



US006993858B2

(12) **United States Patent**
Seamans

(10) **Patent No.:** **US 6,993,858 B2**

(45) **Date of Patent:** **Feb. 7, 2006**

(54) **BREATHABLE FOOTWEAR PIECES**

D431,346 S *	10/2000	Birkenstock	.....	D2/916
6,237,249 B1 *	5/2001	Aguerre	.....	36/11.5
6,256,906 B1 *	7/2001	Matis et al.	.....	36/11.5
6,640,464 B2 *	11/2003	Hsin et al.	.....	36/11.5

(75) Inventor: **Scott Seamans**, Longmont, CO (US)

(73) Assignee: **Crocs, Inc.**, Niwot, CO (US)

FOREIGN PATENT DOCUMENTS

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 133 days.

EP	0802039	A2	10/1997
EP	0802040	A2	10/1997
EP	0802041	A2	10/1997
EP	0884005	A1	12/1998

(21) Appl. No.: **10/603,126**

OTHER PUBLICATIONS

(22) Filed: **Jun. 23, 2003**

Rhoda Miel, *Snowshoe walks away with best design*, *Plastics News*, Apr. 22, 2002, v14, n8, p4 (2 pages).

(65) **Prior Publication Data**

US 2004/0231189 A1 Nov. 25, 2004

Luisa Zargani, *One Fine Year; Anton Magnani's Quirky Dry-Shod Designs Have Gained the Italian Designer Respect, Recognition and a Deal With Comme Des Garcons*, *Footwear News*, Aug. 2, 1999, p. 102 (2 pages).

Related U.S. Application Data

(60) Provisional application No. 60/473,360, filed on May 23, 2003, provisional application No. 60/473,371, filed on May 23, 2003.

Finproject Brews an Extralight (Evasol Plastics and Finproject signed a joint venture agreement to introduce a range of new block and net-fit soles for shoes), *FN World*, Aug. 4, 1997, v. 53, n.31, p. 8 (1 page).

(Continued)

(51) **Int. Cl.**

A43B 7/06 (2006.01)
A43B 3/12 (2006.01)

Primary Examiner—Jila M. Mohandesi

(52) **U.S. Cl.** **36/3 A**; 36/11.5; 36/50.1

(74) *Attorney, Agent, or Firm*—Townsend and Townsend and Crew LLP

(58) **Field of Classification Search** 36/3 R,
36/3 A, 3 B, 7.5, 11.5, 98, 29

See application file for complete search history.

(57) **ABSTRACT**

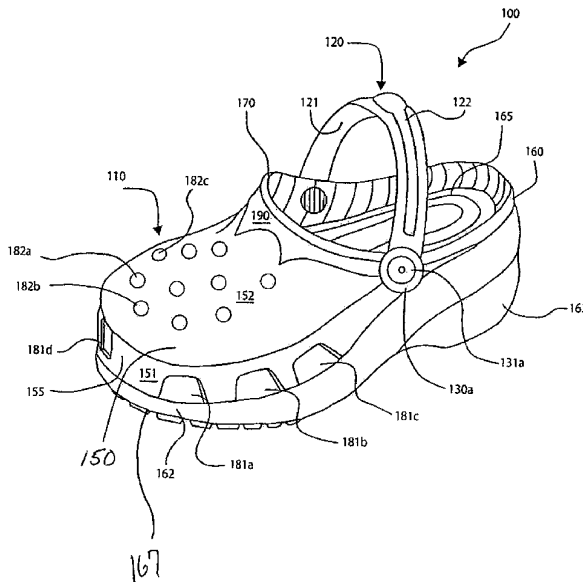
(56) **References Cited**

U.S. PATENT DOCUMENTS

2,180,924 A *	11/1939	Dunbar	.....	36/3 B
4,476,600 A *	10/1984	Seidel et al.	.....	12/142 V
4,888,887 A *	12/1989	Solow	.....	36/3 R
4,967,750 A *	11/1990	Cherniak	.....	36/140
5,369,895 A *	12/1994	Hammerschmidt	.....	36/3 A
D381,794 S *	8/1997	Gelli	.....	D2/916
5,814,254 A *	9/1998	Bisconti	.....
D416,667 S *	11/1999	Lamstein	.....	D2/916

Among other things, the present invention provides various footwear pieces, and methods for manufacturing such pieces. In various cases, the footwear pieces are molded from a lofting material. Further, in various cases, the footwear pieces include one or more ventilators formed in the footwear piece that are surrounded by liquid conductors capable of channeling liquid spilled on the surface of the footwear pieces away from a foot within the footwear pieces.

2 Claims, 12 Drawing Sheets



OTHER PUBLICATIONS

Cindy Macdonald, *The entrepreneurs: they're bilingual, multicultural and talented. Distance and language present no barriers to Quebec plastics processors and moldmakers as the province's plastics industry continues to increase its level of exports and welcome new companies*, *Canadian Plastics*, O'99, v. 57(10), p. 35-50 (9 pages).

The Elastomers Times: Engage Adds Comfort to Sporting Components, *Chemical Business NewsBase: The Elastomers Times*, Friday, Dec. 1, 2000, (1 page).

Comfortable Walking, *Italian Technology*, Oct., 1999, No. 3, p. 168, (abstract, 1 page).

Injected Eva, *Macplas International*, Aug., 1999, No. 10, p. 90, (abstract, 1 page).

Walking on Modified Eva, *Italian Technology*, May 1999, No. 2, p. 121, (abstract, 1 page).

Trade Name Record, *Official Gazette of the US Patent and Trademarks Office*, Mar. 24, 1998, 1208, No. 4, p. 73, (abstract, 1 page).

Engage® polyolefin elastomers, the critical ingredient for success, DuPont Dow elastomers, Copyright @ 2000 DuPont Dow Elastomers, www.dupont-dow.com/engage (12 pages).

waldenstore.com, Footwear, Watdies, Aug. 4, 2003, <http://www.waldenstore.com/waldies.html>, (1 page).

Birkenstock®, Spring & Summer 2003 Catalog, *Birkenstock Orthopudie GmbH, Germany*.

* cited by examiner

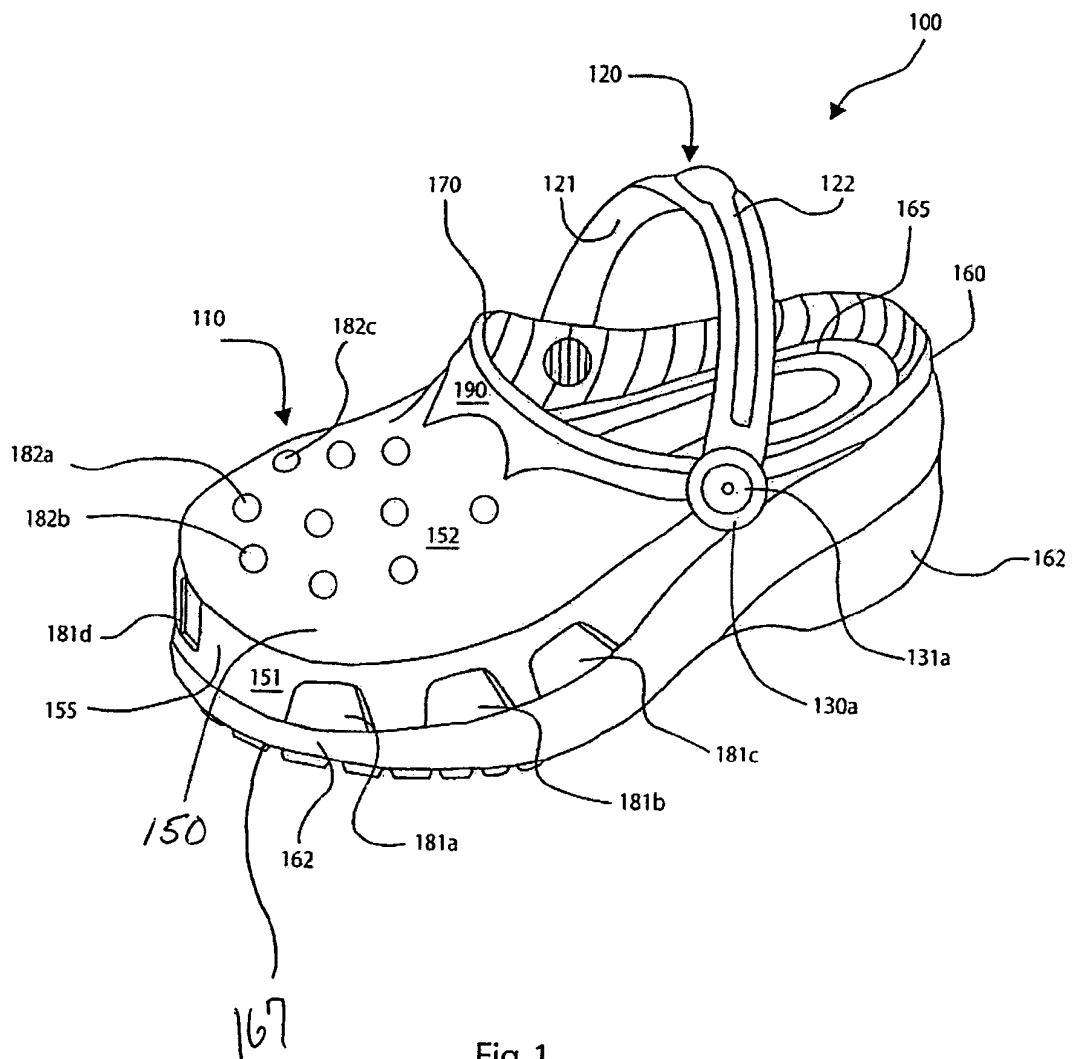


Fig. 1

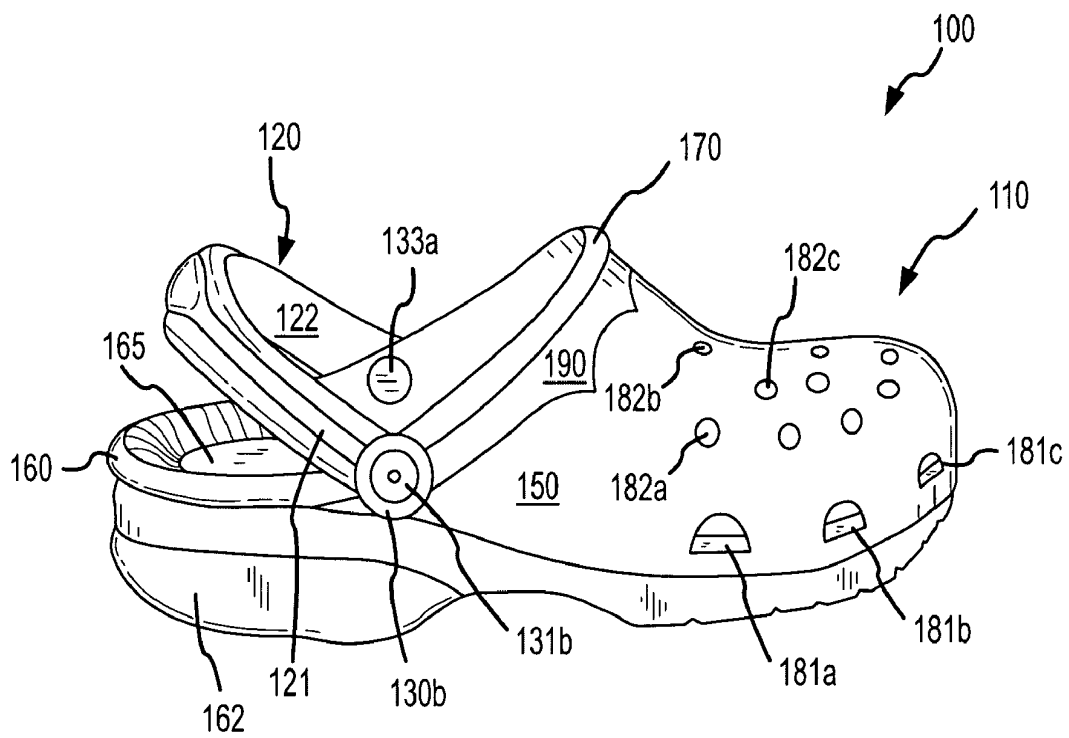


FIG.2

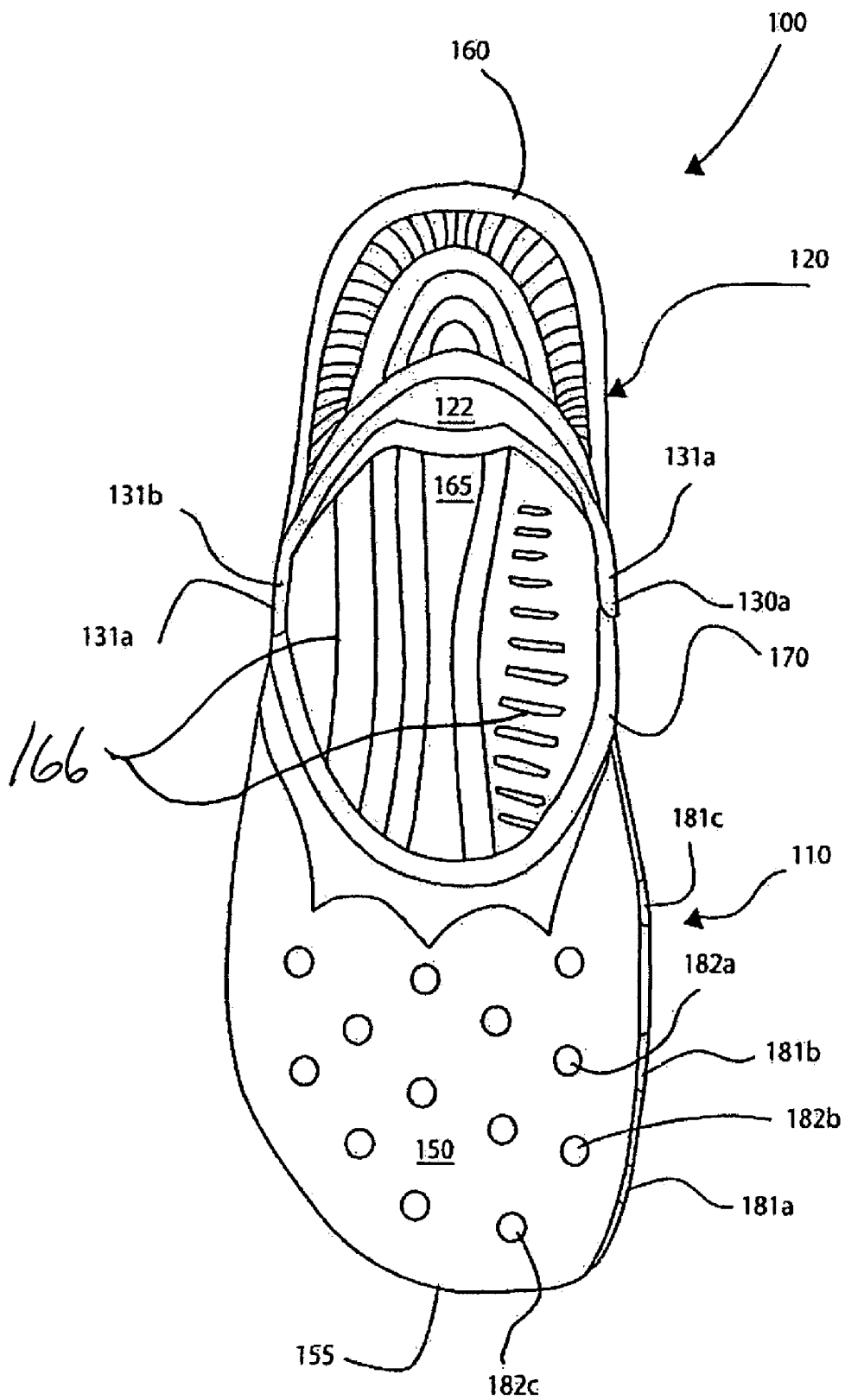


Fig. 3

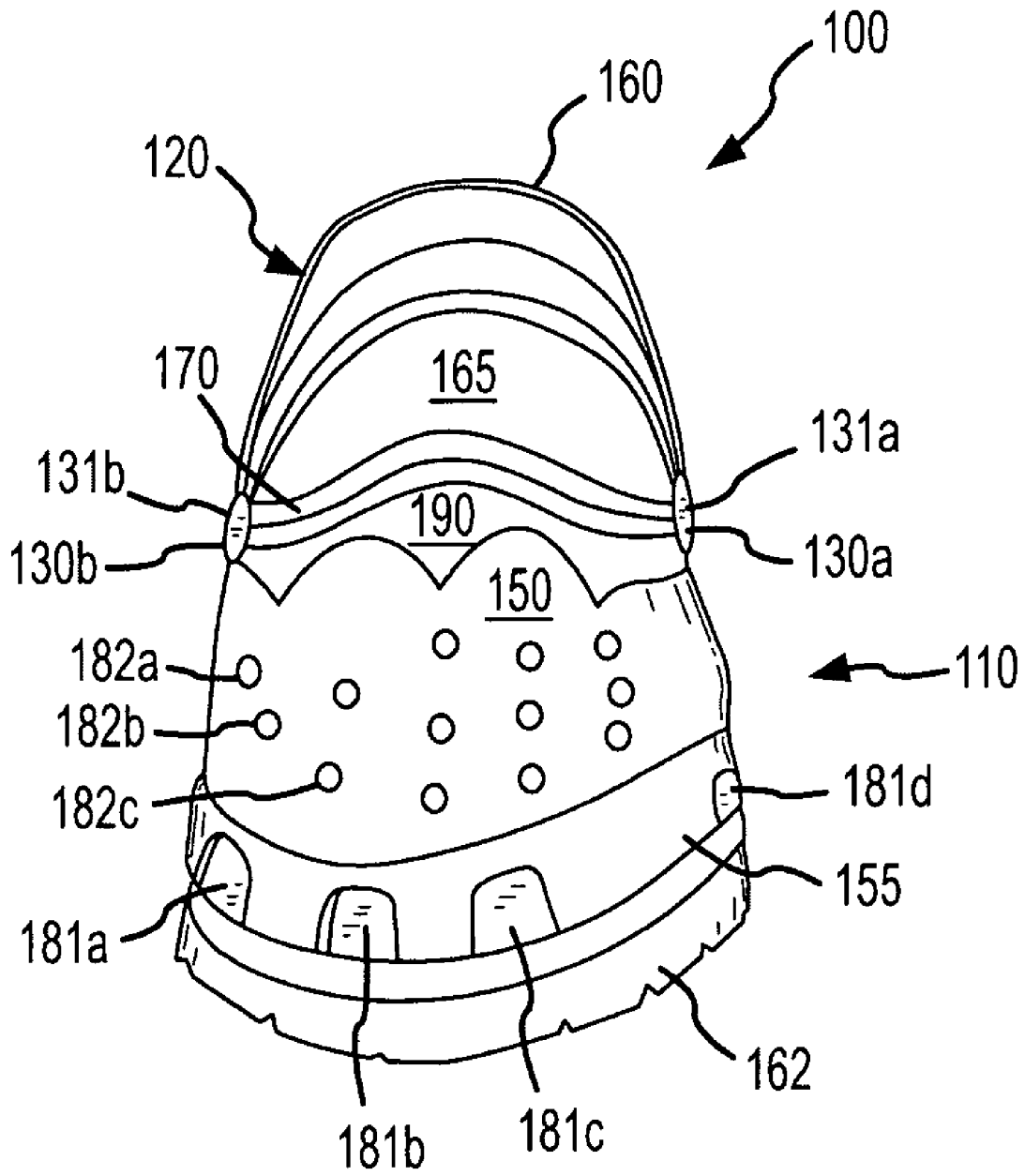


FIG.4

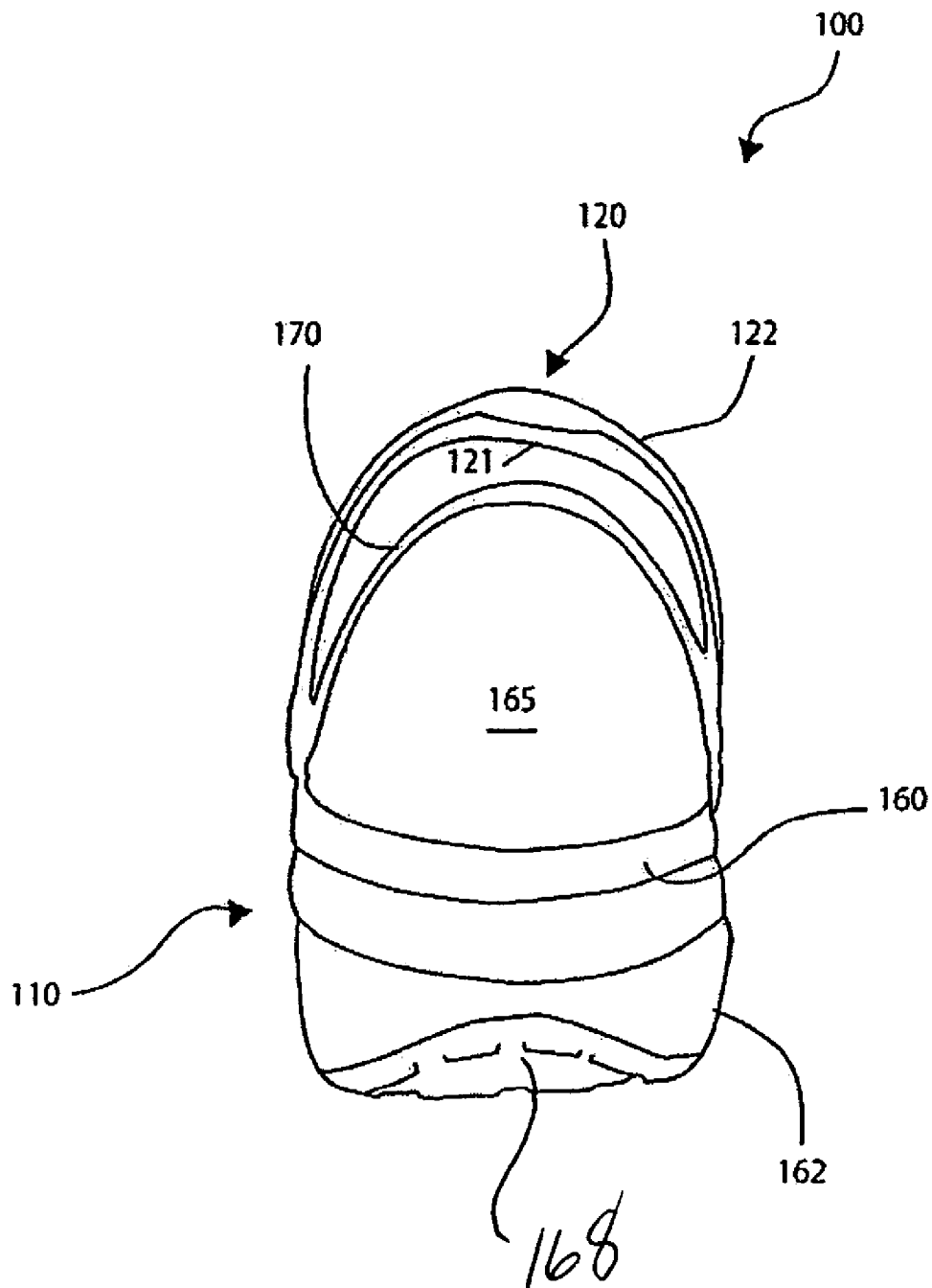


Fig. 5

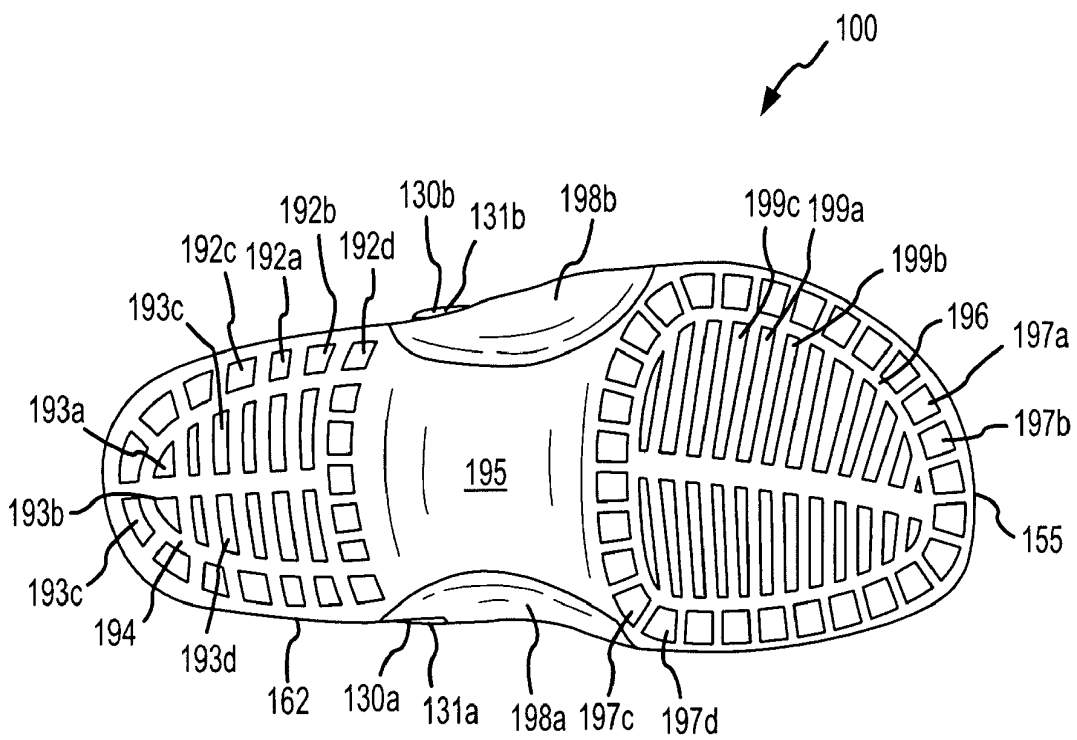


FIG.6

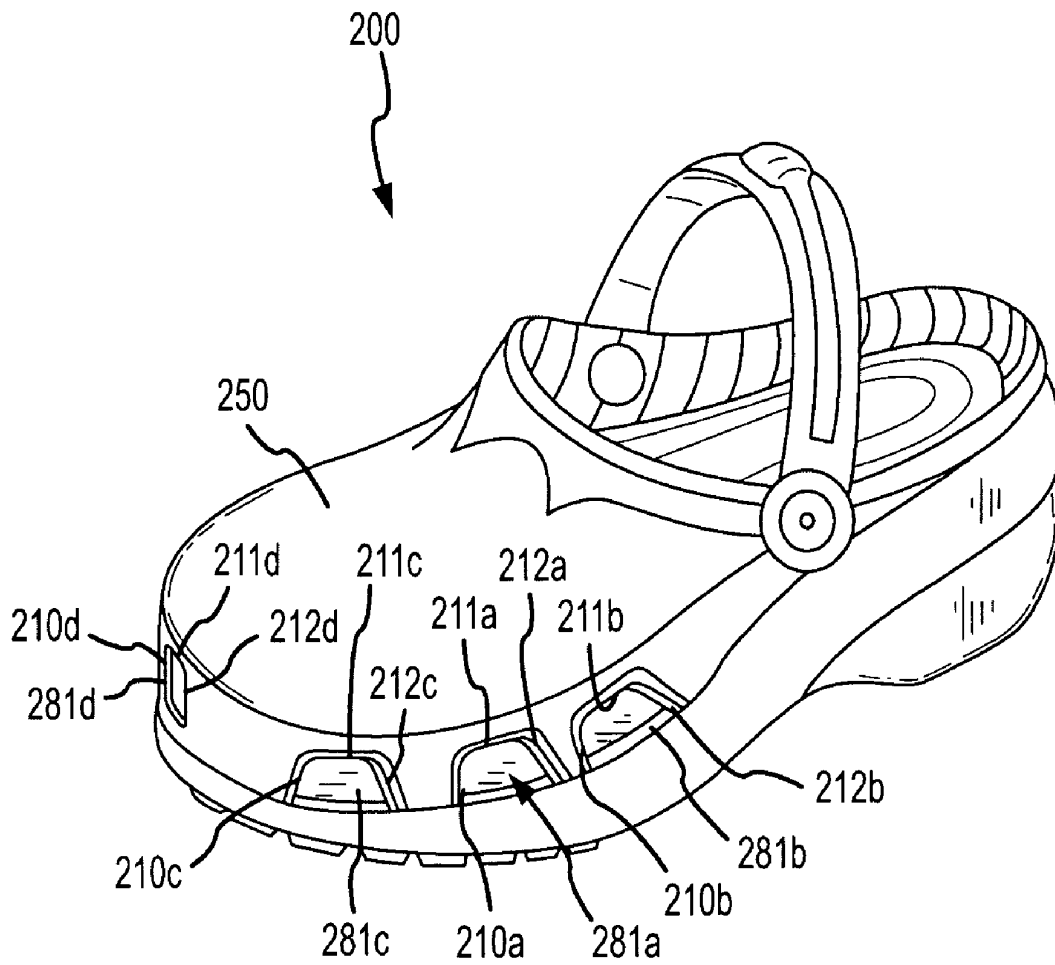


FIG. 7

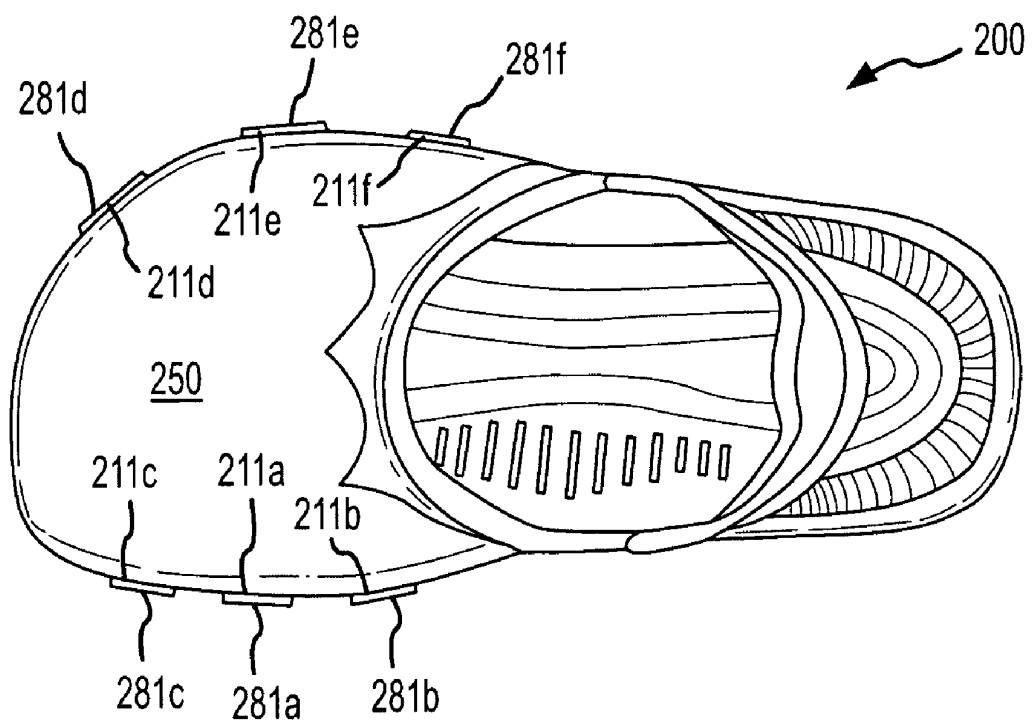


FIG. 8

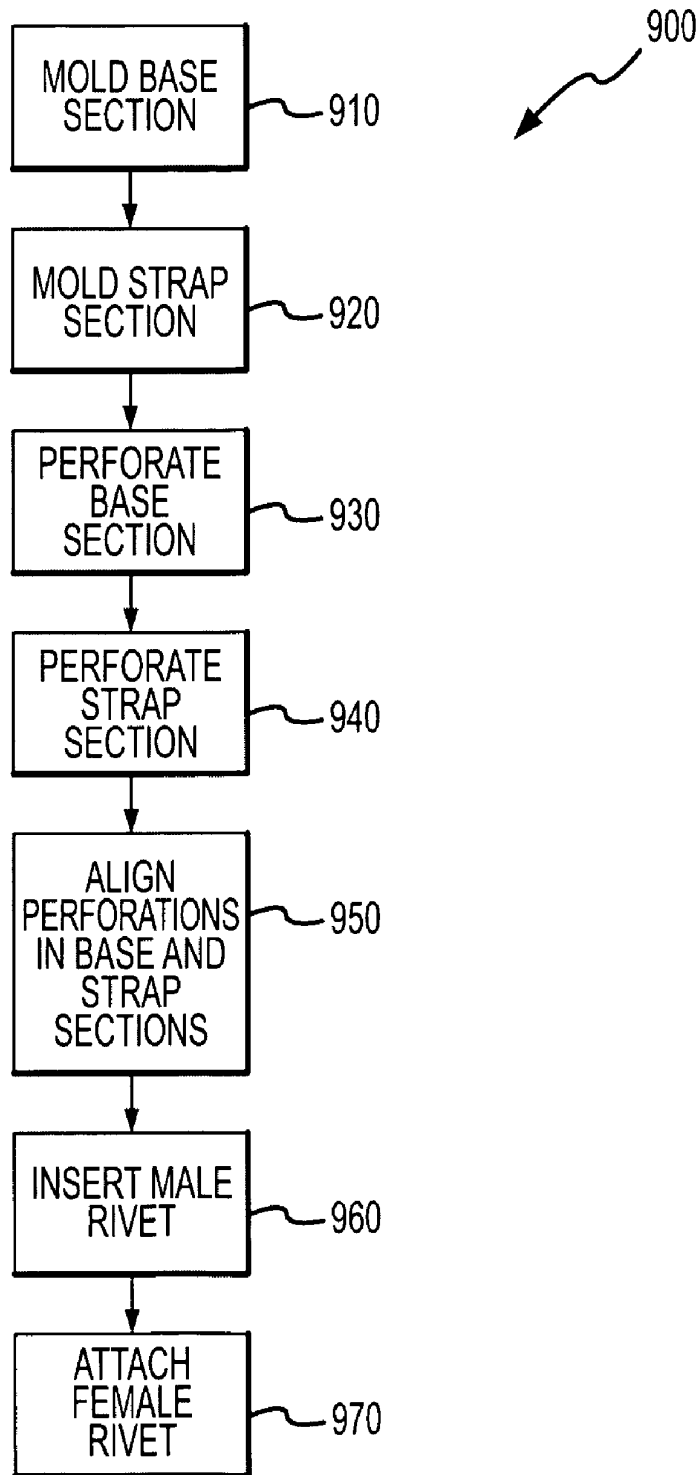


FIG.9

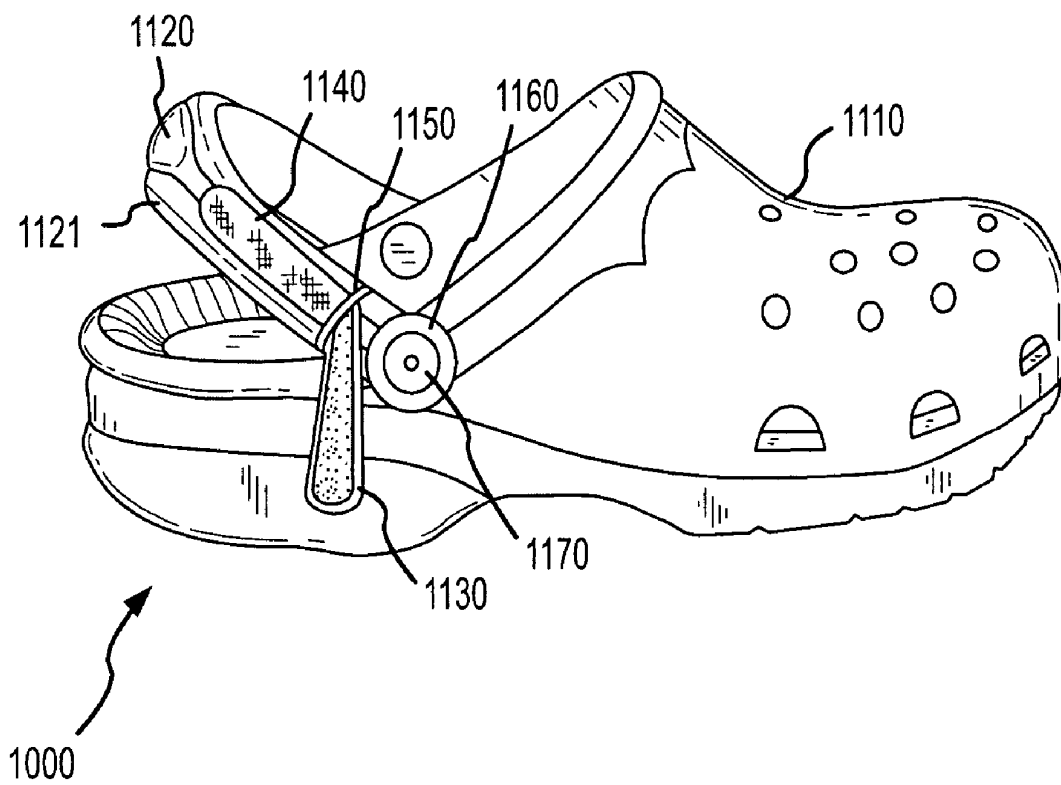


FIG.10a

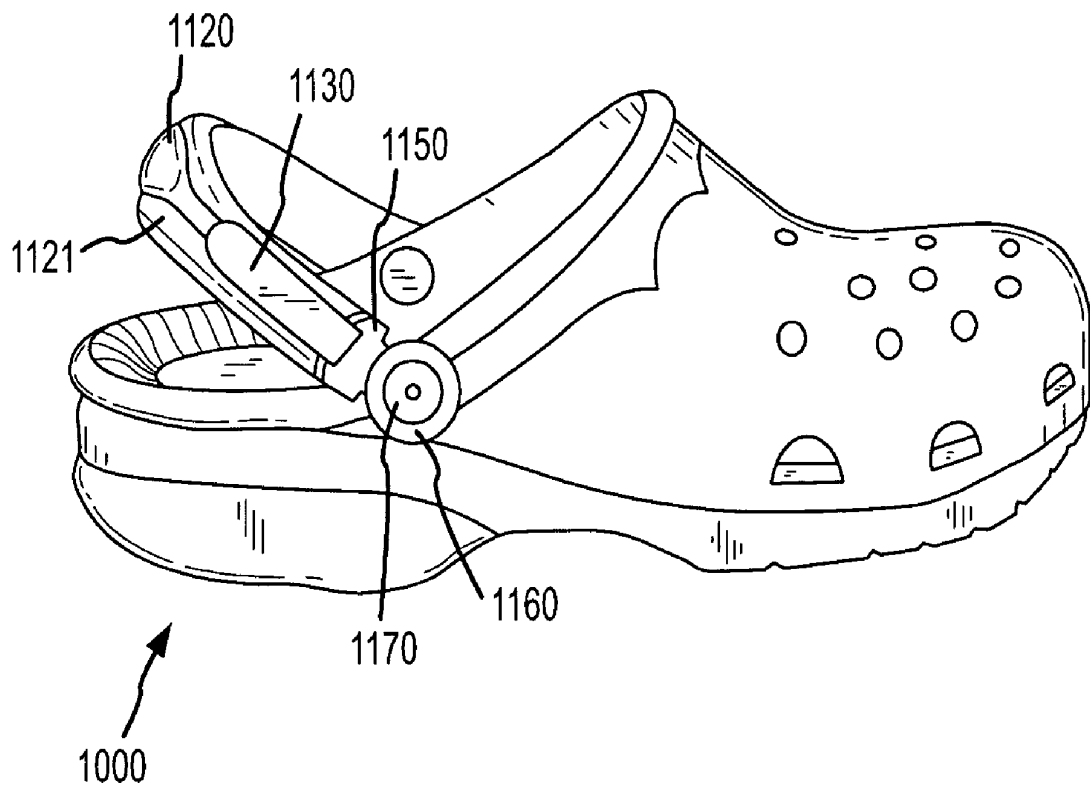
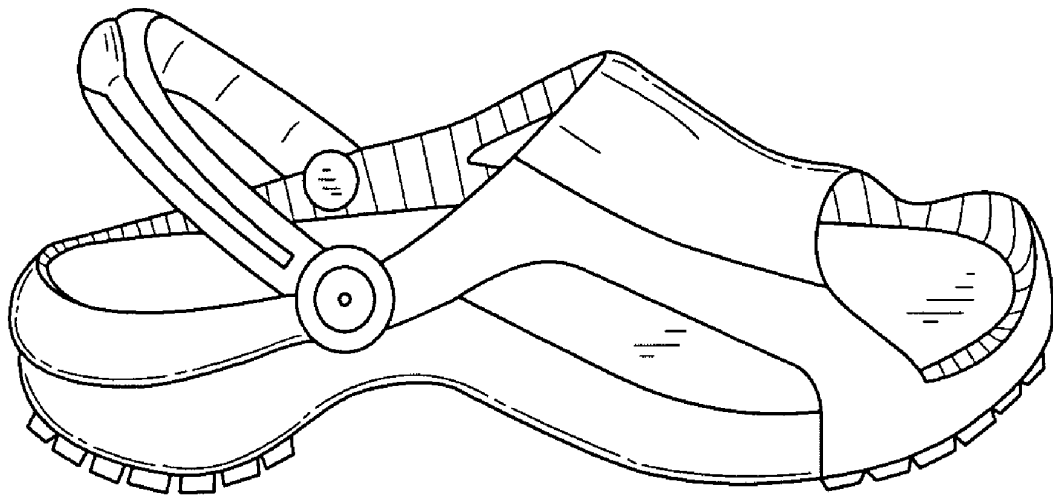


FIG.10b



1100

FIG.11

BREATHABLE FOOTWEAR PIECES

The present application claims priority to U.S. Provisional Pat. Appl. No. 60/473,360, entitled "FOOTWEAR PIECES AND METHODS FOR MANUFACTURING SUCH," filed May 23, 2003 and assigned to an entity common herewith; and U.S. Provisional Pat. Appl. No. 60/473,371, entitled "METHODS AND COMPOSITES FOR MANUFACTURING FOOTWEAR PIECES," also filed May 23, 2003 and assigned to an entity common herewith. Further, the present application is related to U.S. Pat. Appl. No. 10/602,416, entitled "FOOTWEAR PIECES AND METHODS FOR MANUFACTURING SUCH", filed on a date even herewith and assigned to an entity common herewith. The entirety of each of the aforementioned patent applications are incorporated herein by reference for all purposes.

BACKGROUND OF THE INVENTION

The present invention is related to footwear, and in particular to footwear including ventilation.

Current trends are toward wearing comfortable footwear in the work environment. However, many types of comfortable footwear are not compatible with various work environments. For example, many work environments would allow the use of the commonly known flip-flop, however, such flip-flops are typically not compatible with the work environment because they are not secure and are not waterproof. Similarly, sandals are not waterproof, and are thus not compatible with various work environments. As just one example, in a hospital setting it may be possible to wear comfortable shoes, however, it is common for liquids to be spilled. Thus, neither a flip-flop or sandal may not offer sufficient protection from such spilled liquids.

Thus, there exists a need in the art to address these and other limitations.

BRIEF SUMMARY OF THE INVENTION

Among other things, the present invention provides various footwear pieces, and methods for manufacturing such pieces. In various cases, the footwear pieces are molded from a lofted material. Further, in various cases, the footwear pieces include liquid conductors formed around ventilators, or openings in the upper of the footwear piece. Such liquid conductors operate to disperse liquids away from a foot inserted in the footwear piece.

Some embodiments of the present invention provide breathable footwear pieces that include a base section comprising an upper and a sole. The upper includes a substantially horizontal portion and a substantially vertical portion. The substantially horizontal portion is a solid portion, while the substantially vertical portion includes one or more ventilators formed in the substantially vertical portion. In particular instances, liquid conductors are formed around each of the ventilators. In some cases, the liquid conductors are molded as part of the upper, while in other cases, the liquid conductors are attached to the upper after the upper is otherwise formed. In one particular case, the material used to form the base section exhibits a final growth value of approximately 1.51. Such a growth value provides a lightweight, comfortable footwear piece that floats in water, and is slip resistant when used on, for example, wet floors.

Other embodiments of the present invention provide sectional shoe pieces that include a base section and a strap section. The base section includes an upper and a sole formed as a part. The strap section is formed as a second part

that is attached to the base section such that the strap pivots relative to the base section. In some instances, the base section is molded of a continuous piece of foam material. Such foam material can be lofted material manufactured using a resin. Where a resin material is used, it can be mixed to exhibit an expansion coefficient, and a contraction coefficient. In particular cases, multiplying the expansion coefficient and the contraction coefficient results in a product of between 1.46 and 1.58, inclusively.

In various instances, the base section and the strap section are formed of the same material. Such material can be the aforementioned foam material formed into different shapes. In other cases, the strap section and the base section are formed of different materials. For example, the base section may be formed of leather and/or rubber, while the strap section is formed of foam. As another example, the base section may be formed of one type of foam, while the strap section is formed of another type of foam.

In some cases, the strap section is attached to the base section by rivets. In particular, one end of the strap section is riveted to one side of the base section, while the other end of the strap is riveted to the other side of the base section. In some cases, both the base section and the strap are punched to form holes through which the rivet is placed. In other cases, holes are formed in the strap section and/or base section as part of the manufacturing process. Such holes can be subsequently used to receive the rivets attaching the strap section to the base section. The rivets can be plastic rivets, or rivets formed of other materials such as, for example, metal and rubber. In many cases, the rivets are formed of a material that is denser than that of either the base section or the strap section.

The rivets can be placed at attachment points located on either side of the base section. Such attachment points can be located near a rear sole perimeter and/or near a upper opening perimeter. In some cases, the distance from the one attachment point to the other attachment point along the rear sole perimeter is approximately the same as the distance between the attachment points measured along the strap section. Thus, the strap section can pivot relative to the base section such that an inner portion of the strap section contacts an outer portion of the rear sole perimeter. A frictional force between the strap section and the base section at the contact between the inner portion of the strap section and the outer portion of the rear sole perimeter maintains the strap section fixed relative to the base section. In such a position, the strap section forms what appears to be a decorative portion of the base section, and does not interfere with inserting and removing a foot from the base section.

Similarly, the distance from one attachment point to the other attachment point along the upper opening perimeter is approximately the same as the distance between the attachment points measured along the strap section. Thus, the strap section can pivot relative to the base section such that an inner portion of the strap section contacts an outer portion of the upper opening perimeter. A frictional force between the strap section and the base section at the contact between the inner portion of the strap section and the outer portion of the upper opening perimeter maintains the strap section fixed relative to the base section. Again, in such a position, the strap section forms what appears to be a decorative portion of the base section, and does not interfere with inserting and removing a foot from the base section. Further, in some cases, the strap can be fixed in contact with either the upper opening perimeter or the rear sole perimeter.

3

In various cases, a number of ventilators are formed in the upper. Such ventilators can be holes of varying sizes that allow liquid and or air to pass through at prescribed locations in the upper. In some cases, such ventilators are formed in both a substantially horizontal portion of the upper and a substantially vertical portion of the upper. This provides for a significant amount of ventilation for applications where it is not necessary to protect the foot from exposure to liquids entering through the ventilators. Such applications can include, but are not limited to, boating, beach use, fishing, and the like.

Alternatively, some instances include a solid covering over the substantially horizontal portion of the upper, while including ventilators formed in the vertical portions of the uppers. This provides for sufficient ventilation, while at the same time protecting a foot from spilled liquids. Such an approach may be desirable for applications including use by medical personnel, chefs, and the like. Further, in some cases, a liquid conductor is formed around at least a portion of a perimeter of each of the plurality of ventilators. Such a liquid conductor transfers a liquid spilled on the upper around and away from the various ventilators formed in the substantially vertical portion. Such conductors can thus further protect the foot from exposure to spilled liquids.

In particular cases, the toe region of the upper is extended at a location corresponding to the larger toes of the human foot. Thus, the toe region of the upper generally follows the contour of a human foot from larger toes on the inside of the shoe to smaller toes on the outside of the shoe. Such an approach can provide increased comfort and/or functionality. Further, the rear perimeter of the sole can be raised above a support base further increasing the functionality of the shoe. This support base can include a raised pattern where the foot contacts the shoe.

Other embodiments of the present invention provide sectional shoe pieces that include a base section and a strap section. The strap section is attached to the base section using a rivet such that the strap is pivotable relative to the base section. The rivet can be made of metal, plastic, or some other material. In some cases, the base section is formed of a continuous piece of foam, while in other cases, the base section includes an assemblage of multiple constituent parts. The parts can be formed of various materials including, but not limited to, foam, plastic, rubber, leather, and/or the like.

Yet other embodiments of the present invention provide methods for manufacturing a sectional shoe. The methods include molding a base section and a strap section. The methods further include attaching the strap section to the base section such that the strap pivots relative to the base section. In some cases, the strap section is attached to the base section by riveting opposite ends of the strap to opposing sides of the base section. In various cases, holes are punched through the base section and the strap section prior to riveting the strap section in place. In other cases, the holes through which the rivet are placed are formed during the molding of the base section and/or strap section.

The base section can include a sole and an upper. The sole includes a rear sole perimeter, and the upper includes an upper opening perimeter. In particular cases, rivet holes are placed approximately equidistant from a midway point of the rear sole perimeter and from a midway point of the upper opening perimeter. Thus, the strap can be folded over the upper and the sole and worn as a decorative feature, or in contrast worn away from either the sole or the upper as a functional strap.

4

This summary provides only a general outline of some embodiments according to the present invention. Many other objects, features, advantages and other embodiments of the present invention will become more fully apparent from the following detailed description, the appended claims and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

A further understanding of the various embodiments of the present invention may be realized by reference to the figures which are described in remaining portions of the specification. In the figures, like reference numerals are used throughout several to refer to similar components. In some instances, a sub-label consisting of a lower case letter is associated with a reference numeral to denote one of multiple similar components. When reference is made to a reference numeral without specification to an existing sub-label, it is intended to refer to all such multiple similar components.

FIGS. 1–6 are views of a footwear piece in accordance with embodiments of the present invention;

FIGS. 7–8 are views of another footwear piece in accordance with other embodiments of the present invention;

FIG. 9 is a flow diagram illustrating methods for manufacturing in accordance with embodiments of the present invention;

FIG. 10 illustrates another footwear piece in accordance with other embodiments of the present invention; and

FIG. 11 illustrates yet another footwear piece in accordance with various embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Among other things, the present invention provides various footwear pieces, and methods for manufacturing such pieces. In various cases, the footwear pieces are molded from a lofted, or foam material material. Further, in various cases, the footwear pieces include liquid conductors formed around ventilators, or holes, in the footwear piece. Such liquid conductors operate to disperse liquids away from a foot inserted in the footwear piece.

Turning to FIG. 1, a footwear piece **100** in accordance with some embodiments of the present invention is illustrated. Footwear piece **100** includes a base section **110** and a strap section **120**. Base section **110** includes an upper **150** and a sole **162**. In some embodiments, base section **110** is molded as a single piece of foam material. In other embodiments, sole **162** is molded from a foam or other foam like material, while upper **150** is manufactured of a different material that is later assembled with sole **162** to form base section **110**.

Upper **150** includes a substantially horizontal portion **152** that can include one or more ventilators **182**. Ventilators **182** can be, but are not limited to, openings that are formed in upper **150** as base section **110** is being molded. Alternatively, ventilators **182** can be openings formed in upper **150** after formation and/or assembly of upper **150**. As yet another alternative, ventilators **182** can be formed as part of an assembly process associated with upper **150**. Thus, for example, ventilators **182** can be openings between assembled parts of upper **150**. Based on the disclosure provided herein, one of ordinary skill in the art will appreciate a number of different ventilator types and methods for forming such.

Upper **150** further includes a substantially vertical region **151** that includes one or more ventilators **181**. FIG. **1** illustrates a preferred embodiment wherein each of the ventilators **181** extend up a majority of the height of vertical region **151**. As with ventilators **182**, ventilators **181** can be, but are not limited to, openings that are formed in upper **150** as base section **110** is being molded. Alternatively, ventilators **181** can be openings formed in upper **150** after formation and/or assembly of upper **150**. As yet another alternative, ventilators **181** can be formed as part of an assembly process associated with upper **150**. Thus, for example, ventilators **181** can be openings between assembled parts of upper **150**. Based on the disclosure provided herein, one of ordinary skill in the art will appreciate a number of different ventilator types and methods for forming such.

Upper **150** further includes a toe region **155** that surrounds the toes of a human foot inserted into base section **110**. In some embodiments, toe region **155** tapers from the inner area of base section **110** to the outer area of base section **110** such that it generally follows the contour of a human foot where larger toes exist at the inside of the foot, and the foot tapers to smaller toes on the outside. This can be functionally advantageous as the footwear piece **100** conforms to the shape of the human foot. In other embodiments, toe region **155** is a square cross section that does not exhibit tapering, while yet other embodiments provide a rounded square where the toe section has its greatest extension near the a central point of base section **110**, and tapers in both directions from the central point. Based on the disclosure provided herein, one of ordinary skill in the art will appreciate a number of shapes for toe region **155**.

As depicted, upper **150** includes a substantially horizontal region **152** that rises toward an upper opening perimeter **170**. When worn, the upper opening perimeter can contact an area of the human foot in front of, and below the ankle. Upper **150** can be designed such that upper opening perimeter **170** is disposed only a short distance from toe region **155**, in which case it will be formed in substantially horizontal region **152**. Alternatively, upper **150** can be designed to extend farther up the foot toward the ankle, in which cases it will be in a more vertical region of upper **150**. A decorative pattern **190** may or may not be molded or otherwise created near upper opening perimeter **170**. As depicted, upper opening perimeter **170** and decorative pattern **190** can extend from the location of rivet **131a** to that of rivet **131b** (shown in other figures).

Sole **162** includes a rear sole perimeter **160** that defines the rear portion of sole **160**. In some cases, this region is raised above a support base **165** that is the area that is in contact with the bottom part of the human foot. Such a raised rear sole perimeter provides some support to the heel of the human foot and helps maintain footwear piece **100** in position. In other embodiments, rear sole perimeter **160** is not raised. In addition, support base **165** includes a raised pattern **166** throughout the surface where the foot contacts support base **165**. As shown in FIG. **1**, the bottom surface of sole **162** includes a toe portion **167** that is raised slightly from the generally flat plane of sole **162**. As best shown in FIG. **5**, the bottom surface of sole **162** also preferably includes a heel portion **168** that is raised slightly from the generally flat plane of sole **162**.

Strap section **120** includes an outer region **122**, an inner region **121**, and rounded ends **130**. In some cases, strap section **120** is attached to base section **110** by rivets **131** that are placed through holes in both strap ends **130**, and in upper **150** at an attachment point. Strap section **120** can be pivoted in relation to base section **110** such that strap section **120** can

contact upper opening perimeter **170** when pivoted in one direction, and rear sole perimeter **160** when pivoted in the other direction. In some embodiments strap section **120** includes dimensions such that when strap section **120** is pivoted forward, inner region **121** contacts an outer surface of upper opening perimeter **170**. A frictional force at the contact of inner region **121** and upper opening perimeter **170** maintains strap section **120** in a fixed position relative to base section **110**.

Alternatively, strap section **120** can include dimensions such that when strap section **120** is pivoted backward, inner region **121** contacts an outer surface of rear sole perimeter **160**. A frictional force at the contact of inner region **121** and rear sole perimeter **160** maintains strap section **120** in a fixed position relative to base section **110**. In such positions, strap **120** can be a decorative portion of footwear piece **100**.

As yet another alternative, strap section **120** can be placed in an intermediary position between rear sole perimeter **160** upper opening perimeter **170**. In this position, the strap serves the utilitarian purpose of lending support to the Achilles portion of the human foot, thus helping to maintain footwear piece **100** in position on the human foot. In some embodiments, a frictional force developed between strap **120** and upper **150** at the location of the rivets is sufficient to maintain strap **120** in place. This helps to assure that strap **120** remains in place even when the Achilles part of the foot is not pressing against strap **120**. Without such friction, strap **120** would succumb to gravity and fall to a position where the foot would not be supported. At the same time, it can be desirable to reduce the friction at the contact point sufficient to allow strap **120** to be readily moved.

In particular embodiments, strap **120** is formed of a foam material capable of significant deformation making footwear piece **100** comfortable for a large number of foot types. In other embodiments, strap **120** is form of a less deformable material that provides a stronger security for the foot. Yet other embodiments include an adjustable strap that includes significant deformability, yet is capable of capable of being securely strapped to the foot. Such embodiments are discussed further in relation to FIG. **10** below.

FIG. **2** depicts a side view of footwear piece **100**, while FIG. **3** provides a top view of footwear piece **100**. FIGS. **4** and **5** provide front and rear views, respectively, of footwear piece **100**. Further, FIG. **6** illustrates the bottom of sole **162**. As illustrated, sole **162** includes raised side portions **198**, front tread pattern **196**, and rear tread pattern **194**. Front tread pattern **196** includes inner longitudinal tread portions **199**, and outer rectangular tread portions **197**. Similarly, rear tread pattern **194** includes inner longitudinal tread portions **193**, and outer rectangular tread portions **192**. Based on this, one of ordinary skill in the art will appreciate a number of other trade patterns and/or formations that can be used in relation to footwear piece **100**.

Turning to FIG. **7**, another footwear piece **200** in accordance with other embodiments of the present invention is illustrated. Footwear piece **200** includes a number of features similar to that of the previously described footwear piece **100**. In contrast, however, substantially horizontal portion **250** of the upper is of solid construction. As such, liquid materials that are spilled or otherwise contact substantially horizontal portion **250** do not permeate footwear piece **200**. This can be advantageous in medical or other commercial applications where the foot needs at least some protection from spilled materials. Further, a number of ventilators **281** are formed in the substantially vertical portion of the upper. Liquid conductive portions **210**, **211**, **212** are formed around each of ventilators **281**. Liquid

conductive portions **210**, **211**, **212** can be any formation or structure that can divert a liquid falling from above footwear piece **200** from entering through ventilators **281**. In one embodiment, liquid conductive portions **210**, **211**, **212** are molded as part of the upper. FIG. **8** is a top view of footwear piece depicting the various liquid conductive portions.

FIG. **9** is a flow diagram **900** illustrating a method in accordance with the present invention for manufacturing footwear pieces. Following flow diagram **900**, a base section and strap section are molded (blocks **910**, **920**). The base section and strap section are perforated at the location where the two pieces are to be connected (blocks **930**, **940**). The perforations in the strap and base section are aligned (block **950**), a male portion of a rivet is inserted through the aligned perforations (block **960**), and a female portion of the rivet is mated to the male portion, thus securing the strap to the base section.

Turning to FIG. **10**, another footwear piece **1000** in accordance with other embodiments of the present invention is illustrated. Footwear piece **1000** is similar to previously described footwear piece **100**, except that strap **1120** has been modified to allow for adjustment. As illustrated, strap **1120** includes a main portion **1121** and a connection portion **1160**. Connection portion **1160** is attached to a base section **1110** of footwear piece **1000** by a rivet **1170**, or some other pivotable connection as is known in the art. Main portion **1121** is attached to the opposite side via a rivet (not shown), and includes a male Velcro portion **1140** attached thereon, and a female Velcro portion **1130** extending like a tongue therefrom.

Female Velcro portion **1130** is fed through a buckle **1150** that is attached to connection portion **1160** and pulled until the desired tightness is achieved. Female Velcro portion **1130** is then laid over male Velcro portion **1140** as depicted in FIG. **10b**. One of ordinary skill in the art will appreciate that other connection materials can be used in place of Velcro and that the male **1140** and female **1130** Velcro portions can be interchanged. Further, based on the disclosure provided herein, one of ordinary skill in the art will appreciate that an adjustment can be used on either or both sides of strap **1120**, or can be placed in the center of strap **1120**.

FIG. **11** illustrates yet another footwear piece **1100** in accordance with some embodiments of the present invention. Footwear piece **1100** is an open toe model with a pivotable strap. Based on the disclosure provided herein, one of ordinary skill in the art will appreciate that adjustable strap **1120** depicted in FIG. **10** can also be used in relation to footwear piece **1100**.

As previously suggested, the footwear pieces disclosed herein can be made of a lofted foam material. Manufacturing footwear pieces using such a lofted foam material can include providing a resin that includes a pre-mixture of resin, pigment, and a growth additive. The resin, originally in pellet form, is heated to a liquid state. This liquid resin is screwed into a mold that has been heated prior to receiving the resin. The volume of resin injected into the mold is controlled by the pitch of the screw that drives the liquid resin into the mold. The liquid resin is allowed to set, at which time the mold is opened and the formed footwear piece is removed from the mold. The formed footwear piece is then placed on a cooling last, where it is allowed to air dry.

During this process, a relatively small footwear piece confirming to the size of the mold is created, but when the mold opens, the footwear piece springs out as it expands in size. Then, as the footwear piece is air cooled, it contracts to a final size. Thus, the process involves both an expansion

characteristic and a contraction characteristic. Multiplying the size of the shoe in the mold by the expansion characteristic yields the size of the footwear piece after the mold is opened. Multiplying the expansion characteristic by the contraction characteristic provides a final growth value representative of the final size of the shoe relative to the mold.

In such a manufacturing process, a number of elements can be controlled to achieve the desired end result. These elements include, the volume of material introduced into the mold, the size of the mold, the composition of the material being used, and the size of the cooling last. Previous manufacturers of molded footwear products have used, for example, four sizes of molds to create six different sizes of footwear pieces. Thus, for example, to create two different sized shoes from the same mold, one volume of a material is screwed into a mold to create one shoe size, and another volume of the same material is screwed into the same mold to create a different shoe size. Once removed from the mold, the shoes are cooled on cooling lasts of different sizes. Thus, the process uses a modified volume and cooling last size to control the end product, while keeping the mold size and the composition fixed. While this creates shoes of different sizes, it has been found that control of the final sizes is somewhat limited and/or unpredictable.

In part to address this, embodiments of the present invention use a fixed volume and composition of material, and cooling last size, while varying mold sizes to control the size of the end product. It has been found that such an approach results in a heightened degree of control, when compared to the previously described approach. This approach is particularly valuable for shoes manufactured of the same color resin. Where different colors are involved, the composition of the resin may be varied across the colors to achieve size control between colors. This composition adjustment is more fully described below.

In one particular embodiment, the resin is Ethylene Vinyl Acetate copolymer (EVA) based material. In this particular case, additives are included with the EVA base to create an expansible and cross-linking material. More particularly, an expanding powder is added which decomposes at a specific temperature to produce gases which cause the material to rise as it sets within a mold. Accordingly, when the mold is opened, an instantaneous expansion of the molded part results. During this expansion, the dimensions of the part increase rapidly, while the proportions and shape remain reasonably constant providing a consistent shape of the end part relative to the original mold. Additional disclosure of such cross-linking and expansion is provided in European Patent 0 802 039 A2, filed on Mar. 25, 1997, and assigned to FINPROJECT™ of Italy.

Some embodiments of the present invention utilize an EVA as previously described that is known commercially as LEVIREX™, and is marketed by FINPROJECT™ of Italy. It has been found desirable to create a mixture of LEVIREX™ that exhibits a final growth value of between 1.47 and 1.58. In one particularly desirable embodiment, a final growth value of approximately 1.51 is used. This includes an expansion characteristic of approximately 2.5, and a contraction characteristic of approximately 0.6. This provides a relatively soft footwear piece that has very good anti-slip capabilities, and at the same time, size reproducibility and durability.

In some cases, the resin mixture (LEVIREX™, growth additive such as ENGAGE™ by DUPONT™, and pigment) is modified depending upon the desired color of the footwear piece. This is at least in part due to the density of the pigment

associated with certain colors. Were the resin mixture not adjusted, a green shoe would be produced appreciably smaller than a khaki shoe where all other factors remain constant. This can be unacceptable where, for example, the footwear pieces are to be sold over the Internet and the consumer is not capable of trying the footwear piece on before purchasing. To alleviate this, the final growth value for a green resin is adjusted to approximately 1.515, where the final growth value for the khaki resin is adjusted to approximately 1.505. Thus, by modifying the mixture, shoes of accurate sizes across multiple colors can be produced.

While footwear pieces can be molded as previously described, based on the disclosure provided herein, one of ordinary skill in the art will appreciate that various embodiments of the present invention can be utilized in relation to other molding processes, and or assembly methods. For example, a hard plastic footwear piece could be injection molded using techniques known in the art, or a footwear piece could be at least partially made of leather or other natural materials. As another example, the footwear piece could be Freon cooled, rather than air cooled. This could be used to speed the manufacturing process.

The invention has now been described in detail for purposes of clarity and understanding. However, it will be appreciated that certain changes and modifications may be practiced within the scope of the appended claims. Accordingly, it should be recognized that many other systems, functions, methods, and combinations thereof are possible in accordance with the present invention. Thus, although the invention is described with reference to specific embodiments and figures thereof, the embodiments and figures are merely illustrative, and not limiting of the invention. Rather, the scope of the invention is to be determined solely by the appended claims.

What is claimed is:

1. A footwear piece comprising:

- a base section including an upper and a sole formed as a single part manufactured from a moldable foam material; and
- a strap section formed of a moldable material that is attached at opposite ends thereof to the upper of the base section with plastic connectors such that the moldable foam material of the strap section is in direct contact with the moldable material of the base section and pivots relative to the base section at the connectors; wherein the upper includes an open rear region defined by an upper opening perimeter, and wherein frictional forces developed by the contact between the strap section and the base section at the plastic connectors are sufficient to maintain the strap section in place in an intermediary position after pivoting, whereby the strap section lends support to the Achilles portion of the human foot inserted in the open rear region; and wherein the upper includes a substantially horizontal portion and a substantially vertical portion forming a toe region that generally follows the contour of a human foot, wherein the toe region tapers from an inner area of the base section where the larger toes exist to an outer area of the base section where the smaller toes exist; and

wherein the sole includes a bottom surface having front and rear tread patterns longitudinally connected by a flat section.

2. A footwear piece comprising:

- a base section including an upper and a sole formed as a single part manufactured from a moldable foam material; and
- a strap section formed of a molded foam material attached at opposite ends thereof to the base section such that the strap section is in direct contact with the base section and pivots relative to the base section; and wherein the upper includes an open rear region defined by an upper opening perimeter; and wherein the sole includes a rear perimeter; and wherein the strap section pivots between a first contact point on the upper opening perimeter and a second contact point on the rear perimeter, and wherein frictional forces developed by the contact between the strap section and the base section at the points of attachment are sufficient to maintain the strap section in place in an intermediary position after pivoting whereby the strap section lends support to the Achilles portion of a human foot inserted in the open rear region; and wherein the upper includes a substantially horizontal portion and a substantially vertical portion forming a toe region that generally follows the contour of a human foot, wherein the toe region tapers from the inner area of the base section where the larger toes exist to the outer area of the base section where the smaller toes exist; and wherein a decorative pattern of raised bumps is molded or otherwise created in the upper near to and extending the length of the upper opening perimeter; and wherein a plurality of ventilators are formed in both the substantially vertical portion and the substantially horizontal portion, and wherein the ventilators extend up a majority of the height of the vertical portion; wherein the vertical portion of the upper includes an upper strip, wherein the ventilators are formed in the upper strip, and wherein the upper strip extends from the toe region to the points of attachment for the strap section, and wherein the sole includes a lower strip that parallels the upper strip and is separated by a line that extends from the toe region to a heel of the footwear piece, and wherein the lower strip vertically rises in a direction toward the heel; and wherein the sole includes a bottom surface having front and rear tread patterns longitudinally connected by a flat section without tread patterns bounded by raised side portions; and wherein the sole further includes a top surface having a support base including a raised pattern where a foot contacts the support base.

* * * * *