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(54) Title: TRIATHLON INSOLE

(57) Abstract: An insole which provides cushioning and support to a user's foot subjected to ground forces and/or differing weather conditions encountered during active sports, for example triathlons, is herein disclosed. The insole comprises a base having a bottom side which defines recesses adapted to receive pads and pods having particular properties. The location and materials of the various pads and pods work together to provide ankle and foot stabilization, enhanced cushioning features, and resistance to insole movement during shoe operation.

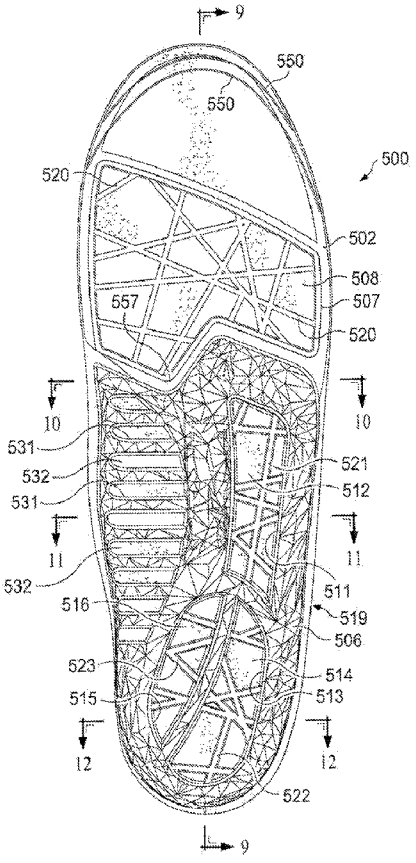

FIG. 5

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TRIATHLON INSOLE

RELATED APPLICATION DATA

[0001] Not applicable.

TECHNICAL FIELD

[0002] The present invention relates to a shoe insole with improved cushioning and support to the foot of a wearer engaging in cross training and triathlon sporting activities.

BACKGROUND OF THE INVENTION

[0003] The human foot is a very complex biological mechanism. The load on the foot at heel strike is typically about one and a half times a person's body weight when a person walks. When running or carrying extra weight, such as a backpack, loads on the foot can exceed three times the body weight. The many bones, muscles, ligaments, and tendons of the foot function to absorb and dissipate the forces of impact, carry the weight of the body and other loads, and provide forces for propulsion. Properly designed shoe insoles can assist the foot in performing these functions and protect the foot from injury.

[0004] Insoles may be custom made to address the specific needs of an individual. They may be made based on casts of the end user's foot or may be made of a thermoplastic material that is molded to the contours of the end user's foot. Like most custom made items, custom insoles tend to be expensive because of the low volume and extensive time needed to make and fit them properly. As such, it is not practical to make such custom made insoles for the general public.

[0005] To be practical for distribution to the general public, an insole must be able to provide benefit to the user without requiring individualized adjustment and fitting. A first type of insole commonly available over-the-counter emphasizes cushioning the foot so as to maximize shock absorption. For typical individuals cushioning insoles perform adequately while engaged in light to moderate activities, such as walking or running. That is, a cushioning insole provides sufficient cushioning and support for such activities. However, for more strenuous or technically challenging activities, such as carrying a heavy backpack or traversing difficult terrain, a typical cushioning insole will not be adequate. Under such conditions, a cushioning insole by itself would not provide enough support and control, and tends to bottom out during use by fully compressing the cushioning insole.

[0006] Another type of over-the-counter insole emphasizes control. Typically, such insoles are made to be relatively stiff and rigid so as to control the bending and twisting of the foot by limiting foot motion. The rigid structure is good at controlling motion, but is not very forgiving. As a result, when motion of the foot reaches a limit imposed by the rigid structure, the load on the foot tends to change abruptly and increases the load on the structures of the foot. Because biological tissues such as tendons and ligaments are sensitive to the rate at which they are loaded, the abrupt change in load causes injury or damage to the foot, ankle or leg.

[0007] In view of the foregoing, it would be desirable to provide an over-the-counter insole that provides both cushioning and control. It would also be desirable to provide an insole that provides both cushioning and control and is practical for use by the general public during cross-training or triathlon-related activities.

[0008] The Applicant has received patents for insoles having a stability cradle and multiple pods located thereon. These patents include U.S. Patent Nos. 7484319, 7665169, 7908768 and 8250784. These patents, however, do not address the possible movement of the insole during shoe operation or provide more enhanced cushioning characteristics to address constant run training, for example for a triathlon.

[0009] There is a present need for a shoe insole that accomplishes the goals to: (1) provide increased ankle and foot stability, (2) cushion the heel and forefoot during push-offs and landings, (3) custom-contour to the inside shape of all running and cross-training shoes, (4) be extremely light, (5) provide enhanced cushioning capabilities and (6) have essentially zero movement or sliding during shoe operation and change-overs.

SUMMARY OF THE INVENTION

[0010] It is also an object of the present invention to provide an insole that provides both cushioning and control and is practical for use by the general public. The above, and other objects and advantages of the present are provided by an insole that provides both motion control and cushioning. The insole includes a system of interacting components that cooperate to achieve a desired combination of foot cushioning and motion control. The components include a foam core, a semi-rigid or rigid stability cradle, and a number of elastomeric pods and pads. The characteristics of the components, their size and shape, and

their position are selected to provide a desired blend of cushioning and control, and more specifically to achieve a desired biomechanical function.

[0011] In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe.

[0012] In a preferred embodiment of the present invention, the components of an insole are permanently affixed to each other to create an insole designed for an intended type or category of activity. Many insole designs can be made to address a broad range of different activities. In one embodiment of the invention, an insole comprises a kit including a number of interchangeable pods having different characteristics. Using such a kit, an end user can selectively change the pods to customize the insole to accommodate a specific activity.

[0013] The current invention is an insole that incorporates, but is not limited to: (1) a faceted stability cradle with transverse stability ribs, (2) plurality of pods, (3) a forefoot pad (4) criss-cross groove patterns on the bottom surface of the pods and forefoot pad, and (5) a jadeite cooling top cloth. The present invention accomplishes the goals to: (1) improve ankle and foot stability, (2) cushion the heel and forefoot during push-offs and landings, (3) help prevent insole movement or sliding during shoe operation and change-overs, and (4) provide enhanced cushioning features to the heel, midfoot, arch and forefoot for running and cross-training exercises.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1 is a exploded bottom perspective view of an illustrative embodiment of an insole in accordance with the principles of the present invention;

[0015] FIG. 2 is a bottom perspective view showing the base of the insole;

[0016] FIG. 3A is a bottom view of the stability cradle;

[0017] FIG. 3B is a bottom perspective view of the stability cradle;

[0018] FIG. 4 is a top (dorsal) view of the insole;

[0019] FIG. 5 bottom (plantar) view of the insole;

[0020] FIG. 6 is a lateral (outer side) view of the insole;

[0021] FIG. 7 is a medial (inner side) view of the insole;

[0022] FIG. 8 is a rear (proximal) view of the insole;

[0023] FIG. 9 is a longitudinal cross sectional view of the insole along 9-9;

[0024] FIG. 10 is a transverse cross sectional view behind the metatarsal area of the insole along 10-10;

[0025] FIG. 11 is a transverse cross sectional view through the arch area of the insole along 11-11;

[0026] FIG. 12 is a transverse cross sectional view through the heel area of the insole along 12-12;

[0027] FIG. 13 is a view of the bones of the foot superimposed on a bottom (plantar) view of the insole;

[0028] FIG. 14 is a bottom view illustrating the various areas of the insole;

[0029] FIGS. 15A-15E illustrate the preferred embodiment or an insole for triathlon racing; and,

[0030] FIGS. 16A-16D illustrate a second preferred embodiment or an insole for triathlon training.

DETAILED DESCRIPTION

[0031] All insoles with a heelcup and a degree of medial longitudinal arch support are likely to provide a modicum (a couple of degrees) of pronation "control." A degree of medical longitudinal and support is just a couple of degrees based on research evidence. By pronation "control," we mean the increase in supination moments acting around the joints of the rearfoot and decrease the magnitude of pronation moments).

[0032] The current invention is an insole that incorporates, but is not limited to: (1) a faceted stability cradle with a plurality of stability ribs, (2) plurality of pods, (3) a forefoot

pad (4) criss-cross groove patterns on the bottom surface of the pods and forefoot pads, and (5) a jadeite cooling top cloth. In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe. The present invention accomplishes the goals to: (1) improve ankle and foot stability, (2) cushion the heel and forefoot during push-offs and landings, (3) help prevent insole movement or sliding during shoe operation and change-overs, and (4) provide enhanced cushioning features to the heel, midfoot, arch and forefoot during running and cross-training exercises.

[0033] In reference to FIGS. 1 through 16, an insole constructed in accordance with the principles of the present invention is disclosed. It should be understood that insoles are generally adapted to be inserted inside a user's shoe. A user's right shoe and left shoe are mirror images of one another as are the insoles adapted to be inserted in a right shoe and a left shoe respectively. Only the left insole is illustrated in the Figures. It will be understood by those of skill in the art that the right insole has a mirror image construction of the left insole.

[0034] The insole of the invention is shaped essentially like the bottom interior of an athletic shoe (and therefore adapted to receive a user's foot which has a generally similar shape when at rest). The insole extends from a heel end (proximal) to a toe end (distal) and has a medial border or side on the arch side of the foot, connecting said toe end to said heel end along the arch side of the insole and a lateral border or side on the other side thereof, connecting said toe end to said heel end on the other side of the insole. The insole also has a forefoot area (area that correlates with the metatarsal and phalanges of the foot), an arch area (along the medial side), a heel area (just forward of the heel end), and a midfoot area (between the heel area and forefoot area).

[0035] As shown in the exploded view of FIG. 1, insole 100 preferably comprises a top sheet 101 and a base 102 having a top surface secured to said top sheet and an opposite

bottom surface. Base 102 also defines a longitudinal arch support 119 that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[0036] Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support that lies under the metatarsal head area of the foot (best shown in FIGS. 4 and 10). The upward extension of transverse arch support pushes up a portion of the top sheet 101 that corresponds to the area of the transverse arch support.

[0037] The bottom surface of base 102 defines a forefoot pad recession area 107 in the forefoot area and a stability cradle recession area 105 along the midfoot and heel areas. The bottom surface of base 102 also defines one or more ribs or protrusions 132 that extend outwardly along the arch area. The ribs 132 are preferably longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. An alternate embodiment has the ribs or protrusions defined by the stability cradle 106 and extending outwardly from the stability cradle 106 in the arch area.

[0038] Base 102 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. As best seen in FIGS. 10-12, the height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[0039] The forefoot pad recession area 107 begins partially proximal form the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area 107 extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area 107 has a rear apex 157 that lies between the 1st and 2nd metatarsals.

[0040] Forefoot pad 108 is shaped essentially the same as forefoot pad recession area 107 and is secured therein. Forefoot pad 108 has a medial edge, a lateral edge, a proximal (back) edge and a distal (front) edge. The medial edge of forefoot pad 108 extends along a line spaced laterally from said medial border of said insole. The proximal edge extends from said medial edge laterally and proximally to said rear apex 157, laterally and distally towards the 3rd metatarsal head, then laterally and proximally to the lateral edge

approximately along the 3rd through 5th metatarsal heads. The lateral edge connects said proximal edge to said top edge of said forefoot pad. In use, forefoot pad recession area 107 and forefoot pad 108 underlie the big toe of a user's foot, and the "ball" of the foot, excluding the first metatarsal head or medial ball of the user's foot. Figure 11 shows the placement of foot bones on the insole.

[0041] An adhesive is be used to secure the components. The forefoot pad 108 provides cushioning and energy return on landing from a vertical jump. It serves as a propulsion pad and support for the metatarsal heads of a user's foot, especially the 1st and 2nd metatarsal heads.

[0042] It is estimated that using tougher materials increases the durability of the insole by 35% to 65% over insoles that use softer materials for this portion of the foot insole.

[0043] The stability cradle recession area 105 is located in the midfoot and heel areas of the bottom surface of base 102. The stability cradle recession area 105 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area 107 to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 106 is shaped essentially the same as stability cradle recession area 105 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 105.

[0044] Stability cradle 106 has walls that wrap up the sides and rear of base 102 to provide support for the foot. Preferably, stability cradle 106 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 106 are preferably higher on the medial side of the foot because of the higher loading. Preferably, stability cradle 106 is made of a nylon material with a hardness of approximately Shore A 95. In a preferred embodiment, the stability cradle is semi-rigid. In an alternate embodiment, the stability cradle is rigid.

[0045] Preferably, the shoe facing surface of stability cradle 106 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping and "change-over" of shoes and running gear to other footwear, or vice versa is a very common practice during

triathlon events and practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[0046] The stability cradle 106 preferably defines one or more rib-shaped openings 131. In a preferred embodiment, the rib-shaped openings 131 allow said ribs 132 of base 102 to extend therethrough. Preferably, base 102 is molded so that the ribs 132 project into rib-shaped openings 131 so that the ribs 132 are approximately flush with the outer surface of stability cradle 106 and mechanically lock stability cradle 106 and base 102 together. Advantageously, the ribs 132 are also able to bulge through rib-shaped openings 131 when base 102 is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs 132 extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-shaped openings 131 allow the stability cradle 106 to be more flexible in the arch area compared to the rest of the stability cradle 106.

[0047] In an alternate embodiment, stability cradle 106 defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The protruding ribs are longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[0048] Stability cradle 106 defines a lateral midfoot pod opening 111 that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. The length of the lateral midfoot pod opening 111 is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. Lateral midfoot pod 112 is shaped essentially the same as lateral midfoot pod opening 111 and is secured to the bottom surface of base 102 within the stability cradle recession area 105 in a location that correlates to the lateral midfoot pod opening 111 and allows lateral midfoot pod 112 to extend out through said lateral midfoot pod opening 111.

[0049] Lateral midfoot pod 112 is preferably made from TPR or PU of a hardness of about 45-50 ASKER C. If TPR is used, a fabric is in turn secured to the base 102 in the lateral

midfoot pod opening 111 of said base 102. The fabric component allows the TPR to properly adhere to the base 102.

[0050] Stability cradle 106 also defines a lateral heel pod opening 113 that extends through the lateral side of the heel area of stability cradle 106 from approximately rearward of the lateral midfoot pod opening 111 toward the heel end. Lateral heel pod 114 is shaped essentially the same as lateral heel pod opening 113 and is secured to the bottom surface of base 102 within the stability cradle recession area 105 in a location that correlates to the lateral heel pod opening 113 and allows lateral heel pod 114 to extend out through said lateral heel pod opening 113. Lateral heel pod 114 has a lateral edge which extends along the lateral border of insole 100 from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod 114 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines.

[0051] The configuration, material and position of the lateral heel pod 114 provides cushioning and works in association with the medial heel pod 115 to stabilize the ankle. The hardness of the lateral heel pod is preferably essentially the same as the lateral midfoot pod, which work in concert to help reduce the incidence of lateral ankle roll-overs. It is preferably made of TPR or PU of a hardness of about Shore C 45-50. If TPR is used, a fabric is in turn secured to the base 102 in the lateral heel pod opening 113 of said base 102. The fabric component allows the TPR to properly adhere to the base 102.

[0052] Stability cradle 106 defines a medial heel pod opening 115 that extends through the heel area along the medial side of heel area on the bottom surface of base 102 just short of the heel end. Medial heel pod 116 is shaped essentially the same as medial heel pod opening 115 and is secured to the bottom surface of base 102 within the stability cradle recession area 105 in a location that correlates to the medial heel pod opening 115 and allows medial heel pod 116 to extend out through said medial heel pod opening 115. The medial heel pod 116 has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod.

[0053] Medial heel pod 116 is preferably made from TPR or PU of a hardness of about 60 ASKER C ±3. If TPR is used, a fabric is in turn secured to the base 102 in the medial heel

pod opening 115 of said base 102. The fabric component allows the TPR to properly adhere to the base 102.

[0054] Foot contact with the ground is generally divided into three phases: heel strike, midfoot support, and toe off. During heel strike, the heel of the foot impacts the ground with significant force. To cushion the impact, lateral heel pod 114 is positioned along the rear and lateral side of the calcaneus (heel bone) and extends outwardly below stability cradle 106. Preferably, lateral heel pod 114 is made of a material having suitable cushioning properties and are selected based on an intended type of activity.

[0055] Following the initial impact of the heel with the ground, the foot twists, or pronates, bringing the medial side of the heel into contact with the ground. The foot is sensitive to the amount of pronation as well as the rate at which the pronation occurs. Pronation is natural, and some degree of pronation is desirable because it serves to absorb the stresses and forces on the foot during walking or running. However, an excessive amount or rate of pronation can result in injury.

[0056] Stability cradle 106 provides firm support along the medial portion of the foot to help control the amount of pronation. Medial heel pod 116 helps to control the rate of pronation by forming medial heel pod 116 out of a material having different characteristics than lateral heel pod 114. For example, to reduce a pronation rate, medial heel pod 116 is made from a firmer material than lateral heel pod 114. A firmer or stiffer material does not compress as much or as fast as a softer material under the same load. Thus, a medial heel pod 116 made from a firmer material would compress less than a lateral heel pod 114 made of a softer material. As a result, medial heel pod 116 tends to resist or counteract pronation and thereby help to reduce the degree and rate of pronation. Conversely, making medial heel pod 116 from a softer material than lateral heel pod 114 would tend to increase the amount and rate of pronation.

[0057] Preferably, the firmness of the material used in medial heel pod 116 is selected based on the firmness of lateral heel pod 114 and on the type of intended activity. For example, the firmness of lateral heel pod 114 and medial heel pod 116 differs by about 20-30 % for an insole to be used during light to moderate activities.

[0058] Carrying a heavy backpack or other articles significantly increases the load on the foot and the rate of pronation during and following heel strike. Accordingly, medial heel

pod 116 is made significantly firmer in an insole designed for use while backpacking. As an example, a difference in firmness of about 20-40% is more appropriate for such activities.

[0059] Lateral midfoot pod 112 provides cushioning and control to the lateral side of the foot during the midstance portion of a step. Typically, lateral midfoot pod 112 is formed of a material having the same properties, e.g., firmness, as lateral heel pod 114. However, a material having different characteristics may also be used.

[0060] The use of dual density heel pods is employed to cause a kinetic change in foot function to promote ankle stability. It is also not out of the scope of the invention to have the medial heel pod softer than the lateral heel pod and/or lateral midfoot pod or any combination thereof to address different joint moments or ankle rolls.

[0061] At the beginning of the propulsion or toe-off phase of a step, the heel begins to lift from the ground and weight shifts to the ball of the foot. Forefoot pad 108 is located under this part of the foot. Preferably, forefoot pad 108 is formed of a relatively resilient material so that energy put into compressing forefoot pad 108 is returned to help propel the foot at toe-off.

[0062] During toe off, the first metatarsal naturally flexes downward. Preventing this natural downward flex of the first metatarsal causes the the arch of the foot to flatten and the foot to over pronate, increasing stress on the ankles and knees. To accommodate the downward flex, the medial portion of forefoot pad 108 extends rearward into a corresponding concave edge portion of the distal edge of stability cradle 106. The shape of the stability cradle 106 and forefoot pad 108 permit the first metatarsal to flex more naturally and thereby encourage loading of the great toe during toe off.

[0063] Base 102 is preferably made of foam or other material having suitable cushioning properties. Preferably, base 102 comprises an Ethylene vinyl acetate ("EVA") foam, which is a copolymer of ethylene and vinyl acetate, or a Thermoplastic Rubber ("TPR")/EVA mix. A preferred EVA or TPR/EVA mix has a durometer (hardness) of about Asker C 45-50.

[0064] Forefoot pad 108 is preferably made from a Thermoplastic Rubber ("TPR") or Polyurethane ("PU"). The hardness of the TPR or PU used in the forefoot pad is preferably about 30 Asker C ±3.

[0065] The forefoot pad 120, lateral midfoot pod 121, lateral heel pod 122, and medial heel pod 123 are constructed with a criss-cross groove pattern on the bottom surface of the pod or pad. The criss-cross groove pattern introduces air gaps into the pod/pad surfaces. Such air gaps and criss-cross groove patterns positively influence the impact absorption properties of each pod and pad. It also allows for use of less material and therefore a lighter insole while still providing the desired cushioning function. Preferably, the forefoot criss-cross groove pattern 120 is approximately 0.75 mm deep. Preferably the lateral midfoot and heel criss-cross groove patterns 121 and 122 are approximately 1.00 to 3.00 mm deep. Preferably, the medial heel criss-cross groove pattern 123 is approximately 1.00 to 2.50 mm deep. Preferably the TPR pods have the deeper criss-cross groove pattern and the PU pods have the shallower criss-cross groove pattern due to the compression characteristics of the materials. The criss-cross groove patterns assists with securing the insole in the shoe cavity and keeping the insole in place such that it will not move or slide around The criss-cross groove pattern also allows for air circulation and/or provides different cushioning and spring properties.

[0066] For a men's size 11-12 insole, the width of the forefoot pad from the medial to lateral side is about 85 to 95 mm. The height is about 100 to 110 mm. The depth is about 0.95 to 1.50 mm.

[0067] It is desirable to minimize the total weight of the insoles by selection of materials working with the structural features of the insole. It is desirable that the total weight of the preferred embodiment of the insole (men's size 10/11) be about 4.0 ounces. It is desirable that the total weight of an alternate embodiment of the insole be about 5.0 to 6.0 ounces for a men's size 10/11 and about 6.5 to 7.5 ounces for a men's size 12/13. Other sizes will be proportional. Using the criss-cross groove pattern designs will help provide a lighter insole.

[0068] In a preferred embodiment, base 102 is covered with top sheet 101 from toe to heel areas of the insole, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 101 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[0069] In a first preferred embodiment of the present invention, the various components of an insole which are secured to base 102 in the recession areas defined by base 102 on the bottom surface are permanently affixed to base 102 using an appropriate means such as an adhesive. The components are also secured during the molding process using techniques known in the art of molding insoles.

[0070] The recession areas can also be lined with a cloth having a base surface and a pad/pod surface, secured to said base along said base surface and said pad/pod along said pad/pod surface. Alternatively, a cloth is secured to pad/pod and then the composite structure secured to the recession area.

[0071] Some shoes may slightly differ in size on the inner part of the shoe. Some shoes may also provide extra padding along the inner sides, front or back of the shoe that alter the actual space provided for the foot and/or an insole on the inner part of the shoe. Base 102 may have sizing guides 150 that allow a user to shorten the length of the insole for proper fit within the shoe, sizing guides 150 provide various cutting guide lines that the user would cut along, preferably with scissors.

[0072] The current invention is an insole that incorporates, but is not limited to: (1) a faceted stability cradle with a plurality of stability ribs, (2) plurality of pods, (3) a forefoot pad (4) criss-cross groove patterns on the bottom surface of the pods and forefoot pads, and (5) a jadeite cooling top cloth. In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe. The present invention accomplishes the goals to: (1) improve ankle and foot stability, (2) cushion the heel and forefoot during push-offs and landings, (3) help prevent insole movement or sliding during shoe operation and change-overs, and (4) provide enhanced cushioning features to the heel, midfoot, arch and forefoot during running and cross-training exercises.

[0073] FIG. 2 illustrates a perspective view of the bottom of base 202 without any pads, pods, or attachments. Base 202 has a top surface and an opposite bottom surface. Base 202 also defines a longitudinal arch support 219 that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[0074] The bottom surface of base 202 defines a forefoot pad recession area 207 in the forefoot area and a stability cradle recession area 205 along the midfoot and heel areas. The bottom surface of base 202 defines one or more ribs or protrusions 232 that extend outwardly along the arch area. The ribs 232 are preferably longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. An alternate embodiment has the ribs or protrusions defined by a stability cradle and extending outwardly from the stability cradle in the arch area.

[0075] Base 202 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. As best seen in FIGS. 10-12, the height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[0076] The forefoot pad recession area 207 begins partially proximal form the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area 207 extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area 207 has a rear apex 257 that lies between the 1st and 2nd metatarsals.

[0077] The stability cradle recession area 205 is located in the midfoot and heel areas of the bottom surface of base 202. The stability cradle recession area 205 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area 207 to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off.

[0078] Base 202 is preferably made of foam or other material having suitable cushioning properties. Preferably, base 202 comprises an Ethylene vinyl acetate ("EVA") foam, which

is a copolymer of ethylene and vinyl acetate, or a Thermoplastic Rubber ("TPR")/EVA mix. A preferred EVA or TPR/EVA mix has a durometer (hardness) of about Asker C 45-50.

[0079] FIGS. 3A and 3B are bottom and perspective views of a stability cradle 306. A stability cradle recession area is located in the midfoot and heel areas of the bottom surface of a base. The stability cradle recession area extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of a forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 306 is shaped essentially the same as the stability cradle recession area and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area.

[0080] Stability cradle 306 has walls that wrap up the sides and rear of the base to provide support for the foot. Preferably, stability cradle 306 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 306 are preferably higher on the medial side of the foot because of the higher loading. Preferably, stability cradle 306 is made of a nylon material with a hardness of approximately Shore A 95. In a preferred embodiment, the stability cradle is semi-rigid. In an alternate embodiment, the stability cradle is rigid.

[0081] Preferably, the shoe facing surface of stability cradle 306 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear to other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improves the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[0082] The stability cradle 306 preferably defines one or more rib-shaped openings 331. In a preferred embodiment, the rib-shaped openings 331 allow ribs on the base to extend therethrough. Advantageously, the ribs are also able to bulge through rib-shaped openings 331 when base is compressed (e.g., while walking or running) to provide additional

cushioning and support to the arch of the foot. The rib-shaped openings 331 allow the stability cradle 306 to be more flexible in the arch area compared to the rest of the stability cradle 306.

[0083] Stability cradle 306 defines a lateral midfoot pod opening 311 that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. The length of the lateral midfoot pod opening 311 is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. The lateral midfoot pod opening 311 is designed to allow a lateral midfoot pod to extend there through.

[0084] Stability cradle 306 also defines a lateral heel pod opening 313 that extends through the lateral side of the heel area of stability cradle 306 from approximately rearward of the lateral midfoot pod opening 311 toward the heel end. Lateral heel pod opening 313 has a lateral edge which extends along the lateral border of insole from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod opening 311. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod opening 313 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines. Lateral heel pod opening 313 is designed to allow a lateral heel pod to extend there through.

[0085] Medial heel pod opening 315 extends through the heel area along the medial side of heel area on the bottom surface of base 302 just short of the heel end. The medial heel pod opening 315 has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod opening. Medial heel pod opening 315 is designed to allow a medial heel pod to extend there through.

[0086] Stability cradle 306 provides firm support along the medial portion of the foot to help control the amount of pronation.

[0087] FIG. 4 is a top view of the insole illustrating the top sheet 401 and transverse arch support 438. Insole 400 comprises a top sheet 401 secured across the entire top surface of the base from toe area to heel area. Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support 438 that lies under the metatarsal head area of the foot. The upward extension of transverse arch support 438 pushes up a portion of the top sheet 401 that corresponds to the area of the transverse arch support 438.

[0088] Traverse arch support 438 preferably lies under the second to fourth metatarsal heads. Traverse arch support 438 provides additional stability and cushioning to the forefoot and middle of the foot.

[0089] In a preferred embodiment, top sheet 401 is a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 401 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi. A series of air holes extend through top sheet 401 and the base to permit air circulation above and below insole 400.

[0090] FIG. 5 illustrates the bottom view of the insole. Insole 500 preferably comprises a top sheet 501 and a base 502 having a top surface secured to said top sheet and an opposite bottom surface. Base 502 also defines a longitudinal arch support 519 that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[0091] The bottom surface of base 502 defines a forefoot pad recession area 507 in the forefoot area and a stability cradle recession area 505 along the midfoot and heel areas. The bottom surface of base 502 also defines one or more ribs or protrusions 532 that extend outwardly along the arch area. The ribs 532 are preferably longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape.

[0092] Base 502 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. As best seen in FIGS. 10-12, the height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[0093] The forefoot pad recession area 507 begins partially proximal form the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area 507 extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial

portion. Preferably the forefoot pad recession area 507 has a rear apex 557 that lies between the 1st and 2nd metatarsals.

[0094] Forefoot pad 508 is shaped essentially the same as forefoot pad recession area 507 and is secured therein. Forefoot pad 508 has a medial edge, a lateral edge, a proximal (back) edge and a distal (front) edge. The medial edge of forefoot pad 508 extends along a line spaced laterally from said medial border of said insole. The proximal edge extends from said medial edge laterally and proximally to said rear apex 557, laterally and distally towards the 3rd metatarsal head, then laterally and proximally to the lateral edge approximately along the 3rd through 5th metatarsal heads. The lateral edge connects said proximal edge to said top edge of said forefoot pad. In use, forefoot pad recession area 507 and forefoot pad 508 underlie the big toe of a user's foot, and the "ball" of the foot, excluding the first metatarsal head or medial ball of the user's foot. Figure 11 shows the placement of foot bones on the insole.

[0095] An adhesive is used to secure the components. The forefoot pad 508 provides cushioning and energy return on landing from a vertical jump. It serves as a propulsion pad and support for the metatarsal heads of a user's foot, especially the 1st and 2nd metatarsal heads.

[0096] It is estimated that using tougher materials increase the durability of the insole by 35% to 65% over insoles that use softer materials for this portion of the foot insole.

[0097] The stability cradle recession area 505 is located in the midfoot and heel areas of the bottom surface of base 502. The stability cradle recession area 505 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area 507 to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 506 is shaped essentially the same as stability cradle recession area 505 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 505.

[0098] Stability cradle 506 has walls that wrap up the sides and rear of base 502 to provide support for the foot. Preferably, stability cradle 506 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of

stability cradle 506 are preferably higher on the medial side of the foot because of the higher loading. Preferably, stability cradle 506 is made of a nylon material with a hardness of approximately Shore A 95. In a preferred embodiment, the stability cradle is semi-rigid. In an alternate embodiment, the stability cradle is rigid.

[0099] Preferably, the shoe facing surface of stability cradle 506 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear to other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00100] The stability cradle 506 preferably defines one or more rib-shaped openings 531. In a preferred embodiment, the rib-shaped openings 531 allow said ribs 532 of base 502 to extend therethrough. Preferably, base 502 is molded so that the ribs 532 project into rib-shaped openings 531 so that the ribs 532 are approximately flush with the outer surface of stability cradle 506 and mechanically lock stability cradle 506 and base 502 together. Advantageously, the ribs 532 are also able to bulge through rib-shaped openings 531 when base 502 is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs 532 extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-shaped openings 531 allow the stability cradle 506 to be more flexible in the arch area compared to the rest of the stability cradle 506.

[00101] In an alternate embodiment, stability cradle 506 defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The protruding ribs are longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[00102] Stability cradle 506 defines a lateral midfoot pod opening 511 that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. The

length of the lateral midfoot pod opening 511 is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. Lateral midfoot pod 512 is shaped essentially the same as lateral midfoot pod opening 511 and is secured to the bottom surface of base 502 within the stability cradle recession area 505 in a location that correlates to the lateral midfoot pod opening 511 and allows lateral midfoot pod 512 to extend out through said lateral midfoot pod opening 511.

[00103] Lateral midfoot pod 512 is preferably made from TPR or PU of a hardness of about 45-50 ASKER C. If TPR is used, a fabric is in turn secured to the base 502 in the lateral midfoot pod opening 511 of said base 502. The fabric component allows the TPR to properly adhere to the base 502.

[00104] In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe.

[00105] Stability cradle 506 also defines a lateral heel pod opening 513 that extends through the lateral side of the heel area of stability cradle 506 from approximately rearward of the lateral midfoot pod opening 511 toward the heel end. Lateral heel pod 514 is shaped essentially the same as lateral heel pod opening 513 and is secured to the bottom surface of base 502 within the stability cradle recession area 505 in a location that correlates to the lateral heel pod opening 513 and allows lateral heel pod 514 to extend out through said lateral heel pod opening 513. Lateral heel pod 514 has a lateral edge which extends along the lateral border of insole 500 from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod 514 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines.

[00106] The configuration, material and position of the lateral heel pod 514 provides cushioning and works in association with the medial heel pod 515 to stabilize the ankle. The hardness of the lateral heel pod is preferably essentially the same as the lateral midfoot pod, which work in concert to help reduce the incidence of lateral ankle roll-overs. It is preferably made of TPR or PU of a hardness of about Shore C 45-50. If TPR is used, a fabric is in turn secured to the base 502 in the lateral heel pod opening 511 of said base 502. The fabric component allows the TPR to properly adhere to the base 502.

[00107] Stability cradle 506 defines a medial heel pod opening 515 that extends through the heel area along the medial side of heel area on the bottom surface of base 502 just short of the heel end. Medial heel pod 516 is shaped essentially the same as medial heel pod opening 515 and is secured to the bottom surface of base 502 within the stability cradle recession area 505 in a location that correlates to the medial heel pod opening 515 and allows medial heel pod 516 to extend out through said medial heel pod opening 515. The medial heel pod 516 has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod.

[00108] Medial heel pod 516 is preferably made from TPR or PU of a hardness of about 60 ASKER C ±3. If TPR is used, a fabric is in turn secured to the base 502 in the medial heel pod opening 515 of said base 502. The fabric component allows the TPR to properly adhere to the base 502.

[00109] Foot contact with the ground is generally divided into three phases: heel strike, midfoot support, and toe off. During heel strike, the heel of the foot impacts the ground with significant force. To cushion the impact, lateral heel pod 514 is positioned along the rear and lateral side of the calcaneus (heel bone) and extends outwardly below stability cradle 506. Preferably, lateral heel pod 514 is made of a material having suitable cushioning properties and are selected based on an intended type of activity.

[00110] Following the initial impact of the heel with the ground, the foot twists, or pronates, bringing the medial side of the heel into contact with the ground. The foot is sensitive to the amount of pronation as well as the rate at which the pronation occurs. Pronation is natural, and some degree of pronation is desirable because it serves to absorb the stresses and forces on the foot during walking or running. However, an excessive amount or rate of pronation results in injury.

[00111] Stability cradle 506 provides firm support along the medial portion of the foot to help control the amount of pronation. Medial heel pod 516 helps to control the rate of pronation by forming medial heel pod 516 out of a material having different characteristics than lateral heel pod 514. For example, to reduce a pronation rate, medial heel pod 516 can be made from a firmer material than lateral heel pod 514. A firmer or stiffer material does not compress as much or as fast as a softer material under the same load. Thus, a medial heel pod 516 made from a firmer material would compress less than a lateral heel pod 514 made of a softer material. As a result, medial heel pod 516 tends to resist or counteract pronation and thereby help to reduce the degree and rate of pronation. Conversely, making medial heel pod 516 from a softer material than lateral heel pod 514 would tend to increase the amount and rate of pronation.

[00112] Preferably, the firmness of the material used in medial heel pod 516 is selected based on the firmness of lateral heel pod 514 and on the type of intended activity. For example, the firmness of lateral heel pod 514 and medial heel pod 516 differs by about 20-30 % for an insole to be used during light to moderate activities.

[00113] Carrying a heavy backpack or other articles significantly increases the load on the foot and the rate of pronation during and following heel strike. Accordingly, medial heel pod 516 can be made significantly firmer in an insole designed for use while backpacking. As an example, a difference in firmness of about 20-40% is more appropriate for such activities.

[00114] Lateral midfoot pod 512 provides cushioning and control to the lateral side of the foot during the midstance portion of a step. Typically, lateral midfoot pod 512 is formed of a material having the same properties, e.g., firmness, as lateral heel pod 514. However, a material having different characteristics can also be used.

[00115] The use of dual density heel pods is employed to cause a kinetic change in foot function to promote ankle stability. It is also not out of the scope of the invention to have the medial heel pod softer than the lateral heel pod and/or lateral midfoot pod or any combination thereof to address different joint moments or ankle rolls.

[00116] At the beginning of the propulsion or toe-off phase of a step, the heel begins to lift from the ground and weight shifts to the ball of the foot. Forefoot pad 508 is located under this part of the foot. Preferably, forefoot pad 508 is formed of a relatively resilient material

so that energy put into compressing forefoot pad 508 is returned to help propel the foot at toe-off.

[00117] During toe off, the first metatarsal naturally flexes downward. Preventing this natural downward flex of the first metatarsal causes the arch of the foot to flatten and the foot to over pronate, increasing stress on the ankles and knees. To accommodate the downward flex, the medial portion of forefoot pad 508 extends rearward into a corresponding concave edge portion of the distal edge of stability cradle 506. The shape of the stability cradle 506 and forefoot pad 508 permit the first metatarsal to flex more naturally and thereby encourage loading of the great toe during toe off.

[00118] Base 502 is preferably made of foam or other material having suitable cushioning properties. Preferably, base 502 comprises an Ethylene vinyl acetate ("EVA") foam, which is a copolymer of ethylene and vinyl acetate, or a Thermoplastic Rubber ("TPR")/EVA mix. A preferred EVA or TPR/EVA mix has a durometer (hardness) of about Asker C 45-50.

[00119] Forefoot pad 508 is preferably made from a Thermoplastic Rubber ("TPR") or Polyurethane ("PU"). The hardness of the TPR or PU used in the forefoot pad is preferably about 30 Asker C ±3.

[00120] The forefoot pad 520, lateral midfoot pod 521, lateral heel pod 522, and medial heel pod 523 are constructed with a criss-cross groove pattern on the bottom surface of the pod or pad. The criss-cross groove pattern introduces air gaps into the pod/pad surfaces. Such air gaps and criss-cross groove patterns positively influence the impact absorption properties. It also allows for use of less material and therefore a lighter insole while still providing the desired cushioning function. Preferably, the forefoot criss-cross groove pattern 520 is approximately 0.75 mm deep. Preferably the lateral midfoot and heel criss-cross groove patterns 521 and 522 are approximately 1.00 to 3.00 mm deep. Preferably, the medial heel criss-cross groove pattern 523 is approximately 1.00 to 2.50 mm deep. Preferably the TPR pods have the deeper criss-cross groove pattern and the PU pods have the shallower criss-cross groove pattern due to the compression characteristics of the materials. The criss-cross groove patterns also assists with keeping the insole in place and not move or slide around within the shoe.

[00121] For a men's size 11-12 insole, the width of the forefoot pad from the medial to lateral side is about 85 to 95 mm. The height is about 100 to 110 mm. The depth is about 0.95 to 1.50 mm.

[00122] It is desirable to minimize the total weight of the insoles by selection of materials working with the structural features of the insole. It is desirable that the total weight of the preferred embodiment of the insole (men's size 10/11) be about 4.0 ounces. It is desirable that the total weight of an alternate embodiment of the insole be about 5.0 to 6.0 ounces for a men's size 10/11 and about 6.5 to 7.5 ounces for a men's size 12/13. Other sizes will be proportional. Using the open-cell designs will provide for a lighter insole.

[00123] In a first preferred embodiment of the present invention, the various components of an insole which are secured to base 502 in the recession areas defined by base 502 on the bottom surface are permanently affixed to base 502 using an appropriate means such as an adhesive. The components are secured during the molding process using techniques known in the art of molding insoles.

[00124] The recession areas also is lined with a cloth having a base surface and a pad/pod surface, secured to said base along said base surface and said pad/pod along said pad/pod surface. Alternatively, a cloth is secured to pad/pod and then the composite structure secured to the recession area.

[00125] Some shoes may slightly differ in size on the inner part of the shoe. Some shoes may also provide extra padding along the inner sides, front or back of the shoe that alter the actual space provided for the foot and/or an insole on the inner part of the shoe. Base 502 may have sizing guides 550 that allow a user to shorten the length of the insole for proper fit within the shoe, sizing guides 550 provide various cutting guide lines that the user would cut along, preferably with scissors.

[00126] FIG. 6 illustrates a lateral side view of the insole. Insole 600 preferably comprises a top sheet 601 and a base 602 having a top surface secured to said top sheet 601 and an opposite bottom surface. Base 602 also defines a longitudinal arch support 619 that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[00127] The bottom surface of base 602 defines a forefoot pad recession area in the forefoot area and a stability cradle recession area 605 along the midfoot and heel areas.

[00128] Base 602 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. The height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00129] The forefoot pad recession area begins partially proximal from the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area has a rear apex that lies between the 1st and 2nd metatarsals. A forefoot pad is shaped essentially the same as forefoot pad recession area and is secured therein.

[00130] The stability cradle recession area 605 is located in the midfoot and heel areas of the bottom surface of base 602. The stability cradle recession area 605 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area 607 to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 606 is shaped essentially the same as stability cradle recession area 605 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 605.

[00131] Stability cradle 606 has walls that wrap up the sides and rear of base 602 to provide support for the foot. Preferably, stability cradle 606 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 606 are preferably higher on the medial side of the foot because of the higher loading.

[00132] Preferably, the shoe facing surface of stability cradle 606 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear to other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted

design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00133] Stability cradle 606 defines a lateral midfoot pod opening that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. A lateral midfoot pod 612 is shaped essentially the same as lateral midfoot pod opening and is secured to the bottom surface of base 602 within the stability cradle recession area 605 in a location that correlates to the lateral midfoot pod opening and allows lateral midfoot pod 612 to extend out through said lateral midfoot pod opening.

[00134] Stability cradle 606 also defines a lateral heel pod opening that extends through the lateral side of the heel area of stability cradle 606 from approximately rearward of the lateral midfoot pod opening toward the heel end. Lateral heel pod 614 is shaped essentially the same as lateral heel pod opening and is secured to the bottom surface of base 602 within the stability cradle recession area 605 in a location that correlates to the lateral heel pod opening and allows lateral heel pod 614 to extend out through said lateral heel pod opening.

[00135] Stability cradle 606 defines a medial heel pod opening that extends through the heel area along the medial side of heel area on the bottom surface of base 602 just short of the heel end. Medial heel pod is shaped essentially the same as medial heel pod opening and is secured to the bottom surface of base 602 within the stability cradle recession area 605 in a location that correlates to the medial heel pod opening and allows medial heel pod to extend out through said medial heel pod opening.

[00136] In a preferred embodiment, base 602 is covered with top sheet 601, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 601 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00137] Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support 638 that lies under the metatarsal head area of the foot. The upward

extension of transverse arch support 638 pushes up a portion of the top sheet 601 that corresponds to the area of the transverse arch support 638.

[00138] Traverse arch support 638 preferably lies under the second to fourth metatarsal heads. Traverse arch support 638 provides additional stability and cushioning to the forefoot and middle of the foot.

[00139] FIG. 7 illustrates a medial side view of the insole. Insole 700 preferably comprises a top sheet 701 and a base 702 having a top surface secured to said top sheet and an opposite bottom surface. Base 702 also defines a longitudinal arch support 719 that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[00140] The bottom surface of base 702 defines a forefoot pad recession area in the forefoot area and a stability cradle recession area 705 along the midfoot and heel areas. The bottom surface of base 702 also defines one or more ribs or protrusions 732 that extend outwardly along the arch area. The ribs 732 are preferably longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape.

[00141] Base 702 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. The height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00142] The forefoot pad recession area begins partially proximal from the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area has a rear apex that lies between the 1st and 2nd metatarsals. A forefoot pad is shaped essentially the same as forefoot pad recession area and is secured therein.

[00143] The stability cradle recession area 705 is located in the midfoot and heel areas of the bottom surface of base 702. The stability cradle recession area 705 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to

accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 706 is shaped essentially the same as stability cradle recession area 705 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 705.

[00144] Stability cradle 706 has walls that wrap up the sides and rear of base 702 to provide support for the foot. Preferably, stability cradle 706 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 706 are preferably higher on the medial side of the foot because of the higher loading.

[00145] Preferably, the shoe facing surface of stability cradle 706 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear with other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00146] The stability cradle 706 preferably defines one or more rib-shaped openings 731. In a preferred embodiment, the rib-shaped openings 731 allow said ribs 732 of base 702 to extend therethrough. Preferably, base 702 is molded so that the ribs 732 project into rib-shaped openings 731 so that the ribs 732 are approximately flush with the outer surface of stability cradle 706 and mechanically lock stability cradle 706 and base 702 together. Advantageously, the ribs 732 are also able to bulge through rib-shaped openings 731 when base 702 is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs 732 extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-shaped openings 731 allow the stability cradle 706 to be more flexible in the arch area compared to the rest of the stability cradle 706.

[00147] In an alternate embodiment, stability cradle 706 defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The

protruding ribs are longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[00148] Stability cradle 706 defines a lateral midfoot pod opening that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. A lateral midfoot pod is shaped essentially the same as lateral midfoot pod opening and is secured to the bottom surface of base 702 within the stability cradle recession area 705 in a location that correlates to the lateral midfoot pod opening and allows lateral midfoot pod to extend out through said lateral midfoot pod opening.

[00149] Stability cradle 706 also defines a lateral heel pod opening that extends through the lateral side of the heel area of stability cradle 706 from approximately rearward of the lateral midfoot pod opening toward the heel end. Lateral heel pod is shaped essentially the same as lateral heel pod opening and is secured to the bottom surface of base 702 within the stability cradle recession area 705 in a location that correlates to the lateral heel pod opening and allows lateral heel pod to extend out through said lateral heel pod opening.

[00150] Stability cradle 706 defines a medial heel pod opening that extends through the heel area along the medial side of heel area on the bottom surface of base 702 just short of the heel end. Medial heel pod 716 is shaped essentially the same as medial heel pod opening and is secured to the bottom surface of base 702 within the stability cradle recession area 705 in a location that correlates to the medial heel pod opening and allows medial heel pod 716 to extend out through said medial heel pod opening.

[00151] In a preferred embodiment, base 702 is covered with top sheet 701, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 701 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00152] Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support 738 that lies under the metatarsal head area of the foot. The upward

extension of transverse arch support 738 pushes up a portion of the top sheet 701 that corresponds to the area of the transverse arch support 738.

[00153] Traverse arch support 738 preferably lies under the second to fourth metatarsal heads. Traverse arch support 738 provides additional stability and cushioning to the forefoot and middle of the foot.

[00154] FIG. 8 illustrates a rear view of the insole. Insole 800 preferably comprises a top sheet 801 and a base 802 having a top surface secured to said top sheet and an opposite bottom surface. Base 802 also defines a longitudinal arch support 819 that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[00155] The bottom surface of base 802 defines a forefoot pad recession area in the forefoot area and a stability cradle recession area 805 along the midfoot and heel areas. The bottom surface of base 802 also define one or more ribs or protrusions 832 that extend outwardly along the arch area. The ribs 832 are preferably longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. An alternate embodiment has the ribs or protrusions defined by the stability cradle 806 and extending outwardly from the stability cradle 806 in the arch area.

[00156] Base 802 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. The height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00157] The forefoot pad recession area begins partially proximal from the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area has a rear apex that lies between the 1st and 2nd metatarsals. A forefoot pad is shaped essentially the same as forefoot pad recession area and is secured therein.

[00158] The stability cradle recession area 805 is located in the midfoot and heel areas of the bottom surface of base 802. The stability cradle recession area 805 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the

base and from a distal edge slightly proximal of the forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 806 is shaped essentially the same as stability cradle recession area 805 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 805.

[00159] Stability cradle 806 has walls that wrap up the sides and rear of base 802 to provide support for the foot. Preferably, stability cradle 806 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 806 are preferably higher on the medial side of the foot because of the higher loading.

[00160] Preferably, the shoe facing surface of stability cradle 806 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear with other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improves the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00161] The stability cradle 806 preferably defines one or more rib-shaped openings 831. In a preferred embodiment, the rib-shaped openings 831 allow said ribs 832 of base 802 to extend therethrough. Preferably, base 802 is molded so that the ribs 832 project into rib-shaped openings 831 so that the ribs 832 are approximately flush with the outer surface of stability cradle 806 and mechanically lock stability cradle 806 and base 802 together. Advantageously, the ribs 832 are also able to bulge through rib-shaped openings 831 when base 802 is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs 832 extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-shaped openings 831 allow the stability cradle 806 to be more flexible in the arch area compared to the rest of the stability cradle 806.

[00162] In an alternate embodiment, stability cradle 806 defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The protruding ribs are longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[00163] Stability cradle 806 defines a lateral midfoot pod opening that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. A lateral midfoot pod is shaped essentially the same as lateral midfoot pod opening and is secured to the bottom surface of base 802 within the stability cradle recession area 805 in a location that correlates to the lateral midfoot pod opening and allows lateral midfoot pod to extend out through said lateral midfoot pod opening.

[00164] Stability cradle 806 also defines a lateral heel pod opening that extends through the lateral side of the heel area of stability cradle 806 from approximately rearward of the lateral midfoot pod opening toward the heel end. Lateral heel pod 814 is shaped essentially the same as lateral heel pod opening and is secured to the bottom surface of base 802 within the stability cradle recession area 805 in a location that correlates to the lateral heel pod opening and allows lateral heel pod 814 to extend out through said lateral heel pod opening.

[00165] Stability cradle 806 defines a medial heel pod opening that extends through the heel area along the medial side of heel area on the bottom surface of base 802 just short of the heel end. Medial heel pod 816 is shaped essentially the same as medial heel pod opening and is secured to the bottom surface of base 802 within the stability cradle recession area 805 in a location that correlates to the medial heel pod opening and allows medial heel pod 816 to extend out through said medial heel pod opening.

[00166] In a preferred embodiment, base 802 is covered with top sheet 801, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 801 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00167] FIG. 9 is a section view 9-9 along the middle of the insole as identified in FIGS. 4 and 5. Insole 900 preferably comprises a top sheet 901 and a base 902 having a top surface secured to said top sheet 901 and an opposite bottom surface. The bottom surface of base 902 defines a forefoot pad recession area 907 in the forefoot area and a stability cradle recession area 905 along the midfoot and heel areas.

[00168] Base 902 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. As best seen in FIGS. 10-12, the height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00169] Preferably, the top surface of the base 902 defines an upwardly-extending portion or transverse arch support 938 that lies under the metatarsal head area of the foot. The upward extension of transverse arch support 938 pushes up a portion of the top sheet 901 that corresponds to the area of the transverse arch support 938. Traverse arch support 938 preferably lies under the second to fourth metatarsal heads. Traverse arch support 938 provides additional stability and cushioning to the forefoot and middle of the foot.

[00170] The forefoot pad recession area 907 begins partially proximal form the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area 907 extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area 907 has a rear apex that lies between the 1st and 2nd metatarsals.

[00171] Forefoot pad 908 is shaped essentially the same as forefoot pad recession area 907 and is secured therein. Forefoot pad 908 has a medial edge, a lateral edge, a proximal (back) edge and a distal (front) edge. The medial edge of forefoot pad 908 extends along a line spaced laterally from said medial border of said insole. The proximal edge extends from said medial edge laterally and proximally to said rear apex 957, laterally and distally towards the 3rd metatarsal head, then laterally and proximally to the lateral edge approximately along the 3rd through 5th metatarsal heads. The lateral edge connects said proximal edge to said top edge of said forefoot pad. In use, forefoot pad recession area 907 and forefoot pad 908 underlie the big toe of a user's foot, and the "ball" of the foot,

excluding the first metatarsal head or medial ball of the user's foot. Figure 11 shows the placement of foot bones on the insole.

[00172] An adhesive is be used to secure the components. The forefoot pad 908 provides cushioning and energy return on landing from a vertical jump. It serves as a propulsion pad and support for the metatarsal heads of a user's foot, especially the 1st and 2nd metatarsal heads.

[00173] It is estimated that using tougher materials increases the durability of the insole by 35% to 65% over insoles that use softer materials for this portion of the foot insole.

[00174] The stability cradle recession area 905 is located in the midfoot and heel areas of the bottom surface of base 902. The stability cradle recession area 905 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area 907 to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 906 is shaped essentially the same as stability cradle recession area 905 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 905.

[00175] Stability cradle 906 has walls that wrap up the sides and rear of base 902 to provide support for the foot.

[00176] Preferably, the shoe facing surface of stability cradle 906 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear with other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improves the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00177] In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an

insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe.

[00178] Stability cradle 906 defines a lateral midfoot pod opening that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. The length of the lateral midfoot pod opening is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. Lateral midfoot pod is shaped essentially the same as lateral midfoot pod opening and is secured to the bottom surface of base 902 within the stability cradle recession area 905 in a location that correlates to the lateral midfoot pod opening and allows lateral midfoot pod to extend out through said lateral midfoot pod opening.

[00179] Stability cradle 906 also defines a lateral heel pod opening 913 that extends through the lateral side of the heel area of stability cradle 906 from approximately rearward of the lateral midfoot pod opening 911 toward the heel end. Lateral heel pod 914 is shaped essentially the same as lateral heel pod opening 913 and is secured to the bottom surface of base 902 within the stability cradle recession area 905 in a location that correlates to the lateral heel pod opening 913 and allows lateral heel pod 914 to extend out through said lateral heel pod opening 913. Lateral heel pod 914 has a lateral edge which extends along the lateral border of insole 900 from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod 914 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines.

[00180] The configuration, material and position of the lateral heel pod 914 provides cushioning and works in association with the medial heel pod 915 to stabilize the ankle.

[00181] Stability cradle 906 defines a medial heel pod opening 915 that extends through the heel area along the medial side of heel area on the bottom surface of base 902 just short of the heel end. Medial heel pod 916 is shaped essentially the same as medial heel pod

opening 915 and is secured to the bottom surface of base 902 within the stability cradle recession area 905 in a location that correlates to the medial heel pod opening 915 and allows medial heel pod 916 to extend out through said medial heel pod opening 915. The medial heel pod 916 has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod.

[00182] Foot contact with the ground is generally divided into three phases: heel strike, midfoot support, and toe off. During heel strike, the heel of the foot impacts the ground with significant force. To cushion the impact, lateral heel pod 914 is positioned along the rear and lateral side of the calcaneus (heel bone) and extends outwardly below stability cradle 906. Preferably, lateral heel pod 914 is made of a material having suitable cushioning properties and are selected based on an intended type of activity.

[00183] Following the initial impact of the heel with the ground, the foot twists, or pronates, bringing the medial side of the heel into contact with the ground. The foot is sensitive to the amount of pronation as well as the rate at which the pronation occurs. Pronation is natural, and some degree of pronation is desirable because it serves to absorb the stresses and forces on the foot during walking or running. However, an excessive amount or rate of pronation results in injury.

[00184] Stability cradle 906 provides firm support along the medial portion of the foot to help control the amount of pronation. Medial heel pod 916 helps to control the rate of pronation by forming medial heel pod 916 out of a material having different characteristics than lateral heel pod 914. For example, to reduce a pronation rate, medial heel pod 916 is made from a firmer material than lateral heel pod 914. A firmer or stiffer material does not compress as much or as fast as a softer material under the same load. Thus, a medial heel pod 916 made from a firmer material would compress less than a lateral heel pod 914 made of a softer material. As a result, medial heel pod 916 tends to resist or counteract pronation and thereby help to reduce the degree and rate of pronation. Conversely, making medial heel pod 916 from a softer material than lateral heel pod 914 would tend to increase the amount and rate of pronation.

[00185] Preferably, the firmness of the material used in medial heel pod 916 is selected based on the firmness of lateral heel pod 914 and on the type of intended activity. For

example, the firmness of lateral heel pod 914 and medial heel pod 916 differs by about 20-30 % for an insole to be used during light to moderate activities.

[00186] Carrying a heavy backpack or other articles significantly increases the load on the foot and the rate of pronation during and following heel strike. Accordingly, medial heel pod 916 is made significantly firmer in an insole designed for use while backpacking. As an example, a difference in firmness of about 20-40% is more appropriate for such activities.

[00187] Lateral midfoot pod 912 provides cushioning and control to the lateral side of the foot during the midstance portion of a step. Typically, lateral midfoot pod is formed of a material having the same properties, e.g., firmness, as lateral heel pod 914. However, a material having different characteristics may also be used.

[00188] The use of dual density heel pods is employed to cause a kinetic change in foot function to promote ankle stability. It is also not out of the scope of the invention to have the medial heel pod softer than the lateral heel pod and/or lateral midfoot pod or any combination thereof to address different joint moments or ankle rolls.

[00189] At the beginning of the propulsion or toe-off phase of a step, the heel begins to lift from the ground and weight shifts to the ball of the foot. Forefoot pad 908 is located under this part of the foot. Preferably, forefoot pad 908 is formed of a relatively resilient material so that energy put into compressing forefoot pad 908 is returned to help propel the foot at toe-off.

[00190] During toe off, the first metatarsal naturally flexes downward. Preventing this natural downward flex of the first metatarsal causes the arch of the foot to flatten and the foot to over pronate, increasing stress on the ankles and knees. To accommodate the downward flex, the medial portion of forefoot pad 908 extends rearward into a corresponding concave edge portion of the distal edge of stability cradle 906. The shape of the stability cradle 906 and forefoot pad 908 permit the first metatarsal to flex more naturally and thereby encourage loading of the great toe during toe off.

[00191] The forefoot pad 920, lateral midfoot pod 921, lateral heel pod 922, and medial heel pod 923 are constructed with a criss-cross groove pattern on the bottom surface of the pod or pad. The criss-cross groove pattern introduces air gaps into the pod/pad surfaces. Such air gaps and criss-cross groove patterns positively influence the impact absorption

properties. It also allows for use of less material and therefore a lighter insole while still providing the desired cushioning function. Preferably, the forefoot criss-cross groove pattern 920 is approximately 0.75 mm deep. Preferably the lateral midfoot and heel criss-cross groove patterns are approximately 1.00 to 3.00 mm deep. Preferably, the medial heel criss-cross groove pattern 923 is approximately 1.00 to 2.50 mm deep.

[00192] For a men's size 11-12 insole, the width of the forefoot pad from the medial to lateral side is about 85 to 95 mm. The height is about 100 to 110 mm. The depth is about 0.95 to 1.50 mm.

[00193] It is desirable to minimize the total weight of the insoles by selection of materials working with the structural features of the insole. It is desirable that the total weight of the preferred embodiment of the insole (men's size 10/11) be about 4.0 ounces. It is desirable that the total weight of an alternate embodiment of the insole be about 5.0 to 6.0 ounces for a men's size 10/11 and about 6.5 to 7.5 ounces for a men's size 12/13. Other sizes will be proportional. Using the criss-cross groove pattern designs will help provide a lighter insole.

[00194] In a preferred embodiment, base 902 is covered with top sheet 901, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 901 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00195] In a first preferred embodiment of the present invention, the various components of an insole which are secured to base 902 in the recession areas defined by base 902 on the bottom surface are permanently affixed to base 902 using an appropriate means such as an adhesive. The components also be secured during the molding process using techniques known in the art of molding insoles.

[00196] The recession areas are also be lined with a cloth having a base surface and a pad/pod surface, secured to said base along said base surface and said pad/pod along said pad/pod surface. Alternatively, a cloth is secured to pad/pod and then the composite structure secured to the recession area.

[00197] FIG. 10 illustrates a cross section 10-10 as identified in FIGS. 4 and 5. Insole 1000 preferably comprises a top sheet 1001 and a base 1002 having a top surface secured to said top sheet 1001 and an opposite bottom surface. The bottom surface of base 1002 defines a forefoot pad recession area and a stability cradle recession area.

[00198] The stability cradle recession area 1005 is located in the midfoot and heel areas of the bottom surface of base 1002. The stability cradle recession area 1005 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 106 is shaped essentially the same as stability cradle recession area 1005 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1005.

[00199] Preferably, the shoe facing surface of stability cradle 1006 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use.

[00200] In a preferred embodiment, base 1002 is covered with top sheet 1001, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1001 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00201] Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support 1038 that lies under the metatarsal head area of the foot. The upward extension of transverse arch support 1038 pushes up a portion of the top sheet 1001 that corresponds to the area of the transverse arch support 1038.

[00202] Traverse arch support 1038 preferably lies under the second to fourth metatarsal heads. Traverse arch support 1038 provides additional stability to the forefoot and middle of the foot.

[00203] FIG. 11 illustrates a cross section 11-11 as identified in FIGS. 4 and 5. Insole 1100 preferably comprises a top sheet 1101 and a base 1102 having a top surface secured to said top sheet 1101 and an opposite bottom surface. The bottom surface of base 1102 defines a forefoot pad recession area and a stability cradle recession area.

[00204] The stability cradle recession area 1105 is located in the midfoot and heel areas of the bottom surface of base 1102. The stability cradle recession area 1105 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 116 is shaped essentially the same as stability cradle recession area 1105 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1105. Stability cradle 1106 has walls that wrap up the sides and rear of base 102 to provide support for the foot.

[00205] Preferably, the shoe facing surface of stability cradle 1106 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improves the use and performance of these insoles for this particular use.

[00206] The stability cradle 1106 preferably defines one or more rib-shaped openings 1131. In a preferred embodiment, the rib-shaped openings 1131 allow said ribs 1132 of base 1102 to extend therethrough. Preferably, base 1102 is molded so that the ribs 1132 project into rib-shaped openings 1131 so that the ribs 1132 are approximately flush with the outer surface of stability cradle 1106 and mechanically lock stability cradle 106 and base 1102 together. Advantageously, the ribs 1132 are also able to bulge through rib-shaped openings 1131 when base 1102 is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs 1132 extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-

shaped openings 1131 allow the stability cradle 1106 to be more flexible in the arch area compared to the rest of the stability cradle 1106.

[00207] In an alternate embodiment, stability cradle 1106 defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The protruding ribs are longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[00208] Stability cradle 106 defines a lateral midfoot pod opening 1111 that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. The length of the lateral midfoot pod opening 1111 is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. Lateral midfoot pod 1112 is shaped essentially the same as lateral midfoot pod opening 1111 and is secured to the bottom surface of base 1102 within the stability cradle recession area in a location that correlates to the lateral midfoot pod opening 1111 and allows lateral midfoot pod 1112 to extend out through said lateral midfoot pod opening 1111.

[00209] In a preferred embodiment, base 1102 is covered with top sheet 1101, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1101 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00210] FIG. 12 illustrates a cross section 12-12 as identified in FIGS. 4 and 5. Insole 1200 preferably comprises a top sheet 1201 and a base 1202 having a top surface secured to said top sheet 1201 and an opposite bottom surface. The bottom surface of base 1202 defines a forefoot pad recession area and a stability cradle recession area.

[00211] The stability cradle recession area 1205 is located in the midfoot and heel areas of the bottom surface of base 1202. The stability cradle recession area 1205 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is

shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1206 is shaped essentially the same as stability cradle recession area 1205 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1205. Stability cradle 1206 has walls that wrap up the sides and rear of base 102 to provide support for the foot.

[00212] Preferably, the shoe facing surface of stability cradle 1206 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improves the use and performance of these insoles for this particular use.

[00213] Stability cradle 1206 also defines a lateral heel pod opening 1213 that extends through the lateral side of the heel area of stability cradle 1206 from approximately rearward of the lateral midfoot pod opening 1211 toward the heel end. Lateral heel pod 1214 is shaped essentially the same as lateral heel pod opening 1213 and is secured to the bottom surface of base 1202 within the stability cradle recession area 1205 in a location that correlates to the lateral heel pod opening 1213 and allows lateral heel pod 1214 to extend out through said lateral heel pod opening 1213. Lateral heel pod 1214 has a lateral edge which extends along the lateral border of insole 1200 from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod 1214 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines.

[00214] In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe.

[00215] Stability cradle 1206 defines a medial heel pod opening 1215 that extends through the heel area along the medial side of heel area on the bottom surface of base 1202 just short of the heel end. Medial heel pod 1216 is shaped essentially the same as medial heel pod opening 1215 and is secured to the bottom surface of base 1202 within the stability cradle recession area 1205 in a location that correlates to the medial heel pod opening 1215 and allows medial heel pod 1216 to extend out through said medial heel pod opening 1215. The medial heel pod 1216 has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod.

[00216] In a preferred embodiment, base 1202 is covered with top sheet 1201, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1201 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00217] FIG. 13 illustrates the bones of the foot superimposed over a bottom view of the insole of the present invention. At the heel of the foot is the calcaneus 1370 and forward of the calcaneus 1370 is the talus 1372. Forward of the talus 1372 on the medial side is the navicular 1374 and on the lateral side is the cuboid 1376. Forward of the cuboid 1376 and the navicular 1374 are cuneiforms 1378. Forward of the cuneiforms 1378 and cuboid 1376 are the metatarsals 1380A-1380E. The first metatarsal 1380A is located on the medial side of the foot and the fifth metatarsal 1380E is located on the lateral side of the foot. Forward of the metatarsals 1380A-1380E are the proximal phalanges 1382. Forward of the proximal phalanges 1382 are the middle phalanges 1384, and at the end of each toe are the distal phalanges 1386.

[00218] FIG. 14 shows the bottom view of the insole (similar to FIG. 5) and illustrates the various areas of the insole: distal medial arch area 1465, lateral midfoot area 1466, proximal medial arch area 1467, medial heel area 1468, lateral heel area 1469, forefoot area 1493, toe area 1491, metatarsal head area 1492, midfoot area 1494, and heel area 1495.

[00219] Forefoot area 1493 comprises toe area 1491 and metatarsal head area 1492, encompassing the entire width of the insole from the toe end to behind the metatarsal heads

or "balls" of the feet. Toe area 1491 has a length extending from the toe end to a diagonal edge that runs generally behind the 1st distal phalange and 2nd and 3rd middle phalanges and 4th and 5th distal phalanges and forward of the metatarsal heads. Toe area 1491 has a width extending from the medial border to the lateral border. Metatarsal head area 1492, comprising first metatarsal head area 1403 and lesser metatarsal head area 1404, has a length extending from a front diagonal edge, adjacent the diagonal edge of toe area 1491, to a back diagonal edge that generally runs behind the metatarsal heads. Metatarsal head area 1492 has a width extending from the medial border to the lateral border.

[00220] Midfoot area 1494 comprises distal medial arch area 1465 and lateral midfoot area 1466. Midfoot area 1494 has a front edge adjacent forefoot area 1493 or metatarsal head area 1492 and a back edge that runs diagonally from between the talus and navicular on the medial side to just behind the cuboid on the lateral side. Midfoot area 1494 has a width extending from the medial border to the lateral border.

[00221] Distal medial arch area 1465 extends from a front edge just behind the first metatarsal head and adjacent the back diagonal edge of metatarsal head area 1492 to a back edge between the talus and navicular. The width of distal medial arch area 1465 extends from the medial border to near the middle of the foot. Lateral midfoot area 1466 extends from the back diagonal edge of metatarsal head area 1492 to a back edge just behind the cuboid. The width of lateral midfoot area extends from near the middle of the foot to the lateral border.

[00222] Heel area 1495 comprises proximal medial arch area 1467, medial heel area 1468, and lateral heel area 1469. Heel area 1495 has a front edge adjacent the back edge of midfoot area 1494 and extends proximally to the heel end. Heel area 1495 has a width extending from the medial border to the lateral border.

[00223] Proximal medial arch area 1467 extends from a front edge between the talus and navicular or adjacent the front edge of heel area 1495 to a back point along the medial border about midway between the heel end and the talus. The width of proximal medial arch area 1467 extends from the medial border to diagonal lateral edge where the diagonal lateral edge extends from about a third of the insole width laterally from the medial border along the front edge of the heel area 1495 to the back point of proximal medial arch area 1467.

[00224] Lateral heel area 1469 extends from a front edge just behind the cuboid or adjacent the front edge of heel area 1495 to the heel end. The width of lateral heel area extends from a diagonal medial edge to the lateral border where diagonal medial edge extends from about a third of the insole width medially from the lateral border along the front edge of the heel area 1495 to a point just medial of the heel end.

[00225] Medial heel area 1468 extends from the front edge of the heel area 1495 to the medial border just medial of the heel end. The width of medial heel area 1468 extends from the lateral diagonal edge of proximal medial arch area 1467 to the medial diagonal edge of lateral heel area 1469.

[00226] Forefoot pad recession area 1467 preferably extends the entire length of the metatarsal head area 1492 on the medial half and from the front diagonal edge of metatarsal head area 1492 to 3rd through 5th metatarsal heads on the lateral half. Forefoot pad 1468 is secured to the forefoot pad recession area 1467.

[00227] Stability cradle 1406 is located in the entire midfoot area 1494 and heel area 1495. A portion of stability cradle 1406 on the lateral half extends forward into metatarsal head area 1492 to just behind the 3rd through 5th metatarsal heads.

[00228] In a preferred embodiment, ribs 1432 of base 1402 extend through rib openings 1431 and are located in the majority of the distal medial arch area 1465 and proximal medial arch area 1467. In an alternate embodiment, the ribs or protrusions are defined by the stability cradle 1406 and extending outwardly from the stability cradle 1406 and are located in the majority of the distal medial arch area 1465 and proximal medial arch area 1467.

[00229] Lateral midfoot pod opening is located approximately in the middle third of the lateral midfoot area 1466. Lateral midfoot pod opening extends essentially the entire length of lateral midfoot area 1466. Lateral midfoot pod 1412 is secured to lateral midfoot pod opening.

[00230] Medial heel pod opening is located in the majority of the medial heel area 1468. Medial heel pod 1416 is secured to medial heel pod opening. Lateral heel pod opening is located in the majority of the lateral heel area 1469. Lateral heel pod 1414 is secured to lateral heel pod opening.

[00231] FIGS. 15A-15E illustrate the preferred embodiment or an insole for triathlon racing. FIG. 15A-1 and 15A-2 shows the top and bottom perspective views. The current invention is an insole that incorporates, but is not limited to: (1) a faceted stability cradle with a plurality of stability ribs, (2) plurality of pods, (3) a forefoot pad (4) criss-cross groove patterns on the bottom surface of the pods and forefoot pads, and (5) a jadeite cooling top cloth. In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe. The present invention accomplishes the goals to: (1) improve ankle and foot stability, (2) cushion the heel and forefoot during push-offs and landings, (3) help prevent insole movement or sliding during shoe operation and change-overs, and (4) provide enhanced cushioning features to the heel, midfoot, arch and forefoot during running and cross-training exercises.

[00232] FIG. 15A-1 is a top view of the insole 1500 illustrating the top sheet 1501 and transverse arch support 1538. Insole 1500 comprises a top sheet 1501 secured across the entire top surface of the base from toe area to heel area. Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support 1538 that lies under the metatarsal head area of the foot. The upward extension of transverse arch support 1538 pushes up a portion of the top sheet 401 that corresponds to the area of the transverse arch support 1538.

[00233] Traverse arch support 1538 preferably lies under the second to fourth metatarsal heads. Traverse arch support 1538 provides additional stability and cushioning to the forefoot and middle of the foot.

[00234] In a preferred embodiment, top sheet 1501 is a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1501 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred

embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi. A series of air holes extend through top sheet 1501 and the base to permit air circulation above and below insole 1500.

[00235] FIG. 15A-2 illustrates the bottom view of the insole. Insole 1500 preferably comprises a top sheet 1501 and a base 1502 having a top surface secured to said top sheet and an opposite bottom surface. Base 1502 also defines a longitudinal arch support 1519 that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[00236] The bottom surface of base 1502 defines a forefoot pad recession area 1507 in the forefoot area and a stability cradle recession area 1505 along the midfoot and heel areas. The bottom surface of base 1502 also defines one or more ribs or protrusions 1532 that extend outwardly along the arch area. The ribs 1532 are preferably longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape.

[00237] Base 1502 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. As best seen in FIGS. 15B-7 to 15B-10, the height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00238] The forefoot pad recession area 1507 begins partially proximal form the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area 1507 extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area 1507 has a rear apex 1557 that lies between the 1st and 2nd metatarsals.

[00239] Forefoot pad 1508 is shaped essentially the same as forefoot pad recession area 1507 and is secured therein. Forefoot pad 1508 has a medial edge, a lateral edge, a proximal (back) edge and a distal (front) edge. The medial edge of forefoot pad 1508 extends along a line spaced laterally from said medial border of said insole. The proximal edge extends from said medial edge laterally and proximally to said rear apex 1557, laterally and distally towards the 3rd metatarsal head, then laterally and proximally to the lateral edge

approximately along the 3rd through 5th metatarsal heads. The lateral edge connects said proximal edge to said top edge of said forefoot pad. In use, forefoot pad recession area 1507 and forefoot pad 1508 underlie the big toe of a user's foot, and the "ball" of the foot, excluding the first metatarsal head or medial ball of the user's foot. Figure 13 shows the placement of foot bones on the insole.

[00240] An adhesive is used to secure the components. The forefoot pad 1508 provides cushioning and energy return on landing from a vertical jump. It serves as a propulsion pad and support for the metatarsal heads of a user's foot, especially the 1st and 2nd metatarsal heads.

[00241] It is estimated that using tougher materials increase the durability of the insole by 35% to 65% over insoles that use softer materials for this portion of the foot insole.

[00242] The stability cradle recession area 1505 is located in the midfoot and heel areas of the bottom surface of base 1502. The stability cradle recession area 1505 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area 1507 to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1506 is shaped essentially the same as stability cradle recession area 1505 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1505.

[00243] Stability cradle 1506 has walls that wrap up the sides and rear of base 1502 to provide support for the foot. Preferably, stability cradle 1506 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 1506 are preferably higher on the medial side of the foot because of the higher loading. Preferably, stability cradle 1506 is made of a nylon material with a hardness of approximately Shore A 95. In a preferred embodiment, the stability cradle is semi-rigid. In an alternate embodiment, the stability cradle is rigid.

[00244] Preferably, the shoe facing surface of stability cradle 1506 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear to other footwear, or vice versa, is a very common practice during triathlon events and

practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00245] The stability cradle 1506 preferably defines one or more rib-shaped openings 1531. In a preferred embodiment, the rib-shaped openings 1531 allow said ribs 1532 of base 1502 to extend therethrough. Preferably, base 1502 is molded so that the ribs 1532 project into rib-shaped openings 1531 so that the ribs 1532 are approximately flush with the outer surface of stability cradle 1506 and mechanically lock stability cradle 1506 and base 1502 together. Advantageously, the ribs 1532 are also able to bulge through rib-shaped openings 1531 when base 1502 is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs 1532 extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-shaped openings 1531 allow the stability cradle 1506 to be more flexible in the arch area compared to the rest of the stability cradle 1506.

[00246] In an alternate embodiment, stability cradle 1506 defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The protruding ribs are longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[00247] In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe.

[00248] Stability cradle 1506 defines a lateral midfoot pod opening 1511 that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. The length of the lateral midfoot pod opening 1511 is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. Lateral midfoot pod 1512 is shaped essentially the same as lateral midfoot pod opening 1511 and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the lateral midfoot pod opening 1511 and allows lateral midfoot pod 1512 to extend out through said lateral midfoot pod opening 1511.

[00249] Lateral midfoot pod 1512 is preferably made from TPR or PU of a hardness of about 45-50 ASKER C. If TPR is used, a fabric is in turn secured to the base 1502 in the lateral midfoot pod opening 1511 of said base 1502. The fabric component allows the TPR to properly adhere to the base 1502.

[00250] Stability cradle 1506 also defines a lateral heel pod opening 1513 that extends through the lateral side of the heel area of stability cradle 1506 from approximately rearward of the lateral midfoot pod opening 1511 toward the heel end. Lateral heel pod 1514 is shaped essentially the same as lateral heel pod opening 1513 and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the lateral heel pod opening 1513 and allows lateral heel pod 1514 to extend out through said lateral heel pod opening 1513. Lateral heel pod 1514 has a lateral edge which extends along the lateral border of insole 1500 from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod 1514 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines.

[00251] The configuration, material and position of the lateral heel pod 1514 provides cushioning and works in association with the medial heel pod 515 to stabilize the ankle. The hardness of the lateral heel pod is preferably essentially the same as the lateral midfoot pod, which work in concert to help reduce the incidence of lateral ankle roll-overs. It is preferably made of TPR or PU of a hardness of about Shore C 45-50. If TPR is used, a fabric is in turn secured to the base 1502 in the lateral heel pod opening 1511 of said base 1502. The fabric component allows the TPR to properly adhere to the base 1502.

[00252] Stability cradle 1506 defines a medial heel pod opening 1515 that extends through the heel area along the medial side of heel area on the bottom surface of base 1502 just short of the heel end. Medial heel pod 1516 is shaped essentially the same as medial heel pod opening 1515 and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the medial heel pod opening 1515 and allows medial heel pod 1516 to extend out through said medial heel pod opening 1515. The medial heel pod 1516 has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod.

[00253] Medial heel pod 1516 is preferably made from TPR or PU of a hardness of about 60 ASKER C ±3. If TPR is used, a fabric is in turn secured to the base 1502 in the medial heel pod opening 1515 of said base 1502. The fabric component allows the TPR to properly adhere to the base 1502.

[00254] Foot contact with the ground is generally divided into three phases: heel strike, midfoot support, and toe off. During heel strike, the heel of the foot impacts the ground with significant force. To cushion the impact, lateral heel pod 1514 is positioned along the rear and lateral side of the calcaneus (heel bone) and extends outwardly below stability cradle 1506. Preferably, lateral heel pod 1514 is made of a material having suitable cushioning properties and are selected based on an intended type of activity.

[00255] Following the initial impact of the heel with the ground, the foot twists, or pronates, bringing the medial side of the heel into contact with the ground. The foot is sensitive to the amount of pronation as well as the rate at which the pronation occurs. Pronation is natural, and some degree of pronation is desirable because it serves to absorb the stresses and forces on the foot during walking or running. However, an excessive amount or rate of pronation results in injury.

[00256] Stability cradle 1506 provides firm support along the medial portion of the foot to help control the amount of pronation. Medial heel pod 1516 helps to control the rate of pronation by forming medial heel pod 1516 out of a material having different characteristics than lateral heel pod 1514. For example, to reduce a pronation rate, medial heel pod 1516 can be made from a firmer material than lateral heel pod 1514. A firmer or stiffer material does not compress as much or as fast as a softer material under the same load. Thus, a medial heel pod 1516 made from a firmer material would compress less than a lateral heel

pod 1514 made of a softer material. As a result, medial heel pod 1516 tends to resist or counteract pronation and thereby help to reduce the degree and rate of pronation. Conversely, making medial heel pod 1516 from a softer material than lateral heel pod 1514 would tend to increase the amount and rate of pronation.

[00257] Preferably, the firmness of the material used in medial heel pod 1516 is selected based on the firmness of lateral heel pod 1514 and on the type of intended activity. For example, the firmness of lateral heel pod 1514 and medial heel pod 1516 differs by about 20-30 % for an insole to be used during light to moderate activities.

[00258] Carrying a heavy backpack or other articles significantly increases the load on the foot and the rate of pronation during and following heel strike. Accordingly, medial heel pod 1516 can be made significantly firmer in an insole designed for use while backpacking. As an example, a difference in firmness of about 20-40% is more appropriate for such activities.

[00259] Lateral midfoot pod 1512 provides cushioning and control to the lateral side of the foot during the midstance portion of a step. Typically, lateral midfoot pod 1512 is formed of a material having the same properties, e.g., firmness, as lateral heel pod 1514. However, a material having different characteristics can also be used.

[00260] The use of dual density heel pods is employed to cause a kinetic change in foot function to promote ankle stability. It is also not out of the scope of the invention to have the medial heel pod softer than the lateral heel pod and/or lateral midfoot pod or any combination thereof to address different joint moments or ankle rolls.

[00261] At the beginning of the propulsion or toe-off phase of a step, the heel begins to lift from the ground and weight shifts to the ball of the foot. Forefoot pad 1508 is located under this part of the foot. Preferably, forefoot pad 1508 is formed of a relatively resilient material so that energy put into compressing forefoot pad 1508 is returned to help propel the foot at toe-off.

[00262] During toe off, the first metatarsal naturally flexes downward. Preventing this natural downward flex of the first metatarsal causes the arch of the foot to flatten and the foot to over pronate, increasing stress on the ankles and knees. To accommodate the downward flex, the medial portion of forefoot pad 1508 extends rearward into a corresponding concave edge portion of the distal edge of stability cradle 1506. The shape

of the stability cradle 1506 and forefoot pad 1508 permit the first metatarsal to flex more naturally and thereby encourage loading of the great toe during toe off.

[00263] Base 1502 is preferably made of foam or other material having suitable cushioning properties. Preferably, base 1502 comprises an Ethylene vinyl acetate ("EVA") foam, which is a copolymer of ethylene and vinyl acetate, or a Thermoplastic Rubber ("TPR")/EVA mix. A preferred EVA or TPR/EVA mix has a durometer (hardness) of about Asker C 45-50.

[00264] Forefoot pad 1508 is preferably made from a Thermoplastic Rubber ("TPR") or Polyurethane ("PU"). The hardness of the TPR or PU used in the forefoot pad is preferably about 30 Asker C ±3.

[00265] The forefoot pad 1520, lateral midfoot pod 1521, lateral heel pod 1522, and medial heel pod 1523 are constructed with a criss-cross groove pattern on the bottom surface of the pod or pad. The criss-cross groove pattern introduces air gaps into the pod/pad surfaces. Such air gaps and criss-cross groove patterns positively influence the impact absorption properties. It also allows for use of less material and therefore a lighter insole while still providing the desired cushioning function. Preferably, the forefoot criss-cross groove pattern 1520 is approximately 0.75 mm deep. Preferably the lateral midfoot and heel criss-cross groove patterns 1521 and 1522 are approximately 1.00 to 3.00 mm deep. Preferably, the medial heel criss-cross groove pattern 1523 is approximately 1.00 to 2.50 mm deep. Preferably the TPR pods have the deeper criss-cross groove pattern and the PU pods have the shallower criss-cross groove pattern due to the compression characteristics of the materials. The criss-cross groove patterns also assists with keeping the insole in place and not move or slide around within the shoe.

[00266] For a men's size 11-12 insole, the width of the forefoot pad from the medial to lateral side is about 85 to 95 mm. The height is about 100 to 110 mm. The depth is about 0.95 to 1.50 mm.

[00267] It is desirable to minimize the total weight of the insoles by selection of materials working with the structural features of the insole. It is desirable that the total weight of the preferred embodiment of the insole (men's size 10/11) be about 4.0 ounces. It is desirable that the total weight of an alternate embodiment of the insole be about 5.0 to 6.0 ounces for

a men's size 10/11 and about 6.5 to 7.5 ounces for a men's size 12/13. Other sizes will be proportional. Using the open-cell designs will provide for a lighter insole.

[00268] In a first preferred embodiment of the present invention, the various components of an insole which are secured to base 1502 in the recession areas defined by base 1502 on the bottom surface are permanently affixed to base 1502 using an appropriate means such as an adhesive. The components are secured during the molding process using techniques known in the art of molding insoles.

[00269] The recession areas also is lined with a cloth having a base surface and a pad/pod surface, secured to said base along said base surface and said pad/pod along said pad/pod surface. Alternatively, a cloth is secured to pad/pod and then the composite structure secured to the recession area.

[00270] Some shoes may slightly differ in size on the inner part of the shoe. Some shoes may also provide extra padding along the inner sides, front or back of the shoe that alter the actual space provided for the foot and/or an insole on the inner part of the shoe. Base 1502 may have sizing guides 1550 that allow a user to shorten the length of the insole for proper fit within the shoe, sizing guides 1550 provide various cutting guide lines that the user would cut along, preferably with scissors.

[00271] FIG. 15B-1 to 15B-10 shows the top, bottom, medial side, lateral side, back, and five cross-section views of the insole.

[00272] FIG. 15B-1 illustrates a medial side view of the insole. Insole 1500 preferably comprises a top sheet 1501 and a base 1502 having a top surface secured to said top sheet and an opposite bottom surface. Base 1502 also defines a longitudinal arch support 1519 that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[00273] The bottom surface of base 1502 defines a forefoot pad recession area in the forefoot area and a stability cradle recession area 1505 along the midfoot and heel areas. The bottom surface of base 1502 also defines one or more ribs or protrusions 1532 that extend outwardly along the arch area. The ribs 1532 are preferably longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape.

[00274] Base 1502 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. The height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00275] The forefoot pad recession area begins partially proximal from the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area has a rear apex that lies between the 1st and 2nd metatarsals. A forefoot pad is shaped essentially the same as forefoot pad recession area and is secured therein.

[00276] The stability cradle recession area 1505 is located in the midfoot and heel areas of the bottom surface of base 1502. The stability cradle recession area 1505 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1506 is shaped essentially the same as stability cradle recession area 1505 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1505.

[00277] Stability cradle 1506 has walls that wrap up the sides and rear of base 1502 to provide support for the foot. Preferably, stability cradle 1506 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 1506 are preferably higher on the medial side of the foot because of the higher loading.

[00278] Preferably, the shoe facing surface of stability cradle 1506 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear with other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted

design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00279] The stability cradle 1506 preferably defines one or more rib-shaped openings 1531. In a preferred embodiment, the rib-shaped openings 1531 allow said ribs 1532 of base 1502 to extend therethrough. Preferably, base 1502 is molded so that the ribs 1532 project into rib-shaped openings 1531 so that the ribs 1532 are approximately flush with the outer surface of stability cradle 1506 and mechanically lock stability cradle 1506 and base 1502 together. Advantageously, the ribs 1532 are also able to bulge through rib-shaped openings 1531 when base 1502 is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs 1532 extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-shaped openings 1531 allow the stability cradle 1506 to be more flexible in the arch area compared to the rest of the stability cradle 1506.

[00280] In an alternate embodiment, stability cradle 1506 defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The protruding ribs are longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[00281] In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe.

[00282] Stability cradle 1506 defines a lateral midfoot pod opening that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. A lateral midfoot pod is shaped essentially the same as lateral midfoot pod opening and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location

that correlates to the lateral midfoot pod opening and allows lateral midfoot pod to extend out through said lateral midfoot pod opening.

[00283] Stability cradle 1506 also defines a lateral heel pod opening that extends through the lateral side of the heel area of stability cradle 1506 from approximately rearward of the lateral midfoot pod opening toward the heel end. Lateral heel pod is shaped essentially the same as lateral heel pod opening and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the lateral heel pod opening and allows lateral heel pod to extend out through said lateral heel pod opening.

[00284] Stability cradle 1506 defines a medial heel pod opening that extends through the heel area along the medial side of heel area on the bottom surface of base 1502 just short of the heel end. Medial heel pod 1516 is shaped essentially the same as medial heel pod opening and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the medial heel pod opening and allows medial heel pod 1516 to extend out through said medial heel pod opening.

[00285] In a preferred embodiment, base 1502 is covered with top sheet 1501, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1501 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00286] Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support 1538 that lies under the metatarsal head area of the foot. The upward extension of transverse arch support 1538 pushes up a portion of the top sheet 1501 that corresponds to the area of the transverse arch support 1538.

[00287] Traverse arch support 1538 preferably lies under the second to fourth metatarsal heads. Traverse arch support 1538 provides additional stability and cushioning to the forefoot and middle of the foot.

[00288] FIG. 15A-2 illustrates the bottom view of the insole. Insole 1500 preferably comprises a top sheet 1501 and a base 1502 having a top surface secured to said top sheet and an opposite bottom surface. Base 1502 also defines a longitudinal arch support 1519

that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[00289] The bottom surface of base 1502 defines a forefoot pad recession area 1507 in the forefoot area and a stability cradle recession area 1505 along the midfoot and heel areas. The bottom surface of base 1502 also defines one or more ribs or protrusions 1532 that extend outwardly along the arch area. The ribs 1532 are preferably longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape.

[00290] Base 1502 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. As best seen in FIGS. 15B-7 to 15B-10, the height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00291] The forefoot pad recession area 1507 begins partially proximal form the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area 1507 extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area 1507 has a rear apex 1557 that lies between the 1st and 2nd metatarsals.

[00292] Forefoot pad 1508 is shaped essentially the same as forefoot pad recession area 1507 and is secured therein. Forefoot pad 1508 has a medial edge, a lateral edge, a proximal (back) edge and a distal (front) edge. The medial edge of forefoot pad 1508 extends along a line spaced laterally from said medial border of said insole. The proximal edge extends from said medial edge laterally and proximally to said rear apex 1557, laterally and distally towards the 3rd metatarsal head, then laterally and proximally to the lateral edge approximately along the 3rd through 5th metatarsal heads. The lateral edge connects said proximal edge to said top edge of said forefoot pad. In use, forefoot pad recession area 1507 and forefoot pad 1508 underlie the big toe of a user's foot, and the "ball" of the foot, excluding the first metatarsal head or medial ball of the user's foot. Figure 11 shows the placement of foot bones on the insole.

[00293] An adhesive is used to secure the components. The forefoot pad 1508 provides cushioning and energy return on landing from a vertical jump. It serves as a propulsion pad and support for the metatarsal heads of a user's foot, especially the 1st and 2nd metatarsal heads.

[00294] It is estimated that using tougher materials increase the durability of the insole by 35% to 65% over insoles that use softer materials for this portion of the foot insole.

[00295] The stability cradle recession area 1505 is located in the midfoot and heel areas of the bottom surface of base 1502. The stability cradle recession area 1505 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area 1507 to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1506 is shaped essentially the same as stability cradle recession area 1505 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1505.

[00296] Stability cradle 1506 has walls that wrap up the sides and rear of base 1502 to provide support for the foot. Preferably, stability cradle 1506 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 1506 are preferably higher on the medial side of the foot because of the higher loading. Preferably, stability cradle 1506 is made of a nylon material with a hardness of approximately Shore A 95. In a preferred embodiment, the stability cradle is semi-rigid. In an alternate embodiment, the stability cradle is rigid.

[00297] Preferably, the shoe facing surface of stability cradle 1506 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear to other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00298] The stability cradle 1506 preferably defines one or more rib-shaped openings 1531. In a preferred embodiment, the rib-shaped openings 1531 allow said ribs 1532 of base 1502 to extend therethrough. Preferably, base 1502 is molded so that the ribs 1532 project into rib-shaped openings 1531 so that the ribs 1532 are approximately flush with the outer surface of stability cradle 1506 and mechanically lock stability cradle 1506 and base 1502 together. Advantageously, the ribs 1532 are also able to bulge through rib-shaped openings 1531 when base 1502 is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs 1532 extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-shaped openings 1531 allow the stability cradle 1506 to be more flexible in the arch area compared to the rest of the stability cradle 1506.

[00299] In an alternate embodiment, stability cradle 1506 defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The protruding ribs are longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[00300] In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe.

[00301] Stability cradle 1506 defines a lateral midfoot pod opening 1511 that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. The length of the lateral midfoot pod opening 1511 is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. Lateral midfoot pod 1512 is shaped essentially the same as lateral midfoot pod opening 1511 and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the lateral

midfoot pod opening 1511 and allows lateral midfoot pod 1512 to extend out through said lateral midfoot pod opening 1511.

[00302] Lateral midfoot pod 1512 is preferably made from TPR or PU of a hardness of about 45-50 ASKER C. If TPR is used, a fabric is in turn secured to the base 1502 in the lateral midfoot pod opening 1511 of said base 1502. The fabric component allows the TPR to properly adhere to the base 1502.

[00303] Stability cradle 1506 also defines a lateral heel pod opening 1513 that extends through the lateral side of the heel area of stability cradle 1506 from approximately rearward of the lateral midfoot pod opening 1511 toward the heel end. Lateral heel pod 1514 is shaped essentially the same as lateral heel pod opening 1513 and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the lateral heel pod opening 1513 and allows lateral heel pod 1514 to extend out through said lateral heel pod opening 1513. Lateral heel pod 1514 has a lateral edge which extends along the lateral border of insole 1500 from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod 1514 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines.

[00304] The configuration, material and position of the lateral heel pod 1514 provides cushioning and works in association with the medial heel pod 1515 to stabilize the ankle. The hardness of the lateral heel pod is preferably essentially the same as the lateral midfoot pod, which work in concert to help reduce the incidence of lateral ankle roll-overs. It is preferably made of TPR or PU of a hardness of about Shore C 45-50. If TPR is used, a fabric is in turn secured to the base 1502 in the lateral heel pod opening 1511 of said base 1502. The fabric component allows the TPR to properly adhere to the base 1502.

[00305] Stability cradle 1506 defines a medial heel pod opening 1515 that extends through the heel area along the medial side of heel area on the bottom surface of base 1502 just short of the heel end. Medial heel pod 1516 is shaped essentially the same as medial heel pod opening 1515 and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the medial heel pod opening 1515 and allows medial heel pod 1516 to extend out through said medial heel pod opening 1515. The medial heel pod 1516 has essentially a pea-pod shape; it has a medial edge and a lateral

edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod.

[00306] Medial heel pod 1516 is preferably made from TPR or PU of a hardness of about 60 ASKER C ±3. If TPR is used, a fabric is in turn secured to the base 1502 in the medial heel pod opening 1515 of said base 1502. The fabric component allows the TPR to properly adhere to the base 1502.

[00307] Foot contact with the ground is generally divided into three phases: heel strike, midfoot support, and toe off. During heel strike, the heel of the foot impacts the ground with significant force. To cushion the impact, lateral heel pod 1514 is positioned along the rear and lateral side of the calcaneus (heel bone) and extends outwardly below stability cradle 1506. Preferably, lateral heel pod 1514 is made of a material having suitable cushioning properties and are selected based on an intended type of activity.

[00308] Following the initial impact of the heel with the ground, the foot twists, or pronates, bringing the medial side of the heel into contact with the ground. The foot is sensitive to the amount of pronation as well as the rate at which the pronation occurs. Pronation is natural, and some degree of pronation is desirable because it serves to absorb the stresses and forces on the foot during walking or running. However, an excessive amount or rate of pronation results in injury.

[00309] Stability cradle 1506 provides firm support along the medial portion of the foot to help control the amount of pronation. Medial heel pod 1516 helps to control the rate of pronation by forming medial heel pod 1516 out of a material having different characteristics than lateral heel pod 1514. For example, to reduce a pronation rate, medial heel pod 1516 can be made from a firmer material than lateral heel pod 1514. A firmer or stiffer material does not compress as much or as fast as a softer material under the same load. Thus, a medial heel pod 1516 made from a firmer material would compress less than a lateral heel pod 1514 made of a softer material. As a result, medial heel pod 1516 tends to resist or counteract pronation and thereby help to reduce the degree and rate of pronation. Conversely, making medial heel pod 1516 from a softer material than lateral heel pod 1514 would tend to increase the amount and rate of pronation.

[00310] Preferably, the firmness of the material used in medial heel pod 1516 is selected based on the firmness of lateral heel pod 1514 and on the type of intended activity. For

example, the firmness of lateral heel pod 1514 and medial heel pod 1516 differs by about 20-30 % for an insole to be used during light to moderate activities.

[00311] Carrying a heavy backpack or other articles significantly increases the load on the foot and the rate of pronation during and following heel strike. Accordingly, medial heel pod 1516 can be made significantly firmer in an insole designed for use while backpacking. As an example, a difference in firmness of about 20-40% is more appropriate for such activities.

[00312] Lateral midfoot pod 1512 provides cushioning and control to the lateral side of the foot during the midstance portion of a step. Typically, lateral midfoot pod 1512 is formed of a material having the same properties, e.g., firmness, as lateral heel pod 1514. However, a material having different characteristics can also be used.

[00313] The use of dual density heel pods is employed to cause a kinetic change in foot function to promote ankle stability. It is also not out of the scope of the invention to have the medial heel pod softer than the lateral heel pod and/or lateral midfoot pod or any combination thereof to address different joint moments or ankle rolls.

[00314] At the beginning of the propulsion or toe-off phase of a step, the heel begins to lift from the ground and weight shifts to the ball of the foot. Forefoot pad 1508 is located under this part of the foot. Preferably, forefoot pad 1508 is formed of a relatively resilient material so that energy put into compressing forefoot pad 1508 is returned to help propel the foot at toe-off.

[00315] During toe off, the first metatarsal naturally flexes downward. Preventing this natural downward flex of the first metatarsal causes the arch of the foot to flatten and the foot to over pronate, increasing stress on the ankles and knees. To accommodate the downward flex, the medial portion of forefoot pad 1508 extends rearward into a corresponding concave edge portion of the distal edge of stability cradle 1506. The shape of the stability cradle 1506 and forefoot pad 1508 permit the first metatarsal to flex more naturally and thereby encourage loading of the great toe during toe off.

[00316] Base 1502 is preferably made of foam or other material having suitable cushioning properties. Preferably, base 1502 comprises an Ethylene vinyl acetate ("EVA") foam, which is a copolymer of ethylene and vinyl acetate, or a Thermoplastic Rubber

("TPR")/EVA mix. A preferred EVA or TPR/EVA mix has a durometer (hardness) of about Asker C 45-50.

[00317] Forefoot pad 1508 is preferably made from a Thermoplastic Rubber ("TPR") or Polyurethane ("PU"). The hardness of the TPR or PU used in the forefoot pad is preferably about 30 Asker C ±3.

[00318] The forefoot pad 1520, lateral midfoot pod 1521, lateral heel pod 1522, and medial heel pod 1523 are constructed with a criss-cross groove pattern on the bottom surface of the pod or pad. The criss-cross groove pattern introduces air gaps into the pod/pad surfaces. Such air gaps and criss-cross groove patterns positively influence the impact absorption properties. It also allows for use of less material and therefore a lighter insole while still providing the desired cushioning function. Preferably, the forefoot criss-cross groove pattern 1520 is approximately 0.75 mm deep. Preferably the lateral midfoot and heel criss-cross groove patterns 1521 and 1522 are approximately 1.00 to 3.00 mm deep. Preferably, the medial heel criss-cross groove pattern 1523 is approximately 1.00 to 2.50 mm deep. Preferably the TPR pods have the deeper criss-cross groove pattern and the PU pods have the shallower criss-cross groove pattern due to the compression characteristics of the materials. The criss-cross groove patterns also assists with keeping the insole in place and not move or slide around within the shoe.

[00319] For a men's size 11-12 insole, the width of the forefoot pad from the medial to lateral side is about 85 to 95 mm. The height is about 100 to 110 mm. The depth is about 0.95 to 1.50 mm.

[00320] It is desirable to minimize the total weight of the insoles by selection of materials working with the structural features of the insole. It is desirable that the total weight of the preferred embodiment of the insole (men's size 10/11) be about 4.0 ounces. It is desirable that the total weight of an alternate embodiment of the insole be about 5.0 to 6.0 ounces for a men's size 10/11 and about 6.5 to 7.5 ounces for a men's size 12/13. Other sizes will be proportional. Using the open-cell designs will provide for a lighter insole.

[00321] In a first preferred embodiment of the present invention, the various components of an insole which are secured to base 1502 in the recession areas defined by base 1502 on the bottom surface are permanently affixed to base 1502 using an appropriate means such as an

adhesive. The components are secured during the molding process using techniques known in the art of molding insoles.

[00322] The recession areas also is lined with a cloth having a base surface and a pad/pod surface, secured to said base along said base surface and said pad/pod along said pad/pod surface. Alternatively, a cloth is secured to pad/pod and then the composite structure secured to the recession area.

[00323] Some shoes may slightly differ in size on the inner part of the shoe. Some shoes may also provide extra padding along the inner sides, front or back of the shoe that alter the actual space provided for the foot and/or an insole on the inner part of the shoe. Base 1502 may have sizing guides 1550 that allow a user to shorten the length of the insole for proper fit within the shoe, sizing guides 1550 provide various cutting guide lines that the user would cut along, preferably with scissors.

[00324] FIG. 15B-3 illustrates a lateral side view of the insole. Insole 1500 preferably comprises a top sheet 1501 and a base 1502 having a top surface secured to said top sheet 1501 and an opposite bottom surface. Base 1502 also defines a longitudinal arch support 1519 that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[00325] The bottom surface of base 1502 defines a forefoot pad recession area in the forefoot area and a stability cradle recession area 1505 along the midfoot and heel areas.

[00326] Base 1502 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. The height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00327] The forefoot pad recession area begins partially proximal from the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area has a rear apex that lies between the 1st and 2nd metatarsals. A forefoot pad is shaped essentially the same as forefoot pad recession area and is secured therein.

[00328] The stability cradle recession area 1505 is located in the midfoot and heel areas of the bottom surface of base 1502. The stability cradle recession area 1505 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area 1507 to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1506 is shaped essentially the same as stability cradle recession area 1505 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1505.

[00329] Stability cradle 1506 has walls that wrap up the sides and rear of base 1502 to provide support for the foot. Preferably, stability cradle 1506 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 1506 are preferably higher on the medial side of the foot because of the higher loading.

[00330] Preferably, the shoe facing surface of stability cradle 1506 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear to other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00331] Stability cradle 1506 defines a lateral midfoot pod opening that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. A lateral midfoot pod 1512 is shaped essentially the same as lateral midfoot pod opening and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the lateral midfoot pod opening and allows lateral midfoot pod 1512 to extend out through said lateral midfoot pod opening.

[00332] Stability cradle 1506 also defines a lateral heel pod opening that extends through the lateral side of the heel area of stability cradle 1506 from approximately rearward of the

lateral midfoot pod opening toward the heel end. Lateral heel pod 1514 is shaped essentially the same as lateral heel pod opening and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the lateral heel pod opening and allows lateral heel pod 1514 to extend out through said lateral heel pod opening.

[00333] Stability cradle 1506 defines a medial heel pod opening that extends through the heel area along the medial side of heel area on the bottom surface of base 1502 just short of the heel end. Medial heel pod is shaped essentially the same as medial heel pod opening and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the medial heel pod opening and allows medial heel pod to extend out through said medial heel pod opening.

[00334] In a preferred embodiment, base 1502 is covered with top sheet 1501, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1501 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00335] Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support 1538 that lies under the metatarsal head area of the foot. The upward extension of transverse arch support 1538 pushes up a portion of the top sheet 1501 that corresponds to the area of the transverse arch support 1538.

[00336] Traverse arch support 1538 preferably lies under the second to fourth metatarsal heads. Traverse arch support 1538 provides additional stability and cushioning to the forefoot and middle of the foot.

[00337] FIG. 15A-1 is a top view of the insole illustrating the top sheet 1501 and transverse arch support 1538. Insole 1500 comprises a top sheet 1501 secured across the entire top surface of the base from toe area to heel area. Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support 1538 that lies under the metatarsal head area of the foot. The upward extension of transverse arch support 1538 pushes up a

portion of the top sheet 1501 that corresponds to the area of the transverse arch support 1538.

[00338] Traverse arch support 1538 preferably lies under the second to fourth metatarsal heads. Traverse arch support 1538 provides additional stability and cushioning to the forefoot and middle of the foot.

[00339] In a preferred embodiment, top sheet 1501 is a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1501 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi. A series of air holes extend through top sheet 1501 and the base to permit air circulation above and below insole 1500.

[00340] FIG. 15B-5 is a section view 15B-5 along the middle of the insole as identified in FIGS. 15B-2. Insole 1500 preferably comprises a top sheet 1501 and a base 1502 having a top surface secured to said top sheet 1501 and an opposite bottom surface. The bottom surface of base 1502 defines a forefoot pad recession area 1507 in the forefoot area and a stability cradle recession area 1505 along the midfoot and heel areas.

[00341] Base 1502 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. As best seen in FIGS. 15B-6 to 15B-10, the height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00342] Preferably, the top surface of the base 1502 defines an upwardly-extending portion or transverse arch support 1538 that lies under the metatarsal head area of the foot. The upward extension of transverse arch support 1538 pushes up a portion of the top sheet 1501 that corresponds to the area of the transverse arch support 1538. Traverse arch support 1538 preferably lies under the second to fourth metatarsal heads. Traverse arch support 1538 provides additional stability and cushioning to the forefoot and middle of the foot.

[00343] The forefoot pad recession area 1507 begins partially proximal form the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area 1507 extends rearward to about the 3rd through 5th metatarsal heads on a

lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area 1507 has a rear apex that lies between the 1st and 2nd metatarsals.

[00344] Forefoot pad 1508 is shaped essentially the same as forefoot pad recession area 1507 and is secured therein. Forefoot pad 1508 has a medial edge, a lateral edge, a proximal (back) edge and a distal (front) edge. The medial edge of forefoot pad 1508 extends along a line spaced laterally from said medial border of said insole. The proximal edge extends from said medial edge laterally and proximally to said rear apex 1557, laterally and distally towards the 3rd metatarsal head, then laterally and proximally to the lateral edge approximately along the 3rd through 5th metatarsal heads. The lateral edge connects said proximal edge to said top edge of said forefoot pad. In use, forefoot pad recession area 1507 and forefoot pad 1508 underlie the big toe of a user's foot, and the "ball" of the foot, excluding the first metatarsal head or medial ball of the user's foot. Figure 11 shows the placement of foot bones on the insole.

[00345] An adhesive is be used to secure the components. The forefoot pad 1508 provides cushioning and energy return on landing from a vertical jump. It serves as a propulsion pad and support for the metatarsal heads of a user's foot, especially the 1st and 2nd metatarsal heads.

[00346] It is estimated that using tougher materials increases the durability of the insole by 35% to 65% over insoles that use softer materials for this portion of the foot insole.

[00347] The stability cradle recession area 1505 is located in the midfoot and heel areas of the bottom surface of base 1502. The stability cradle recession area 1505 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area 1507 to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1506 is shaped essentially the same as stability cradle recession area 1505 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1505.

[00348] Stability cradle 1506 has walls that wrap up the sides and rear of base 1502 to provide support for the foot.

[00349] Preferably, the shoe facing surface of stability cradle 1506 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear with other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improves the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00350] Stability cradle 1506 defines a lateral midfoot pod opening that extends from the behind the 3rd through 5th metatarsal heads proximally to the back of the cuboid. The length of the lateral midfoot pod opening is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. Lateral midfoot pod is shaped essentially the same as lateral midfoot pod opening and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the lateral midfoot pod opening and allows lateral midfoot pod to extend out through said lateral midfoot pod opening.

[00351] Stability cradle 1506 also defines a lateral heel pod opening 1513 that extends through the lateral side of the heel area of stability cradle 1506 from approximately rearward of the lateral midfoot pod opening 1511 toward the heel end. Lateral heel pod 1514 is shaped essentially the same as lateral heel pod opening 1513 and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the lateral heel pod opening 1513 and allows lateral heel pod 1514 to extend out through said lateral heel pod opening 1513. Lateral heel pod 1514 has a lateral edge which extends along the lateral border of insole 1500 from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod 1514 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines.

[00352] The configuration, material and position of the lateral heel pod 1514 provides cushioning and works in association with the medial heel pod 1515 to stabilize the ankle.

[00353] Stability cradle 1506 defines a medial heel pod opening 1515 that extends through the heel area along the medial side of heel area on the bottom surface of base 1502 just short of the heel end. Medial heel pod 1516 is shaped essentially the same as medial heel pod opening 1515 and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the medial heel pod opening 1515 and allows medial heel pod 1516 to extend out through said medial heel pod opening 1515. The medial heel pod 1516 has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod.

[00354] Foot contact with the ground is generally divided into three phases: heel strike, midfoot support, and toe off. During heel strike, the heel of the foot impacts the ground with significant force. To cushion the impact, lateral heel pod 1514 is positioned along the rear and lateral side of the calcaneus (heel bone) and extends outwardly below stability cradle 1506. Preferably, lateral heel pod 1514 is made of a material having suitable cushioning properties and are selected based on an intended type of activity.

[00355] Following the initial impact of the heel with the ground, the foot twists, or pronates, bringing the medial side of the heel into contact with the ground. The foot is sensitive to the amount of pronation as well as the rate at which the pronation occurs. Pronation is natural, and some degree of pronation is desirable because it serves to absorb the stresses and forces on the foot during walking or running. However, an excessive amount or rate of pronation results in injury.

[00356] Stability cradle 1506 provides firm support along the medial portion of the foot to help control the amount of pronation. Medial heel pod 1516 helps to control the rate of pronation by forming medial heel pod 1516 out of a material having different characteristics than lateral heel pod 1514. For example, to reduce a pronation rate, medial heel pod 1516 is made from a firmer material than lateral heel pod 1514. A firmer or stiffer material does not compress as much or as fast as a softer material under the same load. Thus, a medial heel pod 1516 made from a firmer material would compress less than a lateral heel pod 1514 made of a softer material. As a result, medial heel pod 1516 tends to resist or counteract pronation and thereby help to reduce the degree and rate of pronation. Conversely, making medial heel pod 1516 from a softer material than lateral heel pod 1514 would tend to increase the amount and rate of pronation.

[00357] Preferably, the firmness of the material used in medial heel pod 1516 is selected based on the firmness of lateral heel pod 1514 and on the type of intended activity. For example, the firmness of lateral heel pod 1514 and medial heel pod 1516 differs by about 20-30 % for an insole to be used during light to moderate activities.

[00358] Carrying a heavy backpack or other articles significantly increases the load on the foot and the rate of pronation during and following heel strike. Accordingly, medial heel pod 1516 is made significantly firmer in an insole designed for use while backpacking. As an example, a difference in firmness of about 20-40% is more appropriate for such activities.

[00359] Lateral midfoot pod 1512 provides cushioning and control to the lateral side of the foot during the midstance portion of a step. Typically, lateral midfoot pod is formed of a material having the same properties, e.g., firmness, as lateral heel pod 1514. However, a material having different characteristics may also be used.

[00360] The use of dual density heel pods is employed to cause a kinetic change in foot function to promote ankle stability. It is also not out of the scope of the invention to have the medial heel pod softer than the lateral heel pod and/or lateral midfoot pod or any combination thereof to address different joint moments or ankle rolls.

[00361] At the beginning of the propulsion or toe-off phase of a step, the heel begins to lift from the ground and weight shifts to the ball of the foot. Forefoot pad 1508 is located under this part of the foot. Preferably, forefoot pad 1508 is formed of a relatively resilient material so that energy put into compressing forefoot pad 1508 is returned to help propel the foot at toe-off.

[00362] During toe off, the first metatarsal naturally flexes downward. Preventing this natural downward flex of the first metatarsal causes the arch of the foot to flatten and the foot to over pronate, increasing stress on the ankles and knees. To accommodate the downward flex, the medial portion of forefoot pad 1508 extends rearward into a corresponding concave edge portion of the distal edge of stability cradle 1506. The shape of the stability cradle 1506 and forefoot pad 1508 permit the first metatarsal to flex more naturally and thereby encourage loading of the great toe during toe off.

[00363] The forefoot pad 120, lateral midfoot pod 121, lateral heel pod 122, and medial heel pod 123 are constructed with a criss-cross groove pattern on the bottom surface of the pod

or pad. The criss-cross groove pattern introduces air gaps into the pod/pad surfaces. Such air gaps and criss-cross groove patterns positively influence the impact absorption properties. It also allows for use of less material and therefore a lighter insole while still providing the desired cushioning function. Preferably, the forefoot criss-cross groove pattern 1520 is approximately 0.75 mm deep. Preferably the lateral midfoot and heel criss-cross groove patterns are approximately 1.00 to 3.00 mm deep. Preferably, the medial heel criss-cross groove pattern 1523 is approximately 1.00 to 2.50 mm deep.

[00364] For a men's size 11-12 insole, the width of the forefoot pad from the medial to lateral side is about 85 to 95 mm. The height is about 100 to 110 mm. The depth is about 0.95 to 1.50 mm.

[00365] It is desirable to minimize the total weight of the insoles by selection of materials working with the structural features of the insole. It is desirable that the total weight of the preferred embodiment of the insole (men's size 10/11) be about 4.0 ounces. It is desirable that the total weight of an alternate embodiment of the insole be about 5.0 to 6.0 ounces for a men's size 10/11 and about 6.5 to 7.5 ounces for a men's size 12/13. Other sizes will be proportional. Using the criss-cross groove pattern designs will help provide a lighter insole.

[00366] In a preferred embodiment, base 1502 is covered with top sheet 1501, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1501 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00367] In a first preferred embodiment of the present invention, the various components of an insole which are secured to base 1502 in the recession areas defined by base 1502 on the bottom surface are permanently affixed to base 1502 using an appropriate means such as an adhesive. The components also be secured during the molding process using techniques known in the art of molding insoles.

[00368] The recession areas are also be lined with a cloth having a base surface and a pad/pod surface, secured to said base along said base surface and said pad/pod along said

pad/pod surface. Alternatively, a cloth is secured to pad/pod and then the composite structure secured to the recession area.

[00369] FIG. 15B-6 illustrates a rear view of the insole. Insole 1500 preferably comprises a top sheet 1501 and a base 1502 having a top surface secured to said top sheet and an opposite bottom surface. Base 1502 also defines a longitudinal arch support 1519 that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[00370] The bottom surface of base 1502 defines a forefoot pad recession area in the forefoot area and a stability cradle recession area 1505 along the midfoot and heel areas. The bottom surface of base 1502 also define one or more ribs or protrusions 1532 that extend outwardly along the arch area. The ribs 1532 are preferably longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. An alternate embodiment has the ribs or protrusions defined by the stability cradle 1506 and extending outwardly from the stability cradle 1506 in the arch area.

[00371] Base 1502 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. The height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00372] The forefoot pad recession area begins partially proximal from the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area has a rear apex that lies between the 1st and 2nd metatarsals. A forefoot pad is shaped essentially the same as forefoot pad recession area and is secured therein.

[00373] The stability cradle recession area 1505 is located in the midfoot and heel areas of the bottom surface of base 1502. The stability cradle recession area 1505 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability

cradle 1506 is shaped essentially the same as stability cradle recession area 1505 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1505.

[00374] Stability cradle 1506 has walls that wrap up the sides and rear of base 1502 to provide support for the foot. Preferably, stability cradle 1506 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 1506 are preferably higher on the medial side of the foot because of the higher loading.

[00375] Preferably, the shoe facing surface of stability cradle 1506 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear with other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improves the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00376] The stability cradle 1506 preferably defines one or more rib-shaped openings 1531. In a preferred embodiment, the rib-shaped openings 1531 allow said ribs 1532 of base 1502 to extend therethrough. Preferably, base 1502 is molded so that the ribs 1532 project into rib-shaped openings 1531 so that the ribs 1532 are approximately flush with the outer surface of stability cradle 1506 and mechanically lock stability cradle 1506 and base 1502 together. Advantageously, the ribs 1532 are also able to bulge through rib-shaped openings 1531 when base 1502 is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs 1532 extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-shaped openings 1531 allow the stability cradle 1506 to be more flexible in the arch area compared to the rest of the stability cradle 1506.

[00377] In an alternate embodiment, stability cradle 1506 defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The protruding ribs are longer around the cuneiforms and gradually shorter distally and

proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[00378] Stability cradle 1506 defines a lateral midfoot pod opening that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. A lateral midfoot pod is shaped essentially the same as lateral midfoot pod opening and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the lateral midfoot pod opening and allows lateral midfoot pod to extend out through said lateral midfoot pod opening.

[00379] Stability cradle 1506 also defines a lateral heel pod opening that extends through the lateral side of the heel area of stability cradle 1506 from approximately rearward of the lateral midfoot pod opening toward the heel end. Lateral heel pod 1514 is shaped essentially the same as lateral heel pod opening and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the lateral heel pod opening and allows lateral heel pod 1514 to extend out through said lateral heel pod opening.

[00380] Stability cradle 1506 defines a medial heel pod opening that extends through the heel area along the medial side of heel area on the bottom surface of base 1502 just short of the heel end. Medial heel pod 1516 is shaped essentially the same as medial heel pod opening and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the medial heel pod opening and allows medial heel pod 1516 to extend out through said medial heel pod opening.

[00381] In a preferred embodiment, base 1502 is covered with top sheet 1501, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1501 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi. Preferably the forefoot pad recession area 1507 has a rear apex that lies between the 1st and 2nd metatarsals.

[00382] FIG. 15B-7 illustrates a cross section 15B-7 as identified in FIGS. 15B-2. Insole 1500 preferably comprises a top sheet 1501 and a base 1502 having a top surface secured to

said top sheet 1501 and an opposite bottom surface. The bottom surface of base 1502 defines a forefoot pad recession area and a stability cradle recession area.

[00383] The stability cradle recession area 1505 is located in the midfoot and heel areas of the bottom surface of base 1502. The stability cradle recession area 1505 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1526 is shaped essentially the same as stability cradle recession area 1505 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1505. Stability cradle 1506 has walls that wrap up the sides and rear of base 1502 to provide support for the foot.

[00384] Preferably, the shoe facing surface of stability cradle 1506 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improves the use and performance of these insoles for this particular use.

[00385] Stability cradle 1506 also defines a lateral heel pod opening 1513 that extends through the lateral side of the heel area of stability cradle 1506 from approximately rearward of the lateral midfoot pod opening 1511 toward the heel end. Lateral heel pod 1514 is shaped essentially the same as lateral heel pod opening 1513 and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the lateral heel pod opening 1513 and allows lateral heel pod 1514 to extend out through said lateral heel pod opening 1513. Lateral heel pod 1514 has a lateral edge which extends along the lateral border of insole 1500 from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod 1514 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines.

[00386] In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an

insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe.

[00387] Stability cradle 1506 defines a medial heel pod opening 1515 that extends through the heel area along the medial side of heel area on the bottom surface of base 1502 just short of the heel end. Medial heel pod 1516 is shaped essentially the same as medial heel pod opening 1515 and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the medial heel pod opening 1515 and allows medial heel pod 1516 to extend out through said medial heel pod opening 1515. The medial heel pod 1516 has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod.

[00388] In a preferred embodiment, base 1502 is covered with top sheet 1501, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1501 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00389] FIG. 15B-9 and 15B-8 illustrates a cross section 15B-9 and 15B-8, respectively, as identified in FIGS. 15B-2. Insole 1500 preferably comprises a top sheet 1501 and a base 1502 having a top surface secured to said top sheet 1501 and an opposite bottom surface. The bottom surface of base 1502 defines a forefoot pad recession area and a stability cradle recession area.

[00390] The stability cradle recession area 1505 is located in the midfoot and heel areas of the bottom surface of base 1502. The stability cradle recession area 1505 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area to a

proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1516 is shaped essentially the same as stability cradle recession area 1505 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1505. Stability cradle 1506 has walls that wrap up the sides and rear of base 1502 to provide support for the foot.

[00391] Preferably, the shoe facing surface of stability cradle 1506 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improves the use and performance of these insoles for this particular use.

[00392] The stability cradle 1506 preferably defines one or more rib-shaped openings 1531. In a preferred embodiment, the rib-shaped openings 1531 allow said ribs 1532 of base 1502 to extend therethrough. Preferably, base 1502 is molded so that the ribs 1532 project into rib-shaped openings 1531 so that the ribs 1532 are approximately flush with the outer surface of stability cradle 1506 and mechanically lock stability cradle 1506 and base 1502 together. Advantageously, the ribs 1532 are also able to bulge through rib-shaped openings 1531 when base 1502 is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs 1532 extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-shaped openings 1531 allow the stability cradle 1506 to be more flexible in the arch area compared to the rest of the stability cradle 1506.

[00393] In an alternate embodiment, stability cradle 1506 defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The protruding ribs are longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[00394] Stability cradle 1506 defines a lateral midfoot pod opening 1511 that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. The length of the lateral midfoot pod opening 1511 is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. Lateral midfoot pod 1512 is shaped essentially the same

as lateral midfoot pod opening 1511 and is secured to the bottom surface of base 1502 within the stability cradle recession area in a location that correlates to the lateral midfoot pod opening 1511 and allows lateral midfoot pod 1512 to extend out through said lateral midfoot pod opening 1511.

[00395] In a preferred embodiment, base 1502 is covered with top sheet 1501, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1501 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00396] FIG. 15B-10 illustrates a cross section 15B-10 as identified in FIGS. 15B-2. Insole 1500 preferably comprises a top sheet 1501 and a base 1502 having a top surface secured to said top sheet 1501 and an opposite bottom surface. The bottom surface of base 1502 defines a forefoot pad recession area and a stability cradle recession area.

[00397] The stability cradle recession area 1505 is located in the midfoot and heel areas of the bottom surface of base 1502. The stability cradle recession area 1505 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1506 is shaped essentially the same as stability cradle recession area 1505 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1505.

[00398] Preferably, the shoe facing surface of stability cradle 1506 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use.

[00399] In a preferred embodiment, base 1502 is covered with top sheet 1501, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1501 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00400] Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support 1538 that lies under the metatarsal head area of the foot. The upward extension of transverse arch support 1538 pushes up a portion of the top sheet 1501 that corresponds to the area of the transverse arch support 1538.

[00401] Traverse arch support 1538 preferably lies under the second to fourth metatarsal heads. Traverse arch support 1538 provides additional stability to the forefoot and middle of the foot.

[00402] FIG. 15C-1 to 15C-8 shows a medial side, bottom, lateral side, back, and four cross-section views of the stability cradle.

[00403] FIGS. 15C-1 to 15C-8 medial side, bottom, lateral side, back and four cross section views of a stability cradle 1506. A stability cradle recession area is located in the midfoot and heel areas of the bottom surface of a base. The stability cradle recession area extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of a forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1506 is shaped essentially the same as the stability cradle recession area and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area.

[00404] Stability cradle 1506 has walls that wrap up the sides and rear of the base to provide support for the foot. Preferably, stability cradle 1506 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 1506 are preferably higher on the medial side of the foot because of the higher loading. Preferably, stability cradle 1506 is made of a nylon material with a

hardness of approximately Shore A 95. In a preferred embodiment, the stability cradle is semi-rigid. In an alternate embodiment, the stability cradle is rigid.

[00405] Preferably, the shoe facing surface of stability cradle 1506 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear to other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improves the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00406] The stability cradle 1506 preferably defines one or more rib-shaped openings 1531. In a preferred embodiment, the rib-shaped openings 1531 allow ribs on the base to extend therethrough. Advantageously, the ribs are also able to bulge through rib-shaped openings 1531 when base is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. The rib-shaped openings 1531 allow the stability cradle 1506 to be more flexible in the arch area compared to the rest of the stability cradle 1506.

[00407] Stability cradle 1506 defines a lateral midfoot pod opening 1511 that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. The length of the lateral midfoot pod opening 1511 is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. The lateral midfoot pod opening 1511 is designed to allow a lateral midfoot pod to extend there through.

[00408] Stability cradle 1506 also defines a lateral heel pod opening 1513 that extends through the lateral side of the heel area of stability cradle 1506 from approximately rearward of the lateral midfoot pod opening 1511 toward the heel end. Lateral heel pod opening 1513 has a lateral edge which extends along the lateral border of insole from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod opening 1511. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod opening 1513 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described

rather than straight lines. Lateral heel pod opening 1513 is designed to allow a lateral heel pod to extend there through.

[00409] Medial heel pod opening 1515 extends through the heel area along the medial side of heel area on the bottom surface of base 1502 just short of the heel end. The medial heel pod opening 1515 has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod opening. Medial heel pod opening 1515 is designed to allow a medial heel pod to extend there through.

[00410] Stability cradle 1506 provides firm support along the medial portion of the foot to help control the amount of pronation.

[00411] FIG. 15D-1 to 15D-5 shows a medial side, bottom, lateral side, prospective and a cross-section of the insole pads 1512, 1514 and 1516.

[00412] Figure 15D-1 to 15D-5 show a medial side, bottom, lateral side, prospective and one cross-section view of the insole pads 1512, 1514 and 1516. Stability cradle 1506 also defines a lateral heel pod opening 1513 that extends through the lateral side of the heel area of stability cradle 1506 from approximately rearward of the lateral midfoot pod opening 1511 toward the heel end. Lateral heel pod 1514 is shaped essentially the same as lateral heel pod opening 1513 and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the lateral heel pod opening 1513 and allows lateral heel pod 1514 to extend out through said lateral heel pod opening 1513. Lateral heel pod 1514 has a lateral edge which extends along the lateral border of insole 1500 from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod 1514 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines.

[00413] The configuration, material and position of the lateral heel pod 1514 provides cushioning and works in association with the medial heel pod 1515 to stabilize the ankle. The hardness of the lateral heel pod is preferably essentially the same as the lateral midfoot pod, which work in concert to help reduce the incidence of lateral ankle roll-overs. It is preferably made of TPR or PU of a hardness of about Shore C 45-50. If TPR is used, a

fabric is in turn secured to the base 102 in the lateral heel pod opening 1513 of said base 1502. The fabric component allows the TPR to properly adhere to the base 1502.

[00414] Stability cradle 1506 defines a medial heel pod opening 1515 that extends through the heel area along the medial side of heel area on the bottom surface of base 1502 just short of the heel end. Medial heel pod 1516 is shaped essentially the same as medial heel pod opening 1515 and is secured to the bottom surface of base 1502 within the stability cradle recession area 1505 in a location that correlates to the medial heel pod opening 1515 and allows medial heel pod 1516 to extend out through said medial heel pod opening 1515. The medial heel pod 1516 has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod.

[00415] Medial heel pod 1516 is preferably made from TPR or PU of a hardness of about 60 ASKER C ±3. If TPR is used, a fabric is in turn secured to the base 1502 in the medial heel pod opening 1515 of said base 1502. The fabric component allows the TPR to properly adhere to the base 1502.

[00416] Foot contact with the ground is generally divided into three phases: heel strike, midfoot support, and toe off. During heel strike, the heel of the foot impacts the ground with significant force. To cushion the impact, lateral heel pod 1514 is positioned along the rear and lateral side of the calcaneus (heel bone) and extends outwardly below stability cradle 1506. Preferably, lateral heel pod 1514 is made of a material having suitable cushioning properties and are selected based on an intended type of activity.

[00417] Following the initial impact of the heel with the ground, the foot twists, or pronates, bringing the medial side of the heel into contact with the ground. The foot is sensitive to the amount of pronation as well as the rate at which the pronation occurs. Pronation is natural, and some degree of pronation is desirable because it serves to absorb the stresses and forces on the foot during walking or running. However, an excessive amount or rate of pronation can result in injury.

[00418] Stability cradle 1506 provides firm support along the medial portion of the foot to help control the amount of pronation. Medial heel pod 1516 helps to control the rate of pronation by forming medial heel pod 1516 out of a material having different characteristics than lateral heel pod 1514. For example, to reduce a pronation rate, medial heel pod 1516 is

made from a firmer material than lateral heel pod 1514. A firmer or stiffer material does not compress as much or as fast as a softer material under the same load. Thus, a medial heel pod 1516 made from a firmer material would compress less than a lateral heel pod 1514 made of a softer material. As a result, medial heel pod 1516 tends to resist or counteract pronation and thereby help to reduce the degree and rate of pronation. Conversely, making medial heel pod 1516 from a softer material than lateral heel pod 1514 would tend to increase the amount and rate of pronation.

[00419] Preferably, the firmness of the material used in medial heel pod 1516 is selected based on the firmness of lateral heel pod 1514 and on the type of intended activity. For example, the firmness of lateral heel pod 1514 and medial heel pod 1516 differs by about 20-30 % for an insole to be used during light to moderate activities.

[00420] Carrying a heavy backpack or other articles significantly increases the load on the foot and the rate of pronation during and following heel strike. Accordingly, medial heel pod 1516 is made significantly firmer in an insole designed for use while backpacking. As an example, a difference in firmness of about 20-40% is more appropriate for such activities.

[00421] Lateral midfoot pod 1512 provides cushioning and control to the lateral side of the foot during the midstance portion of a step. Typically, lateral midfoot pod 1512 is formed of a material having the same properties, e.g., firmness, as lateral heel pod 1514. However, a material having different characteristics may also be used.

[00422] FIG. 15E-1 to 15E-4 shows a medial side, bottom, cross section prospective view of the forefoot pad.

[00423] Figures 15E-1 to 15E-4 show a medial side, bottom, cross-section and prospective view of the forefoot pad 1508. Forefoot pad 108 is preferably made from a Thermoplastic Rubber ("TPR") or Polyurethane ("PU"). The hardness of the TPR or PU used in the forefoot pad is preferably about 30 Asker C ±3. The forefoot pad 1520, lateral midfoot pod 1521, lateral heel pod 1522, and medial heel pod 1523 are constructed with a criss-cross groove pattern on the bottom surface of the pod or pad. The criss-cross groove pattern introduces air gaps into the pod/pad surfaces. Such air gaps and criss-cross groove patterns positively influence the impact absorption properties of each pod and pad. It also allows for use of less material and therefore a lighter insole while still providing the desired

cushioning function. Preferably, the forefoot criss-cross groove pattern 1520 is approximately 0.75 mm deep. Preferably the lateral midfoot and heel criss-cross groove patterns 1521 and 1522 are approximately 1.00 to 3.00 mm deep. Preferably, the medial heel criss-cross groove pattern 1523 is approximately 1.00 to 2.50 mm deep. Preferably the TPR pods have the deeper criss-cross groove pattern and the PU pods have the shallower criss-cross groove pattern due to the compression characteristics of the materials. The criss-cross groove patterns assists with securing the insole in the shoe cavity and keeping the insole in place such that it will not move or slide around. The criss-cross groove pattern also allows for air circulation and/or provides different cushioning and spring properties.

[00424] For a men's size 11-12 insole, the width of the forefoot pad from the medial to lateral side is about 85 to 95 mm. The height is about 100 to 110 mm. The depth is about 0.95 to 1.50 mm.

[00425] It is desirable to minimize the total weight of the insoles by selection of materials working with the structural features of the insole. It is desirable that the total weight of the preferred embodiment of the insole (men's size 10/11) be about 4.0 ounces. It is desirable that the total weight of an alternate embodiment of the insole be about 5.0 to 6.0 ounces for a men's size 10/11 and about 6.5 to 7.5 ounces for a men's size 12/13. Other sizes will be proportional. Using the criss-cross groove pattern designs will help provide a lighter insole.

[00426] In a preferred embodiment, base 1502 is covered with top sheet 1501 from toe to heel areas of the insole, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1501 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00427] Insole preferably comprises a top sheet and a base having a top surface secured to said top sheet and an opposite bottom surface. Base also defines a longitudinal arch support that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[00428] Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support that lies under the metatarsal head area of the foot. The upward

extension of transverse arch support pushes up a portion of the top sheet that corresponds to the area of the transverse arch support.

[00429] The bottom surface of base defines a forefoot pad recession area in the forefoot area and a stability cradle recession area along the midfoot and heel areas. The bottom surface of base also defines one or more ribs or protrusions that extend outwardly along the arch area. The ribs are preferably longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. An alternate embodiment has the ribs or protrusions defined by the stability cradle and extending outwardly from the stability cradle in the arch area.

[00430] Base has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. The height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00431] The forefoot pad recession area begins partially proximal from the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area has a rear apex that lies between the 1st and 2nd metatarsals.

[00432] Forefoot pad is shaped essentially the same as forefoot pad recession area and is secured therein. Forefoot pad has a medial edge, a lateral edge, a proximal (back) edge and a distal (front) edge. The medial edge of forefoot pad extends along a line spaced laterally from said medial border of said insole. The proximal edge extends from said medial edge laterally and proximally to said rear apex , laterally and distally towards the 3rd metatarsal head, then laterally and proximally to the lateral edge approximately along the 3rd through 5th metatarsal heads. The lateral edge connects said proximal edge to said top edge of said forefoot pad. In use, forefoot pad recession area and forefoot pad underlie the big toe of a user's foot, and the "ball" of the foot, excluding the first metatarsal head or medial ball of the user's foot.

[00433] An adhesive is be used to secure the components. The forefoot pad provides cushioning and energy return on landing from a vertical jump. It serves as a propulsion pad

and support for the metatarsal heads of a user's foot, especially the 1st and 2nd metatarsal heads.

[00434] The stability cradle recession area is located in the midfoot and heel areas of the bottom surface of base. The stability cradle recession area extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle is shaped essentially the same as stability cradle recession area and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area.

[00435] Stability cradle has walls that wrap up the sides and rear of base to provide support for the foot. Preferably, stability cradle ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle are preferably higher on the medial side of the foot because of the higher loading. Preferably, stability cradle is made of a nylon material with a hardness of approximately Shore A 95. In a preferred embodiment, the stability cradle is semi-rigid. In an alternate embodiment, the stability cradle is rigid.

[00436] Preferably, the shoe facing surface of stability cradle has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping and "change-over" of shoes and running gear to other footwear, or vice versa is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00437] The stability cradle preferably defines one or more rib-shaped openings. In a preferred embodiment, the rib-shaped openings allow said ribs of base to extend therethrough. Preferably, base is molded so that the ribs project into rib-shaped openings so that the ribs are approximately flush with the outer surface of stability cradle and

mechanically lock stability cradle and base together. Advantageously, the ribs are also able to bulge through rib-shaped openings when base is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-shaped openings allow the stability cradle to be more flexible in the arch area compared to the rest of the stability cradle.

[00438] In an alternate embodiment, stability cradle defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The protruding ribs are longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[00439] Stability cradle 1506 defines a lateral midfoot pod opening that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. The length of the lateral midfoot pod opening is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. Lateral midfoot pod is shaped essentially the same as lateral midfoot pod opening and is secured to the bottom surface of base within the stability cradle recession area in a location that correlates to the lateral midfoot pod opening and allows lateral midfoot pod to extend out through said lateral midfoot pod opening.

[00440] Lateral midfoot pod is preferably made from TPR or PU of a hardness of about 45-50 ASKER C. If TPR is used, a fabric is in turn secured to the base in the lateral midfoot pod opening of said base. The fabric component allows the TPR to properly adhere to the base.

[00441] Stability cradle also defines a lateral heel pod opening that extends through the lateral side of the heel area of stability cradle from approximately rearward of the lateral midfoot pod opening toward the heel end. Lateral heel pod is shaped essentially the same as lateral heel pod opening and is secured to the bottom surface of base within the stability cradle recession area in a location that correlates to the lateral heel pod opening and allows lateral heel pod to extend out through said lateral heel pod opening. Lateral heel pod has a lateral edge which extends along the lateral border of insole from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod also has a medial

curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines.

[00442] The configuration, material and position of the lateral heel pod provides cushioning and works in association with the medial heel pod to stabilize the ankle. The hardness of the lateral heel pod is preferably essentially the same as the lateral midfoot pod, which work in concert to help reduce the incidence of lateral ankle roll-overs. It is preferably made of TPR or PU of a hardness of about Shore C 45-50. If TPR is used, a fabric is in turn secured to the base in the lateral heel pod opening of said base. The fabric component allows the TPR to properly adhere to the base.

[00443] Stability cradle defines a medial heel pod opening that extends through the heel area along the medial side of heel area on the bottom surface of base just short of the heel end. Medial heel pod is shaped essentially the same as medial heel pod opening and is secured to the bottom surface of base 102 within the stability cradle recession area in a location that correlates to the medial heel pod opening and allows medial heel pod to extend out through said medial heel pod opening. The medial heel pod has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod.

[00444] Medial heel pod is preferably made from TPR or PU of a hardness of about 60 ASKER C ±3. If TPR is used, a fabric is in turn secured to the base in the medial heel pod opening of said base. The fabric component allows the TPR to properly adhere to the base.

[00445] Foot contact with the ground is generally divided into three phases: heel strike, midfoot support, and toe off. During heel strike, the heel of the foot impacts the ground with significant force. To cushion the impact, lateral heel pod is positioned along the rear and lateral side of the calcaneus (heel bone) and extends outwardly below stability cradle. Preferably, lateral heel pod is made of a material having suitable cushioning properties and are selected based on an intended type of activity.

[00446] Following the initial impact of the heel with the ground, the foot twists, or pronates, bringing the medial side of the heel into contact with the ground. The foot is sensitive to the amount of pronation as well as the rate at which the pronation occurs. Pronation is natural, and some degree of pronation is desirable because it serves to absorb the stresses

and forces on the foot during walking or running. However, an excessive amount or rate of pronation can result in injury.

[00447] Stability cradle provides firm support along the medial portion of the foot to help control the amount of pronation. Medial heel pod helps to control the rate of pronation by forming medial heel pod out of a material having different characteristics than lateral heel pod. For example, to reduce a pronation rate, medial heel pod is made from a firmer material than lateral heel pod. A firmer or stiffer material does not compress as much or as fast as a softer material under the same load. Thus, a medial heel pod made from a firmer material would compress less than a lateral heel pod made of a softer material. As a result, medial heel pod tends to resist or counteract pronation and thereby help to reduce the degree and rate of pronation. Conversely, making medial heel pod from a softer material than lateral heel pod would tend to increase the amount and rate of pronation.

[00448] Preferably, the firmness of the material used in medial heel pod is selected based on the firmness of lateral heel pod and on the type of intended activity. For example, the firmness of lateral heel pod and medial heel pod differs by about 20-30 % for an insole to be used during light to moderate activities.

[00449] Carrying a heavy backpack or other articles significantly increases the load on the foot and the rate of pronation during and following heel strike. Accordingly, medial heel pod is made significantly firmer in an insole designed for use while backpacking. As an example, a difference in firmness of about 20-40% is more appropriate for such activities.

[00450] Lateral midfoot pod provides cushioning and control to the lateral side of the foot during the midstance portion of a step. Typically, lateral midfoot pod is formed of a material having the same properties, e.g., firmness, as lateral heel pod. However, a material having different characteristics may also be used.

[00451] The use of dual density heel pods is employed to cause a kinetic change in foot function to promote ankle stability. It is also not out of the scope of the invention to have the medial heel pod softer than the lateral heel pod and/or lateral midfoot pod or any combination thereof to address different joint moments or ankle rolls.

[00452] At the beginning of the propulsion or toe-off phase of a step, the heel begins to lift from the ground and weight shifts to the ball of the foot. Forefoot pad is located under this

part of the foot. Preferably, forefoot pad is formed of a relatively resilient material so that energy put into compressing forefoot pad is returned to help propel the foot at toe-off.

[00453] During toe off, the first metatarsal naturally flexes downward. Preventing this natural downward flex of the first metatarsal causes the the arch of the foot to flatten and the foot to over pronate, increasing stress on the ankles and knees. To accommodate the downward flex, the medial portion of forefoot pad extends rearward into a corresponding concave edge portion of the distal edge of stability cradle. The shape of the stability cradle and forefoot pad permit the first metatarsal to flex more naturally and thereby encourage loading of the great toe during toe off.

[00454] Base is preferably made of foam or other material having suitable cushioning properties. Preferably, base comprises an Ethylene vinyl acetate ("EVA") foam, which is a copolymer of ethylene and vinyl acetate, or a Thermoplastic Rubber ("TPR")/EVA mix. A preferred EVA or TPR/EVA mix has a durometer (hardness) of about Asker C 45-50.

[00455] Forefoot pad is preferably made from a Thermoplastic Rubber ("TPR") or Polyurethane ("PU"). The hardness of the TPR or PU used in the forefoot pad is preferably about 30 Asker C ±3.

[00456] The forefoot pad, lateral midfoot pod, lateral heel pod, and medial heel pod are constructed with a criss-cross groove pattern on the bottom surface of the pod or pad. The criss-cross groove pattern introduces a friction fit and air gaps into the pod/pad surfaces. Such air gaps and criss-cross groove patterns positively influence the impact absorption properties of each pod and pad. It also allows for use of less material and therefore a lighter insole while still providing the desired cushioning function. Preferably, the forefoot criss-cross groove pattern is approximately 0.75 mm deep. Preferably the lateral midfoot and heel criss-cross groove patterns and are approximately 1.00 to 3.00 mm deep. Preferably, the medial heel criss-cross groove pattern is approximately 1.00 to 2.50 mm deep. Preferably the TPR pods have the deeper criss-cross groove pattern and the PU pods have the shallower criss-cross groove pattern due to the compression characteristics of the materials. The criss-cross groove patterns assists with securing the insole in the shoe cavity and keeping the insole in place such that it will not move or slide around The criss-cross groove pattern also allows for air circulation and/or provides different cushioning and spring properties.

[00457] For a men's size 11-12 insole, the width of the forefoot pad from the medial to lateral side is about 85 to 95 mm. The height is about 100 to 110 mm. The depth is about 0.95 to 1.50 mm.

[00458] It is desirable to minimize the total weight of the insoles by selection of materials working with the structural features of the insole. It is desirable that the total weight of the preferred embodiment of the insole (men's size 10/11) be about 4.0 ounces. It is desirable that the total weight of an alternate embodiment of the insole be about 5.0 to 6.0 ounces for a men's size 10/11 and about 6.5 to 7.5 ounces for a men's size 12/13. Other sizes will be proportional. Using the criss-cross groove pattern designs will help provide a lighter insole.

[00459] In a preferred embodiment, base is covered with top sheet from toe to heel areas of the insole, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00460] In a first preferred embodiment of the present invention, the various components of an insole which are secured to base in the recession areas defined by base on the bottom surface are permanently affixed to base using an appropriate means such as an adhesive. The components are also secured during the molding process using techniques known in the art of molding insoles.

[00461] The recession areas can also be lined with a cloth having a base surface and a pad/pod surface, secured to said base along said base surface and said pad/pod along said pad/pod surface. Alternatively, a cloth is secured to pad/pod and then the composite structure secured to the recession area.

[00462] Some shoes may slightly differ in size on the inner part of the shoe or provide extra padding along the inner walls that alter the space provided on the inner part of the shoe. Base may have sizing guides that allow a user to shorten the length of the insole for proper fit within the shoe, sizing guides provide various cutting guide lines that the user would cut along, preferably with scissors.

[00463] The dimensions and measurements shown in FIGS. 15A-15E are dimensions and measurements of a preferred embodiment which are incorporated herein.

[00464] FIGS. 16A-16D illustrate the preferred embodiment or an insole for triathlon training. FIG. 16A-1 to 16A-10 shows the top, bottom, medial side, lateral side, back, and five cross-section views of the insole. The current invention is an insole that incorporates, but is not limited to: (1) a faceted stability cradle with a plurality of stability ribs, (2) plurality of pods, (3) a forefoot pad (4) criss-cross groove patterns on the bottom surface of the pods and forefoot pads, and (5) a jadeite cooling top cloth. In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe. The present invention accomplishes the goals to: (1) improve ankle and foot stability, (2) cushion the heel and forefoot during push-offs and landings, (3) help prevent insole movement or sliding during shoe operation and change-overs, and (4) provide enhanced cushioning features to the heel, midfoot, arch and forefoot during running and cross-training exercises.

[00465] FIG. 16A-1 is a top view of the insole 1600 illustrating the top sheet 1601 and transverse arch support 1638. Insole 1600 comprises a top sheet 1601 secured across the entire top surface of the base from toe area to heel area. Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support 1638 that lies under the metatarsal head area of the foot. The upward extension of transverse arch support 1638 pushes up a portion of the top sheet 401 that corresponds to the area of the transverse arch support 1638.

[00466] Traverse arch support 1638 preferably lies under the second to fourth metatarsal heads. Traverse arch support 1638 provides additional stability and cushioning to the forefoot and middle of the foot.

[00467] In a preferred embodiment, top sheet 1601 is a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 401 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi. A series of air holes extend through top sheet 1601 and the base to permit air circulation above and below insole 1600.

[00468] FIG. 16A-2 illustrates the bottom view of the insole. Insole 1600 preferably comprises a top sheet 1601 and a base 1602 having a top surface secured to said top sheet and an opposite bottom surface. Base 1602 also defines a longitudinal arch support 1619 that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[00469] The bottom surface of base 1602 defines a forefoot pad recession area 1607 in the forefoot area and a stability cradle recession area 1605 along the midfoot and heel areas. The bottom surface of base 1602 also defines one or more ribs or protrusions 1632 that extend outwardly along the arch area. The ribs 1632 are preferably longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape.

[00470] Base 1602 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. As best seen in FIGS. 16B-7 to 16B-10, the height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00471] The forefoot pad recession area 1607 begins partially proximal form the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area 1607 extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area 1607 has a rear apex 1657 that lies between the 1st and 2nd metatarsals.

[00472] Forefoot pad 1608 is shaped essentially the same as forefoot pad recession area 1607 and is secured therein. Forefoot pad 1608 has a medial edge, a lateral edge, a proximal

(back) edge and a distal (front) edge. The medial edge of forefoot pad 1608 extends along a line spaced laterally from said medial border of said insole. The proximal edge extends from said medial edge laterally and proximally to said rear apex 1657, laterally and distally towards the 3rd metatarsal head, then laterally and proximally to the lateral edge approximately along the 3rd through 5th metatarsal heads. The lateral edge connects said proximal edge to said top edge of said forefoot pad. In use, forefoot pad recession area 1607 and forefoot pad 1608 underlie the big toe of a user's foot, and the "ball" of the foot, excluding the first metatarsal head or medial ball of the user's foot. Figure 11 shows the placement of foot bones on the insole.

[00473] An adhesive is used to secure the components. The forefoot pad 1608 provides cushioning and energy return on landing from a vertical jump. It serves as a propulsion pad and support for the metatarsal heads of a user's foot, especially the 1st and 2nd metatarsal heads.

[00474] It is estimated that using tougher materials increase the durability of the insole by 35% to 65% over insoles that use softer materials for this portion of the foot insole.

[00475] The stability cradle recession area 1605 is located in the midfoot and heel areas of the bottom surface of base 1602. The stability cradle recession area 1605 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area 1607 to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1606 is shaped essentially the same as stability cradle recession area 1605 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1605.

[00476] Stability cradle 1606 has walls that wrap up the sides and rear of base 1602 to provide support for the foot. Preferably, stability cradle 1606 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 1606 are preferably higher on the medial side of the foot because of the higher loading. Preferably, stability cradle 1606 is made of a nylon material with a hardness of approximately Shore A 95. In a preferred embodiment, the stability cradle is semi-rigid. In an alternate embodiment, the stability cradle is rigid.

[00477] Preferably, the shoe facing surface of stability cradle 1606 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear to other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00478] The stability cradle 1606 preferably defines one or more rib-shaped openings 1631. In a preferred embodiment, the rib-shaped openings 1631 allow said ribs 1632 of base 1602 to extend therethrough. Preferably, base 1602 is molded so that the ribs 1632 project into rib-shaped openings 1631 so that the ribs 1632 are approximately flush with the outer surface of stability cradle 1606 and mechanically lock stability cradle 1606 and base 1602 together. Advantageously, the ribs 1632 are also able to bulge through rib-shaped openings 1631 when base 1602 is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs 1632 extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-shaped openings 1631 allow the stability cradle 1606 to be more flexible in the arch area compared to the rest of the stability cradle 1606.

[00479] In an alternate embodiment, stability cradle 1606 defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The protruding ribs are longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[00480] In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape,

and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe.

[00481] Stability cradle 1606 defines a lateral midfoot pod opening 1611 that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. The length of the lateral midfoot pod opening 1611 is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. Lateral midfoot pod 1612 is shaped essentially the same as lateral midfoot pod opening 1611 and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the lateral midfoot pod opening 1611 and allows lateral midfoot pod 1612 to extend out through said lateral midfoot pod opening 1611.

[00482] Lateral midfoot pod 1612 is preferably made from TPR or PU of a hardness of about 45-50 ASKER C. If TPR is used, a fabric is in turn secured to the base 1602 in the lateral midfoot pod opening 1611 of said base 1602. The fabric component allows the TPR to properly adhere to the base 1602.

[00483] Stability cradle 1606 also defines a lateral heel pod opening 1613 that extends through the lateral side of the heel area of stability cradle 1606 from approximately rearward of the lateral midfoot pod opening 1611 toward the heel end. Lateral heel pod 1614 is shaped essentially the same as lateral heel pod opening 1613 and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the lateral heel pod opening 1613 and allows lateral heel pod 1614 to extend out through said lateral heel pod opening 1613. Lateral heel pod 1614 has a lateral edge which extends along the lateral border of insole 1600 from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod 1614 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines.

[00484] The configuration, material and position of the lateral heel pod 1614 provides cushioning and works in association with the medial heel pod 1616 to stabilize the ankle. The hardness of the lateral heel pod is preferably essentially the same as the lateral midfoot pod, which work in concert to help reduce the incidence of lateral ankle roll-overs. It is preferably made of TPR or PU of a hardness of about Shore C 45-50. If TPR is used, a

fabric is in turn secured to the base 1602 in the lateral heel pod opening 1611 of said base 1602. The fabric component allows the TPR to properly adhere to the base 1602.

[00485] Stability cradle 1606 defines a medial heel pod opening 1615 that extends through the heel area along the medial side of heel area on the bottom surface of base 1602 just short of the heel end. Medial heel pod 1616 is shaped essentially the same as medial heel pod opening 1615 and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the medial heel pod opening 1615 and allows medial heel pod 1616 to extend out through said medial heel pod opening 1615. The medial heel pod 1616 has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod.

[00486] Medial heel pod 1616 is preferably made from TPR or PU of a hardness of about 60 ASKER C ±3. If TPR is used, a fabric is in turn secured to the base 1602 in the medial heel pod opening 1615 of said base 1602. The fabric component allows the TPR to properly adhere to the base 1602.

[00487] Foot contact with the ground is generally divided into three phases: heel strike, midfoot support, and toe off. During heel strike, the heel of the foot impacts the ground with significant force. To cushion the impact, lateral heel pod 1614 is positioned along the rear and lateral side of the calcaneus (heel bone) and extends outwardly below stability cradle 1606. Preferably, lateral heel pod 1614 is made of a material having suitable cushioning properties and are selected based on an intended type of activity.

[00488] Following the initial impact of the heel with the ground, the foot twists, or pronates, bringing the medial side of the heel into contact with the ground. The foot is sensitive to the amount of pronation as well as the rate at which the pronation occurs. Pronation is natural, and some degree of pronation is desirable because it serves to absorb the stresses and forces on the foot during walking or running. However, an excessive amount or rate of pronation results in injury.

[00489] Stability cradle 1606 provides firm support along the medial portion of the foot to help control the amount of pronation. Medial heel pod 1616 helps to control the rate of pronation by forming medial heel pod 1616 out of a material having different characteristics than lateral heel pod 1614. For example, to reduce a pronation rate, medial heel pod 1616

can be made from a firmer material than lateral heel pod 1614. A firmer or stiffer material does not compress as much or as fast as a softer material under the same load. Thus, a medial heel pod 1616 made from a firmer material would compress less than a lateral heel pod 1614 made of a softer material. As a result, medial heel pod 1616 tends to resist or counteract pronation and thereby help to reduce the degree and rate of pronation. Conversely, making medial heel pod 1616 from a softer material than lateral heel pod 1614 would tend to increase the amount and rate of pronation.

[00490] Preferably, the firmness of the material used in medial heel pod 1616 is selected based on the firmness of lateral heel pod 1614 and on the type of intended activity. For example, the firmness of lateral heel pod 1614 and medial heel pod 1616 differs by about 20-30 % for an insole to be used during light to moderate activities.

[00491] Carrying a heavy backpack or other articles significantly increases the load on the foot and the rate of pronation during and following heel strike. Accordingly, medial heel pod 1616 can be made significantly firmer in an insole designed for use while backpacking. As an example, a difference in firmness of about 20-40% is more appropriate for such activities.

[00492] Lateral midfoot pod 1612 provides cushioning and control to the lateral side of the foot during the midstance portion of a step. Typically, lateral midfoot pod 1612 is formed of a material having the same properties, e.g., firmness, as lateral heel pod 1614. However, a material having different characteristics can also be used.

[00493] The use of dual density heel pods is employed to cause a kinetic change in foot function to promote ankle stability. It is also not out of the scope of the invention to have the medial heel pod softer than the lateral heel pod and/or lateral midfoot pod or any combination thereof to address different joint moments or ankle rolls.

[00494] At the beginning of the propulsion or toe-off phase of a step, the heel begins to lift from the ground and weight shifts to the ball of the foot. Forefoot pad 1608 is located under this part of the foot. Preferably, forefoot pad 1608 is formed of a relatively resilient material so that energy put into compressing forefoot pad 1608 is returned to help propel the foot at toe-off.

[00495] During toe off, the first metatarsal naturally flexes downward. Preventing this natural downward flex of the first metatarsal causes the arch of the foot to flatten and the

foot to over pronate, increasing stress on the ankles and knees. To accommodate the downward flex, the medial portion of forefoot pad 1608 extends rearward into a corresponding concave edge portion of the distal edge of stability cradle 1606. The shape of the stability cradle 1606 and forefoot pad 1608 permit the first metatarsal to flex more naturally and thereby encourage loading of the great toe during toe off.

[00496] Base 1602 is preferably made of foam or other material having suitable cushioning properties. Preferably, base 1602 comprises an Ethylene vinyl acetate ("EVA") foam, which is a copolymer of ethylene and vinyl acetate, or a Thermoplastic Rubber ("TPR")/EVA mix. A preferred EVA or TPR/EVA mix has a durometer (hardness) of about Asker C 45-50.

[00497] Forefoot pad 1608 is preferably made from a Thermoplastic Rubber ("TPR") or Polyurethane ("PU"). The hardness of the TPR or PU used in the forefoot pad is preferably about 30 Asker C ±3.

[00498] In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe.

[00499] The forefoot pad 1620, lateral midfoot pod 1621, lateral heel pod 1622, and medial heel pod 1623 are constructed with a criss-cross groove pattern on the bottom surface of the pod or pad. The criss-cross groove pattern introduces air gaps into the pod/pad surfaces. Such air gaps and criss-cross groove patterns positively influence the impact absorption properties. It also allows for use of less material and therefore a lighter insole while still providing the desired cushioning function. Preferably, the forefoot criss-cross groove pattern 1620 is approximately 0.75 mm deep. Preferably the lateral midfoot and heel criss-cross groove patterns 1621 and 1622 are approximately 1.00 to 3.00 mm deep. Preferably, the medial heel criss-cross groove pattern 1623 is approximately 1.00 to 2.50 mm deep. Preferably the TPR pods have the deeper criss-cross groove pattern and the PU pods have

the shallower criss-cross groove pattern due to the compression characteristics of the materials. The criss-cross groove patterns also assists with keeping the insole in place and not move or slide around within the shoe.

[00500] For a men's size 11-12 insole, the width of the forefoot pad from the medial to lateral side is about 85 to 95 mm. The height is about 100 to 110 mm. The depth is about 0.95 to 1.50 mm.

[00501] It is desirable to minimize the total weight of the insoles by selection of materials working with the structural features of the insole. It is desirable that the total weight of the preferred embodiment of the insole (men's size 10/11) be about 4.0 ounces. It is desirable that the total weight of an alternate embodiment of the insole be about 5.0 to 6.0 ounces for a men's size 10/11 and about 6.5 to 7.5 ounces for a men's size 12/13. Other sizes will be proportional. Using the open-cell designs will provide for a lighter insole.

[00502] In a first preferred embodiment of the present invention, the various components of an insole which are secured to base 1602 in the recession areas defined by base 1602 on the bottom surface are permanently affixed to base 1602 using an appropriate means such as an adhesive. The components are secured during the molding process using techniques known in the art of molding insoles.

[00503] The recession areas also is lined with a cloth having a base surface and a pad/pod surface, secured to said base along said base surface and said pad/pod along said pad/pod surface. Alternatively, a cloth is secured to pad/pod and then the composite structure secured to the recession area.

[00504] Some shoes may slightly differ in size on the inner part of the shoe. Some shoes may also provide extra padding along the inner sides, front or back of the shoe that alter the actual space provided for the foot and/or an insole on the inner part of the shoe. Base 1602 may have sizing guides 1650 that allow a user to shorten the length of the insole for proper fit within the shoe, sizing guides 1650 provide various cutting guide lines that the user would cut along, preferably with scissors.

[00505] FIG. 16B-1 to 16B-8 shows a bottom, medial side, lateral side, back, and four cross-section views of the stability cradle.

[00506] FIG. 16B-1 illustrates a medial side view of the insole. Insole 1600 preferably comprises a top sheet 1601 and a base 1602 having a top surface secured to said top sheet

and an opposite bottom surface. Base 1602 also defines a longitudinal arch support 1619 that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[00507] The bottom surface of base 1602 defines a forefoot pad recession area in the forefoot area and a stability cradle recession area 1605 along the midfoot and heel areas. The bottom surface of base 1602 also defines one or more ribs or protrusions 1632 that extend outwardly along the arch area. The ribs 1632 are preferably longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape.

[00508] Base 1602 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. The height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00509] The forefoot pad recession area begins partially proximal from the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area has a rear apex that lies between the 1st and 2nd metatarsals. A forefoot pad is shaped essentially the same as forefoot pad recession area and is secured therein.

[00510] The stability cradle recession area 1605 is located in the midfoot and heel areas of the bottom surface of base 1602. The stability cradle recession area 1605 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1606 is shaped essentially the same as stability cradle recession area 1605 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1605.

[00511] Stability cradle 1606 has walls that wrap up the sides and rear of base 1602 to provide support for the foot. Preferably, stability cradle 1606 ranges from approximately

0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 1606 are preferably higher on the medial side of the foot because of the higher loading.

[00512] Preferably, the shoe facing surface of stability cradle 1606 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear with other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00513] The stability cradle 1606 preferably defines one or more rib-shaped openings 1631. In a preferred embodiment, the rib-shaped openings 1631 allow said ribs 1632 of base 1602 to extend therethrough. Preferably, base 1602 is molded so that the ribs 1632 project into rib-shaped openings 1631 so that the ribs 1632 are approximately flush with the outer surface of stability cradle 1606 and mechanically lock stability cradle 1606 and base 1602 together. Advantageously, the ribs 1632 are also able to bulge through rib-shaped openings 1631 when base 1602 is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs 1632 extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-shaped openings 1631 allow the stability cradle 1606 to be more flexible in the arch area compared to the rest of the stability cradle 1606.

[00514] In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the

midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe.

[00515] In an alternate embodiment, stability cradle 1606 defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The protruding ribs are longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[00516] Stability cradle 1606 defines a lateral midfoot pod opening that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. A lateral midfoot pod is shaped essentially the same as lateral midfoot pod opening and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the lateral midfoot pod opening and allows lateral midfoot pod to extend out through said lateral midfoot pod opening.

[00517] Stability cradle 1606 also defines a lateral heel pod opening that extends through the lateral side of the heel area of stability cradle 1606 from approximately rearward of the lateral midfoot pod opening toward the heel end. Lateral heel pod is shaped essentially the same as lateral heel pod opening and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the lateral heel pod opening and allows lateral heel pod to extend out through said lateral heel pod opening.

[00518] Stability cradle 1606 defines a medial heel pod opening that extends through the heel area along the medial side of heel area on the bottom surface of base 1602 just short of the heel end. Medial heel pod 1616 is shaped essentially the same as medial heel pod opening and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the medial heel pod opening and allows medial heel pod 1616 to extend out through said medial heel pod opening.

[00519] In a preferred embodiment, base 1602 is covered with top sheet 1601, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1601 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial

agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00520] Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support 1638 that lies under the metatarsal head area of the foot. The upward extension of transverse arch support 1638 pushes up a portion of the top sheet 1601 that corresponds to the area of the transverse arch support 1638.

[00521] Traverse arch support 1638 preferably lies under the second to fourth metatarsal heads. Traverse arch support 1638 provides additional stability and cushioning to the forefoot and middle of the foot.

[00522] FIG. 16A-2 illustrates the bottom view of the insole. Insole 1600 preferably comprises a top sheet 1601 and a base 1602 having a top surface secured to said top sheet and an opposite bottom surface. Base 1602 also defines a longitudinal arch support 1619 that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[00523] The bottom surface of base 1602 defines a forefoot pad recession area 1607 in the forefoot area and a stability cradle recession area 1605 along the midfoot and heel areas. The bottom surface of base 1602 also defines one or more ribs or protrusions 1632 that extend outwardly along the arch area. The ribs 1632 are preferably longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape.

[00524] Base 1602 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. As best seen in FIGS. 16B-7 to 16B-10, the height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00525] The forefoot pad recession area 1607 begins partially proximal form the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area 1607 extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area 1607 has a rear apex 1657 that lies between the 1st and 2nd metatarsals.

[00526] Forefoot pad 1608 is shaped essentially the same as forefoot pad recession area 1607 and is secured therein. Forefoot pad 1608 has a medial edge, a lateral edge, a proximal (back) edge and a distal (front) edge. The medial edge of forefoot pad 1608 extends along a line spaced laterally from said medial border of said insole. The proximal edge extends from said medial edge laterally and proximally to said rear apex 1657, laterally and distally towards the 3rd metatarsal head, then laterally and proximally to the lateral edge approximately along the 3rd through 5th metatarsal heads. The lateral edge connects said proximal edge to said top edge of said forefoot pad. In use, forefoot pad recession area 1607 and forefoot pad 1608 underlie the big toe of a user's foot, and the "ball" of the foot, excluding the first metatarsal head or medial ball of the user's foot. Figure 11 shows the placement of foot bones on the insole.

[00527] An adhesive is used to secure the components. The forefoot pad 1608 provides cushioning and energy return on landing from a vertical jump. It serves as a propulsion pad and support for the metatarsal heads of a user's foot, especially the 1st and 2nd metatarsal heads.

[00528] It is estimated that using tougher materials increase the durability of the insole by 35% to 65% over insoles that use softer materials for this portion of the foot insole.

[00529] The stability cradle recession area 1605 is located in the midfoot and heel areas of the bottom surface of base 1602. The stability cradle recession area 1605 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area 1607 to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1606 is shaped essentially the same as stability cradle recession area 1605 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1605.

[00530] Stability cradle 1606 has walls that wrap up the sides and rear of base 1602 to provide support for the foot. Preferably, stability cradle 1606 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 1606 are preferably higher on the medial side of the foot because of the higher loading. Preferably, stability cradle 1606 is made of a nylon material with a

hardness of approximately Shore A 95. In a preferred embodiment, the stability cradle is semi-rigid. In an alternate embodiment, the stability cradle is rigid.

[00531] Preferably, the shoe facing surface of stability cradle 1606 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear to other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00532] The stability cradle 1606 preferably defines one or more rib-shaped openings 1631. In a preferred embodiment, the rib-shaped openings 1631 allow said ribs 1632 of base 1602 to extend therethrough. Preferably, base 1602 is molded so that the ribs 1632 project into rib-shaped openings 1631 so that the ribs 1632 are approximately flush with the outer surface of stability cradle 1606 and mechanically lock stability cradle 1606 and base 1602 together. Advantageously, the ribs 1632 are also able to bulge through rib-shaped openings 1631 when base 1602 is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs 1632 extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-shaped openings 1631 allow the stability cradle 1606 to be more flexible in the arch area compared to the rest of the stability cradle 1606.

[00533] In an alternate embodiment, stability cradle 1606 defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The protruding ribs are longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[00534] Stability cradle 1606 defines a lateral midfoot pod opening 1611 that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. The length of the lateral midfoot pod opening 1611 is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. Lateral midfoot pod 1612 is shaped essentially the same

as lateral midfoot pod opening 1611 and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the lateral midfoot pod opening 1611 and allows lateral midfoot pod 1612 to extend out through said lateral midfoot pod opening 1611.

[00535] Lateral midfoot pod 1612 is preferably made from TPR or PU of a hardness of about 45-50 ASKER C. If TPR is used, a fabric is in turn secured to the base 1602 in the lateral midfoot pod opening 1611 of said base 1602. The fabric component allows the TPR to properly adhere to the base 1602.

[00536] Stability cradle 1606 also defines a lateral heel pod opening 1613 that extends through the lateral side of the heel area of stability cradle 1606 from approximately rearward of the lateral midfoot pod opening 1611 toward the heel end. Lateral heel pod 1614 is shaped essentially the same as lateral heel pod opening 1613 and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the lateral heel pod opening 1613 and allows lateral heel pod 1614 to extend out through said lateral heel pod opening 1613. Lateral heel pod 1614 has a lateral edge which extends along the lateral border of insole 1600 from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod 1614 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines.

[00537] The configuration, material and position of the lateral heel pod 1614 provides cushioning and works in association with the medial heel pod 516 to stabilize the ankle. The hardness of the lateral heel pod is preferably essentially the same as the lateral midfoot pod, which work in concert to help reduce the incidence of lateral ankle roll-overs. It is preferably made of TPR or PU of a hardness of about Shore C 45-50. If TPR is used, a fabric is in turn secured to the base 1602 in the lateral heel pod opening 1611 of said base 1602. The fabric component allows the TPR to properly adhere to the base 1602.

[00538] Stability cradle 1606 defines a medial heel pod opening 1615 that extends through the heel area along the medial side of heel area on the bottom surface of base 1602 just short of the heel end. Medial heel pod 1616 is shaped essentially the same as medial heel pod opening 1615 and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the medial heel pod opening 1615 and

allows medial heel pod 1616 to extend out through said medial heel pod opening 1615. The medial heel pod 1616 has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod.

[00539] Medial heel pod 1616 is preferably made from TPR or PU of a hardness of about 60 ASKER C ±3. If TPR is used, a fabric is in turn secured to the base 1602 in the medial heel pod opening 1615 of said base 1602. The fabric component allows the TPR to properly adhere to the base 1602.

[00540] Foot contact with the ground is generally divided into three phases: heel strike, midfoot support, and toe off. During heel strike, the heel of the foot impacts the ground with significant force. To cushion the impact, lateral heel pod 1614 is positioned along the rear and lateral side of the calcaneus (heel bone) and extends outwardly below stability cradle 1606. Preferably, lateral heel pod 1614 is made of a material having suitable cushioning properties and are selected based on an intended type of activity.

[00541] Following the initial impact of the heel with the ground, the foot twists, or pronates, bringing the medial side of the heel into contact with the ground. The foot is sensitive to the amount of pronation as well as the rate at which the pronation occurs. Pronation is natural, and some degree of pronation is desirable because it serves to absorb the stresses and forces on the foot during walking or running. However, an excessive amount or rate of pronation results in injury.

[00542] Stability cradle 1606 provides firm support along the medial portion of the foot to help control the amount of pronation. Medial heel pod 1616 helps to control the rate of pronation by forming medial heel pod 1616 out of a material having different characteristics than lateral heel pod 1614. For example, to reduce a pronation rate, medial heel pod 1616 can be made from a firmer material than lateral heel pod 1614. A firmer or stiffer material does not compress as much or as fast as a softer material under the same load. Thus, a medial heel pod 1616 made from a firmer material would compress less than a lateral heel pod 1614 made of a softer material. As a result, medial heel pod 1616 tends to resist or counteract pronation and thereby help to reduce the degree and rate of pronation. Conversely, making medial heel pod 1616 from a softer material than lateral heel pod 1614 would tend to increase the amount and rate of pronation.

[00543] Preferably, the firmness of the material used in medial heel pod 1616 is selected based on the firmness of lateral heel pod 1614 and on the type of intended activity. For example, the firmness of lateral heel pod 1614 and medial heel pod 1616 differs by about 20-30 % for an insole to be used during light to moderate activities.

[00544] Carrying a heavy backpack or other articles significantly increases the load on the foot and the rate of pronation during and following heel strike. Accordingly, medial heel pod 1616 can be made significantly firmer in an insole designed for use while backpacking. As an example, a difference in firmness of about 20-40% is more appropriate for such activities.

[00545] Lateral midfoot pod 1612 provides cushioning and control to the lateral side of the foot during the midstance portion of a step. Typically, lateral midfoot pod 1612 is formed of a material having the same properties, e.g., firmness, as lateral heel pod 1614. However, a material having different characteristics can also be used.

[00546] The use of dual density heel pods is employed to cause a kinetic change in foot function to promote ankle stability. It is also not out of the scope of the invention to have the medial heel pod softer than the lateral heel pod and/or lateral midfoot pod or any combination thereof to address different joint moments or ankle rolls.

[00547] At the beginning of the propulsion or toe-off phase of a step, the heel begins to lift from the ground and weight shifts to the ball of the foot. Forefoot pad 1608 is located under this part of the foot. Preferably, forefoot pad 1608 is formed of a relatively resilient material so that energy put into compressing forefoot pad 1608 is returned to help propel the foot at toe-off.

[00548] During toe off, the first metatarsal naturally flexes downward. Preventing this natural downward flex of the first metatarsal causes the arch of the foot to flatten and the foot to over pronate, increasing stress on the ankles and knees. To accommodate the downward flex, the medial portion of forefoot pad 1608 extends rearward into a corresponding concave edge portion of the distal edge of stability cradle 1606. The shape of the stability cradle 1606 and forefoot pad 1608 permit the first metatarsal to flex more naturally and thereby encourage loading of the great toe during toe off.

[00549] Base 1602 is preferably made of foam or other material having suitable cushioning properties. Preferably, base 1602 comprises an Ethylene vinyl acetate ("EVA") foam,

which is a copolymer of ethylene and vinyl acetate, or a Thermoplastic Rubber ("TPR")/EVA mix. A preferred EVA or TPR/EVA mix has a durometer (hardness) of about Asker C 45-50.

[00550] Forefoot pad 1608 is preferably made from a Thermoplastic Rubber ("TPR") or Polyurethane ("PU"). The hardness of the TPR or PU used in the forefoot pad is preferably about 30 Asker C ±3.

[00551] The forefoot pad 1620, lateral midfoot pod 1621, lateral heel pod 1622, and medial heel pod 1623 are constructed with a criss-cross groove pattern on the bottom surface of the pod or pad. The criss-cross groove pattern introduces air gaps into the pod/pad surfaces. Such air gaps and criss-cross groove patterns positively influence the impact absorption properties. It also allows for use of less material and therefore a lighter insole while still providing the desired cushioning function. Preferably, the forefoot criss-cross groove pattern 1620 is approximately 0.75 mm deep. Preferably the lateral midfoot and heel criss-cross groove patterns 1621 and 1622 are approximately 1.00 to 3.00 mm deep. Preferably, the medial heel criss-cross groove pattern 1623 is approximately 1.00 to 2.50 mm deep. Preferably the TPR pods have the deeper criss-cross groove pattern and the PU pods have the shallower criss-cross groove pattern due to the compression characteristics of the materials. The criss-cross groove patterns also assists with keeping the insole in place and not move or slide around within the shoe.

[00552] For a men's size 11-12 insole, the width of the forefoot pad from the medial to lateral side is about 85 to 95 mm. The height is about 100 to 110 mm. The depth is about 0.95 to 1.50 mm.

[00553] It is desirable to minimize the total weight of the insoles by selection of materials working with the structural features of the insole. It is desirable that the total weight of the preferred embodiment of the insole (men's size 10/11) be about 4.0 ounces. It is desirable that the total weight of an alternate embodiment of the insole be about 5.0 to 6.0 ounces for a men's size 10/11 and about 6.5 to 7.5 ounces for a men's size 12/13. Other sizes will be proportional. Using the open-cell designs will provide for a lighter insole.

[00554] In a first preferred embodiment of the present invention, the various components of an insole which are secured to base 1602 in the recession areas defined by base 1602 on the bottom surface are permanently affixed to base 1602 using an appropriate means such as an

adhesive. The components are secured during the molding process using techniques known in the art of molding insoles.

[00555] The recession areas also is lined with a cloth having a base surface and a pad/pod surface, secured to said base along said base surface and said pad/pod along said pad/pod surface. Alternatively, a cloth is secured to pad/pod and then the composite structure secured to the recession area.

[00556] Some shoes may slightly differ in size on the inner part of the shoe. Some shoes may also provide extra padding along the inner sides, front or back of the shoe that alter the actual space provided for the foot and/or an insole on the inner part of the shoe. Base 1602 may have sizing guides 1650 that allow a user to shorten the length of the insole for proper fit within the shoe, sizing guides 1650 provide various cutting guide lines that the user would cut along, preferably with scissors.

[00557] FIG. 16B-3 illustrates a lateral side view of the insole. Insole 1600 preferably comprises a top sheet 1601 and a base 1602 having a top surface secured to said top sheet 1601 and an opposite bottom surface. Base 1602 also defines a longitudinal arch support 1619 that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[00558] The bottom surface of base 1602 defines a forefoot pad recession area in the forefoot area and a stability cradle recession area 1605 along the midfoot and heel areas.

[00559] Base 1602 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. The height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00560] The forefoot pad recession area begins partially proximal from the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area has a rear apex that lies between the 1st and 2nd metatarsals. A forefoot pad is shaped essentially the same as forefoot pad recession area and is secured therein.

[00561] The stability cradle recession area 1605 is located in the midfoot and heel areas of the bottom surface of base 1602. The stability cradle recession area 1605 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area 1607 to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1606 is shaped essentially the same as stability cradle recession area 1605 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1605.

[00562] Stability cradle 1606 has walls that wrap up the sides and rear of base 1602 to provide support for the foot. Preferably, stability cradle 1606 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 1606 are preferably higher on the medial side of the foot because of the higher loading.

[00563] Preferably, the shoe facing surface of stability cradle 1606 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear to other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00564] Stability cradle 1606 defines a lateral midfoot pod opening that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. A lateral midfoot pod 1612 is shaped essentially the same as lateral midfoot pod opening and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the lateral midfoot pod opening and allows lateral midfoot pod 1612 to extend out through said lateral midfoot pod opening.

[00565] Stability cradle 1606 also defines a lateral heel pod opening that extends through the lateral side of the heel area of stability cradle 1606 from approximately rearward of the

lateral midfoot pod opening toward the heel end. Lateral heel pod 1614 is shaped essentially the same as lateral heel pod opening and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the lateral heel pod opening and allows lateral heel pod 1614 to extend out through said lateral heel pod opening.

[00566] Stability cradle 1606 defines a medial heel pod opening that extends through the heel area along the medial side of heel area on the bottom surface of base 1602 just short of the heel end. Medial heel pod is shaped essentially the same as medial heel pod opening and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the medial heel pod opening and allows medial heel pod to extend out through said medial heel pod opening.

[00567] In a preferred embodiment, base 1602 is covered with top sheet 1601, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1601 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00568] Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support 1638 that lies under the metatarsal head area of the foot. The upward extension of transverse arch support 1638 pushes up a portion of the top sheet 1601 that corresponds to the area of the transverse arch support 1638.

[00569] Traverse arch support 1638 preferably lies under the second to fourth metatarsal heads. Traverse arch support 1638 provides additional stability and cushioning to the forefoot and middle of the foot.

[00570] FIG. 16B-4 is a top view of the insole illustrating the top sheet 1601 and transverse arch support 1638. Insole 1600 comprises a top sheet 1601 secured across the entire top surface of the base from toe area to heel area. Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support 1638 that lies under the metatarsal head area of the foot. The upward extension of transverse arch support 1638 pushes up a

portion of the top sheet 1601 that corresponds to the area of the transverse arch support 1638.

[00571] Traverse arch support 1638 preferably lies under the second to fourth metatarsal heads. Traverse arch support 1638 provides additional stability and cushioning to the forefoot and middle of the foot.

[00572] In a preferred embodiment, top sheet 1601 is a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1601 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi. A series of air holes extend through top sheet 1601 and the base to permit air circulation above and below insole 1600.

[00573] FIG. 16B-5 is a section view line 16B-5 along the middle of the insole as identified in FIGS. 16B-2. Insole 1600 preferably comprises a top sheet 1601 and a base 1602 having a top surface secured to said top sheet 1601 and an opposite bottom surface. The bottom surface of base 1602 defines a forefoot pad recession area 1607 in the forefoot area and a stability cradle recession area 1605 along the midfoot and heel areas.

[00574] Base 1602 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. As best seen in FIGS. 16B-6 to 16B-10, the height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00575] Preferably, the top surface of the base 1602 defines an upwardly-extending portion or transverse arch support 1638 that lies under the metatarsal head area of the foot. The upward extension of transverse arch support 1638 pushes up a portion of the top sheet 1601 that corresponds to the area of the transverse arch support 1638. Traverse arch support 1638 preferably lies under the second to fourth metatarsal heads. Traverse arch support 1638 provides additional stability and cushioning to the forefoot and middle of the foot.

[00576] The forefoot pad recession area 1607 begins partially proximal form the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area 1607 extends rearward to about the 3rd through 5th metatarsal heads on a

lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area 1607 has a rear apex that lies between the 1st and 2nd metatarsals.

[00577] Forefoot pad 1608 is shaped essentially the same as forefoot pad recession area 1607 and is secured therein. Forefoot pad 1608 has a medial edge, a lateral edge, a proximal (back) edge and a distal (front) edge. The medial edge of forefoot pad 1608 extends along a line spaced laterally from said medial border of said insole. The proximal edge extends from said medial edge laterally and proximally to said rear apex 1657, laterally and distally towards the 3rd metatarsal head, then laterally and proximally to the lateral edge approximately along the 3rd through 5th metatarsal heads. The lateral edge connects said proximal edge to said top edge of said forefoot pad. In use, forefoot pad recession area 1607 and forefoot pad 1608 underlie the big toe of a user's foot, and the "ball" of the foot, excluding the first metatarsal head or medial ball of the user's foot. Figure 11 shows the placement of foot bones on the insole.

[00578] An adhesive is be used to secure the components. The forefoot pad 1608 provides cushioning and energy return on landing from a vertical jump. It serves as a propulsion pad and support for the metatarsal heads of a user's foot, especially the 1st and 2nd metatarsal heads.

[00579] It is estimated that using tougher materials increases the durability of the insole by 35% to 65% over insoles that use softer materials for this portion of the foot insole.

[00580] The stability cradle recession area 1605 is located in the midfoot and heel areas of the bottom surface of base 1602. The stability cradle recession area 1605 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area 1607 to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1606 is shaped essentially the same as stability cradle recession area 1605 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1605.

[00581] Stability cradle 1606 has walls that wrap up the sides and rear of base 1602 to provide support for the foot.

[00582] Preferably, the shoe facing surface of stability cradle 1606 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear with other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improves the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00583] Stability cradle 1606 defines a lateral midfoot pod opening that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. The length of the lateral midfoot pod opening is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. Lateral midfoot pod is shaped essentially the same as lateral midfoot pod opening and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the lateral midfoot pod opening and allows lateral midfoot pod to extend out through said lateral midfoot pod opening.

[00584] Stability cradle 1606 also defines a lateral heel pod opening 1613 that extends through the lateral side of the heel area of stability cradle 1606 from approximately rearward of the lateral midfoot pod opening 1611 toward the heel end. Lateral heel pod 1614 is shaped essentially the same as lateral heel pod opening 1613 and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the lateral heel pod opening 1613 and allows lateral heel pod 1614 to extend out through said lateral heel pod opening 1613. Lateral heel pod 1614 has a lateral edge which extends along the lateral border of insole 1600 from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod 1614 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines.

[00585] The configuration, material and position of the lateral heel pod 1614 provides cushioning and works in association with the medial heel pod 1615 to stabilize the ankle.

[00586] Stability cradle 1606 defines a medial heel pod opening 1615 that extends through the heel area along the medial side of heel area on the bottom surface of base 1602 just short of the heel end. Medial heel pod 1616 is shaped essentially the same as medial heel pod opening 1615 and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the medial heel pod opening 1615 and allows medial heel pod 1616 to extend out through said medial heel pod opening 1615. The medial heel pod 1616 has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod.

[00587] Foot contact with the ground is generally divided into three phases: heel strike, midfoot support, and toe off. During heel strike, the heel of the foot impacts the ground with significant force. To cushion the impact, lateral heel pod 1614 is positioned along the rear and lateral side of the calcaneus (heel bone) and extends outwardly below stability cradle 1606. Preferably, lateral heel pod 1614 is made of a material having suitable cushioning properties and are selected based on an intended type of activity.

[00588] Following the initial impact of the heel with the ground, the foot twists, or pronates, bringing the medial side of the heel into contact with the ground. The foot is sensitive to the amount of pronation as well as the rate at which the pronation occurs. Pronation is natural, and some degree of pronation is desirable because it serves to absorb the stresses and forces on the foot during walking or running. However, an excessive amount or rate of pronation results in injury.

[00589] Stability cradle 1606 provides firm support along the medial portion of the foot to help control the amount of pronation. Medial heel pod 1616 helps to control the rate of pronation by forming medial heel pod 1616 out of a material having different characteristics than lateral heel pod 1614. For example, to reduce a pronation rate, medial heel pod 1616 is made from a firmer material than lateral heel pod 1614. A firmer or stiffer material does not compress as much or as fast as a softer material under the same load. Thus, a medial heel pod 1616 made from a firmer material would compress less than a lateral heel pod 1614 made of a softer material. As a result, medial heel pod 1616 tends to resist or counteract pronation and thereby help to reduce the degree and rate of pronation. Conversely, making medial heel pod 1616 from a softer material than lateral heel pod 1614 would tend to increase the amount and rate of pronation.

[00590] Preferably, the firmness of the material used in medial heel pod 1616 is selected based on the firmness of lateral heel pod 1614 and on the type of intended activity. For example, the firmness of lateral heel pod 1614 and medial heel pod 1616 differs by about 20-30 % for an insole to be used during light to moderate activities.

[00591] Carrying a heavy backpack or other articles significantly increases the load on the foot and the rate of pronation during and following heel strike. Accordingly, medial heel pod 1616 is made significantly firmer in an insole designed for use while backpacking. As an example, a difference in firmness of about 20-40% is more appropriate for such activities.

[00592] Lateral midfoot pod 1612 provides cushioning and control to the lateral side of the foot during the midstance portion of a step. Typically, lateral midfoot pod is formed of a material having the same properties, e.g., firmness, as lateral heel pod 1614. However, a material having different characteristics may also be used.

[00593] The use of dual density heel pods is employed to cause a kinetic change in foot function to promote ankle stability. It is also not out of the scope of the invention to have the medial heel pod softer than the lateral heel pod and/or lateral midfoot pod or any combination thereof to address different joint moments or ankle rolls.

[00594] At the beginning of the propulsion or toe-off phase of a step, the heel begins to lift from the ground and weight shifts to the ball of the foot. Forefoot pad 1608 is located under this part of the foot. Preferably, forefoot pad 1608 is formed of a relatively resilient material so that energy put into compressing forefoot pad 1608 is returned to help propel the foot at toe-off.

[00595] During toe off, the first metatarsal naturally flexes downward. Preventing this natural downward flex of the first metatarsal causes the arch of the foot to flatten and the foot to over pronate, increasing stress on the ankles and knees. To accommodate the downward flex, the medial portion of forefoot pad 1608 extends rearward into a corresponding concave edge portion of the distal edge of stability cradle 1606. The shape of the stability cradle 1606 and forefoot pad 1608 permit the first metatarsal to flex more naturally and thereby encourage loading of the great toe during toe off.

[00596] In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an

insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe.

[00597] The forefoot pad 1620, lateral midfoot pod 1621, lateral heel pod 1622, and medial heel pod 1623 are constructed with a criss-cross groove pattern on the bottom surface of the pod or pad. The criss-cross groove pattern introduces air gaps into the pod/pad surfaces. Such air gaps and criss-cross groove patterns positively influence the impact absorption properties. It also allows for use of less material and therefore a lighter insole while still providing the desired cushioning function. Preferably, the forefoot criss-cross groove pattern 1620 is approximately 0.75 mm deep. Preferably the lateral midfoot and heel criss-cross groove patterns are approximately 1.00 to 3.00 mm deep. Preferably, the medial heel criss-cross groove pattern 1623 is approximately 1.00 to 2.50 mm deep.

[00598] For a men's size 11-12 insole, the width of the forefoot pad from the medial to lateral side is about 85 to 95 mm. The height is about 100 to 110 mm. The depth is about 0.95 to 1.50 mm.

[00599] It is desirable to minimize the total weight of the insoles by selection of materials working with the structural features of the insole. It is desirable that the total weight of the preferred embodiment of the insole (men's size 10/11) be about 4.0 ounces. It is desirable that the total weight of an alternate embodiment of the insole be about 5.0 to 6.0 ounces for a men's size 10/11 and about 6.5 to 7.5 ounces for a men's size 12/13. Other sizes will be proportional. Using the criss-cross groove pattern designs will help provide a lighter insole.

[00600] In a preferred embodiment, base 1602 is covered with top sheet 1601, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1601 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00601] In a first preferred embodiment of the present invention, the various components of an insole which are secured to base 1602 in the recession areas defined by base 1602 on the bottom surface are permanently affixed to base 1602 using an appropriate means such as an adhesive. The components also be secured during the molding process using techniques known in the art of molding insoles.

[00602] The recession areas are also be lined with a cloth having a base surface and a pad/pod surface, secured to said base along said base surface and said pad/pod along said pad/pod surface. Alternatively, a cloth is secured to pad/pod and then the composite structure secured to the recession area.

[00603] FIG. 16B-6 illustrates a rear view of the insole. Insole 1600 preferably comprises a top sheet 1601 and a base 1602 having a top surface secured to said top sheet and an opposite bottom surface. Base 1602 also defines a longitudinal arch support 1619 that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[00604] The bottom surface of base 1602 defines a forefoot pad recession area in the forefoot area and a stability cradle recession area 1605 along the midfoot and heel areas. The bottom surface of base 1602 also define one or more ribs or protrusions 1632 that extend outwardly along the arch area. The ribs 1632 are preferably longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. An alternate embodiment has the ribs or protrusions defined by the stability cradle 1606 and extending outwardly from the stability cradle 1606 in the arch area.

[00605] Base 1602 has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. The height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00606] The forefoot pad recession area begins partially proximal from the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area has a rear apex that lies between the 1st and 2nd metatarsals.

A forefoot pad is shaped essentially the same as forefoot pad recession area and is secured therein.

[00607] The stability cradle recession area 1605 is located in the midfoot and heel areas of the bottom surface of base 1602. The stability cradle recession area 1605 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1606 is shaped essentially the same as stability cradle recession area 1605 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1605.

[00608] Stability cradle 1606 has walls that wrap up the sides and rear of base 1602 to provide support for the foot. Preferably, stability cradle 1606 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 1606 are preferably higher on the medial side of the foot because of the higher loading.

[00609] Preferably, the shoe facing surface of stability cradle 1606 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear with other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improves the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00610] The stability cradle 1606 preferably defines one or more rib-shaped openings 1631. In a preferred embodiment, the rib-shaped openings 1631 allow said ribs 1632 of base 1602 to extend therethrough. Preferably, base 1602 is molded so that the ribs 1632 project into rib-shaped openings 1631 so that the ribs 1632 are approximately flush with the outer surface of stability cradle 1606 and mechanically lock stability cradle 1606 and base 1602 together. Advantageously, the ribs 1632 are also able to bulge through rib-shaped openings

1631 when base 1602 is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs 1632 extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-shaped openings 1631 allow the stability cradle 1606 to be more flexible in the arch area compared to the rest of the stability cradle 1606.

[00611] In an alternate embodiment, stability cradle 1606 defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The protruding ribs are longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[00612] Stability cradle 1606 defines a lateral midfoot pod opening that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. A lateral midfoot pod is shaped essentially the same as lateral midfoot pod opening and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the lateral midfoot pod opening and allows lateral midfoot pod to extend out through said lateral midfoot pod opening.

[00613] Stability cradle 1606 also defines a lateral heel pod opening that extends through the lateral side of the heel area of stability cradle 1606 from approximately rearward of the lateral midfoot pod opening toward the heel end. Lateral heel pod 1614 is shaped essentially the same as lateral heel pod opening and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the lateral heel pod opening and allows lateral heel pod 1614 to extend out through said lateral heel pod opening.

[00614] Stability cradle 1606 defines a medial heel pod opening that extends through the heel area along the medial side of heel area on the bottom surface of base 1602 just short of the heel end. Medial heel pod 1616 is shaped essentially the same as medial heel pod opening and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the medial heel pod opening and allows medial heel pod 1616 to extend out through said medial heel pod opening.

[00615] In a preferred embodiment, base 1602 is covered with top sheet 1601, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the

possibility of blisters. Preferably, top sheet 1601 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi. Preferably the forefoot pad recession area 1607 has a rear apex that lies between the 1st and 2nd metatarsals.

[00616] FIG. 16B-7 illustrates a cross section 16B-7 as identified in FIGS. 16B-2. Insole 1600 preferably comprises a top sheet 1601 and a base 1602 having a top surface secured to said top sheet 1601 and an opposite bottom surface. The bottom surface of base 1602 defines a forefoot pad recession area and a stability cradle recession area.

[00617] The stability cradle recession area 1605 is located in the midfoot and heel areas of the bottom surface of base 1602. The stability cradle recession area 1605 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1626 is shaped essentially the same as stability cradle recession area 1605 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1605. Stability cradle 1606 has walls that wrap up the sides and rear of base 1602 to provide support for the foot.

[00618] Preferably, the shoe facing surface of stability cradle 1606 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improves the use and performance of these insoles for this particular use.

[00619] Stability cradle 1606 also defines a lateral heel pod opening 1613 that extends through the lateral side of the heel area of stability cradle 1606 from approximately rearward of the lateral midfoot pod opening 1611 toward the heel end. Lateral heel pod 1614 is shaped essentially the same as lateral heel pod opening 1613 and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the lateral heel pod opening 1613 and allows lateral heel pod 1614 to extend

out through said lateral heel pod opening 1613. Lateral heel pod 1614 has a lateral edge which extends along the lateral border of insole 1600 from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod 1614 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines.

[00620] Stability cradle 1606 defines a medial heel pod opening 1615 that extends through the heel area along the medial side of heel area on the bottom surface of base 1602 just short of the heel end. Medial heel pod 1616 is shaped essentially the same as medial heel pod opening 1615 and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the medial heel pod opening 1615 and allows medial heel pod 1616 to extend out through said medial heel pod opening 1615. The medial heel pod 1616 has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod.

[00621] In a preferred embodiment, base 1602 is covered with top sheet 1601, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1601 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00622] FIG. 16B-9 and 16B-8 illustrates a cross section 16B-9 and 16B-8, respectively, as identified in FIGS. 16B-2. Insole 1600 preferably comprises a top sheet 1601 and a base 1602 having a top surface secured to said top sheet 1601 and an opposite bottom surface. The bottom surface of base 1602 defines a forefoot pad recession area and a stability cradle recession area.

[00623] The stability cradle recession area 1605 is located in the midfoot and heel areas of the bottom surface of base 1602. The stability cradle recession area 1605 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is

shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1616 is shaped essentially the same as stability cradle recession area 1605 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1605. Stability cradle 1606 has walls that wrap up the sides and rear of base 1602 to provide support for the foot.

[00624] Preferably, the shoe facing surface of stability cradle 1606 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improves the use and performance of these insoles for this particular use.

[00625] The stability cradle 1606 preferably defines one or more rib-shaped openings 1631. In a preferred embodiment, the rib-shaped openings 1631 allow said ribs 1632 of base 1602 to extend therethrough. Preferably, base 1602 is molded so that the ribs 1632 project into rib-shaped openings 1631 so that the ribs 1632 are approximately flush with the outer surface of stability cradle 1606 and mechanically lock stability cradle 1606 and base 1602 together. Advantageously, the ribs 1632 are also able to bulge through rib-shaped openings 1631 when base 1602 is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs 1632 extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-shaped openings 1631 allow the stability cradle 1606 to be more flexible in the arch area compared to the rest of the stability cradle 1606.

[00626] In an alternate embodiment, stability cradle 1606 defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The protruding ribs are longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[00627] Stability cradle 1606 defines a lateral midfoot pod opening 1611 that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. The length of the lateral midfoot pod opening 1611 is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. Lateral midfoot pod 1612 is shaped essentially the same as lateral midfoot pod opening 1611 and is secured to the bottom surface of base 1602

within the stability cradle recession area in a location that correlates to the lateral midfoot pod opening 1611 and allows lateral midfoot pod 1612 to extend out through said lateral midfoot pod opening 1611.

[00628] In a preferred embodiment, base 1602 is covered with top sheet 1601, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1601 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00629] FIG. 16B-10 illustrates a cross section 16B-10 as identified in FIGS. 16B-2. Insole 1600 preferably comprises a top sheet 1601 and a base 1602 having a top surface secured to said top sheet 1601 and an opposite bottom surface. The bottom surface of base 1602 defines a forefoot pad recession area and a stability cradle recession area.

[00630] The stability cradle recession area 1605 is located in the midfoot and heel areas of the bottom surface of base 1602. The stability cradle recession area 1605 extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1606 is shaped essentially the same as stability cradle recession area 1605 and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area 1605.

[00631] Preferably, the shoe facing surface of stability cradle 1606 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use.

[00632] In a preferred embodiment, base 1602 is covered with top sheet 1601, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the

possibility of blisters. Preferably, top sheet 1601 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00633] Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support 1638 that lies under the metatarsal head area of the foot. The upward extension of transverse arch support 1638 pushes up a portion of the top sheet 1601 that corresponds to the area of the transverse arch support 1638.

[00634] Traverse arch support 1638 preferably lies under the second to fourth metatarsal heads. Traverse arch support 1638 provides additional stability to the forefoot and middle of the foot.

[00635] FIGS. 16C-1 to 16C-8 medial side, bottom, lateral side, back and four cross section views of a stability cradle 1606. A stability cradle recession area is located in the midfoot and heel areas of the bottom surface of a base. The stability cradle recession area extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of a forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle 1606 is shaped essentially the same as the stability cradle recession area and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area.

[00636] Stability cradle 1606 has walls that wrap up the sides and rear of the base to provide support for the foot. Preferably, stability cradle 1606 ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle 1606 are preferably higher on the medial side of the foot because of the higher loading. Preferably, stability cradle 1606 is made of a nylon material with a hardness of approximately Shore A 95. In a preferred embodiment, the stability cradle is semi-rigid. In an alternate embodiment, the stability cradle is rigid.

[00637] Preferably, the shoe facing surface of stability cradle 1606 has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place"

when a user's foot is being placed into or out of the shoe. Swapping shoes and running gear to other footwear, or vice versa, is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improves the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00638] The stability cradle 1606 preferably defines one or more rib-shaped openings 1631. In a preferred embodiment, the rib-shaped openings 1631 allow ribs on the base to extend therethrough. Advantageously, the ribs are also able to bulge through rib-shaped openings 1631 when base is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. The rib-shaped openings 1631 allow the stability cradle 1606 to be more flexible in the arch area compared to the rest of the stability cradle 1606.

[00639] Stability cradle 1606 defines a lateral midfoot pod opening 1611 that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. The length of the lateral midfoot pod opening 1611 is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. The lateral midfoot pod opening 1611 is designed to allow a lateral midfoot pod to extend there through.

[00640] In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe.

[00641] Stability cradle 1606 also defines a lateral heel pod opening 1613 that extends through the lateral side of the heel area of stability cradle 1606 from approximately rearward of the lateral midfoot pod opening 1611 toward the heel end. Lateral heel pod

opening 1613 has a lateral edge which extends along the lateral border of insole from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod opening 1611. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod opening 1613 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines. Lateral heel pod opening 1613 is designed to allow a lateral heel pod to extend there through.

[00642] Medial heel pod opening 1615 extends through the heel area along the medial side of heel area on the bottom surface of base 1602 just short of the heel end. The medial heel pod opening 1615 has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod opening. Medial heel pod opening 1615 is designed to allow a medial heel pod to extend there through.

[00643] Stability cradle 1606 provides firm support along the medial portion of the foot to help control the amount of pronation.

[00644] FIG. 16C-1 to 16C-5 shows a bottom and side views of the lateral midfoot pod, medial heel pod, and lateral heel pod, and a section view of the medial heel pod and lateral heel pod.

[00645] Figure 16D-1 to 16D-5 show a medial side, bottom, lateral side, prospective and one cross-section view of the insole pads 1612, 1614 and 1616. Stability cradle 1606 also defines a lateral heel pod opening 1613 that extends through the lateral side of the heel area of stability cradle 1606 from approximately rearward of the lateral midfoot pod opening 1611 toward the heel end. Lateral heel pod 1614 is shaped essentially the same as lateral heel pod opening 1613 and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the lateral heel pod opening 1613 and allows lateral heel pod 1614 to extend out through said lateral heel pod opening 1613. Lateral heel pod 1614 has a lateral edge which extends along the lateral border of insole 1600 from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod 1614 also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines.

[00646] The configuration, material and position of the lateral heel pod 1614 provides cushioning and works in association with the medial heel pod 1615 to stabilize the ankle. The hardness of the lateral heel pod is preferably essentially the same as the lateral midfoot pod, which work in concert to help reduce the incidence of lateral ankle roll-overs. It is preferably made of TPR or PU of a hardness of about Shore C 45-50. If TPR is used, a fabric is in turn secured to the base 102 in the lateral heel pod opening 1613 of said base 1602. The fabric component allows the TPR to properly adhere to the base 1602.

[00647] Stability cradle 1606 defines a medial heel pod opening 1615 that extends through the heel area along the medial side of heel area on the bottom surface of base 1602 just short of the heel end. Medial heel pod 1616 is shaped essentially the same as medial heel pod opening 1615 and is secured to the bottom surface of base 1602 within the stability cradle recession area 1605 in a location that correlates to the medial heel pod opening 1615 and allows medial heel pod 1616 to extend out through said medial heel pod opening 1615. The medial heel pod 1616 has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod.

[00648] Medial heel pod 1616 is preferably made from TPR or PU of a hardness of about 60 ASKER C ±3. If TPR is used, a fabric is in turn secured to the base 102 in the medial heel pod opening 1615 of said base 1602. The fabric component allows the TPR to properly adhere to the base 1602.

[00649] Foot contact with the ground is generally divided into three phases: heel strike, midfoot support, and toe off. During heel strike, the heel of the foot impacts the ground with significant force. To cushion the impact, lateral heel pod 1614 is positioned along the rear and lateral side of the calcaneus (heel bone) and extends outwardly below stability cradle 1606. Preferably, lateral heel pod 1614 is made of a material having suitable cushioning properties and are selected based on an intended type of activity.

[00650] Following the initial impact of the heel with the ground, the foot twists, or pronates, bringing the medial side of the heel into contact with the ground. The foot is sensitive to the amount of pronation as well as the rate at which the pronation occurs. Pronation is natural, and some degree of pronation is desirable because it serves to absorb the stresses and forces on the foot during walking or running. However, an excessive amount or rate of pronation can result in injury.

[00651] Stability cradle 1606 provides firm support along the medial portion of the foot to help control the amount of pronation. Medial heel pod 1616 helps to control the rate of pronation by forming medial heel pod 1616 out of a material having different characteristics than lateral heel pod 1614. For example, to reduce a pronation rate, medial heel pod 1616 is made from a firmer material than lateral heel pod 1614. A firmer or stiffer material does not compress as much or as fast as a softer material under the same load. Thus, a medial heel pod 1616 made from a firmer material would compress less than a lateral heel pod 1614 made of a softer material. As a result, medial heel pod 1616 tends to resist or counteract pronation and thereby help to reduce the degree and rate of pronation. Conversely, making medial heel pod 1616 from a softer material than lateral heel pod 1614 would tend to increase the amount and rate of pronation.

[00652] Preferably, the firmness of the material used in medial heel pod 1616 is selected based on the firmness of lateral heel pod 1614 and on the type of intended activity. For example, the firmness of lateral heel pod 1614 and medial heel pod 1616 differs by about 20-30 % for an insole to be used during light to moderate activities.

[00653] Carrying a heavy backpack or other articles significantly increases the load on the foot and the rate of pronation during and following heel strike. Accordingly, medial heel pod 1616 is made significantly firmer in an insole designed for use while backpacking. As an example, a difference in firmness of about 20-40% is more appropriate for such activities.

[00654] Lateral midfoot pod 1612 provides cushioning and control to the lateral side of the foot during the midstance portion of a step. Typically, lateral midfoot pod 1612 is formed of a material having the same properties, e.g., firmness, as lateral heel pod 1614. However, a material having different characteristics may also be used.

[00655] FIG. 16D-1 to 16D-4 shows a bottom, side, cross section and prospective view of the forefoot pad.

[00656] Figures 16E-1 to 16E-4 show a medial side, bottom, cross-section and prospective view of the forefoot pad 1608. Forefoot pad 108 is preferably made from a Thermoplastic Rubber ("TPR") or Polyurethane ("PU"). The hardness of the TPR or PU used in the forefoot pad is preferably about 30 Asker C ±3. The forefoot pad 1620, lateral midfoot pod 1621, lateral heel pod 1622, and medial heel pod 1623 are constructed with a criss-cross

groove pattern on the bottom surface of the pod or pad. The criss-cross groove pattern introduces air gaps into the pod/pad surfaces. Such air gaps and criss-cross groove patterns positively influence the impact absorption properties of each pod and pad. It also allows for use of less material and therefore a lighter insole while still providing the desired cushioning function. Preferably, the forefoot criss-cross groove pattern 1620 is approximately 0.75 mm deep. Preferably the lateral midfoot and heel criss-cross groove patterns 1621 and 1622 are approximately 1.00 to 3.00 mm deep. Preferably, the medial heel criss-cross groove pattern 1623 is approximately 1.00 to 2.50 mm deep. Preferably the TPR pods have the deeper criss-cross groove pattern and the PU pods have the shallower criss-cross groove pattern due to the compression characteristics of the materials. The criss-cross groove patterns assists with securing the insole in the shoe cavity and keeping the insole in place such that it will not move or slide around. The criss-cross groove pattern also allows for air circulation and/or provides different cushioning and spring properties.

[00657] For a men's size 11-12 insole, the width of the forefoot pad from the medial to lateral side is about 85 to 95 mm. The height is about 100 to 110 mm. The depth is about 0.95 to 1.50 mm.

[00658] It is desirable to minimize the total weight of the insoles by selection of materials working with the structural features of the insole. It is desirable that the total weight of the preferred embodiment of the insole (men's size 10/11) be about 4.0 ounces. It is desirable that the total weight of an alternate embodiment of the insole be about 5.0 to 6.0 ounces for a men's size 10/11 and about 6.5 to 7.5 ounces for a men's size 12/13. Other sizes will be proportional. Using the criss-cross groove pattern designs will help provide a lighter insole.

[00659] In a preferred embodiment, base 1602 is covered with top sheet 1601 from toe to heel areas of the insole, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet 1601 is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00660] Insole preferably comprises a top sheet and a base having a top surface secured to said top sheet and an opposite bottom surface. Base also defines a longitudinal arch support

that extends upwardly along the medial side of the insole to provide extra cushion and support to the arch area of the foot.

[00661] Preferably, the top surface of the base defines an upwardly-extending portion or transverse arch support that lies under the metatarsal head area of the foot. The upward extension of transverse arch support pushes up a portion of the top sheet that corresponds to the area of the transverse arch support.

[00662] The bottom surface of base defines a forefoot pad recession area in the forefoot area and a stability cradle recession area along the midfoot and heel areas. The bottom surface of base also defines one or more ribs or protrusions that extend outwardly along the arch area. The ribs are preferably longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. An alternate embodiment has the ribs or protrusions defined by the stability cradle and extending outwardly from the stability cradle in the arch area.

[00663] Base has a raised edge that wraps around the heel and extends partially along the sides of the foot such that the insole has a heel cup, which conforms to the natural shape of the foot. The height of the raised edge is generally higher and thicker on the medial side of the insole and is lower and thinner on the lateral side of the insole.

[00664] The forefoot pad recession area begins partially proximal from the toe end of the insole near the distal ends of the proximal phalanges of the foot. The forefoot pad recession area extends rearward to about the 3rd through 5th metatarsal heads on a lateral portion and approximately halfway along the 1st and 2nd metatarsals on a medial portion. Preferably the forefoot pad recession area has a rear apex that lies between the 1st and 2nd metatarsals.

[00665] Forefoot pad is shaped essentially the same as forefoot pad recession area and is secured therein. Forefoot pad has a medial edge, a lateral edge, a proximal (back) edge and a distal (front) edge. The medial edge of forefoot pad extends along a line spaced laterally from said medial border of said insole. The proximal edge extends from said medial edge laterally and proximally to said rear apex , laterally and distally towards the 3rd metatarsal head, then laterally and proximally to the lateral edge approximately along the 3rd through 5th metatarsal heads. The lateral edge connects said proximal edge to said top edge of said forefoot pad. In use, forefoot pad recession area and forefoot pad underlie the big toe of a

user's foot, and the "ball" of the foot, excluding the first metatarsal head or medial ball of the user's foot.

[00666] An adhesive is be used to secure the components. The forefoot pad provides cushioning and energy return on landing from a vertical jump. It serves as a propulsion pad and support for the metatarsal heads of a user's foot, especially the 1st and 2nd metatarsal heads.

[00667] The stability cradle recession area is located in the midfoot and heel areas of the bottom surface of base. The stability cradle recession area extends from a medial edge approximate the medial border to a lateral edge approximate the lateral border of the base and from a distal edge slightly proximal of the forefoot recession area to a proximal edge approximate the heel end of the base. A medial portion of the distal edge is shaped to accommodate downward motion of the 1st metatarsal during toe off. Stability cradle is shaped essentially the same as stability cradle recession area and has a base facing surface and a shoe facing surface. The base facing surface is secured to said stability cradle recession area.

[00668] Stability cradle has walls that wrap up the sides and rear of base to provide support for the foot. Preferably, stability cradle ranges from approximately 0.5 mm to 3 mm thick and the walls taper from approximately 3 mm to about 0.5 mm. The sides of stability cradle are preferably higher on the medial side of the foot because of the higher loading. Preferably, stability cradle is made of a nylon material with a hardness of approximately Shore A 95. In a preferred embodiment, the stability cradle is semi-rigid. In an alternate embodiment, the stability cradle is rigid.

[00669] Preferably, the shoe facing surface of stability cradle has a "faceted" surface texture. This textured faceted surface increases the ability of the insole to "stay in place" when a user's foot is being placed into or out of the shoe. Swapping and "change-over" of shoes and running gear to other footwear, or vice versa is a very common practice during triathlon events and practice sessions. As such, these faceted textures significantly improve the use and performance of these insoles for this particular use by allowing the insole to resist movement out of the shoe during these change-over or swapping activities. The faceted design increases the internal function quotient of the insole significantly (by as much as 50% compared to non-faceted or smooth stability cradles) when located in the shoe cavity, thereby preventing the insole's movement or exit from the shoe cavity.

[00670] The stability cradle preferably defines one or more rib-shaped openings. In a preferred embodiment, the rib-shaped openings allow said ribs of base to extend therethrough. Preferably, base is molded so that the ribs project into rib-shaped openings so that the ribs are approximately flush with the outer surface of stability cradle and mechanically lock stability cradle and base together. Advantageously, the ribs are also able to bulge through rib-shaped openings when base is compressed (e.g., while walking or running) to provide additional cushioning and support to the arch of the foot. Preferably said ribs extend outwardly approximately 0.50 mm to 1.5 mm and have a width of approximately 4 mm. The rib-shaped openings allow the stability cradle to be more flexible in the arch area compared to the rest of the stability cradle.

[00671] In an alternate embodiment, stability cradle defines one or more protruding ribs instead of openings. The protruding ribs extend outwardly along the arch area. The protruding ribs are longer around the cuneiforms and gradually shorter distally and proximally from the cuneiforms creating a parabolic-like overall shape. The protruding ribs extend outward approximately 0.50 mm.

[00672] Stability cradle 106 defines a lateral midfoot pod opening that extends from the behind the 3rd though 5th metatarsal heads proximally to the back of the cuboid. The length of the lateral midfoot pod opening is preferably sufficient to provide cushioning to the lateral aspect of the midfoot. Lateral midfoot pod is shaped essentially the same as lateral midfoot pod opening and is secured to the bottom surface of base within the stability cradle recession area in a location that correlates to the lateral midfoot pod opening and allows lateral midfoot pod to extend out through said lateral midfoot pod opening.

[00673] Lateral midfoot pod is preferably made from TPR or PU of a hardness of about 45-50 ASKER C. If TPR is used, a fabric is in turn secured to the base in the lateral midfoot pod opening of said base. The fabric component allows the TPR to properly adhere to the base.

[00674] Stability cradle also defines a lateral heel pod opening that extends through the lateral side of the heel area of stability cradle from approximately rearward of the lateral midfoot pod opening toward the heel end. Lateral heel pod is shaped essentially the same as lateral heel pod opening and is secured to the bottom surface of base within the stability cradle recession area in a location that correlates to the lateral heel pod opening and allows lateral heel pod to extend out through said lateral heel pod opening. Lateral heel pod has a

lateral edge which extends along the lateral border of insole from said heel end to a lateral heel edge spaced apart from said lateral midfoot pod. The lateral edge curves in the area of the heel to follow the outline of the insole heel end. The lateral heel pod also has a medial curvilinear edge. The overall configuration is roughly a multi-sided geometric shape with curved edges as described rather than straight lines.

[00675] The configuration, material and position of the lateral heel pod provides cushioning and works in association with the medial heel pod to stabilize the ankle. The hardness of the lateral heel pod is preferably essentially the same as the lateral midfoot pod, which work in concert to help reduce the incidence of lateral ankle roll-overs. It is preferably made of TPR or PU of a hardness of about Shore C 45-50. If TPR is used, a fabric is in turn secured to the base in the lateral heel pod opening of said base. The fabric component allows the TPR to properly adhere to the base.

[00676] In accordance with principles of the present invention, a cushioning core or base is combined with a relatively stiff stability cradle and a number of elastomeric pods to form an insole that provides cushioning, stability, and control. Each pod can have a different firmness, and there are three pods that include a lateral midfoot pod, a medial heel pod, and a lateral heel pod. The pods can be adjusted to address issues of over/under pronation, over/under supination, and other problems related to foot motion by altering the size, shape, and material properties of the pods. The pods are separate in the heel pad area, and the midfoot and heel pads have grooved patterns on their bottom surface for better cushioning and traction grip in the shoe.

[00677] Stability cradle defines a medial heel pod opening that extends through the heel area along the medial side of heel area on the bottom surface of base just short of the heel end. Medial heel pod is shaped essentially the same as medial heel pod opening and is secured to the bottom surface of base 102 within the stability cradle recession area in a location that correlates to the medial heel pod opening and allows medial heel pod to extend out through said medial heel pod opening. The medial heel pod has essentially a pea-pod shape; it has a medial edge and a lateral edge which are connected to one another at a first distal apex and a second proximal apex. The edges widen out opposite one another to define said medial heel pod.

[00678] Medial heel pod is preferably made from TPR or PU of a hardness of about 60 ASKER C ±3. If TPR is used, a fabric is in turn secured to the base in the medial heel pod opening of said base. The fabric component allows the TPR to properly adhere to the base.

[00679] Foot contact with the ground is generally divided into three phases: heel strike, midfoot support, and toe off. During heel strike, the heel of the foot impacts the ground with significant force. To cushion the impact, lateral heel pod is positioned along the rear and lateral side of the calcaneus (heel bone) and extends outwardly below stability cradle. Preferably, lateral heel pod is made of a material having suitable cushioning properties and are selected based on an intended type of activity.

[00680] Following the initial impact of the heel with the ground, the foot twists, or pronates, bringing the medial side of the heel into contact with the ground. The foot is sensitive to the amount of pronation as well as the rate at which the pronation occurs. Pronation is natural, and some degree of pronation is desirable because it serves to absorb the stresses and forces on the foot during walking or running. However, an excessive amount or rate of pronation can result in injury.

[00681] Stability cradle provides firm support along the medial portion of the foot to help control the amount of pronation. Medial heel pod helps to control the rate of pronation by forming medial heel pod out of a material having different characteristics than lateral heel pod. For example, to reduce a pronation rate, medial heel pod is made from a firmer material than lateral heel pod. A firmer or stiffer material does not compress as much or as fast as a softer material under the same load. Thus, a medial heel pod made from a firmer material would compress less than a lateral heel pod made of a softer material. As a result, medial heel pod tends to resist or counteract pronation and thereby help to reduce the degree and rate of pronation. Conversely, making medial heel pod from a softer material than lateral heel pod would tend to increase the amount and rate of pronation.

[00682] Preferably, the firmness of the material used in medial heel pod is selected based on the firmness of lateral heel pod and on the type of intended activity. For example, the firmness of lateral heel pod and medial heel pod differs by about 20-30 % for an insole to be used during light to moderate activities.

[00683] Carrying a heavy backpack or other articles significantly increases the load on the foot and the rate of pronation during and following heel strike. Accordingly, medial heel

pod is made significantly firmer in an insole designed for use while backpacking. As an example, a difference in firmness of about 20-40% is more appropriate for such activities.

[00684] Lateral midfoot pod provides cushioning and control to the lateral side of the foot during the midstance portion of a step. Typically, lateral midfoot pod is formed of a material having the same properties, e.g., firmness, as lateral heel pod. However, a material having different characteristics may also be used.

[00685] The use of dual density heel pods is employed to cause a kinetic change in foot function to promote ankle stability. It is also not out of the scope of the invention to have the medial heel pod softer than the lateral heel pod and/or lateral midfoot pod or any combination thereof to address different joint moments or ankle rolls.

[00686] At the beginning of the propulsion or toe-off phase of a step, the heel begins to lift from the ground and weight shifts to the ball of the foot. Forefoot pad is located under this part of the foot. Preferably, forefoot pad is formed of a relatively resilient material so that energy put into compressing forefoot pad is returned to help propel the foot at toe-off.

[00687] During toe off, the first metatarsal naturally flexes downward. Preventing this natural downward flex of the first metatarsal causes the the arch of the foot to flatten and the foot to over pronate, increasing stress on the ankles and knees. To accommodate the downward flex, the medial portion of forefoot pad extends rearward into a corresponding concave edge portion of the distal edge of stability cradle. The shape of the stability cradle and forefoot pad permit the first metatarsal to flex more naturally and thereby encourage loading of the great toe during toe off.

[00688] Base is preferably made of foam or other material having suitable cushioning properties. Preferably, base comprises an Ethylene vinyl acetate ("EVA") foam, which is a copolymer of ethylene and vinyl acetate, or a Thermoplastic Rubber ("TPR")/EVA mix. A preferred EVA or TPR/EVA mix has a durometer (hardness) of about Asker C 45-50.

[00689] Forefoot pad is preferably made from a Thermoplastic Rubber ("TPR") or Polyurethane ("PU"). The hardness of the TPR or PU used in the forefoot pad is preferably about 30 Asker C ±3.

[00690] The forefoot pad , lateral midfoot pod , lateral heel pod , and medial heel pod are constructed with a criss-cross groove pattern on the bottom surface of the pod or pad. The criss-cross groove pattern introduces air gaps into the pod/pad surfaces. Such air gaps and

criss-cross groove patterns positively influence the impact absorption properties of each pod and pad. It also allows for use of less material and therefore a lighter insole while still providing the desired cushioning function. Preferably, the forefoot criss-cross groove pattern is approximately 0.75 mm deep. Preferably the lateral midfoot and heel criss-cross groove patterns and are approximately 1.00 to 3.00 mm deep. Preferably, the medial heel criss-cross groove pattern is approximately 1.00 to 2.50 mm deep. Preferably the TPR pods have the deeper criss-cross groove pattern and the PU pods have the shallower criss-cross groove pattern due to the compression characteristics of the materials. The criss-cross groove patterns assists with securing the insole in the shoe cavity and keeping the insole in place such that it will not move or slide around The criss-cross groove pattern also allows for air circulation and/or provides different cushioning and spring properties.

[00691] For a men's size 11-12 insole, the width of the forefoot pad from the medial to lateral side is about 85 to 95 mm. The height is about 100 to 110 mm. The depth is about 0.95 to 1.50 mm.

[00692] It is desirable to minimize the total weight of the insoles by selection of materials working with the structural features of the insole. It is desirable that the total weight of the preferred embodiment of the insole (men's size 10/11) be about 4.0 ounces. It is desirable that the total weight of an alternate embodiment of the insole be about 5.0 to 6.0 ounces for a men's size 10/11 and about 6.5 to 7.5 ounces for a men's size 12/13. Other sizes will be proportional. Using the criss-cross groove pattern designs will help provide a lighter insole.

[00693] In a preferred embodiment, base is covered with top sheet from toe to heel areas of the insole, which is preferably a non-woven fabric layer with a low coefficient of friction so as to minimize the possibility of blisters. Preferably, top sheet is made of a cooling fabric which contains a special low temperature jade obtained from a natural source. The form of jade in the fabric is a jadeite. In a preferred embodiment, the fabric is treated with an antibacterial agent, which in combination with a moisture barrier reduces odor causing bacteria and fungi.

[00694] In a first preferred embodiment of the present invention, the various components of an insole which are secured to base in the recession areas defined by base on the bottom surface are permanently affixed to base using an appropriate means such as an adhesive. The components are also secured during the molding process using techniques known in the art of molding insoles.

[00695] The recession areas can also be lined with a cloth having a base surface and a pad/pod surface, secured to said base along said base surface and said pad/pod along said pad/pod surface. Alternatively, a cloth is secured to pad/pod and then the composite structure secured to the recession area.

[00696] Some shoes may slightly differ in size on the inner part of the shoe or provide extra padding along the inner walls that alter the space provided on the inner part of the shoe. Base may have sizing guides that allow a user to shorten the length of the insole for proper fit within the shoe, sizing guides provide various cutting guide lines that the user would cut along, preferably with scissors.

[00697] The dimensions and measurements shown in FIGS. 16A-16D are dimensions and measurements of a second preferred embodiment which are incorporated herein.

[00698] While preferred embodiments of the invention have been shown and described, modifications thereof can be made by one skilled in the art without departing from the spirit and teachings of the invention. The embodiments described herein are exemplary only, and are not intended to be limiting. Many variations and modifications of the invention disclosed herein are possible and are within the scope of the invention.

[00699] Having described the invention, we claim:

CLAIMS:

1. An insole for use in a shoe having a top side for contacting a user's foot and a bottom side for contacting the inside of a user's shoe, comprising:

a. a base, said base having a base top surface and a base bottom surface, said base having a heel end, a toe end, a medial border and a lateral border, said medial and lateral borders extending from said heel end to said toe end along the medial and lateral sides of the insole, respectively, said base bottom side defining:

(i) a forefoot area extending from the toe end to a location behind a metatarsal head area of the feet,

(ii) a midfoot area that extends from said metatarsal head area to an edge that lies forward of the calcaneus of the foot,

(iii) a heel area that extends from said midfoot area to said heel end,

(iv) a forefoot pad recession area located in said forefoot area, and extending under the hallux of the foot from near the distal end of the base proximally to the front of the first metatarsal head, and

(v) a stability cradle recession area located essentially along the midfoot and heel areas of the foot,

b. an arch support located in said midfoot area, said arch support extends transverse upwardly along the medial border and under the arch of the foot;

c. a stability cradle made of semi-rigid material and secured to said stability cradle recession area of said base bottom side, said stability cradle having a plurality of pod openings that allow pod components to extend therethrough and said stability cradle having a faceted bottom surface;

d. a forefoot pad secured to said forefoot pad recession area, said forefoot pad extending laterally and proximally under the lesser metatarsal heads of the foot to beneath the greater metatarsals; and

e. a lateral heel pod extending through a lateral heel pod opening in said stability cradle and being located on the lateral side of said heel area, said lateral heel pod having a criss-cross groove pattern on its bottom surface, and

f. a medial heel pod being located on the medial side of the heel area and extending through a medial heel pod opening, said medial heel pod being separated from said lateral heel pod component by a groove gap and said medical heel pod having a criss-cross groove pattern on its bottom surface.

2. The insole of claim 1 wherein the pod disposed under the medial side of the heel is made of a firmer material than the material of the lateral heel pod.

3. The insole of claim 2, wherein the firmness of the lateral heel pod is in the range of Shore C 45-50 and the firmness of the medial heel pod is approximately Shore C 60.

4. The insole of claim 2, wherein the firmness of the lateral heel pod is in the range of Shore C 50-55 and the firmness of the medial heel pod is in the range of about Shore C 65-70.

5. The insole of claim 2, wherein the firmness of the pods is selected to control a rate of pronation.

6. The insole of claim 2, wherein the firmness of the pods is selected based on a type of activity for which the insole is designed.

7. The insole of claim 1, wherein the stability cradle is shaped to enable flexing of the first metatarsal during toe off.

8. The insole of claim 1 further comprising:

a lateral midfoot pod located in the midfoot area along the lateral side of the insole and extending through a lateral midfoot pod opening, said lateral midfoot pod having a criss-cross groove pattern on its bottom surface.

9. The insole of claim 8, wherein the firmness of the pods is selected to control the rate of pronation.

10. The insole of claim 8, wherein the firmness of the pods is selected based on the type of activity for which the insole is designed.

11. An insole for use in a shoe having a top side for contacting a user's foot and a bottom side for contacting the inside of a user's shoe, comprising:

a. a base, said base having a base top surface and a base bottom surface, said base having a heel end, a toe end, a medial border and a lateral border, said medial and lateral borders extending from said heel end to said toe end along the medial and lateral sides of the insole, respectively,

b. an arch support extending transverse upwardly along the medial border and under the arch of the foot;

c. a stability cradle made of semi-rigid material with stability ribs, said stability cradle having pod openings that allow pod components to extend therethrough and said stability cradle having a faceted bottom surface;

d. a lateral heel pod extending through a lateral heel pod opening in said stability cradle on the lateral side of said heel area, said lateral heel pod components having a criss-cross groove pattern on its bottom surface,

e. a medial heel pod extending through a medial heel pod opening on the medial side of the heel area, said medial heel pod separated from said lateral heel pod component by a gap and said medial heel pod having a criss-cross groove pattern on its bottom surface, and

f. a lateral midfoot pod being located in the midfoot area along the lateral side of the insole and extending through a lateral midfoot pod opening, said lateral midfoot pod having a criss-cross groove pattern on its bottom surface.

12. The insole of claim 11 wherein the pod disposed under the medial side of the heel is made of a firmer material than the material of the lateral heel pod.

13. The insole of claim 12, wherein the firmness of the lateral heel pod is in the range of Shore C 45-50 and the firmness of the medial heel pod is approximately Shore C 60.

14. The insole of claim 12, wherein the firmness of the lateral heel pod is in the range of Shore C 50-55 and the firmness of the medial heel pod is in the range of about Shore C 65-70.

15. The insole of claim 12, wherein the firmness of the pods is selected to control the rate of pronation.

16. The insole of claim 12, wherein the firmness of the pods is selected based on the type of activity for which the insole is designed.

17. The insole of claim 11, wherein the stability cradle is shaped to enable flexing of the 1st metatarsal during toe off.

18. The insole of claim 11 wherein the lateral midfoot pod is made of softer material than material used in medial heel pod.

19. The insole of claim 18, wherein the firmness of the lateral midfoot pod is in the range of Shore C 45-50 and the firmness of the medial heel pod is approximately Shore C 60.

20. The insole of claim 18, wherein the firmness of the lateral midfoot pod is in the range of Shore C 50-55 and the firmness of the medial heel pod is in the range of about Shore C 65-70.

21. A method of making a cushion to control the motion of a foot in a shoe, the method comprising:

providing a base having a base top surface and a base bottom surface, said base having a heel end, a toe end, a medial border and a lateral border, said borders extending from said heel end to said toe end, said base bottom side defining:

(a) a forefoot area extending from the toe end to a location behind a metatarsal head area of the feet,

(b) a midfoot area that extends from said metatarsal head area to an edge that lies forward of the calcaneus of the foot, and

(c) a heel area that extends from said midfoot area to said heel end;

coupling a stability cradle to the base, said stability cradle being made of semi-rigid material and said stability cradle secured to a stability cradle recession area of said base bottom side, said stability cradle recession area located essentially along the midfoot and heel areas of the foot, said stability cradle having pod openings that allow pod components to extend therethrough and said stability cradle having a faceted surface;

coupling an arch support to the base, said arch support extends transverse upwardly along the medial border and under the arch of the foot;

coupling a forefoot pad to the base, said forefoot pad extending laterally and proximally under the lesser metatarsal heads of the foot to beneath the greater metatarsal; and,

extending interacting cooperative pod components through pod openings in said stability cradle, said pod components including a lateral heel pod located on the lateral side of said heel area, a medial heel pod separated from said lateral heel pod and located on the medial side of said heel area, and a lateral midfoot pod located on the lateral side of the midfoot area of the insole, said pod components having a criss-cross groove pattern on their bottom surface.

22. The method of claim 21 wherein the medial heel pod is made of a firmer material than the material of the lateral heel pod.

23. The method of claim 22, wherein the firmness of the lateral heel pod is in the range of Shore C 45-50 and the firmness of the medial heel pod is approximately Shore C 60.

24. The method of claim 22, wherein the firmness of the lateral heel pod is in the range of Shore C 50-55 and the firmness of the medial heel pod is in the range of about Shore C 65-70.

25. The method of claim 21 wherein the medial heel pod is made of a firmer material than the material of the lateral midfoot pod.

26. The method of claim 25, wherein the firmness of the lateral midfoot pod is in the range of Shore C 45-50 and the firmness of the medial heel pod is approximately Shore C 60.

27. The method of claim 25, wherein the firmness of the lateral midfoot pod is in the range of Shore C 50-55 and the firmness of the medial heel pod is in the range of about Shore C 65-70.

28. The method of claims 22 and 25, wherein the firmness of the pods is selected to control the rate of pronation.

29. The method of claims 22 and 25, wherein the firmness of the pods is selected based on the type of activity for which the insole is designed.

30. The method of claim 21, wherein the stability cradle is shaped to enable flexing of the first metatarsal during toe off.

31. The method of claim 21 wherein the base comprises an EVA foam material.

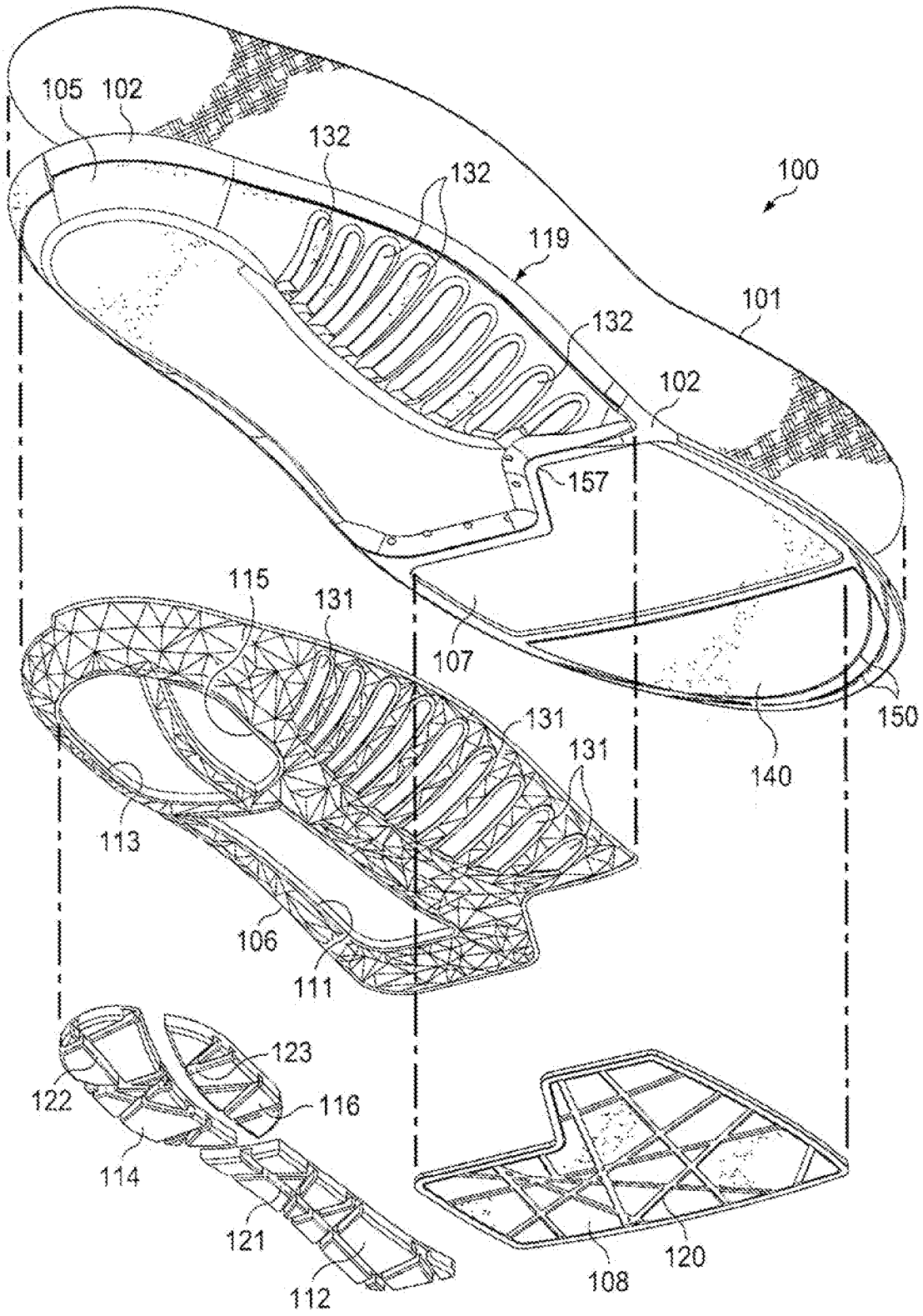
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FIG. 1

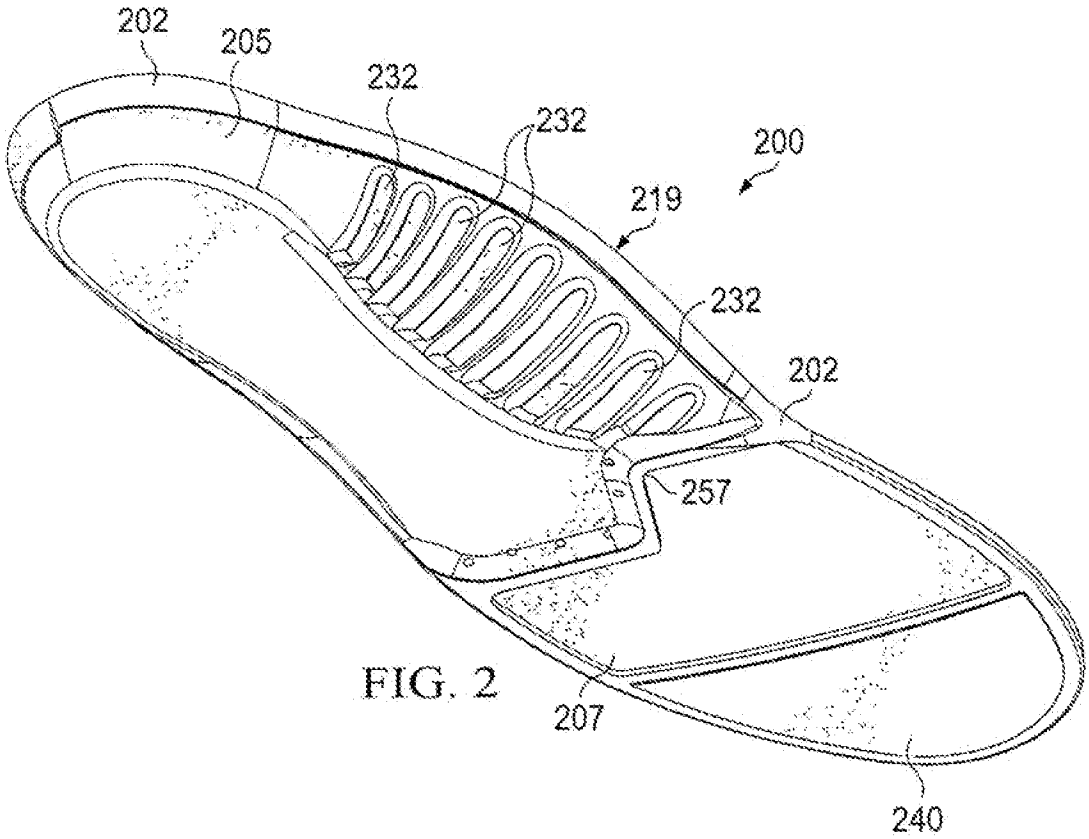
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FIG. 2

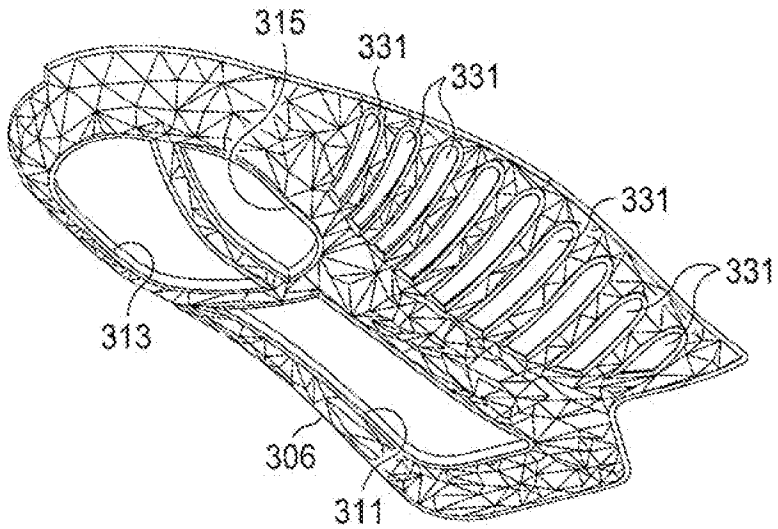
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FIG. 3B

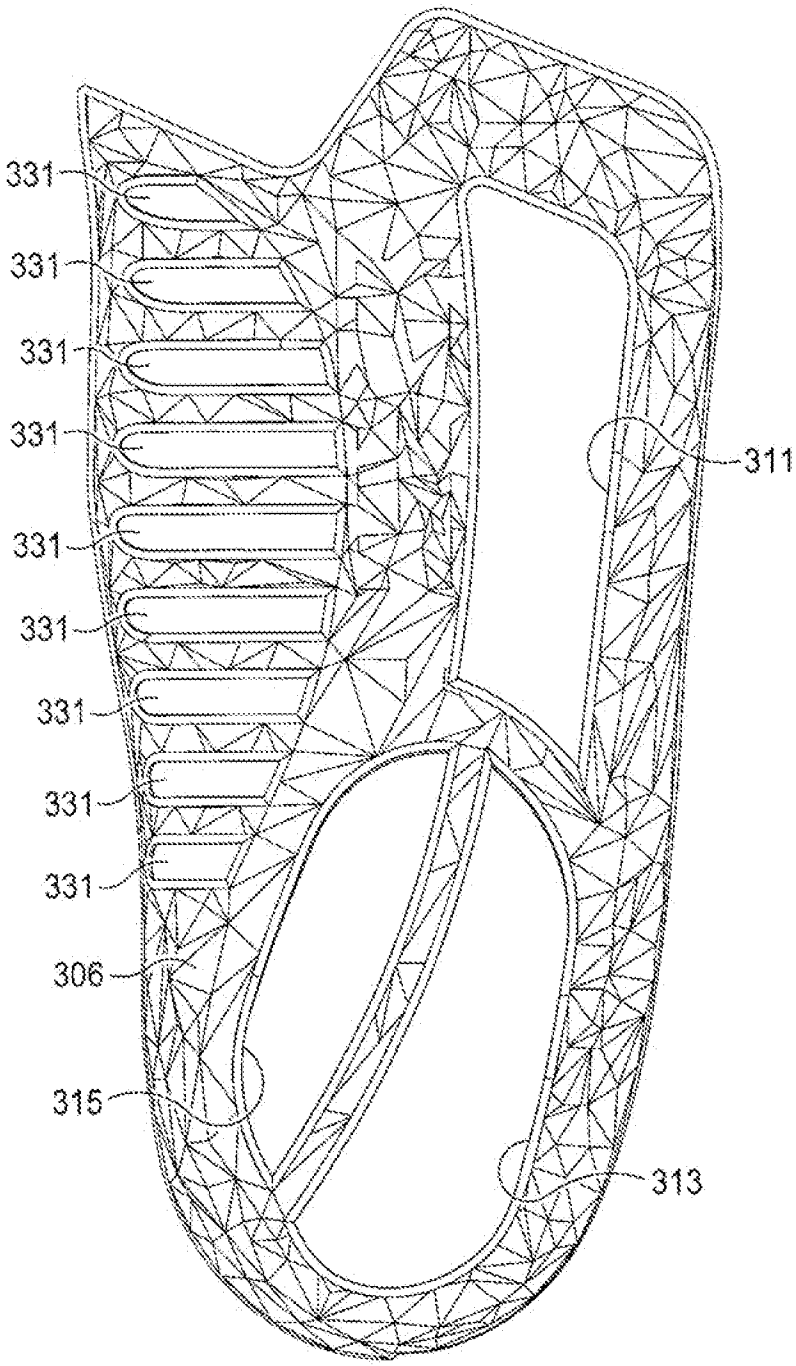

FIG. 3A

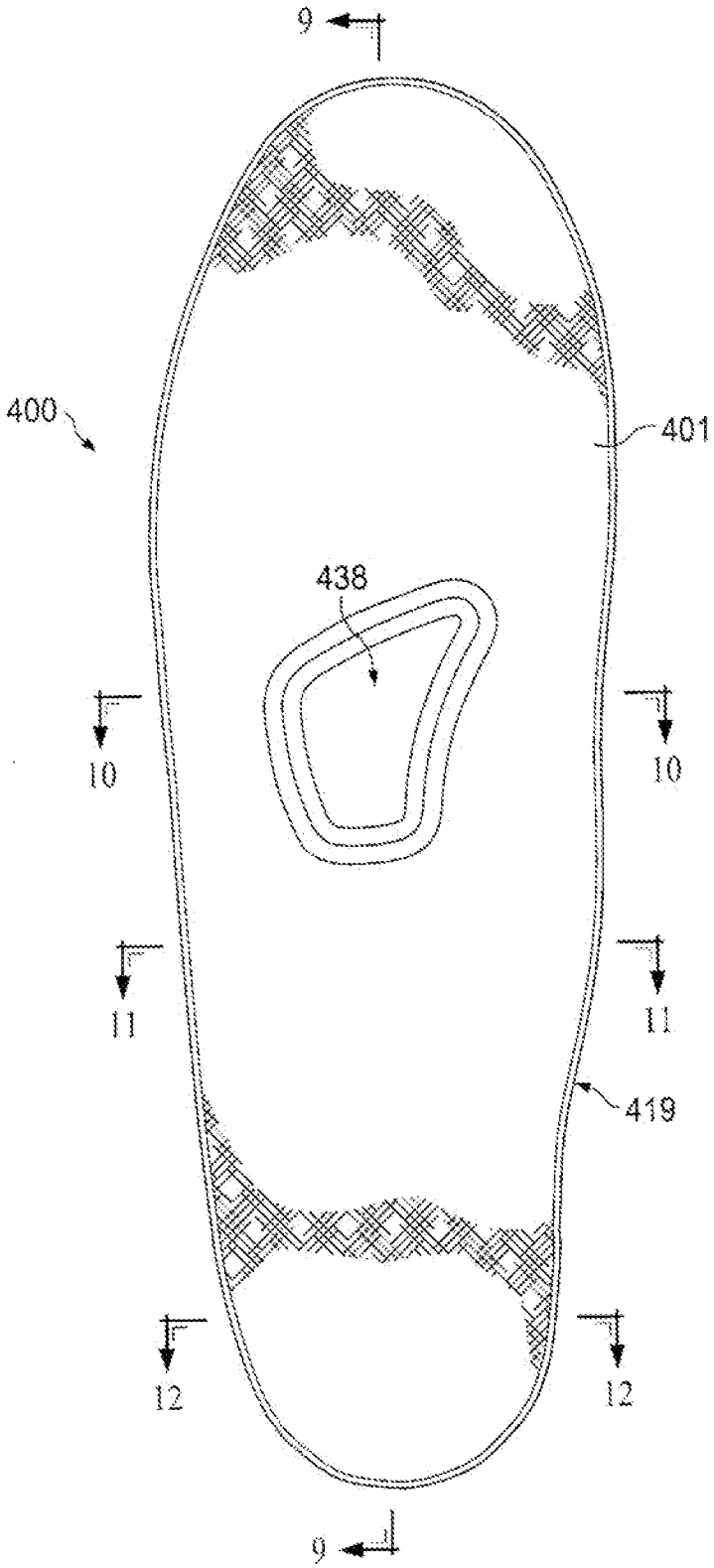

FIG. 4

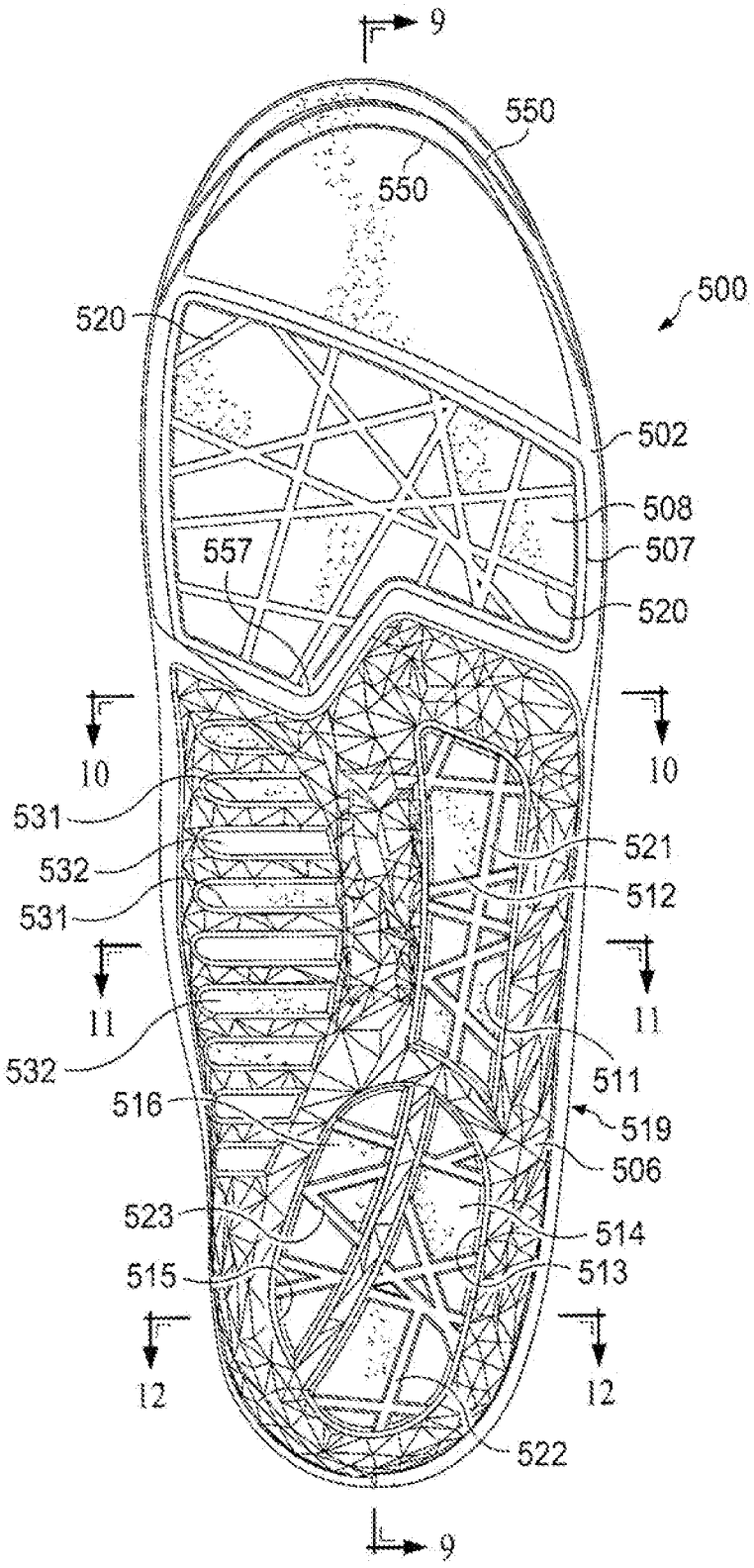
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FIG. 5

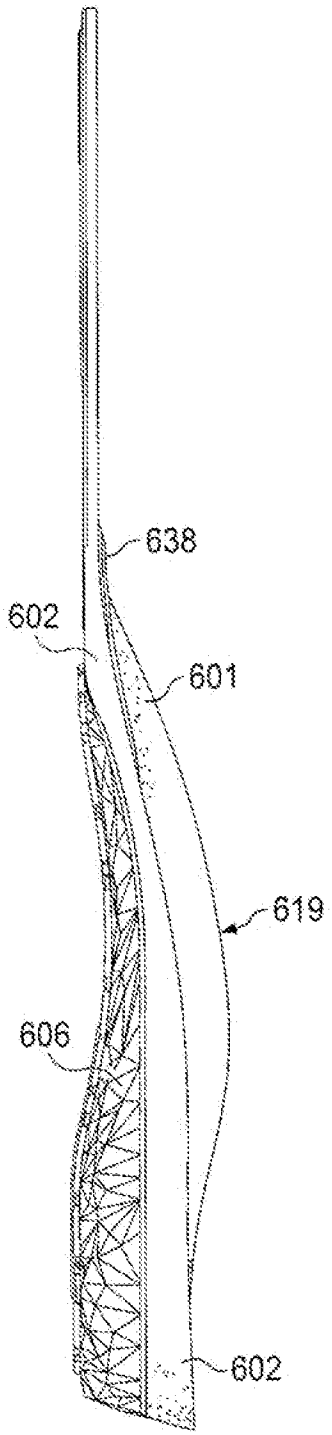

FIG. 6

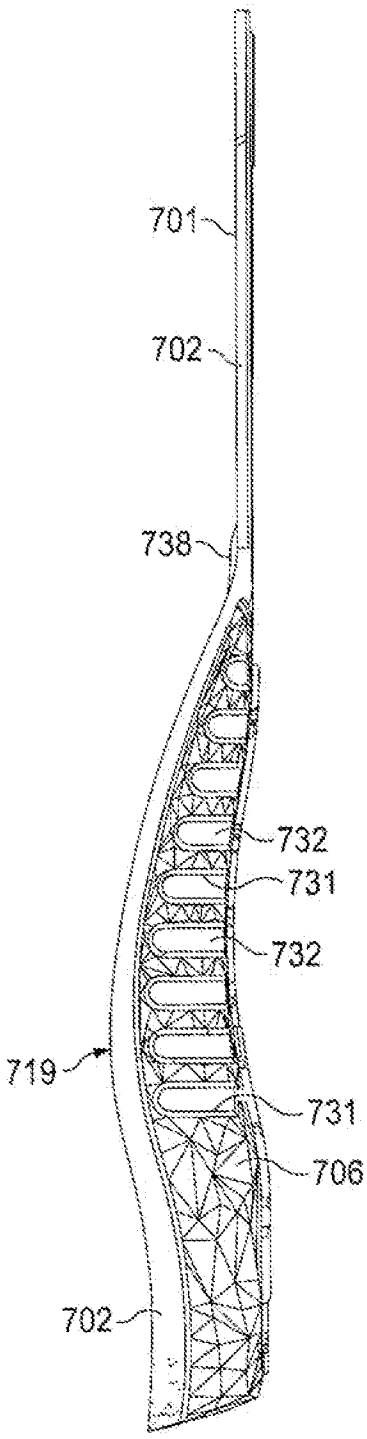

FIG. 7

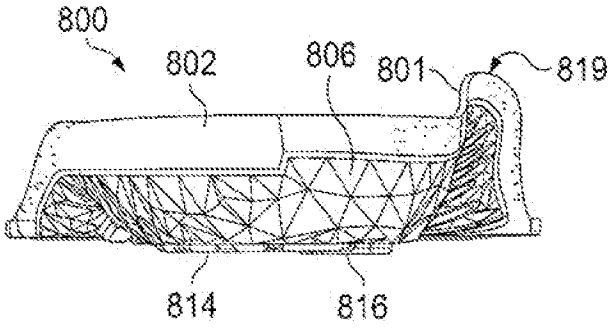

FIG. 8

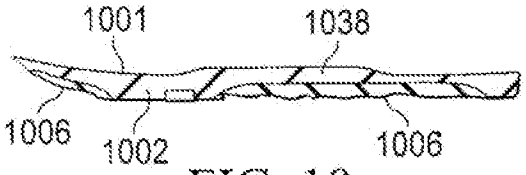

FIG. 10

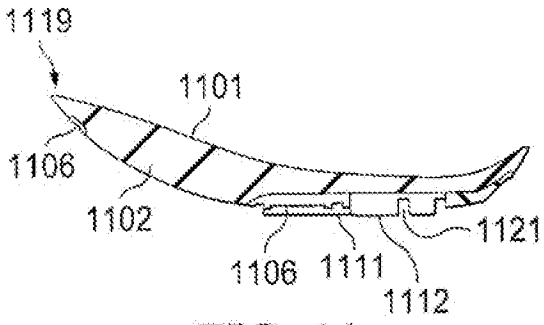

FIG. 11

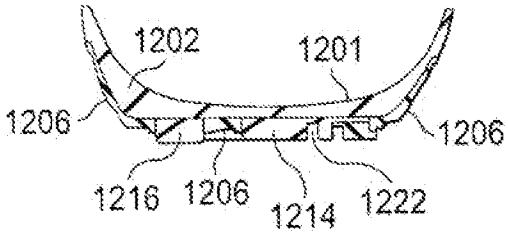

FIG. 12

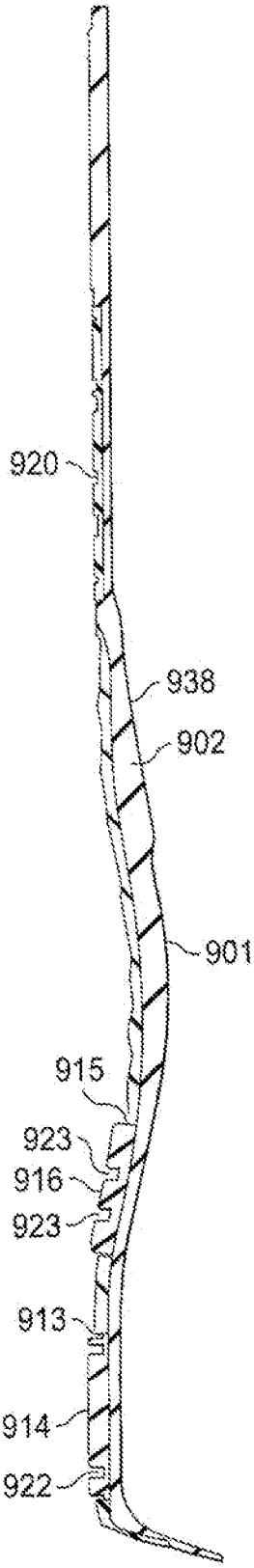

FIG. 9

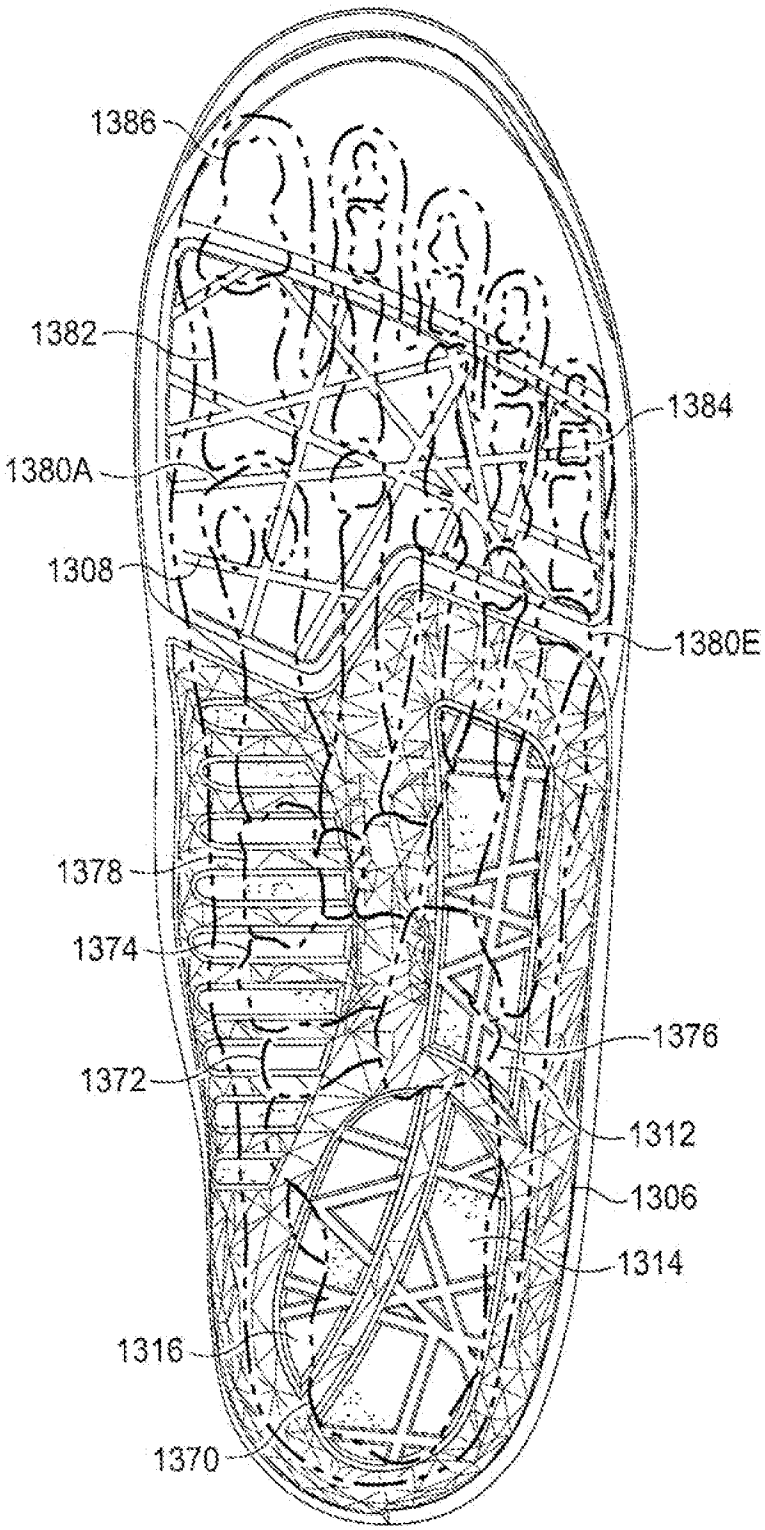
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FIG. 13

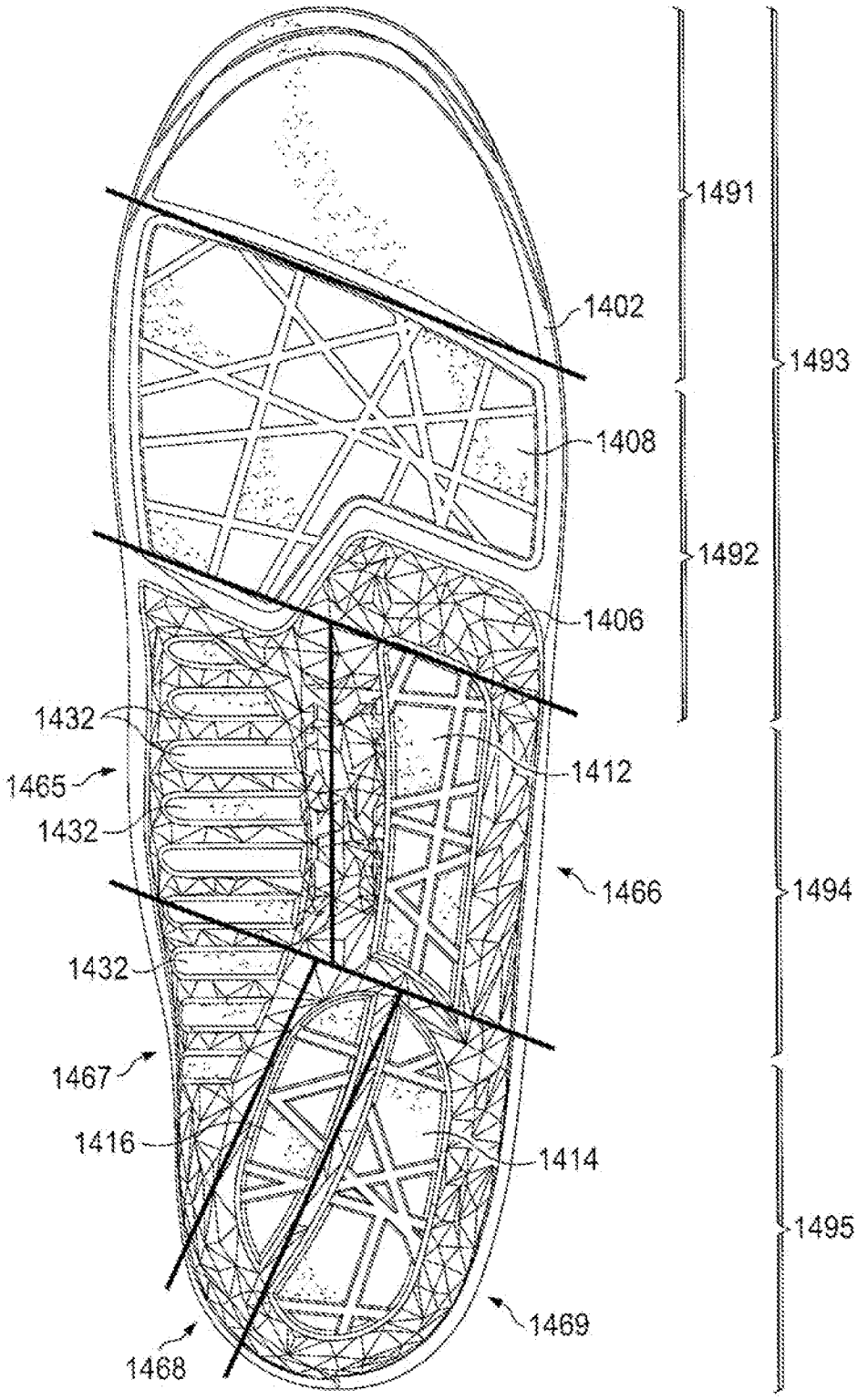
1491
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FIG. 14

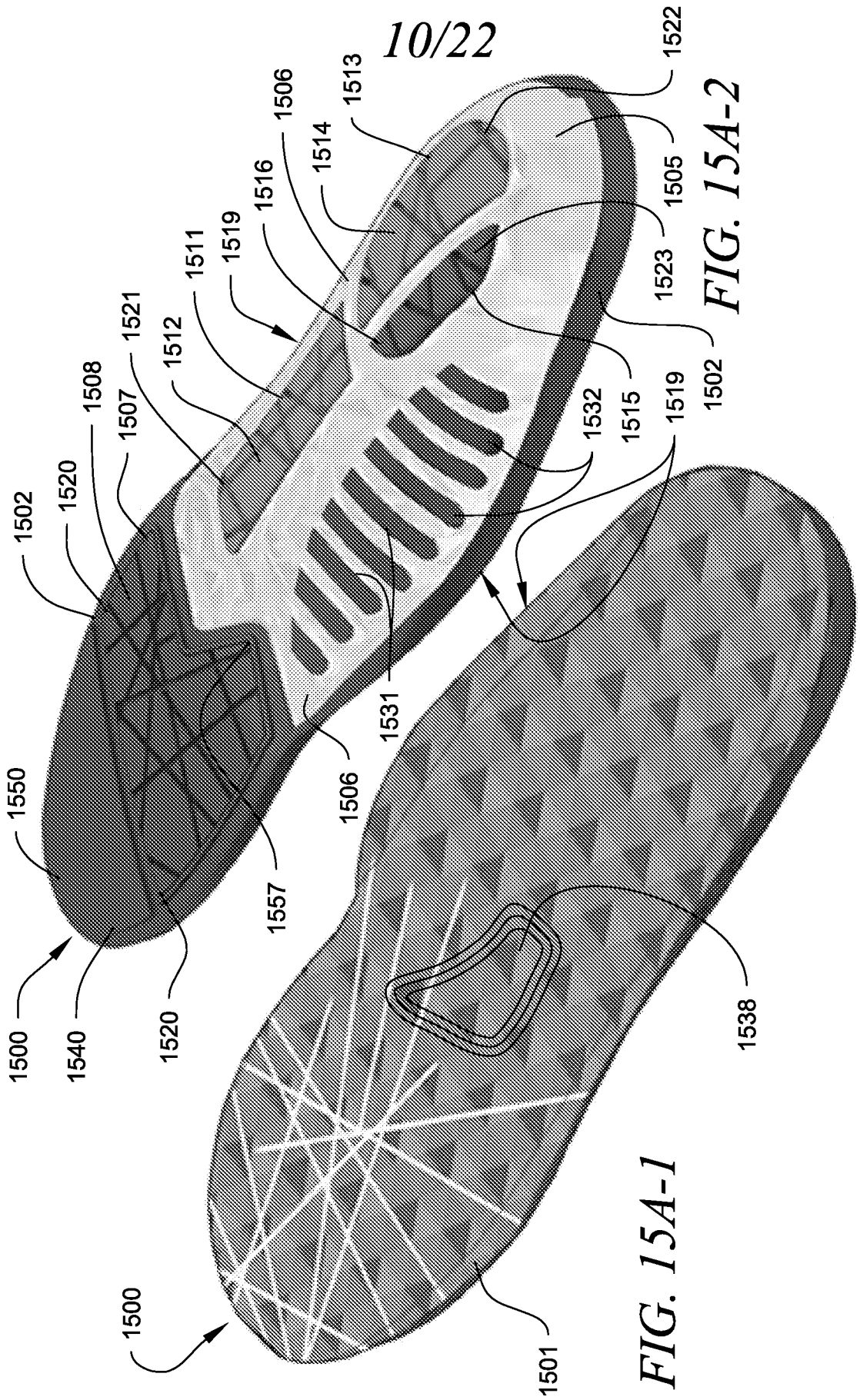

FIG. 15A-1

FIG. 15A-2

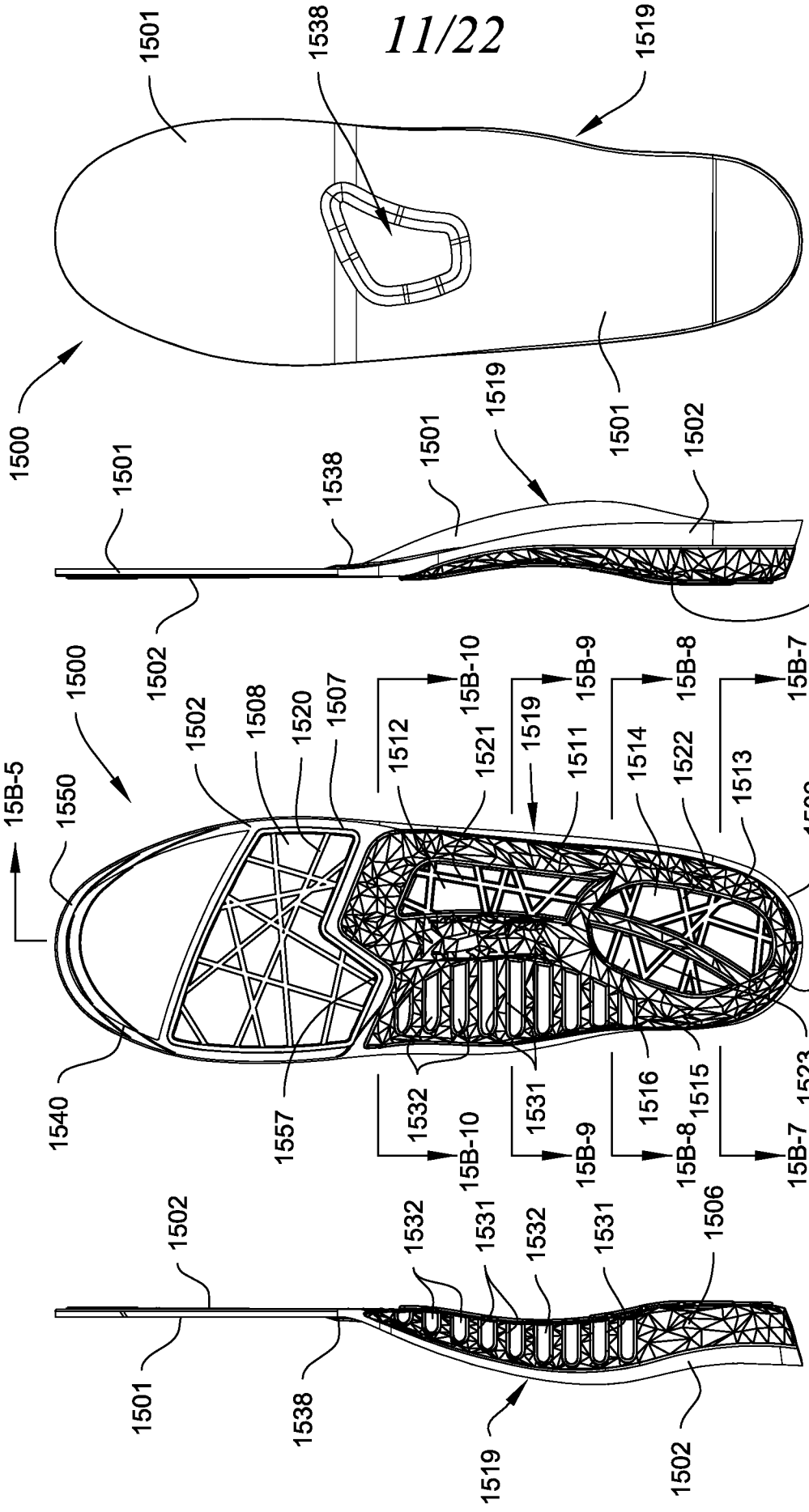

FIG. 15B-4

FIG. 15B-3

FIG. 15B-2

FIG. 15B-1

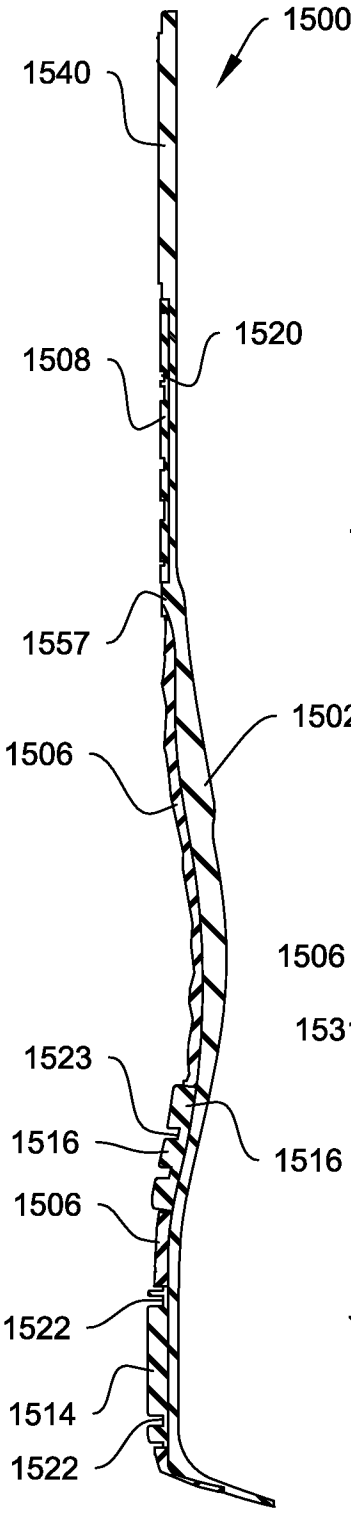

FIG. 15B-5

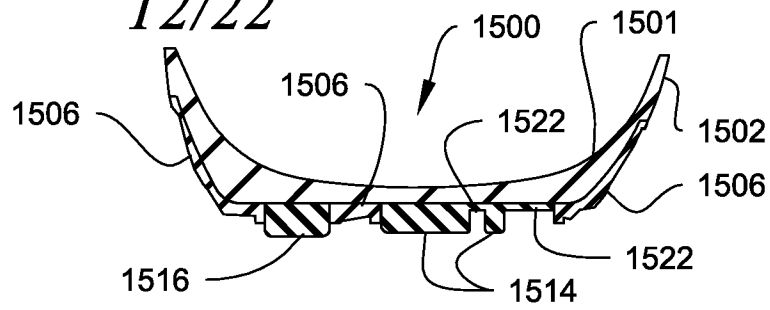

FIG. 15B-7

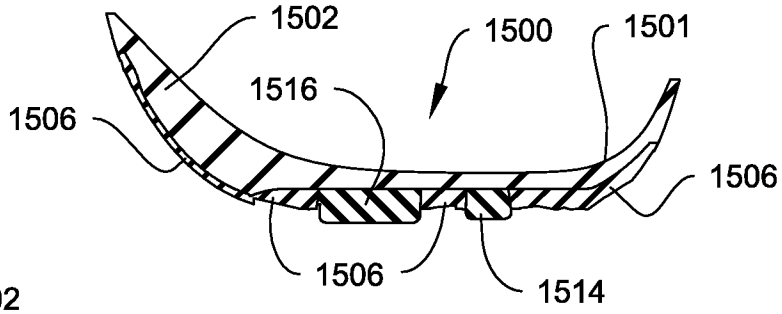

FIG. 15B-8

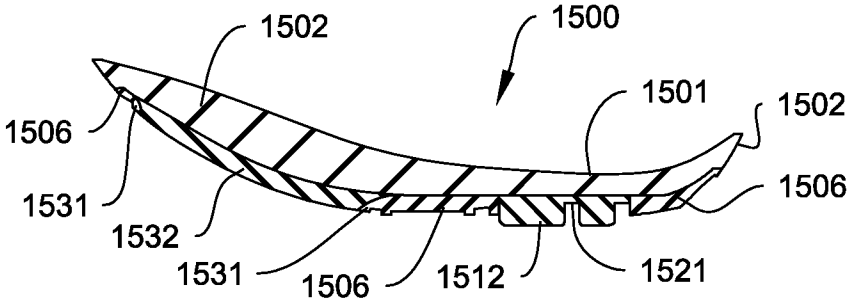

FIG. 15B-9

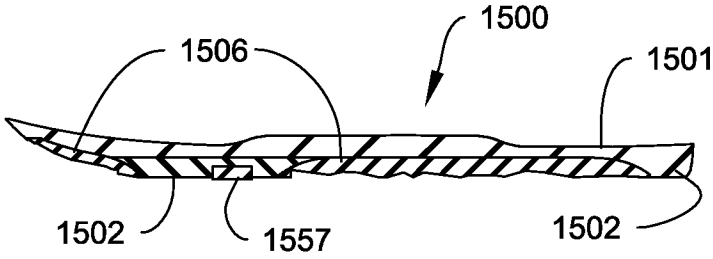

FIG. 15B-10

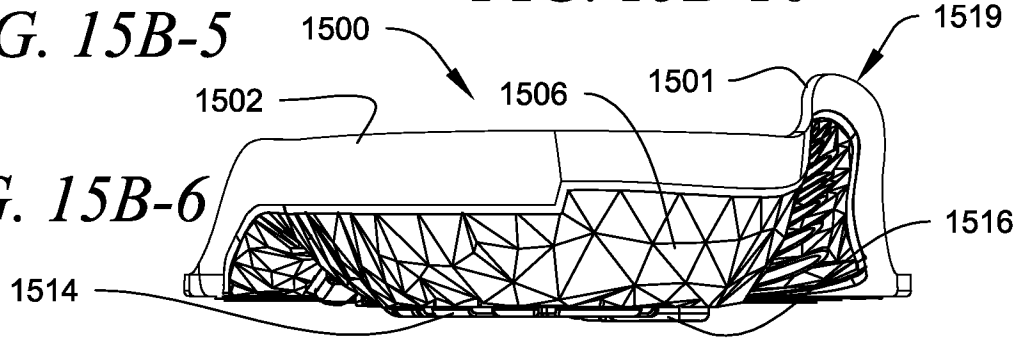

FIG. 15B-6

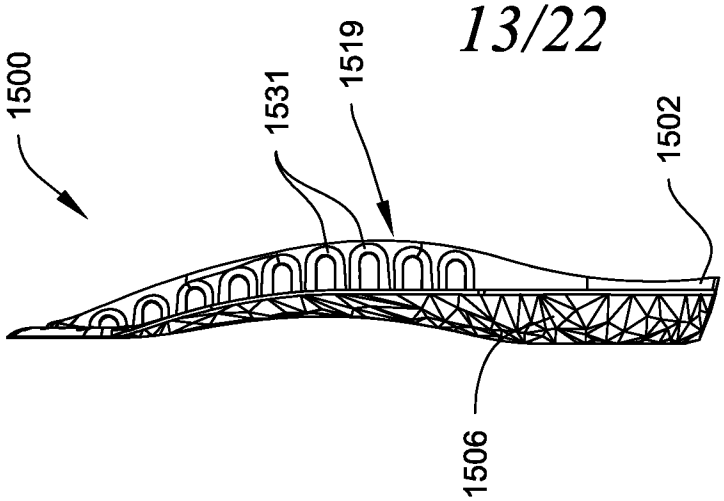

FIG. 15C-3

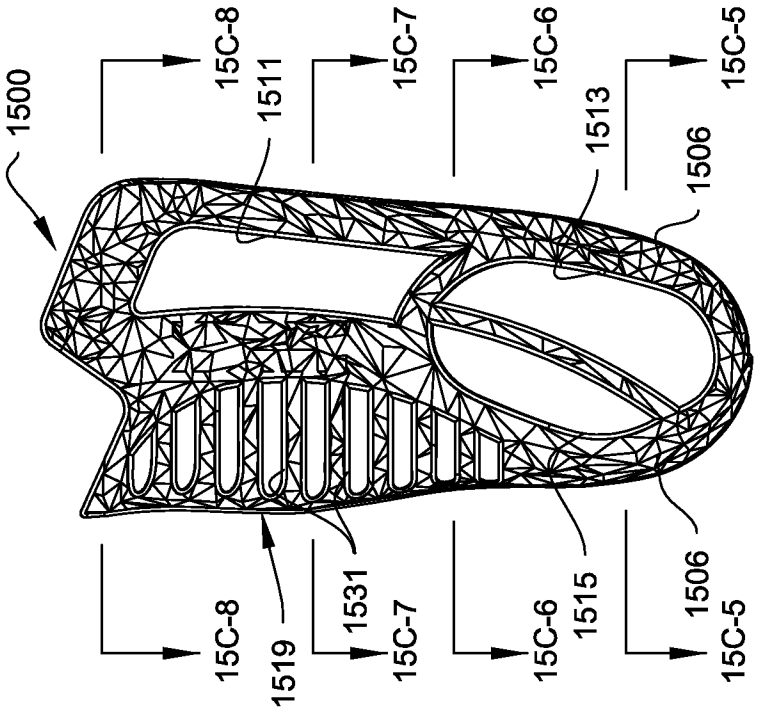

FIG. 15C-2

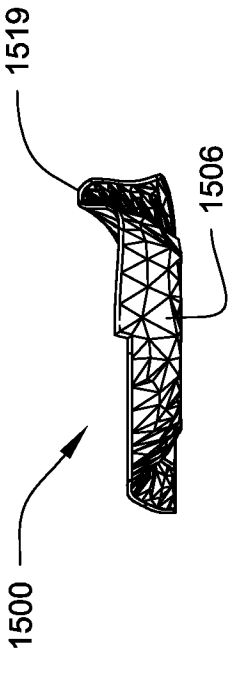

FIG. 15C-4

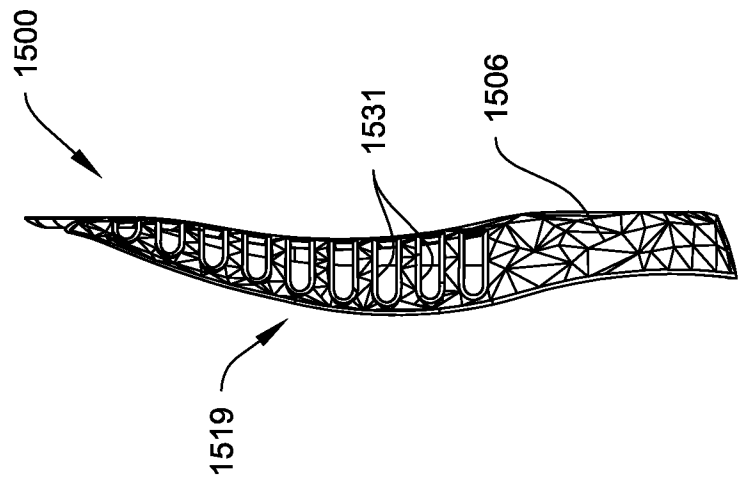

FIG. 15C-1

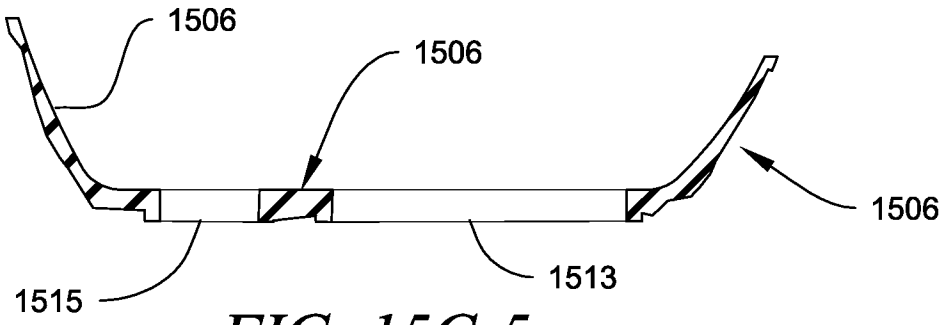

FIG. 15C-5

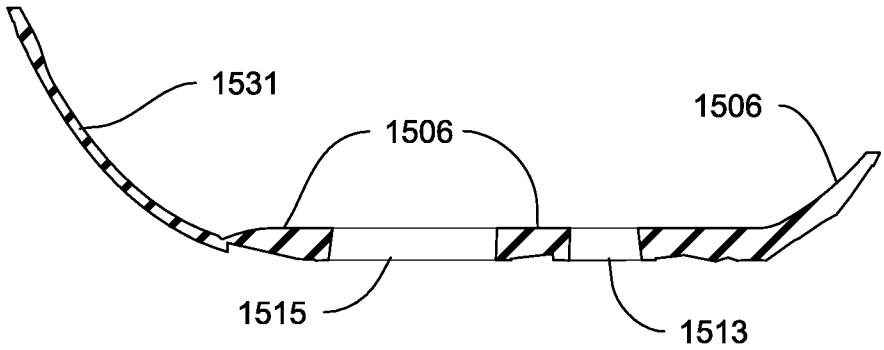

FIG. 15C-6

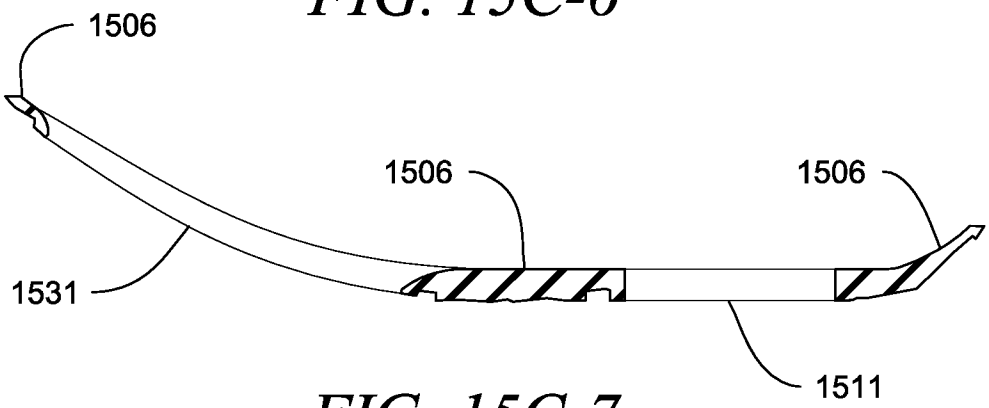

FIG. 15C-7

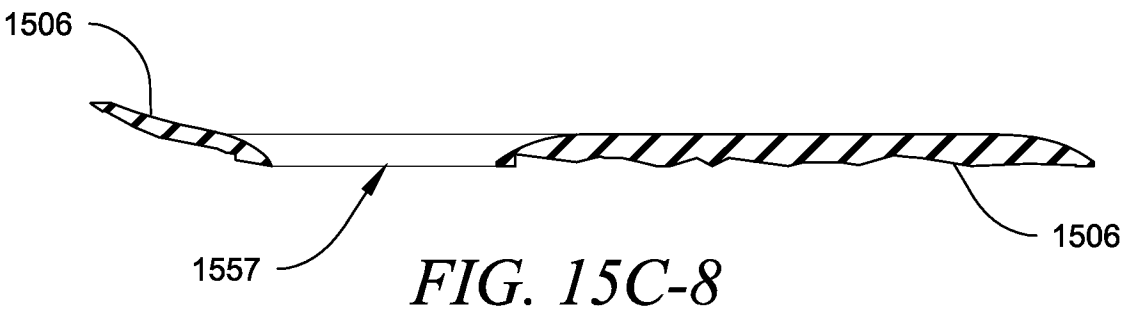

FIG. 15C-8

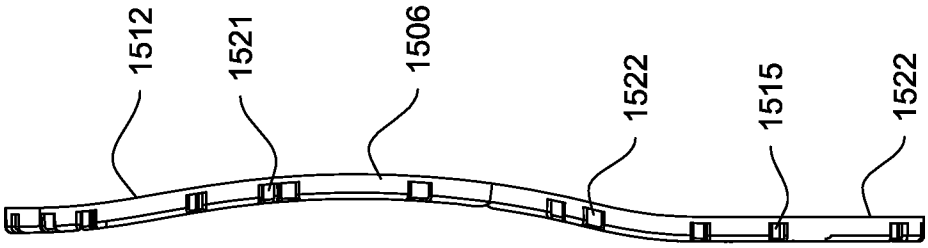

FIG. 15D-3

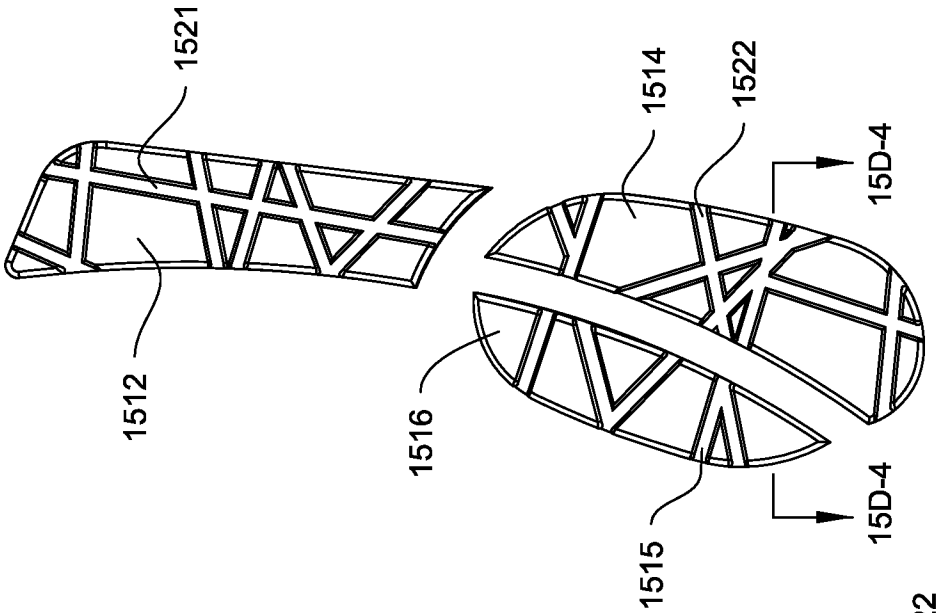

FIG. 15D-2

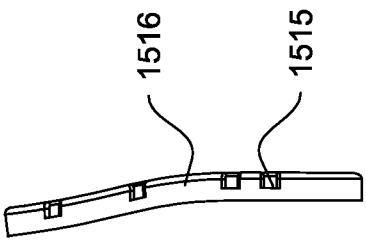

FIG. 15D-1

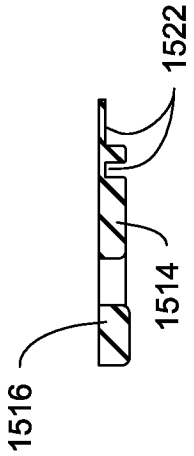

FIG. 15D-4

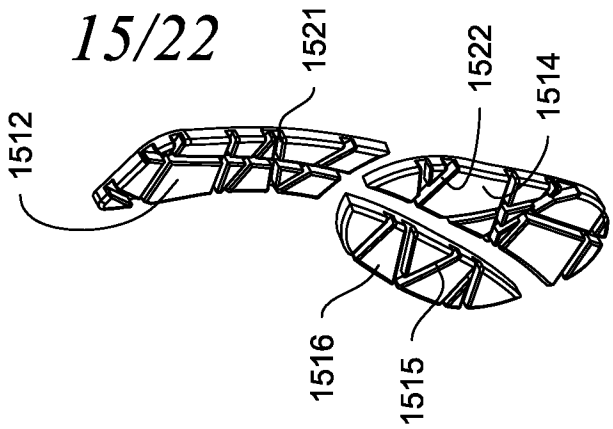

FIG. 15D-5

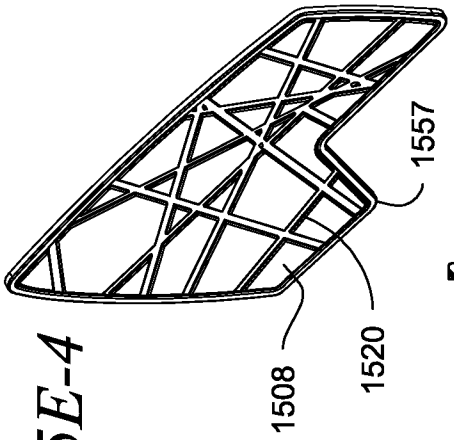

FIG. 15E-4

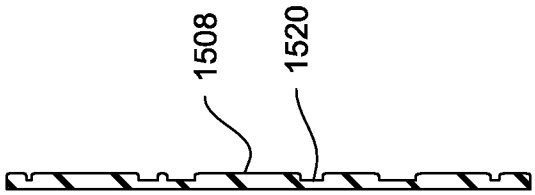

FIG. 15E-3

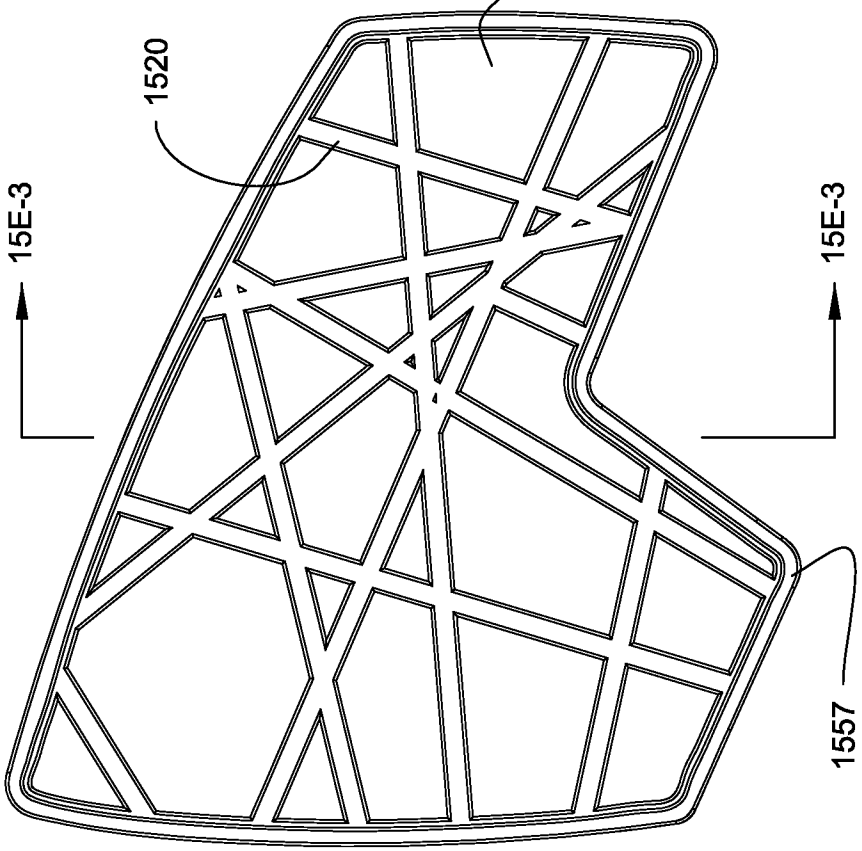

FIG. 15E-2

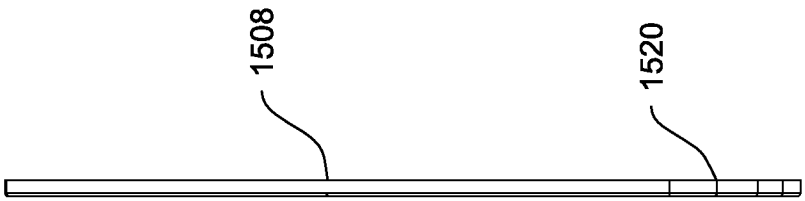

FIG. 15E-1

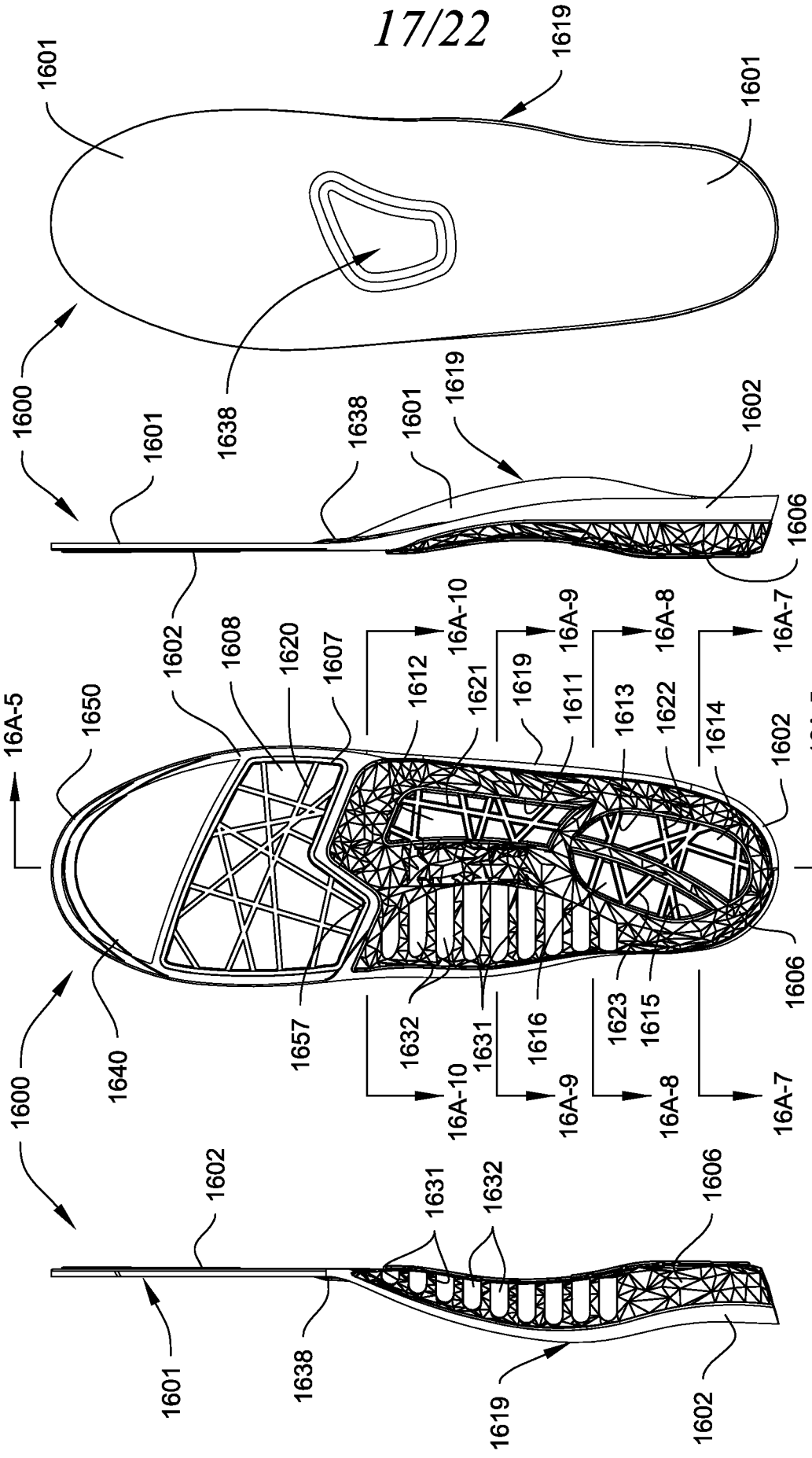

FIG. 16A-1 FIG. 16A-2 FIG. 16A-3 FIG. 16A-4

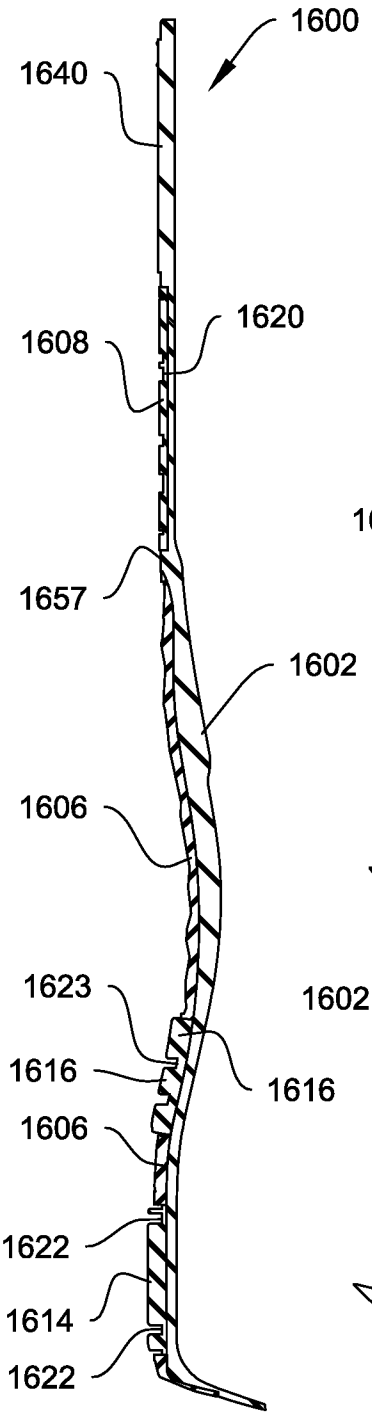

FIG. 16A-5

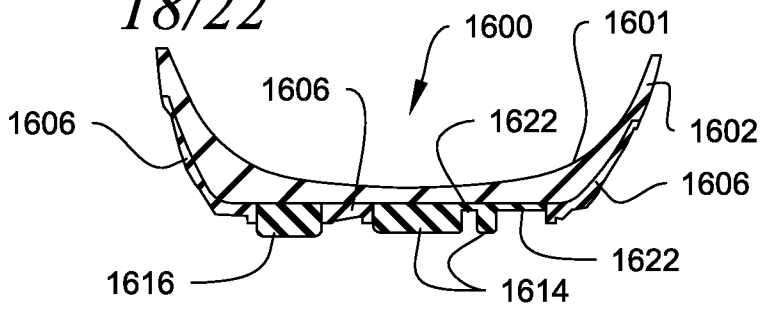

FIG. 16A-7

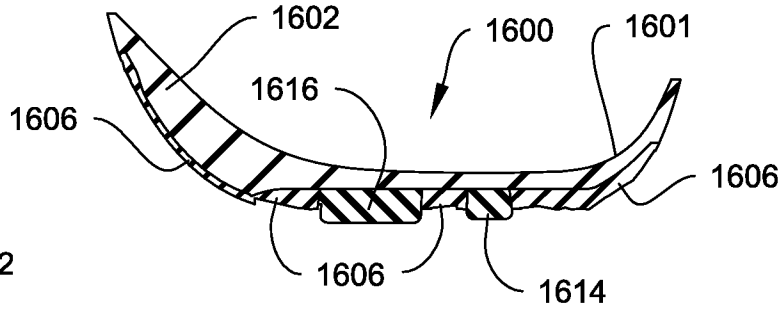

FIG. 16A-8

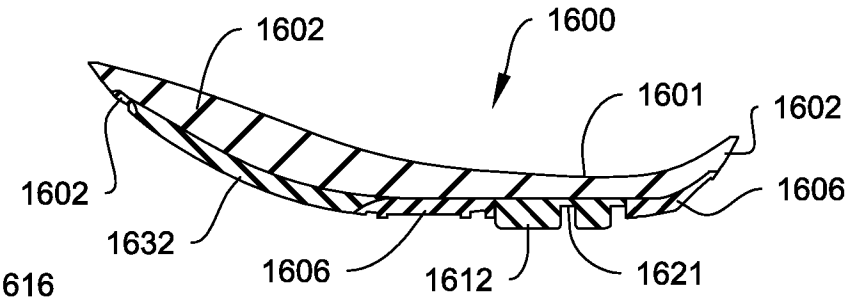

FIG. 16A-9

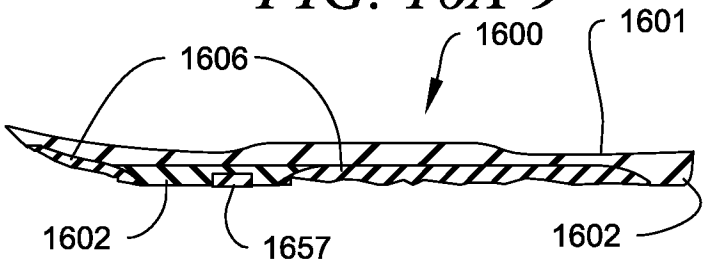

FIG. 16A-10

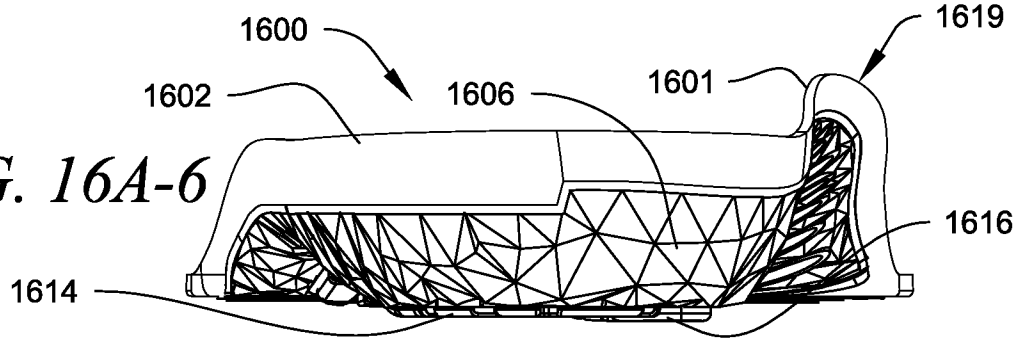

FIG. 16A-6

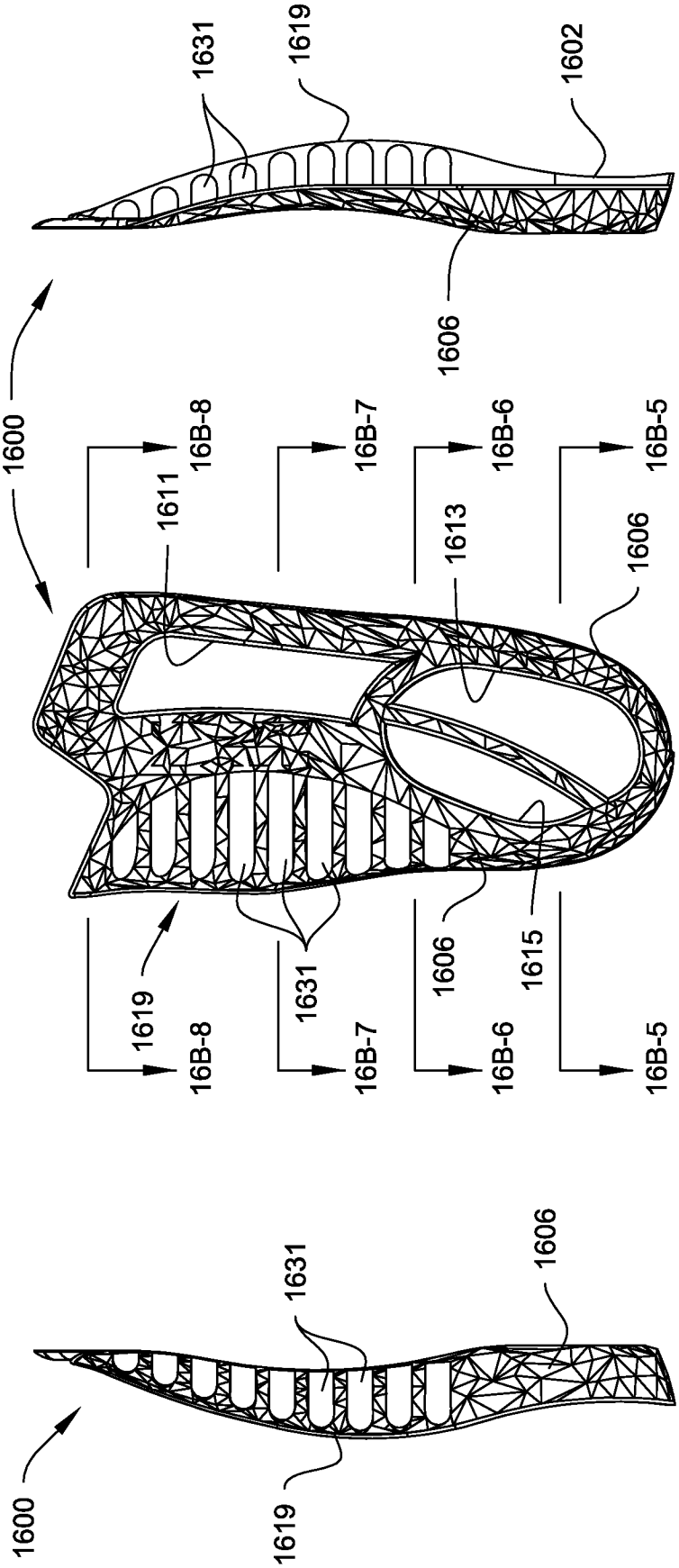

FIG. 16B-1

FIG. 16B-3

FIG. 16B-2

FIG. 16B-4

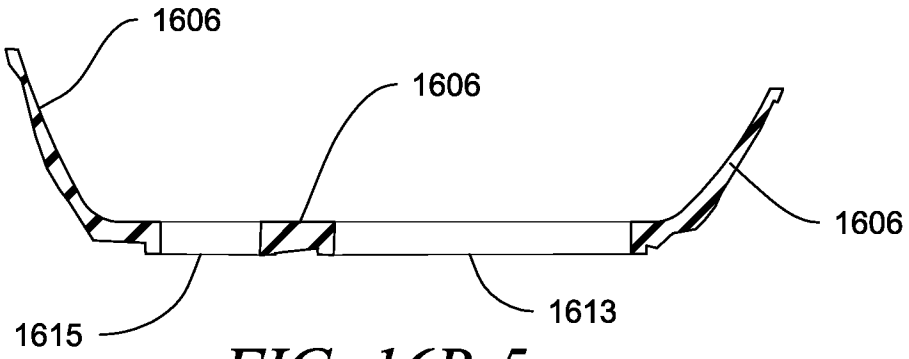

FIG. 16B-5

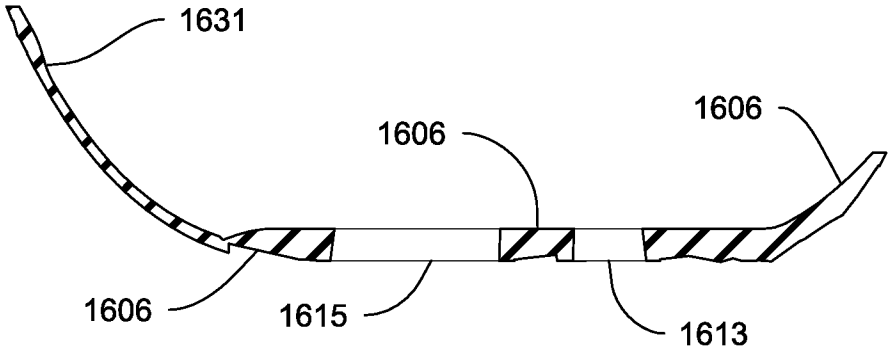

FIG. 16B-6

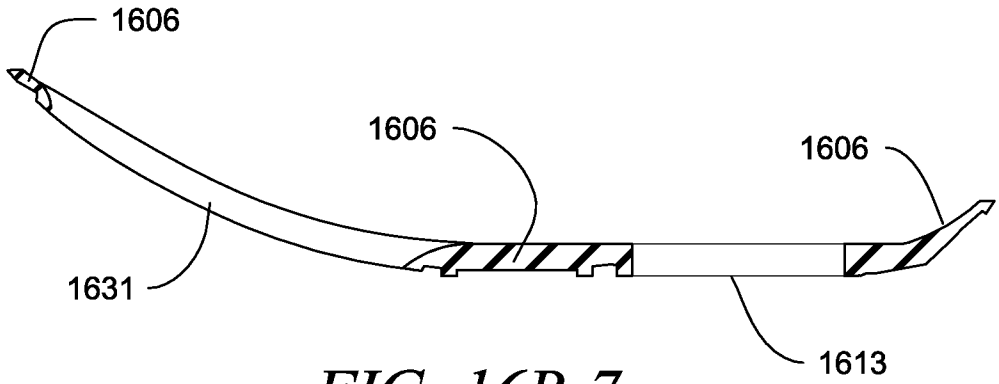

FIG. 16B-7

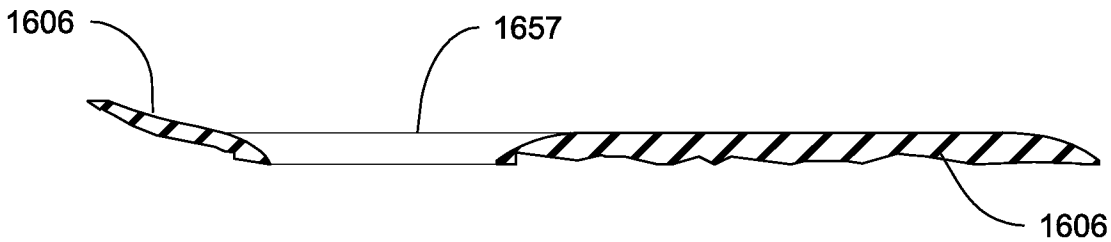

FIG. 16B-8

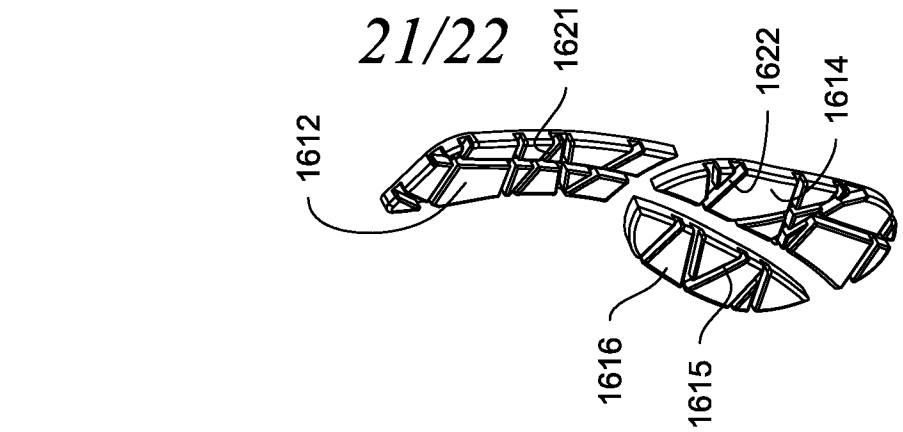

FIG. 16C-5

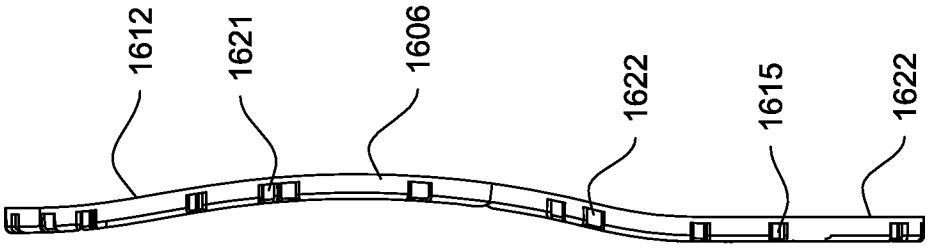

FIG. 16C-3

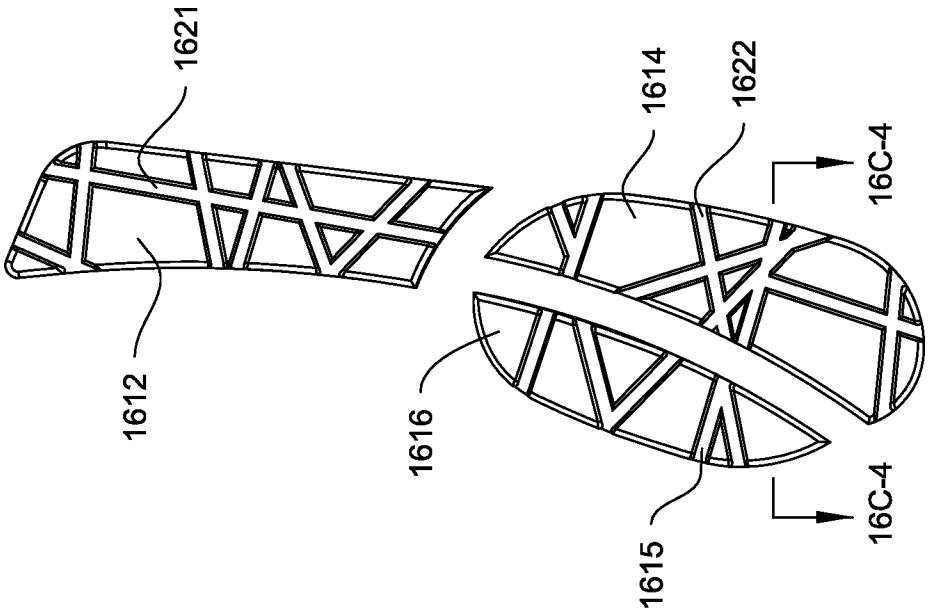

FIG. 16C-2

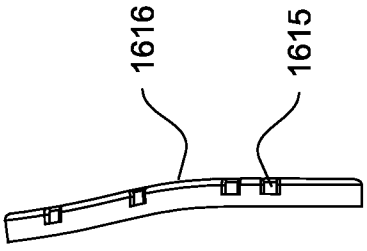

FIG. 16C-1

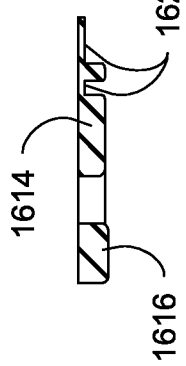

FIG. 16C-4

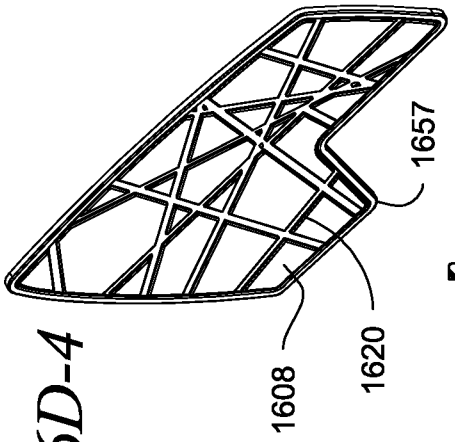

FIG. 16D-4

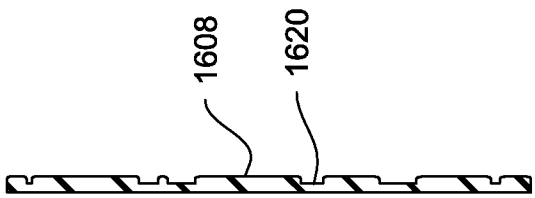

FIG. 16D-3

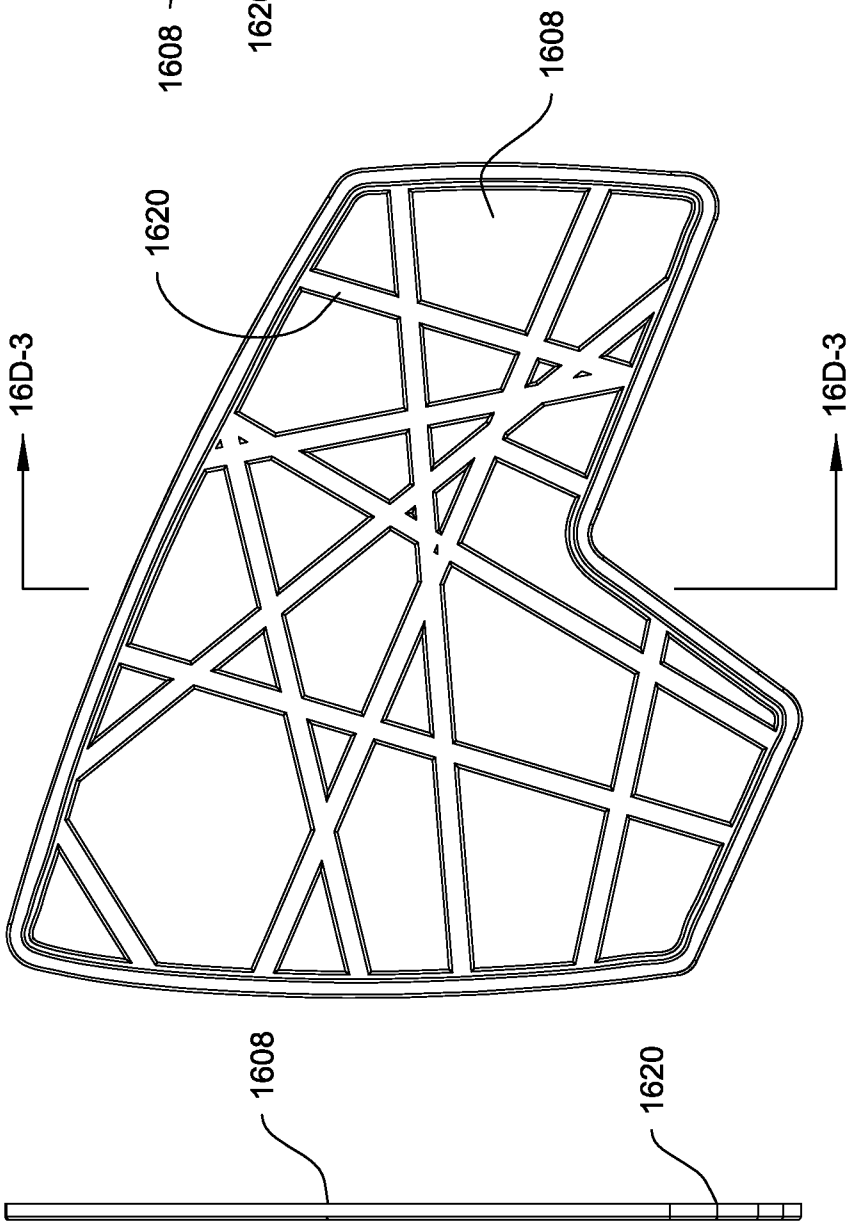

FIG. 16D-2

FIG. 16D-1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/055133

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☒ Claims Nos.: 28, 29
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required addtional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of any additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/055133

A. CLASSIFICATION OF SUBJECT MATTER

A43B 13/40(2006.01)i, A43B 13/18(2006.01)i, A43B 13/14(2006.01)i, A43B 7/32(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 13/40; A43B 13/38; A61F 5/14; A43B 3/26; A43B 13/14; A43B 13/18; A43B 7/32

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
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords: insole, shoe, arch support, stability cradle, pod, groove, pattern

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011-0131835 A1 (CHESKIN, M. P. et al.) 09 June 2011 See paragraphs [0021], [0022], [0030]-[0033], [0035]; claims 1-3, 9; and figures 1, 2.	1-27,30,31
A	US 2007-0039209 A1 (WHITE, J. et al.) 22 February 2007 See abstract; paragraphs [0061]-[0069]; claims 1, 22; and figure 7.	1-27,30,31
A	US 2013-0160331 A1 (BURKE, R. G. et al.) 27 June 2013 See paragraphs [0059], [0078]-[0080]; claim 1; and figures 10-14.	1-27,30,31
A	US 2004-0194344 A1 (TADIN, A. G.) 07 October 2004 See abstract; paragraphs [0060]-[0066]; claims 1, 28; and figure 1.	1-27,30,31
A	US 6481120 B1 (XIA, B. et al.) 19 November 2002 See column 3, line 60-column 4, line 43; claims 1-11; and figures 1-3.	1-27,30,31

☐ 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
"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
15 January 2015 (15.01.2015)	**15 January 2015 (15.01.2015)**

Name and mailing address of the ISA/KR
International Application Division
Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701,
Republic of Korea
Facsimile No. ++82 42 472 3473

Authorized officer
HONG, Sung Ran
Telephone No. +82-42-481-5405

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2014/055133

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011-0131835 A1	09/06/2011	AU 2006-280479 A1	22/02/2007
		AU 2006-280479 B2	14/07/2011
		CN 101282664 A0	08/10/2008
		CN 101282664 B	20/04/2011
		CN 102113740 A	06/07/2011
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		EP 2476330 A2	18/07/2012
		EP 2476330 A3	22/01/2014
		JP 05043843 B2	10/10/2012
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