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(54) **MULTI-UTILITY FOOTWEAR DEVICE**

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(57) **ABSTRACT**

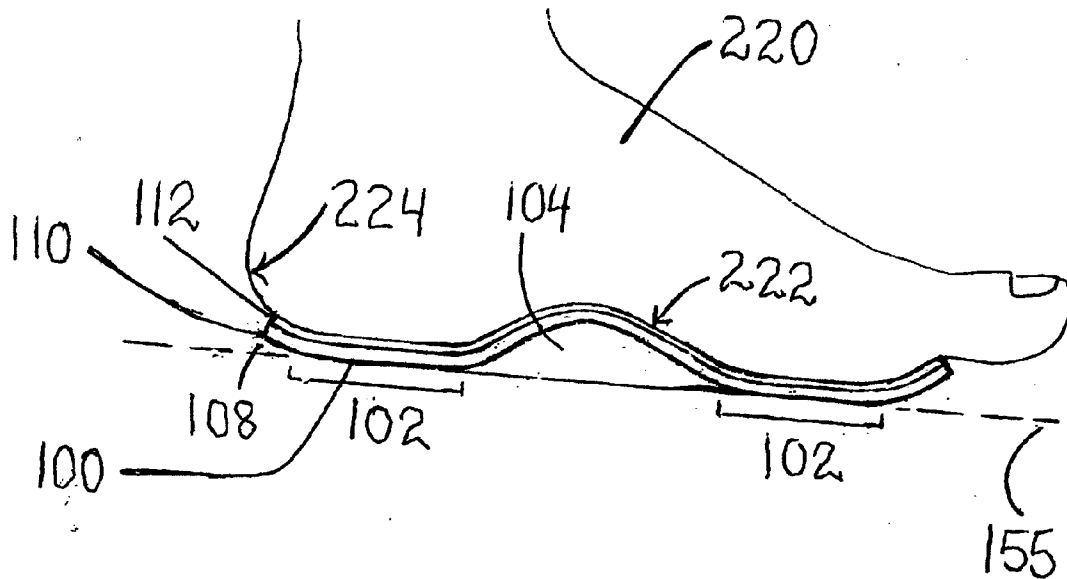
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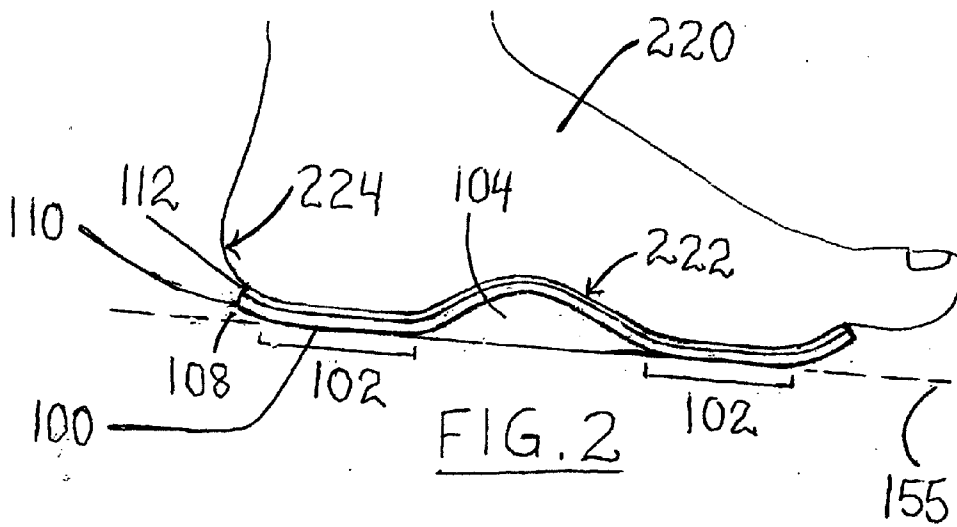
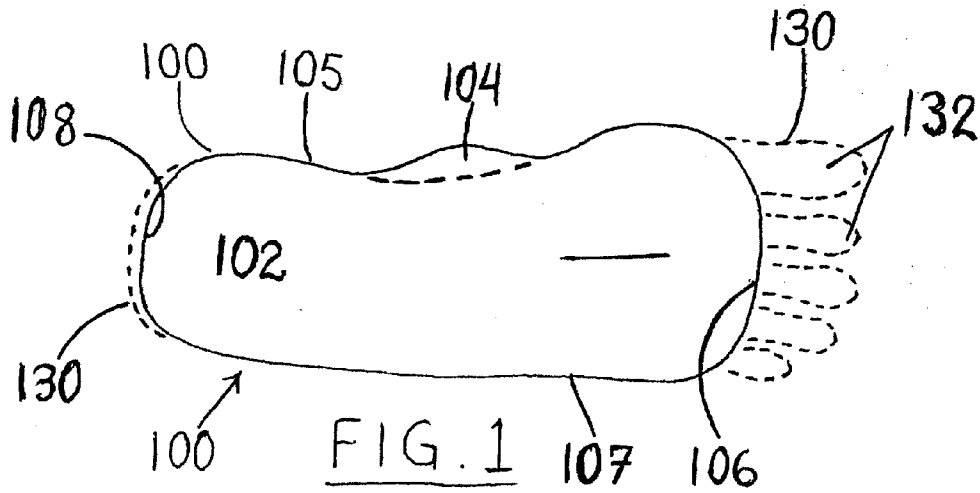
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A device suitable for covering the sole of a foot. An embodiment includes a first layer having a shape of the sole, sized to fit along the sole without covering adjoining toes. Bonding material along a surface of the first layer is suitable for attaching the first layer to the sole or to an article of clothing covering the sole. The bonding material may be water resistant and suited to effect reversible attachment to the skin. In a related method, a first layer has a shape of the sole, sized to fit along the sole. When applied to the sole, the shape and size are configured to not extend along the toes. A bonding material, provided along a surface of the first layer, is suitable for attaching the first layer directly to skin on the sole or to an article of clothing covering the sole of the foot.

Related U.S. Application Data

(60) Provisional application No. 60/953,476, filed on Aug. 2, 2007, provisional application No. 60/978,464, filed on Oct. 9, 2007.





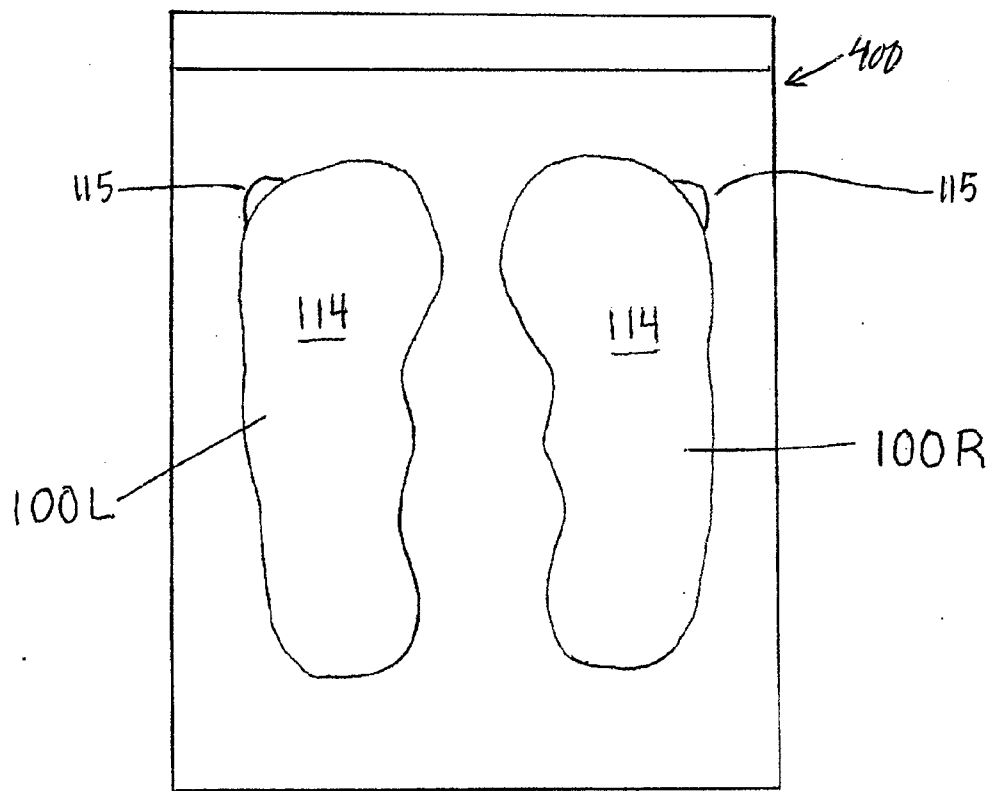
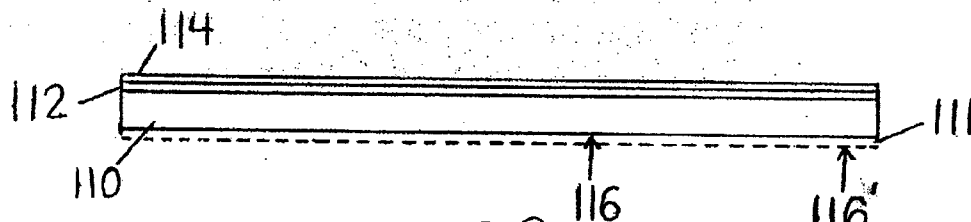
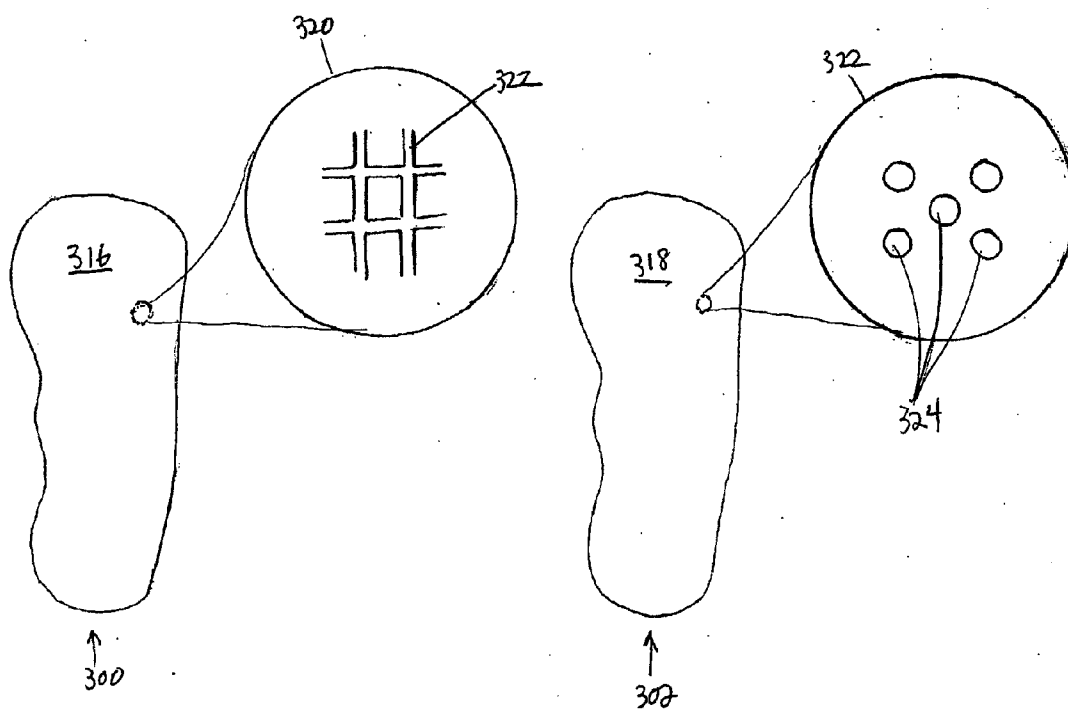


FIG. 3B



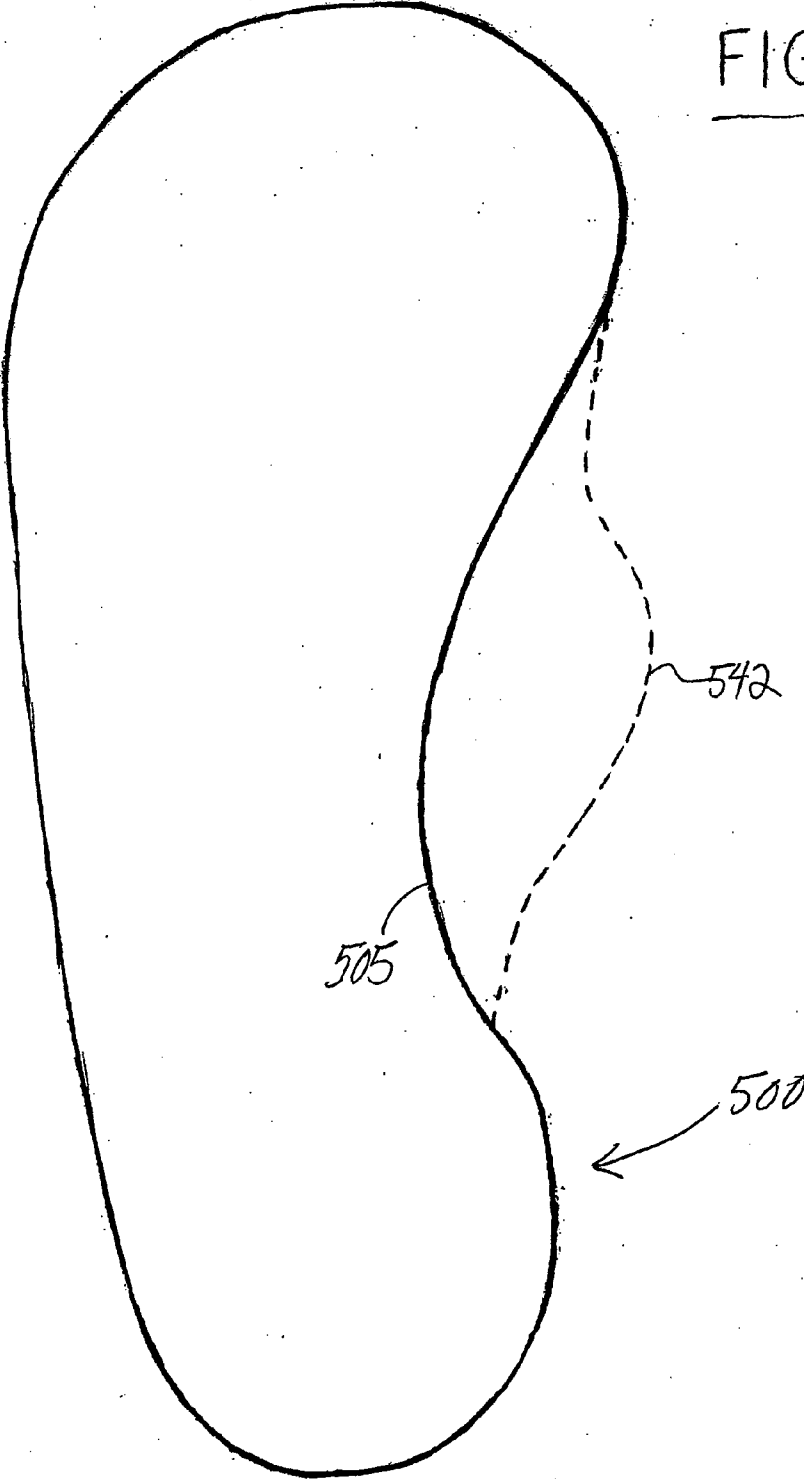


FIG 5

FIG. 6

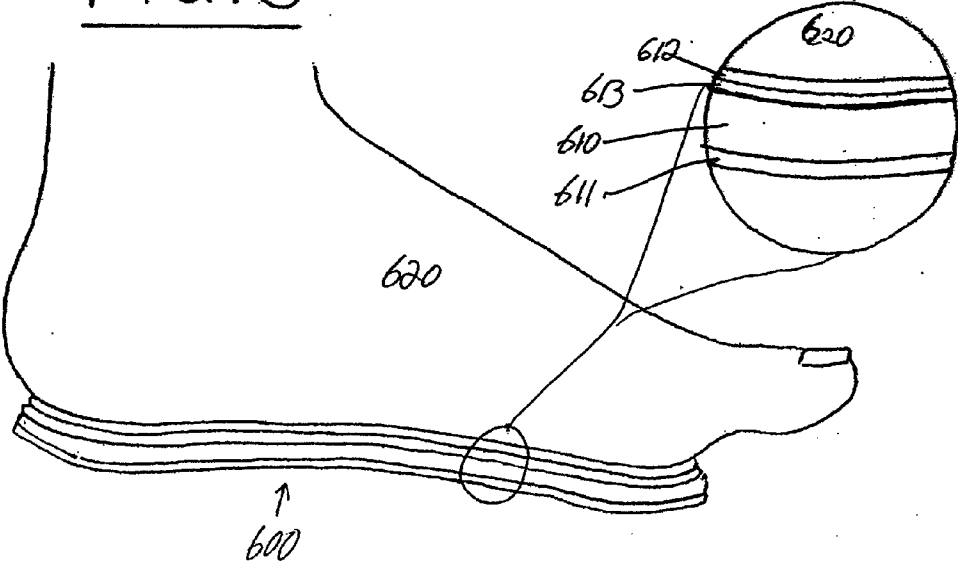
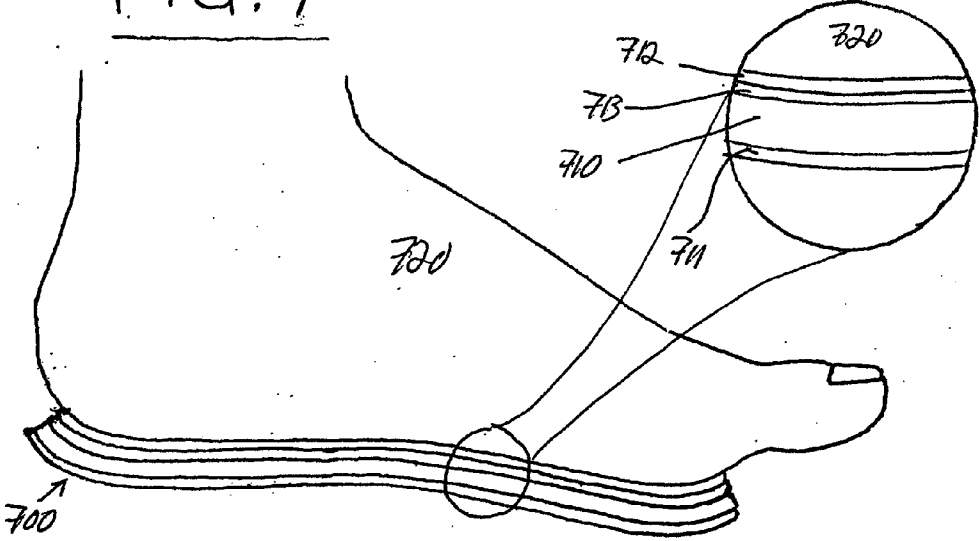
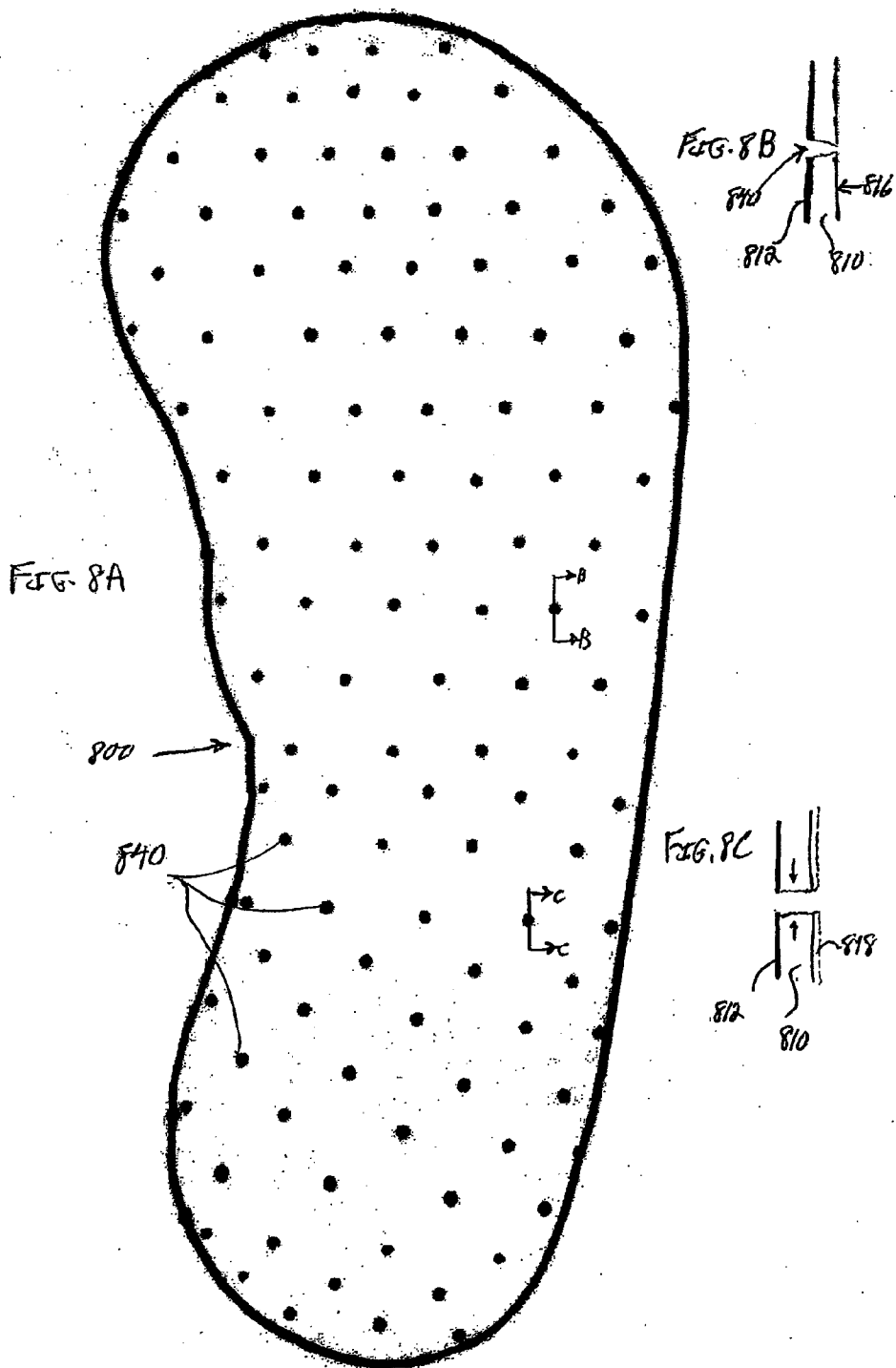


FIG. 7





MULTI-UTILITY FOOTWEAR DEVICE

RELATED APPLICATIONS

[0001] This application claims priority to provisional patent application U.S. 60/953,476 filed 2 Aug. 2007 and U.S. 60/978,464 filed 9 Oct. 2007, each of which is incorporated herein by reference in the entirety.

FIELD OF THE INVENTION

[0002] The invention relates to footwear. In particular, the invention concerns footwear that is attachable to and detachable from the bottoms, e.g., the soles of feet.

BACKGROUND OF THE INVENTION

[0003] Numerous classes of footwear are manufactured and marketed for use at beaches, by swimming pools, on boats, and for aquatic sports. These include sandals, sneakers, moccasins, and surfing and dive booties. Each class may include a variety of designs each offering certain advantages while perhaps also exhibiting limitations or disadvantages relative to user needs, e.g., performance requirements, weight, protective needs, comfort and style. A market has also been established for varied types of disposable footwear, some of which may be utilized in at least some of the locales noted above. One type of such disposable footwear comprises a layer, such as a foam rubber, having placed over an upper surface an adhesive for attaching the layer to the bottom of a foot, and sized proportionately so that the entire foot of the user, including the toes, can extend over the foam rubber layer.

[0004] Generally there is a market for temporary footwear, i.e., apparel that is to be used for relatively brief periods of time or on isolated occasions. Such footwear may be used in wet or dry environments including households, hospitals and other institutions, e.g., in bathrooms and showers, security checkpoints and clean rooms. Frequently there is a need to remove street shoes and also provide a form of alternate foot cover or protection, e.g., to prevent slippage or contamination or simply provide some minimum foot cover such as when shoes and socks are removed during a security check.

[0005] There remain unmet needs for more effective, comfortable, and widely functional footwear for occasional or temporary use. The footwear should be designed for ease of removal and disposal. The design should also be adaptable for use in a wide range of beach and marine activities, as well as institutional and household uses.

SUMMARY OF THE INVENTION

[0006] In a series of embodiments according to the invention a footwear device is provided which is suitable for covering the sole of a foot. The device includes a first layer having a shape of the sole of a foot and sized to fit along the sole without extending to cover adjoining toes of the foot. A bonding material along a surface of the first layer is suitable for attaching the first layer directly to skin on the sole of the foot or to an article of clothing covering the sole of the foot. In certain example embodiments of the device the bonding material is water resistant and suited to effect reversible attachment of the first layer to the skin of the sole. By reversible attachment it is meant that the layer can be both applied to and removed from the sole of the foot. In some embodiments the same device may be repeatedly applied to and removed from the sole. Further, a person may attach the first

layer to the sole of the foot for immediate use, e.g., without requiring any curing of the bonding material, and on demand may immediately remove the first layer from the sole of the foot.

[0007] According to a related method for protecting a foot, a first layer is provided which has a shape of the sole of a foot and is sized to fit along the sole of the foot so that, when applied to the sole, the shape and size are configured to not extend along toes of the foot. A bonding material is provided along a surface of the first layer. The bonding material is suitable for attaching the first layer directly to skin on the sole of the foot or to an article of clothing covering the sole of the foot. The bonding material may be an adhesive.

[0008] In certain examples, the first layer may be a thermoplastic rubber layer. Formation of the device may begin with providing a roll of the rubber layer and a roll of two-sided hypoallergenic pressure sensitive adhesive layer, e.g., about 3 mils or 0.8 mm in thickness. Commonly the two opposing sides of two-sided adhesive layers are covered with a smooth bleached paper that is coated with a silicone release. One of the two adhesive sides of the adhesive layer is affixed to the rubber layer with pressure. The resulting laminate structure may then be processed with a press to create perforations which extend partly or entirely through the rubber layer. Following this step a tool is applied to cut the footwear device in an appropriate shape and size to fit a foot of desired size.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The invention will be more clearly understood from the following description wherein embodiments are illustrated, by way of example only, with reference to the accompanying drawings, in which:

[0010] FIG. 1 is a schematic view along an upper surface of a device according to of an embodiment of the invention when placed against a foot;

[0011] FIG. 2 is a side view of the device shown in FIG. 1 when attached to the sole of a foot;

[0012] FIG. 3A is a side view of the device shown in FIG. 1 prior to placement against the sole of a foot;

[0013] FIG. 3B depicts designs of lower surfaces of devices according to alternate embodiments;

[0014] FIG. 4 illustrates a kit comprising a pair of devices according to the invention;

[0015] FIG. 5 illustrates another embodiment of a device according to the invention;

[0016] FIG. 6 is a side view of still another embodiment of a device according to the invention showing the device attached to a foot;

[0017] FIG. 7 is a side view of yet another embodiment of a device according to the invention showing the device attached to a foot;

[0018] FIG. 8A is a view along an upper surface of a device according to still another embodiment of the invention illustrating holes or perforations which may extend through the device;

[0019] FIG. 8B is a partial side view, taken along line B-B of FIG. 8A, illustrating one design for the holes or perforations shown in FIG. 8A; and

[0020] FIG. 8C is a partial side view, taken along line C-C of FIG. 8A, illustrating another design for the holes or perforations shown in FIG. 8A.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0021] In the past, disposable footwear has accommodated a limited number of functional requirements and these designs have been satisfactory for a limited number of uses. For example, when such footwear is formed with a layer or sheet of foam material, the layer has been patterned to extend from behind the heel through the length of the toes to provide an “entire foot covered” approach. When such a design is worn in an outdoor environment, this results in a situation where sand or other gritty material adheres to exposed adhesive. The exposed adhesive may be between or about the toes or may be in gaps which exist between the sole of the foot and the adjoining surface of the footwear. This can lead to discomfort while wearing such footwear. Further, even after removal of the footwear, residual adhesive on the foot and toes can cause sand or other debris to stick to the skin. In such footwear designs which adhere to the toes, sand which lands along the interface between the foot and the footwear can weaken the adhesive bond to the point wherein the footwear may detach from the bottoms of the foot and toes.

[0022] According to embodiments of the invention a footwear device remains in secure or conformal contact with the sole of the foot while not extending from the sole to the toes. Rather, devices according to the invention may adhere to the bottom of the foot more like a continuous layer of skin along the sole of the foot. By not extending along the toes, there are relatively few or no gaps along the interface between the device and the skin into which sand may seep and interfere with a person’s comfort. Moreover, the bond between the sole and the footwear device has greater immunity to factors which, in the past, have more readily caused separation of a layer or sheet of foam material from the skin of a user.

[0023] With prior footwear designs of the type formed with a layer or sheet of foam material, both the layer and adhesive have extended to bond with skin of the toes. It is now recognized that such a design is not necessary. By limiting the bond region to exclude the toes, greater freedom is allowed in order to manipulate the toes and use the toes to test ambient conditions. This improved utilization of the toes while wearing devices according to the invention is a useful addition in a number of applications including beach and aquatic situations. In essence, many embodiments of devices according to the invention come closer to providing desirable functions and feel that are achievable when the foot is bare and no adhesive layer is present along the bottom of the foot. At the same time, depending on the particular device design, the device may provide certain desirable functions such as slip resistance, isolation from sharp, rough or abrasive surfaces, and an ability to walk with greater comfort over relatively hot surfaces.

[0024] Embodiments according to the invention are footwear devices formed with relatively thin, skin-like layers sized to cover and bond to the soles of feet while excluding contact with the toes. This leaves the toes available to test ambient conditions as desired, such as the temperature of beach sand or a walking surface. If the ground surface is too hot for the toes, the wearer may walk further with the toes extended upward from the ground surface to minimize thermal contact. Such upward positioning can also provide a

healthful stretching of foot muscles, providing an additional benefit). This “free-toes” footwear device also allows for sensitive balancing as well as free and independent movement of the toes while wearing the footwear device. Such functionality is, for example, desirable when standing over water on a surfboard. Embodiments the present invention provide substantial protection for a most vulnerable part of the foot, i.e., the sole, while not constraining mobility of the toes, e.g., in a variety of aquatic activities when the foot may be submerged. Generally, with such free and independent movement of the toes, devices according to the invention provide improved balance in ordinary terrestrial walking activities. Embodiments according to the invention provide other advantages, relative to aforescribed prior designs, as well as certain sandals and “flip-flop” type footwear. For example, some prior footwear designs have exposed heel sections which, while walking over loose sand, cause catching and vaulting of a portion of the sand upward. It has been found that when an adhesive layer is used to bond the footwear to the skin, the sand granules will disturb the bonding interface and deteriorate the integrity of the bond. Embodiments according to the invention do not cause such a collection or throwing up of sand, grit or other debris.

[0025] Having described advantages according to certain embodiments of the invention, the following discussion of several embodiments depicted in the appended drawings will provide a greater understanding of the invention and various associated features.

[0026] FIG. 1 provides a top view of a footwear device 100 according to the invention, relative to a shape exemplary of the bottom surface of a right human foot 130. The following description is provided with reference to the foot 130 to facilitate understanding of orientations of the device as it may be applied. It is to be understood that embodiments of devices 100 may be made for both left and right feet, each being a mirror image of the other. Such devices may be sold in pairs of matched sizes for selection by consumers. Because of the similarity between devices suitable for the left and right feet, details of a device suitable for the right foot are illustrated such that the reader may extend these teachings to devices best suited for left feet.

[0027] In FIG. 1, the shape of the right foot 130 coincides in part with the shape and outline of the device 100, and otherwise is indicated by dashed lines. The footwear device 100 is sized and shaped to be substantially anatomically correct for the sole portion of the foot 130 (excluding the toes), comprising a sole contact region 102 which includes an arch contact region 104 disposed along an inner edge 105, i.e., along the left side of the foot 130. A front-most edge 106, i.e., nearest the toes 132 of the foot 130, is shown positioned behind the toes 132. An outer foot edge 107, i.e., along the left side of the foot 130, conforms to the adjoining portion of the shape along the outer right side of foot 130. The heel end 108 of footwear device 100, positionable along the rear, heel portion of the foot 130 also is identified. The illustrated heel end 108 does not extend to the rear-most portion of the heel of the foot (see FIG. 2), but this is not required for all embodiments of the invention. Further, for some embodiments, the device may extend a limited distance upward along the rear of the foot to provide protection along the curved portion of the heel region which extends upward from the sole of the foot.

[0028] FIG. 2 provides a view of the left side of the device 100 when the device 100 is affixed to a foot 220. The foot 220, shown in a left side view, corresponds to the right foot

130 that is shown schematically in FIG. 1 and like reference numbers denote like components. Prior to use the device **100**, while flexible in shape, may lay in a relatively flat position or may for example be rolled in a compact coil-like configuration. The device configuration during use is described with reference to a plane **155** underlying the sole of the foot **220**. The arch contact region **104**, upon placing the footwear device **100** onto a foot in need of protection, flexes from the plane **155**. The plane **155** defines most of a bottom contact region **102** of the foot **220** but with flexing of the device **100** contact is made with skin of the arch **222** of the foot **220**. In various walking conditions the arch, such as arch **222**, is exposed to heat, debris and other environmental conditions that call for its protection. The arch contact region **104** of the device **100** serves to protect the arch **222**.

[0029] FIG. 2 also shows the footwear device **100** as having two layers, i.e., comprising a lower-most protective cushion layer **110** which comes into contact with a ground surface when walking, and an adhesive layer **112** which contacts the sole of the foot **220**. The adhesive layer **112** reversibly adheres to the foot **220** during the period of use. That is, the layer effects a bond between the layer **112** and the skin of the foot **220** but the layer **112** may be pulled away from the foot to remove the device.

[0030] Thus, as depicted in FIGS. 1 and 2, embodiments of the invention advance the art by providing an anatomically appropriate footwear device that protects the foot's sole, including the region along the arch, while leaving the toes unconstrained so that the toes are free for desired activities and/or functions. The toes are best not covered for various uses. Also, per above, in this embodiment the heel end **108** of the footwear device **100** may not extend to a most rearward portion **224** of the heel of the foot **220**.

[0031] FIG. 3A depicts a side view of the footwear device **100** shown in FIGS. 1 and 2, in a relatively flat orientation prior to application on a foot. In addition to the cushion layer **110** and the adhesive layer **112**, the illustrated embodiment includes a protective peelable layer **114** disposed over the adhesive layer **112**. The protective peelable layer **114** may be a thin, pliable paper, plastic, composite or other material, and may have a surface coating on the side contacting adhesive layer **112** so as to facilitate easy removal from the adhesive layer **112** prior to application to the foot. An exemplary protective peelable layer may comprise silicone coated paper.

[0032] With continued reference to FIG. 3A, according to several embodiments, a bottom surface **116** of the device **100** may be configured to provide a grip function to the surface being walked upon. Such a gripping surface **116** may be integrally formed along the cushion layer **110**, or may be provided as an additional optional layer **111**. The layer **111** is shown in FIG. 3A with dashed lines to indicate it is optionally formed as a separate layer, which when present provides a bottom surface **116'** for contact with an underlying walking surface. A gripping bottom surface, such as on surface **116** or surface **116'** of FIG. 3A, may include surface contours of a non-skid type that provide a grip-like feel when walking on a solid surface such as a boat deck. FIG. 3B depicts exemplary bottom surface contours illustrating different non-skid and grip variations. A first footwear device **300** comprises a gripping bottom surface **316** shown in the enlargement **320** as a raised squared-rib pattern **322**. A second footwear device **302** includes a gripping bottom surface **318** shown in the enlargement **322** as comprising raised circular ribs or cups **324**. As discussed elsewhere, these square ribbed patterns, nubs or

cups may be embossed on the cushion layer or provided on an additional layer formed on the bottom of the cushion layer.

[0033] An example of a cushion layer suitable for incorporation in the invention, comprising an embossed-on grip surface, is "4EO VOLARA® thermoplastic rubber with burlap embossed." This is manufactured by Sekisui Voltek LLC Corporation, 100 Shepard Street, Lawrence, Mass. 01843. Examples of adhesives suitable for use in embodiments of the invention are transfer type adhesives, and, more particularly, acrylate-based transfer type adhesives. In various embodiments these adhesives are hypoallergenic.

[0034] The illustration of FIG. 4 depicts an exemplary package **400** holding inside a pair of footwear devices **100L** and **100R** for the left and right foot, respectively. Each device **100L** and **100R** includes an optional tab extension **115** of the protective peelable layer **114** provided in some embodiments to facilitate gradual removal of the protective peelable layer **114** while placing each of the devices **100L** and **100R** on the bottom of a foot. This encourages proper placement, i.e., alignment, of each device with respect to the sole of the foot. However, the positioning of the optional tab extensions **115** in the locations shown in the figure is exemplary and not meant to be limiting. Footwear devices according to embodiments of the invention are sufficiently flexible and malleable so as to provide a continuous surface for attachment to the foot, including along the arch. In several embodiments, the device **100** is also stretchable along a major plane of the layers **112** or **116**, e.g., including directions along the plane **155** shown in FIG. 2. With a combination of pliability and a stretchable nature, attachment may easily proceed so that there is full contact between skin along the sole (including the arch, when an arch section is provided) and the adhesive layer. This improved attachment due to flexibility (and optionally also stretchability) can be effected with both relatively thin and thicker embodiments of the footwear device **100**. A relatively thin device **100** may be about 0.040 inches (1 millimeter ("mm")) thick, while a thicker embodiment may be about 0.080 inches thick (2 mm), and an even thicker embodiment may be about 0.125 inches (3.175 mm) thick. Still thicker embodiments may be about 0.188 inches (4.75 mm) thick. Embodiments with these thicknesses may include the removable peelable layer **114** positioned over the adhesive layer. It is noted that embodiments may be provided in any range, or sub-range, of thicknesses from the thinnest to the thickest value provided in this paragraph. As further described herein, still thinner layers, less than 1 mm thick, are suitable according to other embodiments of the invention.

[0035] The relatively thin embodiments of the device **100** may be worn within sandals, flip-flops, shoes, etc., and even over socks, so as to be pre-positioned to provide protection when needed, e.g. such as at airport and other security checkpoints. For convenience, such footwear devices can also be supplied from dispensers that are situated before security checkpoints, so as to accelerate the inspection process while affording fast and inexpensive protection to the feet to those passing through the security checkpoints. Alternately, the devices **100** may be affixed to socks.

[0036] In various embodiments, the footwear device is sized so as to only contact and adhere to the sole and arch that are most exposed when walking, and to not cover the sides of the foot not in contact with a surface while walking, and to not cover the toes, as discussed above.

[0037] In use, the footwear devices **100** may be worn on the feet for multiple hours at a time while at the beach or engaged

in an aquatic activity, so as to provide temporary relief from exposure to hot surfaces, and to provide protection from abrasive material and various objects, such as certain sharp objects on a beach or boat. Also, embodiments may be used in households for various purposes, and also to keep feet clean in parks, lawns and at outdoor concerts.

[0038] Embodiments of the invention are suitable for household use during a variety of activities including wet activities and environments or situations in which it is less desirable to wear shoes or sandals but necessary to provide cover or a gripping surface to the bottom of the feet. The devices are advantageous in hospitals and other institutions and other facilities including gymnasiums and locker rooms. The devices **100** find application in bathrooms, showers and generally in situations when short-term foot protection or skid protection is desired. Embodiments of the invention can be worn at security checkpoints, such as in airports, when shoes must be removed. One application of the invention provides a new solution to a need which exists in use of a surfboard. There are often difficulties in walking along the surface of a surfboard when on the water without slipping off the board due to presence of water on the surface. In the past, this problem was addressed by applying a wax to the walking surface of the surfboard. Given the hydrophobic surface characteristics of wax, water can disperse from the waxed surface, allowing some gripping capability between the feet and the surfboard. Other more recent solutions include application of a permanent or semi-permanent application non-slip foam or other plastic surface coating on the portion of the surfboard surface over which a person's feet are positioned. Still another solution is use of so-called surf booties, typically worn in cold water, as these may provide a non-slip surface that may help reduce or prevent slipping, whether on a waxed or non-waxed board. Embodiments of the footwear device of the present invention are advantageous relative to prior solutions and may also be used in conjunction with conventional techniques such as application of wax. According to the invention, the devices **100** may be used on unwaxed surfaces of a surfboard when the devices **100** include grip surfaces such as described with reference to FIG. 3B. Such embodiments may include a relatively strong adhesive, especially resilient to saltwater, placed along the bottom surface of the device **100** for resistive contact with the surface of the surfboard. For example, a transfer adhesive sold as catalog or serial number 1524 by 3M Corporation (Maplewood, Minn.) is a suitable adhesive. Also, for surfboard applications, the footwear devices **100** may be shaped to contact only the areas of the sole most in contact with the surfboard, while not covering the arch area. This way the user may retain greater mobility or flexibility to move or elevate the arches as well as the toes. This application provides for a good grip between the feet of the surfer and the surface on a surfboard without the need of wax although the devices may also be used in conjunction with wax or other gripping means. Generally, the toes are totally free to make fine and quick adjustments for balance on the surfboard surface while the contact areas along the soles of the feet, through the footwear device, provide stability and aid in balance and counterbalance to the toe balancing.

[0039] FIG. 5 schematically illustrates an exemplary shape of a footwear device according to another embodiment of the invention. This top view shows a device **500** patterned for mounting on a left foot. It is shaped to have an inner foot edge **505** that curves inward so as to match the contour of an inner edge of a foot that is in contact with a surface upon which the

foot is placed. That is, the inner foot edge **505** of footwear device **500** is shaped to exclude an arch contact region (such as **104** in FIGS. 1 and 2). With surface area of the device **500** omitting material beneath the foot arch, the dashed line **542** indicates a maximum outer boundary within which such an arch contact region is present in embodiments of the device **100**. For embodiments of the device **500** the inner boundary of the excluded arch region is along the solid line **505** between the junctions with the dashed line **542**. Embodiments such as that of FIG. 5 may find use in sports and other activities.

[0040] More generally, for various footwear device embodiments, the nature and application of the adhesive layer, e.g., layer **112**, may be varied, such as to give a stronger attachment when an embodiment is sold for use at the beach or for potentially wet activities, or a relatively weaker attachment for more temporary and less demanding uses, such as to place on one's feet or socks at a security checkpoint. Footwear devices according to the invention may be attached to bare feet, or to socks, stockings or panty hose that are fit over feet. The adhesive may vary and be optimized for each different application and purpose. Formulations for the adhesives generally may be hypoallergenic and non-invasive to the dermal layer of the skin. The adhesive may be of such light nature and with appropriate adhesive properties that no cleaning of the foot or sock is needed after removal. Such adhesives are particularly applicable for temporary footwear devices to be used at airport security checkpoints. Alternatively, when a more durable or time lasting bond to the skin (or to a sock or other fabric about the foot) is created, after removal of the footwear device it may be desirable to wash the soles of the feet with soap and water, or to wipe the soles with a solvent-based, e.g., alcohol-based, wiping material such as the type commonly provided in sealed foil packs. One brand of such cleaning materials, in the form of towelettes, is a towelette manufactured by Victoria Bay, Totowa, N.J.

[0041] Thus, depending on the particular use, and the period of time the device is attached to the foot, and depending on the type of adhesive used in the particular footwear device embodiment, a cleaning of the foot may or may not be necessary to remove a residual portion of the adhesive.

[0042] In still other embodiments the invention a wicking layer may be added to or integrated with the other layers, e.g., layer **110**, to wick away moisture, such as sweat, from the foot surface to which the footwear device is attached. See FIG. 6, a side view of a footwear device **600** according to the invention which is shown attached to a foot **620**. The enlargement of the dashed section shows an adhesive layer **612**, below which is positioned a wicking layer **613**, below which is placed a cushion layer **610**. An optional grip-surface or layer **611** is along the lower portion of the cushion layer for contact with a walking surface. The wicking layer **613** comprises a wicking material, such as a suitable NYLON® or nylon-like polymer fabric that transfers some moisture exuded from the foot to the cushion layer **610**. Once moisture passes to the cushion layer **610**, it may proceed, such as by diffusion based on mass transfer, to the general environment. This system of layers can wick moisture away from the foot so as to maintain a better adhesive bond between the skin of the foot and the adhesive layer **612**. The system of layers may also act as a permeable structure which retains some of the moisture, but which, when exposed to warmth or the sun, quickly dries. The integrity of the adhesive bond is thus extendable in the presence of moisture thereby improving the duration of time that the footwear device can remain securely attached to the foot.

In one method of fabrication, a wicking layer **613** is first attached to cushion layer **610** by thermal bonding or with a suitable adhesive. The subsequent step, the adhesive layer **612** is applied over the wicking layer **613**. In this example, the adhesive layer **612** is porous so that moisture can pass through to the wicking layer **613**.

[0043] Various embodiments may have any desired color, or may be translucent. The cushion layer itself may comprise a plurality of layers bonded together as is known in the art. Also, a desired portion, or the entirety, of the cushion layer, or an additional protective layer may comprise a relatively puncture-proof component, such as tight-weave DACRON®. This may be any thin fabric layer that would stop or impede the penetration of glass fragments or other sharp objects to the skin of the foot. According to another embodiment of the invention, FIG. 7 provides such an example wherein a footwear device **700** is positioned against a foot **720**. The device **700** comprises an adhesive layer **712**, a cushion layer **710**, and an intervening protective layer **713** positioned between the layers **712** and **710**. The protective layer **713** may be formed of a tight-weave DACRON® (trademark of E. I. DuPont, Wilmington, Del.) fabric such as any one of the types used in protective clothing. Alternately the layer **713** may be a KEVLAR® (trademark of E. I. DuPont, Wilmington, Del.) layer comprising a polyparaphenylene terephthalamide woven fabric, a Spectra Fiber layer, e.g., a polyethylene composite in a flexible resin within a laminate film, or a layer of any other protective material commonly known to those skilled in the art. The protective layer **713** may be positioned as shown between the adhesive layer **712** and the cushion layer **710**, or may be positioned below the cushion layer **710** or as a component of the cushion layer **710**. FIG. 7 further illustrates an optional grip-surface layer **711**. In some embodiments the grip-surface layer **711** may comprise protective material to perform the function assigned to the layer **713**. Also, the protective material may be uniform, or may be concentrated in certain areas of the footwear device.

[0044] Based in part on testing and evaluation of materials it is recognized that the duration of the adhesive nature of functional material diminishes as a function of the amount of perspiration or other moisture reaching the adhesive material, e.g., emanating from the sole of the foot. For example, during warm or hot weather or periods of intense physical activity, the life of the adhesive material may more rapidly depreciate. That is, the ability of the adhesive on the footwear device to maintain a sufficient bond to the sole of the foot can be compromised so as to allow the footwear device to begin peeling away from the sole. Such peeling away may impair performance and lead, eventually, to the footwear device separating from or having to be removed by the user.

[0045] According to another embodiment integrity of the bond formed with the adhesive layer when subject to foot perspiration is improved by providing a plurality of holes each passing partly or all the way through the footwear device, such as from the adhesive layer through the cushion layer and any optional grip surface layer. In some embodiments, the plurality of perforations may be formed so that they penetrate the adhesive layer and then partially penetrate into the cushioning layer. However, given the flexible foam nature of the cushioning layer, a hole formed through the cushioning layer may partially “collapse” after formation due to the flexible nature of the foam material. When an optional wicking layer is present, the perforations may partially or fully penetrate the optional wicking layer. Generally, the plu-

rality of perforations provide for passage of perspiration released from pores along the sole. The perforations reduce the amount of sweat that would otherwise remain at the interface between the sole and the adhesive layer, and which would work to interfere with the adhesivity of the adhesive of the adhesive layer.

[0046] The sole of the foot comprises numerous sweat glands, of the eccrine type, that function to excrete liquid sweat which, in the foot's normal state, helps provide greater friction and thus traction (see Text Atlas of Podiatric Dermatology, page 14, Dawler, R. et al. Martin Dunitz, Ltd., London, 2001). However, when using the footwear device according to the invention, by providing a suitable number of perforations, which allow for passage and removal of perspiration from the skin, there is improved durability of the bond affected by the adhesion layer.

[0047] Thus, in various embodiments the effect of the plurality of holes is to increase and/or prolong the adhesivity of the adhesive layer adhesive. Sweat that passes through the hole beyond the adhesive layer may be absorbed in the cushion layer, and/or be absorbed in an optional wicking layer, and/or pass all the way through to the exterior of the footwear device.

[0048] FIG. 8A is a top view of an exemplary embodiment of a footwear device **800** of the present invention in which a series of perforations **840** have been formed for passage of perspiration from the sole of a foot (not shown). The perforations **840** are provided in a simple offset pattern with individual rows offset relative to adjacent rows. This geometry is not meant to be limiting and other patterns will be apparent. FIG. 8B provides a partial side view taken along line B-B of FIG. 8A, showing one cross-sectional profile of a perforation **840**. The diameter of the perforation within the adhesive layer **812** is relatively large and comports with the nominal hole size of a drill or punch used for forming it. However, due to the flexibility of the foam of the cushioning layer **810**, and consequent tendency to move during and after hole formation, there may be a narrowing or tapering profile toward the bottom of the cushioning layer **810**. When the hole size is sufficiently small, there may be no visible opening at the bottom surface **816**, or merely, as shown, a smaller opening than that at the adhesive layer **812**. FIG. 8C provides a partial side view taken along line C-C of FIG. 8A, showing a second cross-sectional profile of a perforation **840** having a relatively uniform cross-sectional distance (e.g., diameter) as a function of position through the layer **812**. This uniformity may result from use of a relatively rigid material as the cushioning layer **812** or may result from a process difference in the formation of the perforations **840**. An optional bottom gripping layer **898** is also shown. In some embodiments, during use, compressive force incurred during stepping on the device may force a periodic narrowing of the mid-section of the cushioning layer **812** (see arrows). This aperture reduction may facilitate preventing sand or other fine debris from entering the device through the perforations or movement of the debris to the adhesive layer where it could degrade the integrity of the bond. The two perforation profiles illustrated in FIGS. 8C and 8D are exemplary and not at all limiting of designs and configurations contemplated. The sizes of the perforations may be any reasonable size to achieve the desired functionality of passing perspiration, water or other liquid, away from the interface of the sole and the adhesive layer of the footwear device. In some embodiments the hole is circular and has a diameter ranging from 0.1 to 2.0 millimeters. In other

embodiments the hole is also circular in shape, having a diameter ranging from 1.0 to 2.0 millimeters. In one embodiment, holes were formed using a drill bit approximately 1.5 millimeters in diameter (0.059 inches). Relatively smaller holes may afford an advantage of providing for passage of sweat or other liquids while not being so large as to allow the intrusion of material such as sand. Thus, a large number of small perforations may provide better overall performance depending on the application to which the foot device is deployed. The holes need not be circular, and may be any shape known to those skilled in the art. The holes may be formed by punches or any other method of forming holes known to those skilled in the art.

[0049] The pattern of perforations in the footwear device may be any defined geometric pattern, or may be random, or may be distributed to providing more or larger perforations in areas of the foot where either 1) there are more sweat glands or more active sweat glands or 2) the release of perspiration or other liquid has a relatively greater adverse effect on bond integrity. In numerous embodiments the perforations penetrate through the bottom surface of the footwear device but are sufficiently small in diameter or width that sand and debris cannot pass entirely through. For example, for a chosen perforation width, when pressure is applied the rubber of the cushioning layer deforms to close off or reduce the width, making it difficult for debris to enter to the bond layer. A single embodiment may comprise holes of different sizes, optionally with different perforation cross-sectional profiles.

[0050] In one exemplary embodiment, the perforations are approximately 1.5 mm in diameter, arranged roughly in rows having the perforations staggered relative one another in adjacent rows, with the perforations spaced apart approximately 6 mm on center. This configuration was observed to last on a wearer's foot about sixty percent longer than a similar footwear device not having the perforations. The perforations were found to provide an unexpected improvement. The improvement attributable to the perforations rendered it less critical to modify the adhesive to increase bond strength and durability.

[0051] Ceramic material and reflective, anti-reflective, or radiant barriers may be incorporated in embodiments of the footwear device to limit the rate of heat transfer from a hot surface, such as sand, to the sole of the foot.

[0052] Also, the bottoms and sides of various embodiments may be provided with a decorative glitter accent and/or indicia that may be desired or popular. By indicia is meant any display of symbols, pictures, letters, acronyms, abbreviations, or combination of these, such as are used to display or communicate. For instance, indicia include, but are not limited to: college logos, national, state and city logos, college or professional sports logos and designs, company logos, corporate logos, designs, advertisements and other displays, and even letters and/or symbols to connote political, religious or other affiliations or viewpoints. An indicum is the singular word form of indicia, but as used in the present disclosure, indicia may also refer to a single unit of display. Also, as used herein, a single unit of indicia may include an assembled collection of two or more different symbols, etc.

[0053] Kits may be provided that include one or more pairs of footwear devices according to the invention and a packaged cloth with suitable solvent to remove and clean off residual adhesive. In other kit embodiments, footwear devices are provided on a large sheet of protective layer so that after a first use the devices could be reattached to the sheet

for a second or third use. This may be well-suited for use on boats to keep land shoes away from deck surfaces. As noted above, devices according to the invention can be provided in rolls for easy dispensing. The various component layers of the footwear device may comprise recycled materials and/or biodegradable materials.

[0054] Having described a range of embodiments with various optional features, it is to be understood that these are exemplary and not limiting. Rather the scope of the invention is only limited by the claims which now follow.

The claimed invention is:

1. A footwear device suitable for covering the sole of a foot, comprising:

a first layer having a shape of the sole of a foot and sized to fit along the sole without extending to cover adjoining toes of the foot; and

a bonding material along a surface of the first layer suitable for attaching the first layer directly to skin on the sole of the foot or to an article of clothing covering the sole of the foot.

2. The device of claim 1 wherein the first layer includes first and second opposing surfaces, the first surface having affixed thereto the bonding material and the second surface having a slip resistant quality when the second surface is placed against a moist surface.

3. The device of claim 2 wherein the second surface of the first layer is coated with a second layer to impart the slip resistant quality.

4. The device of claim 1 wherein the first layer includes a contact region for covering an arch of a foot which, when positioned along the arch, can be conformed to adhere thereto by movement of the contact region away from a plane along which other parts of the sole extend.

5. The device of claim 1 wherein the bonding material is formed as a second layer along a first surface of the first layer.

6. The device of claim 1 wherein the first layer is a protective cushion layer suitable for walking over surfaces when bonded to the sole of a foot.

7. The device of claim 1 wherein the bonding material is water resistant and suited to effect reversible attachment of the first layer to the skin of the sole so that a person may attach the first layer to the sole of the foot for immediate use and on demand immediately remove the first layer from the sole of the foot.

8. The footwear device of claim 1 further comprising one or more additional layers selected from the group consisting of a wicking layer, a protective layer, and a grip-surface layer.

9. The footwear device of claim 1 wherein the cushion layer comprises a grip-surface coating.

10. The footwear device of claim 1 wherein the first layer has a shape including an inner foot edge that curves inward so as to match the contour of an edge of the sole of a foot that is in contact with a surface upon which the foot is placed, the shape conforming generally to the shape of the sole while not extending to contact an arch region of the foot.

11. The footwear device of claim 1 wherein the first layer is a cushion layer comprising a grip-surface.

12. The footwear device of claim 11 wherein the grip-surface is a coating formed on the first layer.

13. The footwear device of claim 1 wherein the bonding material is formed as an adhesive layer on a first surface of the first layer, suitable for contacting skin of the sole and attaching the first layer thereto, the device further comprising a

removable peelable layer covering the adhesive layer for protection of the adhesive layer prior to contacting the skin of the sole.

14. The footwear device of claim **1** wherein the first layer, although sized for a particular sole of a foot including a heel portion, does not extend over the entire heel portion of the sole.

15. The footwear device of claim **1** wherein the first layer includes formed therein a plurality of perforations extending partially or completely therethrough.

16. The footwear device of claim **15** wherein when the device is attached to a foot the perforations are positioned to allow perspiration exuded from the foot to pass from the skin of the sole through the first layer.

17. The footwear device of claim **16** wherein movement of perspiration as permitted by the perforations extends the integrity of the bond material to prolong attachment of the device to the foot.

18. The footwear device of claim **1** wherein further comprising a ceramic material effective to reduce the rate of thermal transfer through the device to the foot.

19. The footwear device of claim **1** further comprising a reflective material or a radiant barrier.

20. The footwear device of claim **1** provided in a kit comprising a cleaning solution for removal of any bonding material from the skin after removal of the footwear device from the foot.

21. A method of protecting a foot comprising:

providing a first layer having a shape of the sole of a foot and sized to fit along the sole of the foot so that, when applied to the sole, the shape and size are configured to not extend along toes of the foot; and

providing a bonding material along a surface of the first layer suitable for attaching the first layer directly to skin on the sole of the foot or to an article of clothing covering the sole of the foot.

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