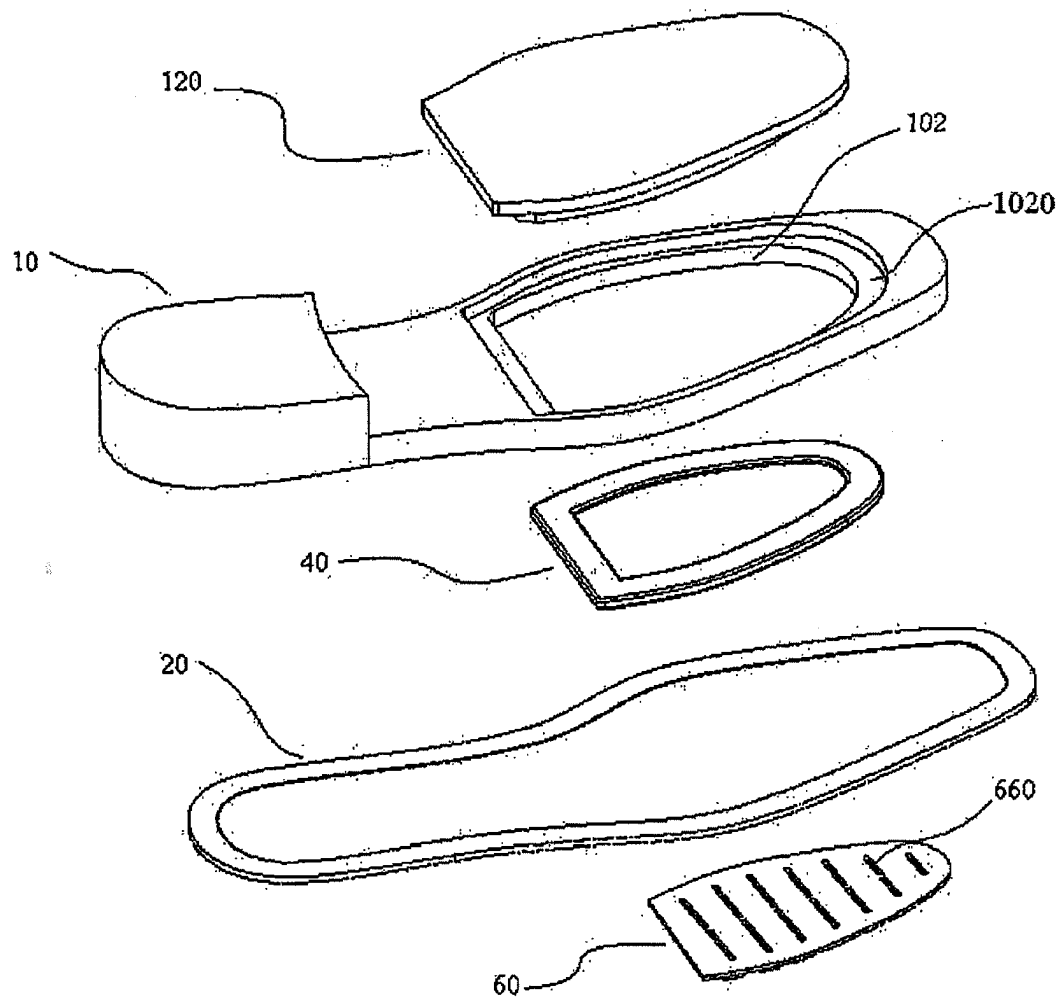


FIG. 7

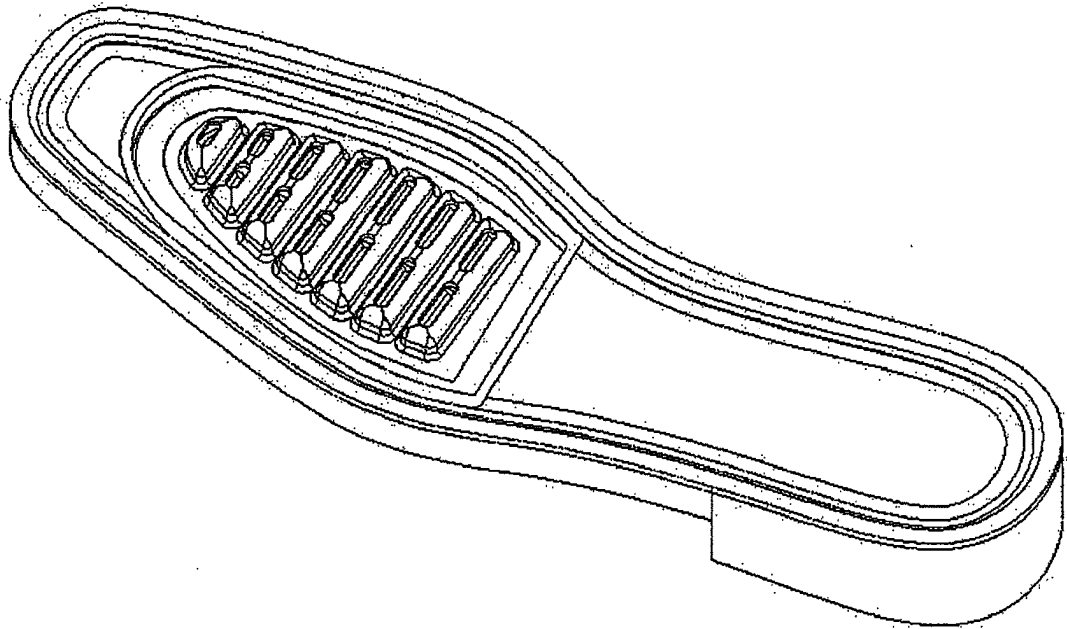


FIG. 8

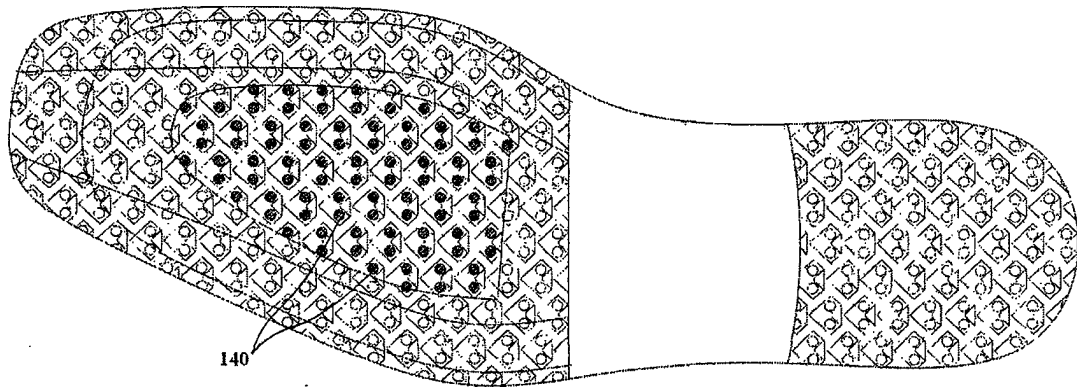


FIG. 9

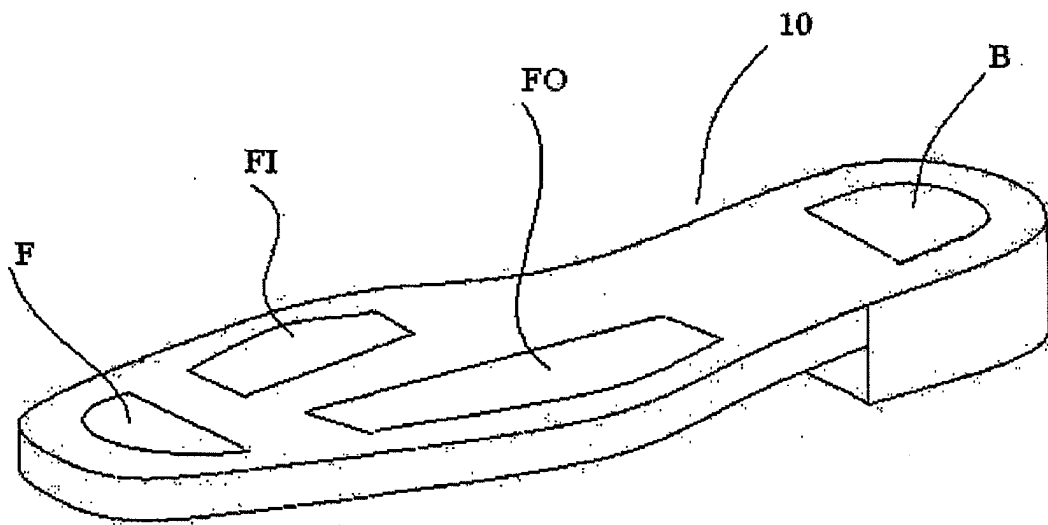


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2011/000453

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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)

IPC: A43B13 A43B7

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

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

CPRSABS; SIPOABS; DWPI; CNKI;

footwear, shoe, sole, waterproof, vent, breathable, permeable, membrane, film, hole, pore, suction, exhaustion

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN201418047Y (WANG, Yifeng) 10 Mar.2010 (10.03.2010), Abstract, Embodiment 1 of Description, Figs. 1-4	1-2,4,7-8
Y		3,5-6,9-10
Y	JP2000166606A (TSUKIHOSHI KASEI KK) 20 Jun.2000 (20.06.2000),description, paragraphs [0023]-[0028], Figs. 1-4	3,5-6,9
Y	WO2008148448A1 (EUROSUOLE SPA) 11 Dec.2008 (11.12.2008),description, page 6 line 5 – page 7 line 15, Figs. 1-3	10
A	CN201234603Y(CHEN, Qixian)13.May 2009 (13.05.2009),the whole document	1-10

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

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“E” earlier application or patent but published on or after the international filing date	“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
“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)	“&”document member of the same patent family
“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	

Date of the actual completion of the international search
26 May 2011(26.05.2011)Date of mailing of the international search report
30 Jun. 2011 (30.06.2011)Name and mailing address of the ISA/CN
The State Intellectual Property Office, the P.R.China
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2011/000453

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN2666223Y(XIA, Yong)29 Dec.2004 (29.12.2004), the whole document	1-10
A	CN2803041Y(LL, Shanghai)09.Aug.2006 (09.08.2006), the whole document	1-10

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2011/000453

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CN2803041Y	09.08.2006	none	

Form PCT/ISA/210 (patent family annex) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2011/000453

Continuation of:

A.CLASSIFICATION OF SUBJECT MATTER

According to International Patent Classification(IPC) or to both national classification and IPC

A43B13/14 (2006.01) i

A43B7/08 (2006.01) i

REFERENCES CITED IN THE DESCRIPTION

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