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(71) Applicant *(for all designated States except US)*: **SCHERING-PLOUGH HEALTHCARE PRODUCTS, INC.** [US/US]; 3030 Jackson Avenue, Memphis, Tennessee 38151 (US).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **HOWLETT, Harold, A.** [US/US]; 4730 Apple Creek Drive, Horn Lake, Mississippi 38637 (US).

(74) Agent: **GOLDEN, Matthew, J.**; Schering Corporation, 2000 Galloping Hill Road, Patent Department K-6-1 1990, Kenilworth, New Jersey 07033-0530 (US).

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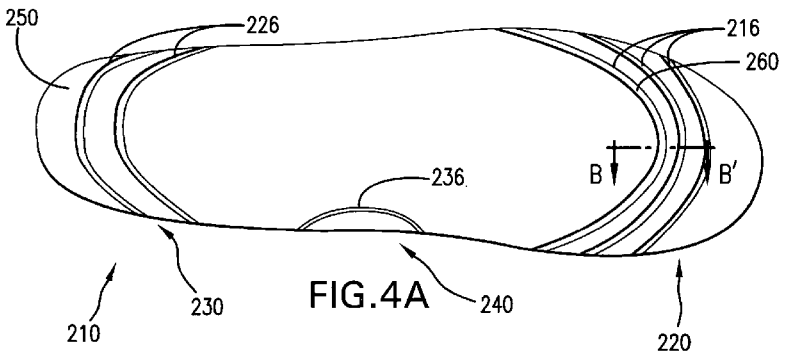

FIG.4A

(57) Abstract: Disclosed is a multilayer laminate footwear insole with a top layer and a bottom layer with at lease one cushioning layer, in which a channel transects the top layer of the insole and one or more punctuations in the channel transect the bottom layer of the insole.

MULTILAYER LAMINATE FOOTWEAR INSOLE

Field of the Invention

The present invention relates to multilayer laminate footwear insoles, methods for manufacturing the insoles and methods for sizing the insoles.

Background

Removable insoles are generally inserted into shoes, in order to provide added cushioning and support for the wearer of the shoes. These insoles are typically made as a one-size-fits-all product, and the consumer purchasing the insoles must trim them to an appropriate size using scissors or similar means to cut through the material of the insoles.

An insole is generally constructed of multiple layers of material, many of which are not easily cut with scissors by consumers. To cut through the material, the consumer must carefully follow a trim pattern that is printed on, molded in or applied to the insole. Consumers typically do not like to trim insoles with scissors for fear of misaligning the pattern while cutting or not cutting the correct mark on the pattern.

U.S. Patent No. 4,864,740 describes a disposable hygienic shoe insole having three layers: a top layer of spunbonded polypropylene material, a composite layer of pulp fibers and polypropylene fibers meltblown onto the top layer, and a bottom layer of polyethylene vinyl acetate meltblown onto the composite layer. The insole includes line perforations at the front and inner arch portions of the insole to allow a user to reduce the length and width of the insole. In addition, the insole includes lines of perforation across an arch area of the insole. These latter lines of perforation allow the length of the insole to be shortened by tearing off a portion of the arch area of the insole and subsequently reattaching toe and heel sections of the insole.

U.S. Patent No. 6,526,676 describes a disposable sandal formed of a piece of sheet material including a fabric laminated to polyurethane foam. A series of perforations are provided at the heel and/or toe portions of the sole of the sandal to allow the sandals to be sized to a user's foot.

U.S. Patent No. 3,925,914 describes a sandal, whose sole member may be made of a laminate having a bottom layer of thermoplastic material and a top layer of fibrous material. The sole member may be provided with rows of holes at the toe and heel ends, in order to allow the sandal to be shortened by breaking away a portion of the sole member at the holes. The holes do not go through the entire sole, but instead, a break-away or tear-away portion is left at the bottom of each hole.

However, none of the aforementioned references describes an insole, that may be cleanly sized by a consumer without the use of mechanical cutting instruments.

Summary

Accordingly, a need has been recognized for a footwear insole that may be sized simply, neatly and without use of a mechanical cutting instrument by a consumer.

In a non-limiting embodiment of the present invention, a multilayer laminate footwear insole comprising a top layer having a top surface, a bottom layer having a bottom surface, wherein the bottom layer includes at least one cushioning layer, a channel in the insole, wherein the channel transects the top layer of the insole, and one or more punctuations in the channel, wherein the punctuation transects the bottom layer of the insole.

In an alternative non-limiting embodiment of the invention, the channel completely transects the top layer.

In an alternative non-limiting embodiment of the invention, the punctuation in the channel transects the bottom surface of the bottom layer.

In an alternative non-limiting embodiment of the invention, the channel penetrates at least part of the bottom layer.

In an alternative non-limiting embodiment of the invention, the channel traverses the top surface of the top layer from opposing edges of the insole.

In an alternative non-limiting embodiment of the invention, the at least one cushioning layer is a foam layer.

In an alternative non-limiting embodiment of the invention, the foam layer comprises at least one of polyurethane, ethylene vinyl acetate copolymer and styrene-ethylene-butadiene-styrene.

In an alternative non-limiting embodiment of the invention, the at least one cushioning layer is a gel layer.

In an alternative non-limiting embodiment of the invention, the gel layer comprises at least one of polyurethane, styrene-ethylene-butadiene-styrene, silicone or hydrogel.

In an alternative non-limiting embodiment of the invention, the top layer includes at least one fabric layer.

In an alternative non-limiting embodiment of the invention, at least one fabric layer comprises at least one of a polymer or natural fiber.

In an alternative non-limiting embodiment of the invention, the channel is laser cut.

In an alternative non-limiting embodiment of the invention, the punctuation is made in predetermined patterns.

In another non-limiting embodiment of the present invention, a method for manufacturing a multilayer laminate footwear insole having a top layer with a top surface, a bottom layer with a bottom surface, wherein the bottom layer includes at least one cushioning layer, comprises the steps of cutting a channel in the top surface of the top layer of the insole, wherein the channel transects the top layer of the insole, and punctuating the bottom layer in the channel.

In an alternative non-limiting embodiment of the invention, the punctuation transects the bottom surface of the bottom layer of the insole.

In an alternative non-limiting embodiment of the invention, the cutting includes cutting two or more channels.

In an alternative non-limiting embodiment of the invention, the top layer is partially transected by the channel.

In an alternative non-limiting embodiment of the invention, the channel is cut using a laser.

In yet another non-limiting embodiment of the present invention, a method of reducing a dimension of a multilayer laminate footwear insole for altering a size of an insole having a predetermined punctuated channel, comprises the step of tearing the insole by hand along the predetermined punctuated channel.

Other features and aspects of the present invention will become more fully apparent from the following brief description of the drawings, the detailed description of the non-limiting embodiments, the appended claims and the accompanying drawings.

Brief Description of the Drawings

FIG. 1 is a schematic plan view of an embodiment of an exemplary footwear insole.

FIG. 2 is a schematic cross-sectional view, along line A-A', of the embodiment of the exemplary footwear insole of FIG. 1.

FIG. 3A is a schematic view of a laser cutter cutting a channel into a footwear insole, according to a non-limiting embodiment of the present invention.

FIG. 3B is a schematic cross-sectional view of the embodiment of a footwear insole of FIG. 3A, having a channel produced by the laser cutter of FIG. 3A.

FIG. 3C is a detail of the schematic cross-sectional view shown in FIG. 3B.

FIG. 3D is a schematic cross-sectional view of an alternative, non-limiting embodiment of the present invention of a footwear insole of FIG. 3A, having a channel produced by the laser cutter of FIG. 3A, partially transecting the top layer.

FIG. 3E is a detail of the schematic cross-sectional view shown in FIG. 3D.

FIG. 4A is a schematic plan view of a footwear insole, according to a non-limiting embodiment of the present invention having a plurality of channels.

FIG. 4B is a schematic cross-sectional view, along line B-B', of the non-limiting embodiment of a footwear insole of FIG. 4A, completely transecting the top layer.

FIG. 5A is a schematic plan view of a footwear insole, according to another non-limiting embodiment of the present invention, illustrated with six channels that traverse the top layer.

FIG. 5B is a schematic cross-sectional view, along line D-D', of the non-limiting embodiment of a footwear insole of FIG. 5A.

FIG. 5C is a schematic cross-sectional view, along line C-C', of the non-limiting embodiment of a footwear insole of FIG. 5A.

FIG. 5D is an alternative, schematic cross-sectional view along line C-C', of the non-limiting embodiment of a footwear insole of FIG. 5A, wherein the punctuation does not transect the bottom surface of the bottom layer.

FIG. 6 is a flow chart of a method for manufacturing a multilayer laminate footwear insole, according to a non-limiting embodiment of the present invention.

FIG. 7 is a flow chart of a method for reducing a dimension of a multilayer laminate footwear insole, according to a non-limiting embodiment of the present invention.

Detailed Description of the Embodiments

A need has been recognized for a footwear insole, whose size may be adjusted by consumers without mechanical cutting instruments such as scissors, even when the insole includes a layer or layers of high-strength fabric and/or high-strength and/or elastic cushioning materials.

FIG. 1 is a schematic plan view, and FIG. 2 a schematic cross-sectional view along line A-A', of a non-limiting embodiment of an exemplary footwear insole 10. The footwear insole 10 includes a toe portion 20, a heel portion 30 and a medial arch portion 40 interconnecting the toe and heel portions 20, 30. The insole may also include a top layer 50 and a bottom layer 60 affixed to the top layer 50. The top layer 50 may include one or more fabric layers, and the bottom layer 60 may include one or

more cushioning layers, such as foam layers and gel layers. However, the top layer 50 may also include foam and/or gel layers. For the sake of simplicity, though, the embodiments discussed in the following will include a top layer 50 made of a layer of fabric and a bottom layer 60 made of a layer of foam or gel. The fabric layer 50 may include at least one polymer or natural fiber such as polyester, acetate, polyethene, acrylic, nylon, rayon, spandex, wool, cotton, silk, bamboo, linen, hemp, urethane, or any material that can be ablated by a laser. In addition, fabric layer 50 may include at least one film, such as polyethylene, polyurethane, or any other material that can be ablated by a laser. Any foam layer used as the bottom layer 60 may include at least one of polyurethane, ethylene vinyl acetate copolymer, styrene-ethylene-butadiene-styrene or other suitable materials for cushioning. Any gel layer used as the bottom layer 60 may include at least one of polyurethane, styrene-ethylene-butadiene-styrene, silicone, hydrogel or other suitable materials for cushioning. The footwear insole 10 may take any of a variety of shapes in order to fit within a variety of shoes. Also, the footwear insole 10 may have any of a variety of contoured, flat, curved, or other surfaces in order to fit within a variety of shoes. Further, the tear strength of the top layer may be greater than the tear strength of the bottom layer.

FIG. 3A is a schematic view of a laser cutter cutting a channel into a footwear insole 110, according to an embodiment of the present invention. The laser cutter 112 focuses a laser beam 114 onto the footwear insole 110 (shown in cross-section) and is moved across a surface of the footwear insole 110 so as to cut a depression or channel 116 into the footwear insole 110. The laser cutter can cut channels of varying width and depth. An example of a laser cutter used to cut the channel 116 is an Epilog Mini 24, 35 Watt laser, manufactured by Epilog Laser of Golden, Colorado. FIG. 3B is a schematic cross-sectional view of the non-limiting embodiment of the footwear insole 110 of FIG. 3A, having a channel produced by the laser cutter of FIG. 3A, and FIG. 3C is a detail of the schematic cross-sectional view shown in FIG. 3B, indicated by a dashed circle 118. As illustrated in FIGS. 3B and 3C, the channel 116 may be cut completely through a top fabric layer 150 of the footwear insole 110. In addition, the channel 116 may extend partially into a bottom foam or gel layer 160.

Examples of settings on the Epilog Mini 24 laser that allowed the laser to burn through essentially only the fabric layer 150 of an exemplary polyester knit

lamination were 100% speed, 50% power, 400 DPI (dots per inch) and 500 Hz. This exemplary polyester knit lamination was comprised of a polyester knit fabric bonded to a urethane film using a hot melt urethane adhesive, in which the fabric laminate was molded to urethane foam using an open cast urethane molding technique. For different materials that may make up the fabric layer, a person having ordinary skill in the art would be able to modify the settings of the laser depending upon the different material properties of the fabric layer, such as thickness, density, moisture content, and other properties. For example, for a thicker fabric layer, a person having ordinary skill in the art would be able to adjust the various settings, such as power, of the laser in order to cut through the fabric layer.

FIG. 3D is an alternative schematic cross-sectional view of a non-limiting embodiment of a footwear insole 110, having a channel produced by the laser cutter of FIG. 3A, and FIG. 3E is a detail of the alternative schematic cross-sectional view shown in FIG. 3D, indicated by a dashed circle 119. As illustrated in FIGS. 3D and 3E, the channel 116 may be cut substantially into the top fabric layer 150 of the footwear insole 110, such that the channel 116 does not extend into a bottom foam or gel layer 160. Further, the channel may be cut to other various depths (not illustrated) ranging from only partially cutting into a top fabric layer 150 to both completely cutting through a top fabric layer 150 and substantially cutting into a bottom foam or gel layer 160 of the footwear insole 110. In each of these non-limiting embodiments, a clean and neat tear line results when a consumer tears along the predetermined channel.

FIG. 4A is a schematic plan view of a footwear insole 210, according to a non-limiting embodiment of the present invention, and FIG. 4B is a schematic cross-sectional view, along line B-B', of the embodiment of a footwear insole 210 of FIG. 4A. The footwear insole 210 includes a toe portion 220, a heel portion 230 and a medial arch portion 240 interconnecting the toe and heel portions 220, 230. The insole 210 includes a top layer 250 of fabric and a bottom layer 260 of cushioning material affixed to the top layer 250. However, the top layer 250 may also include multiple fabric layers, and the bottom layer 260 may include multiple cushioning material layers. A channel 216 cut by the laser cutter 112 is situated in the toe portion 220 of the insole 210. FIG. 4A illustrates three separate channel cuts 216 in the toe

portion 220 of the insole 210. The channel 216 extends laterally and curvilinearly across the top surface of the insole 210 and is configured to correspond to a possible shoe size of a user. In addition, as illustrated in FIG. 4B, the channel 216 may extend approximately perpendicularly through the top layer 250 and partially into the bottom layer 260. Optionally, a channel 226 cut by the laser cutter 112 is situated in the heel portion 230 of the insole 210. FIG. 4A illustrates separate channel cuts 226 in the heel portion 230 of the insole 210. The channel 226 extends laterally and curvilinearly across the top surface of the insole 210 with a direction of curvature opposite to a direction of curvature of channel 216. A channel 236 cut by the laser cutter 112 is situated in the medial arch portion 240 of the insole 210 and extends curvilinearly and longitudinally with respect to the insole 210. The insole 210 may include one or more channels 216 in the toe portion 220, one or more channels 226 in the heel portion 230, and/or one or more channels 236 in the medial arch portion 240. Furthermore, with respect to channels 216, 226, 236, cutting the channels 216, 226, 236 with the laser cutter 112 advantageously produces a clean cut line in the fabric layer 250. In addition, if the fabric layer 250 includes a polymer fabric, the laser beam 114 cauterizes the fabric layer 250, thereby preventing the fabric from fraying at the cut line.

Further with respect to FIGS. 4A and 4B, the bottom foam layer 260 may have a relatively low tear strength, e.g., less than 10 lbsf, for the user to tear the insole 210 cleanly and easily along the channels 216, 226, 236. However, the bottom foam layer 260 may also have a sufficiently high modulus of elasticity, or flexural modulus, in order to ensure that the insole 210 does not permanently bend or wrinkle along the channels 216, 226, 236 when slipped into an article of footwear.

FIG. 5A is a schematic plan view of a footwear insole 310, according to another non-limiting embodiment of the present invention. FIG. 5B is a schematic cross-sectional view of the non-limiting embodiment of a footwear insole 310 of FIG. 5A along line D-D'. FIGS. 5C and 5D are alternative, schematic cross-sectional views of the non-limiting embodiment of a footwear insole 310 of FIG. 5A along line C-C'. As in the embodiment shown in FIG. 4A, the footwear insole 310 includes a toe portion 320, a heel portion 330 and a medial arch portion 340 interconnecting the toe and heel portions 320, 330. In addition, the footwear insole 310 includes a top

layer 350 of fabric and a bottom layer 360 made of a cushioning material. The insole 310 further includes a laser-cut channel 316, which is situated in the toe portion 320 of the insole 310 and runs laterally and curvilinearly across the top surface of the insole 310. As illustrated in FIG. 5B, the channel 316 may extend through the top layer 350 and partially into the bottom layer 360. FIG. 5A illustrates three separate channel cuts 316 in the toe portion 320 of the insole 310. In addition, the insole 310 may further include a laser-cut channel 326, which is situated in the heel portion 330 of the insole 310 and runs laterally and curvilinearly across the top surface of the insole 310 with a direction of curvature opposite to a direction of curvature of channel 316. FIG. 5A illustrates two separate channel cuts 326 in the heel portion 330 of the insole 310. A laser-cut channel 336 is situated optionally in the medial arch portion 340 of the insole 310 and runs curvilinearly and longitudinally with respect to the insole 310. As discussed with respect to the embodiment shown in FIGS. 4A and 4B, the insole 310 may include one or more channels 316 in the toe portion 320, one or more channels 326 in the heel portion 330, and/or one or more channels 336 in the medial arch portion 340 of the insole 310.

However, in contrast to the embodiment shown in FIGS. 4A and 4B, the insole 310 includes punctuations 317 in the bottom gel layer 360. These punctuations may be produced by a die (not shown). As illustrated in FIG. 5C, the punctuations 317 may extend completely through the bottom layer 360 and run along the channels 316, 326, 336. Alternatively, as illustrated in FIG. 5D, the punctuations 317 may extend substantially into but not completely through the bottom layer 360 and run along the channels 316, 326, 336. In addition, as shown in FIG. 5A, the punctuations 317 are separated from one another in the direction of the channels 316, 326, 336 by web elements 318. A spacing of the punctuations 317, and thus a thickness of the web elements 318, may be adjusted such that a user of the insole 310 may tear the insole 310 cleanly and easily along the channels 316, 326, 336, while, at the same time, the insole 310 does not bend or wrinkle along any intact channel in the insole 310 when the insole 310 is slipped into an article of footwear. The punctuations 317 and web elements 318 may be formed of a variety of patterns including, but not limited to, circular, square, rectangular, polygonal, and other shapes, and combinations thereof. Further, punctuations as described in the present invention include patterns that may

otherwise be referred to as perforations, serrations, cuts, punctures, notches, holes, slots, etc., some of which are illustrated in FIG. 5A.

FIG. 6 is a flow chart of a method for manufacturing a multilayer laminate footwear insole, according to a non-limiting embodiment of the present invention. The method begins at step 400. In step 410, a laminated footwear insole is assembled. The insole has at least a top layer and a bottom layer. The top layer may include one or more layers of fabric or film, and the bottom layer may include one or more layers of foam or gel. In step 420, a channel is cut into the top layer of the insole, e.g., by a laser cutter. The channel corresponds to human foot sizes and extends through the top layer and may extend partially into the bottom layer. In step 430, a query is made as to whether another channel is to be cut into the top layer of the insole, e.g., by a laser cutter. If yes, then the method repeats step 420. If no, then in method step 440, a query is made as to whether the bottom layer should be punctuated in the channels. If no, then the method ends at step 460. If yes, then the bottom layer is punctuated in the channel(s) in step 450. The method then ends at step 460.

FIG. 7 is a flow chart of a method for reducing a dimension of a multilayer laminate footwear insole, according to a non-limiting embodiment of the present invention. The method begins at step 500. In step 510, a query is made as to whether a toe region of the insole has a channel corresponding to a desired foot size. If no, then the method advances to step 530. If yes, in step 520, the insole is then torn by hand along the above-mentioned channel in the toe region, after which the method advances to step 530. In step 530, a query is made as to whether a heel region of the insole has a channel corresponding to the desired foot size. If no, then the method advances to step 550. If yes, in step 540, the insole is then torn by hand along the above-mentioned channel in the heel region, after which the method advances to step 550. In step 550, a query is made as to whether a medial arch region of the insole has a channel corresponding to the desired foot size. If no, then the method ends at step 570. If yes, then, in step 560, the insole is torn by hand along the above-mentioned channel in the medial arch region. The method then ends at step 570. Alternatively, query 510 and step 520, query 530 and step 540, and query 550 and step 560 may be re-ordered, as desired by a consumer.

In a preferred non-limiting embodiment of the present invention, a multilayer laminate footwear insole having a top layer having a top surface and a bottom layer having a bottom surface, the bottom layer including at least one cushioning layer, comprises a channel in the insole, wherein the channel transects the top layer of the insole, and one or more punctuations in the channel, wherein the punctuation transects the bottom layer of the insole. The multilayer laminate footwear insole may be a single one-size-fits-all insole, which may be adjusted to various sizes according to predetermined punctuated channels. Each channel may have a preferred punctuation within the channel. In addition, consumers may tear along each predetermined punctuated channel by hand in order to adjust the insole size to fit within shoes.

The foregoing description discloses only non-limiting embodiments of the present invention. Modification of the above-disclosed multilayer laminate footwear insole, as well as methods for making and using the same, which fall within the scope of the invention, will be readily apparent to those of ordinary skill in the art.

Accordingly, while the present invention has been disclosed in connection with the above non-limiting embodiments, it should be understood that other embodiments may fall within the spirit and scope of the invention, as defined by the following claims.

What Is Claimed Is:

1) A multilayer laminate footwear insole having a top layer having a top surface and a bottom layer having a bottom surface, the bottom layer including at least one cushioning layer, the insole comprising:

a channel in the insole, wherein the channel transects the top layer of the insole; and

one or more punctuations in the channel, wherein the punctuation transects the bottom layer of the insole.

2) The multilayer laminate footwear insole of claim 1, wherein the channel completely transects the top layer.

3) The multilayer laminate footwear insole of claim 1, wherein the punctuation transects the bottom surface of the bottom layer.

4) The multilayer laminate footwear insole of claim 1, wherein the channel penetrates at least part of the bottom layer.

5) The multilayer laminate footwear insole of claim 1, wherein the channel traverses the top surface of the top layer from opposing edges of the insole.

6) The multilayer laminate footwear insole of claim 1, wherein the at least one cushioning layer is a foam layer.

7) The multilayer laminate footwear insole of claim 6, wherein the foam layer comprises at least one of polyurethane, ethylene vinyl acetate copolymer and styrene-ethylene-butadiene-styrene.

8) The multilayer laminate footwear insole of claim 1, wherein the at least one cushioning layer is a gel layer.

9) The multilayer laminate footwear insole of claim 8, wherein the gel layer comprises at least one of polyurethane, styrene-ethylene-butadiene-styrene, silicone and hydrogel.

10) The multilayer laminate footwear insole of claim 1, wherein the top layer includes at least one of a fabric or film layer.

11) The multilayer laminate footwear insole of claim 10, wherein the at least one of a fabric or film layer comprises at least one of a polymer or natural fiber.

12) The multilayer laminate footwear insole of claim 1, wherein the channel is laser cut.

13) The multilayer laminate footwear insole of claim 1, wherein the punctuation is made in predetermined patterns.

14) A method for manufacturing a multilayer laminate footwear insole having a top layer with a top surface and a bottom layer with a bottom surface, the bottom layer including at least one cushioning layer, the method comprising the steps of:

cutting a channel in the top surface of the top layer of the insole, wherein the channel transects the top layer of the insole; and

punctuating the bottom layer in the channel.

15) The method of claim 14, wherein the punctuation transects the bottom surface of the bottom layer of the insole.

16) The method of claim 14, wherein the cutting includes cutting two or more channels.

17) The method of claim 14, wherein the top layer is partially transected by the channel.

18) The method of claim 14, wherein the channel is cut using a laser.

19) A method of reducing a dimension of a multilayer laminate footwear insole for altering a size of the insole having a predetermined punctuated channel, the method comprising the steps of:

tearing the insole by hand along the predetermined punctuated channel.

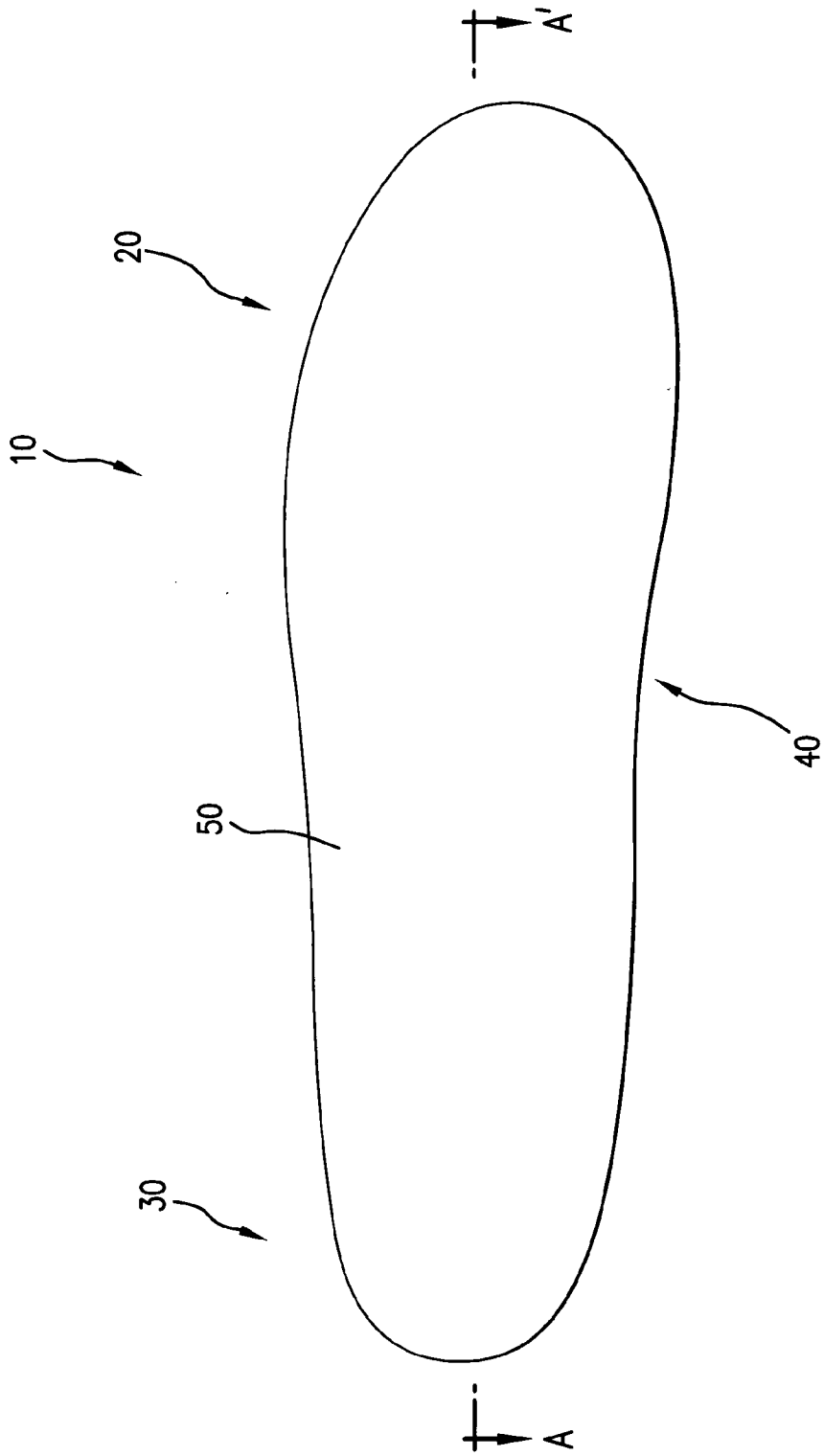

FIG. 1

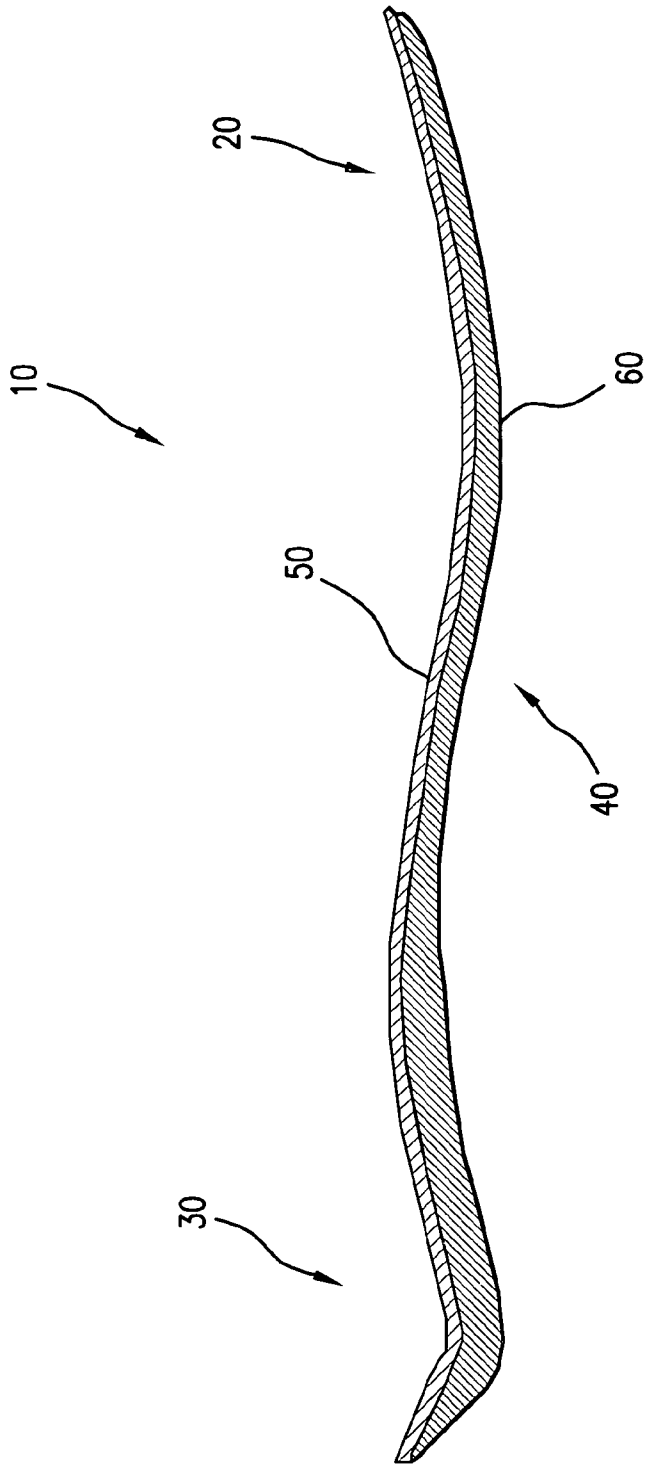

FIG.2

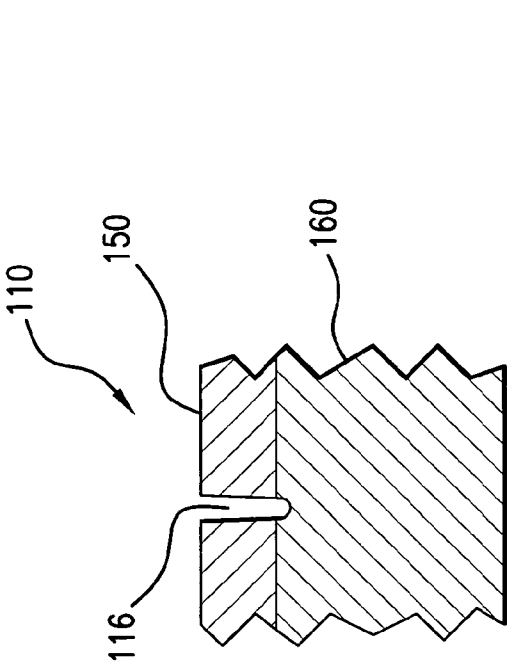

FIG.3C

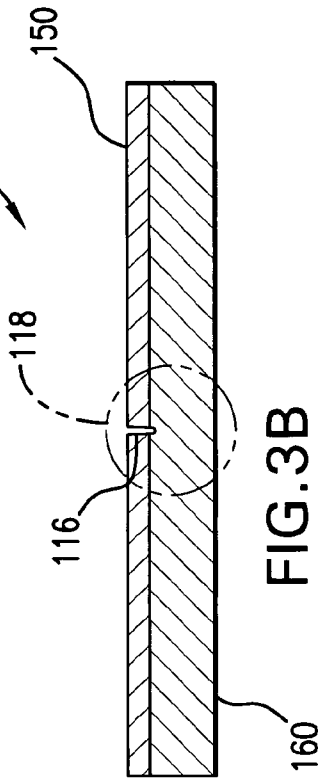

FIG.3B

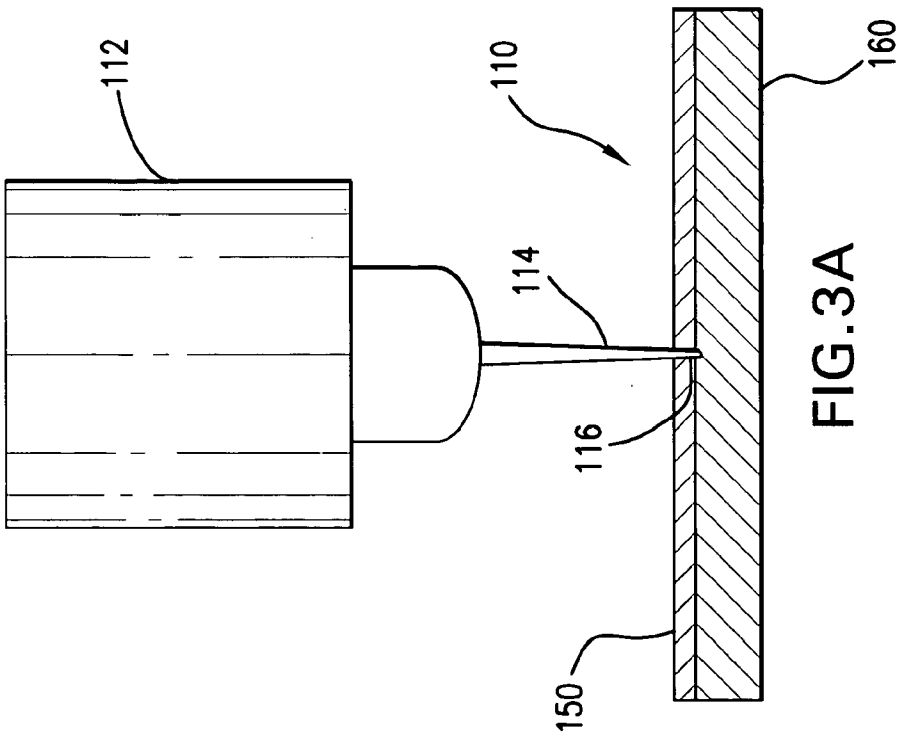

FIG.3A

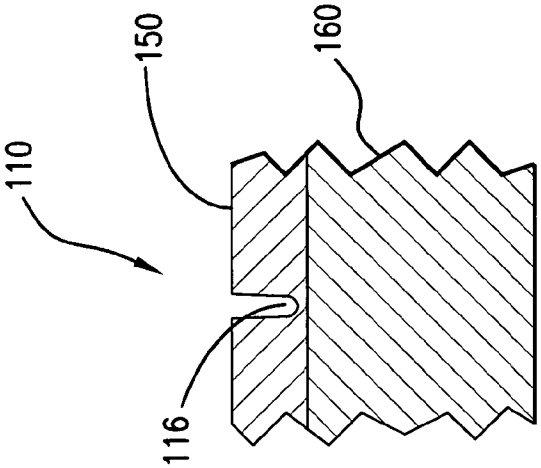

FIG.3E

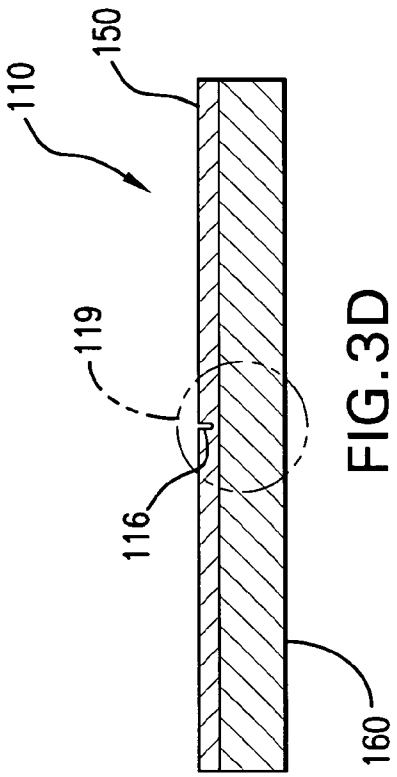

FIG.3D

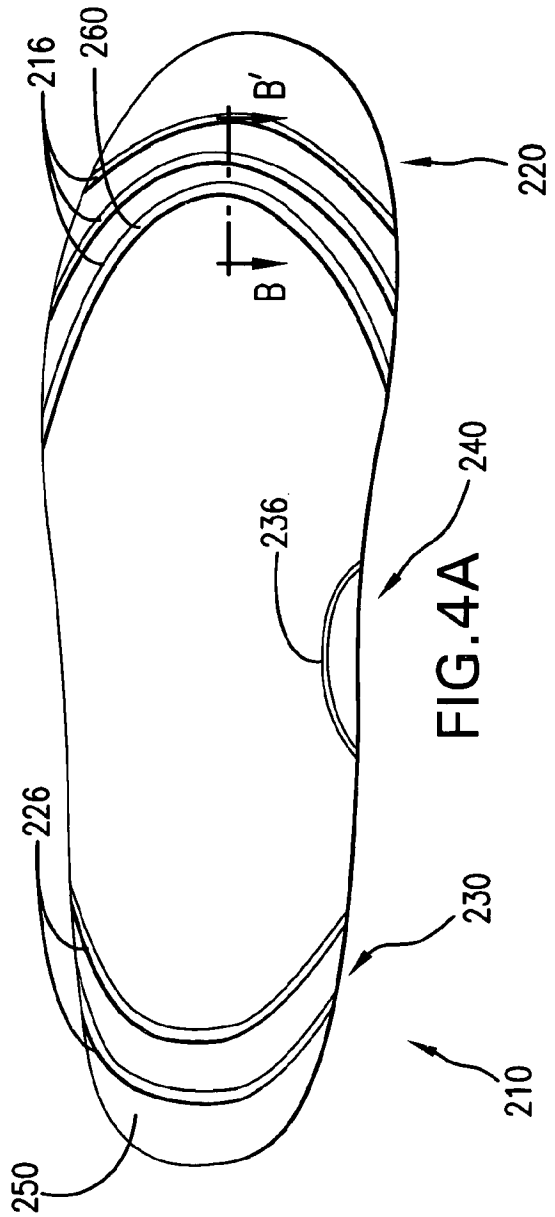

FIG.4A

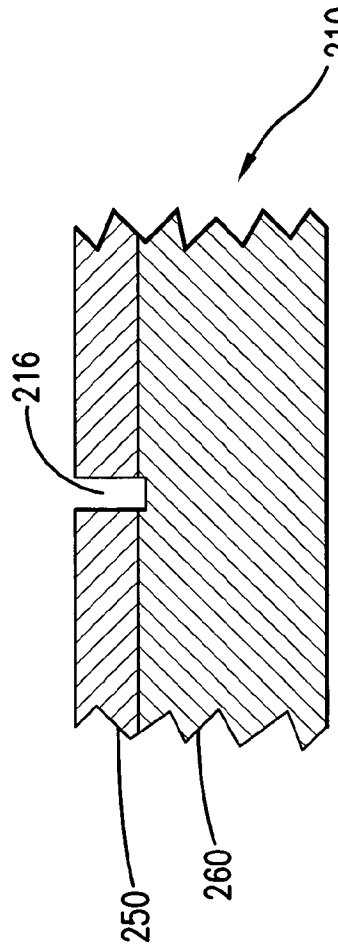

FIG.4B

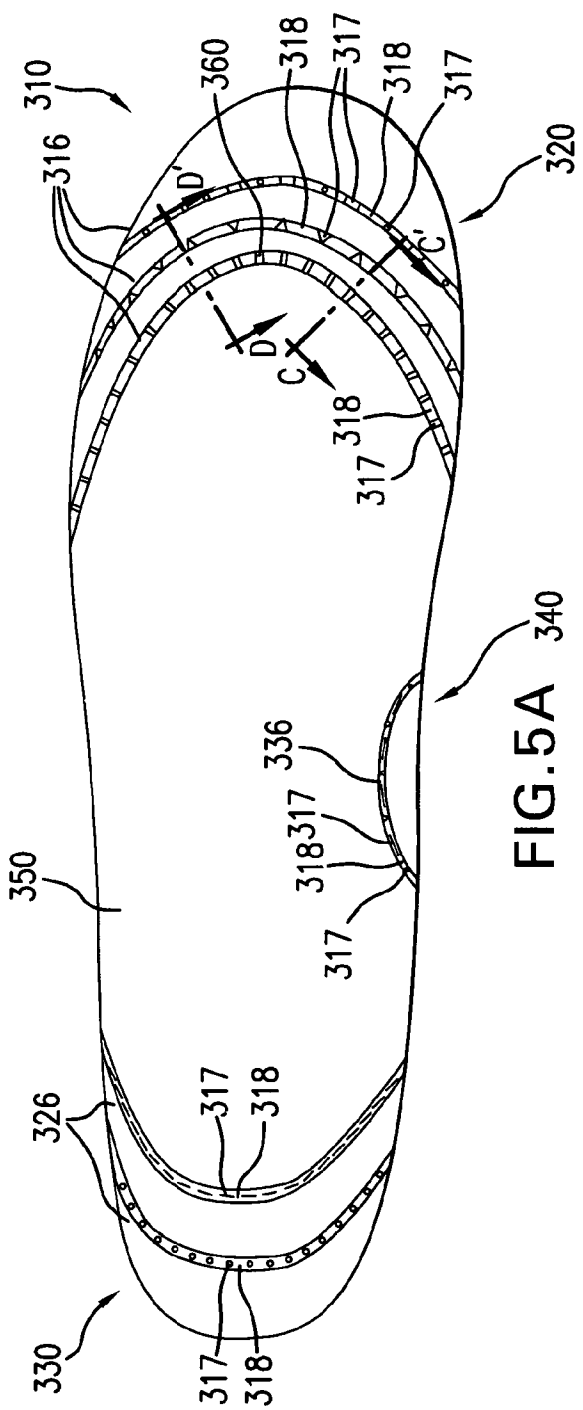

FIG.5A

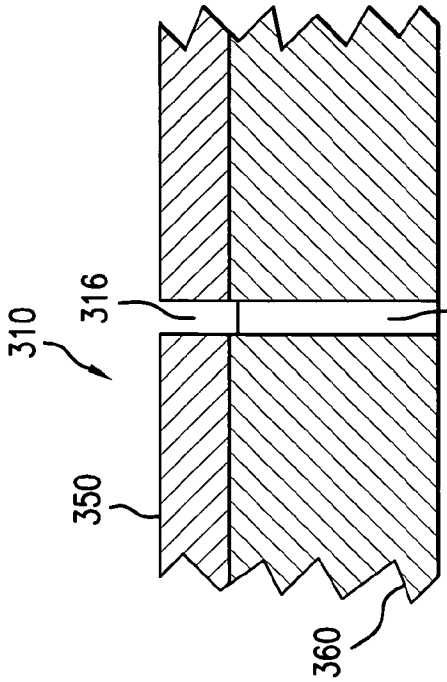

FIG.5C

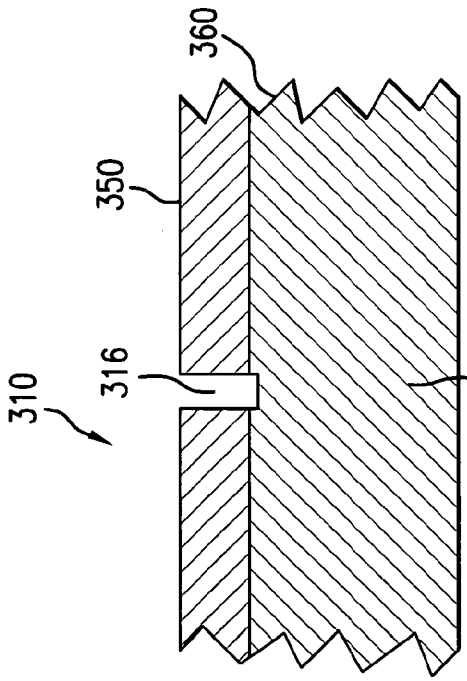

FIG.5B

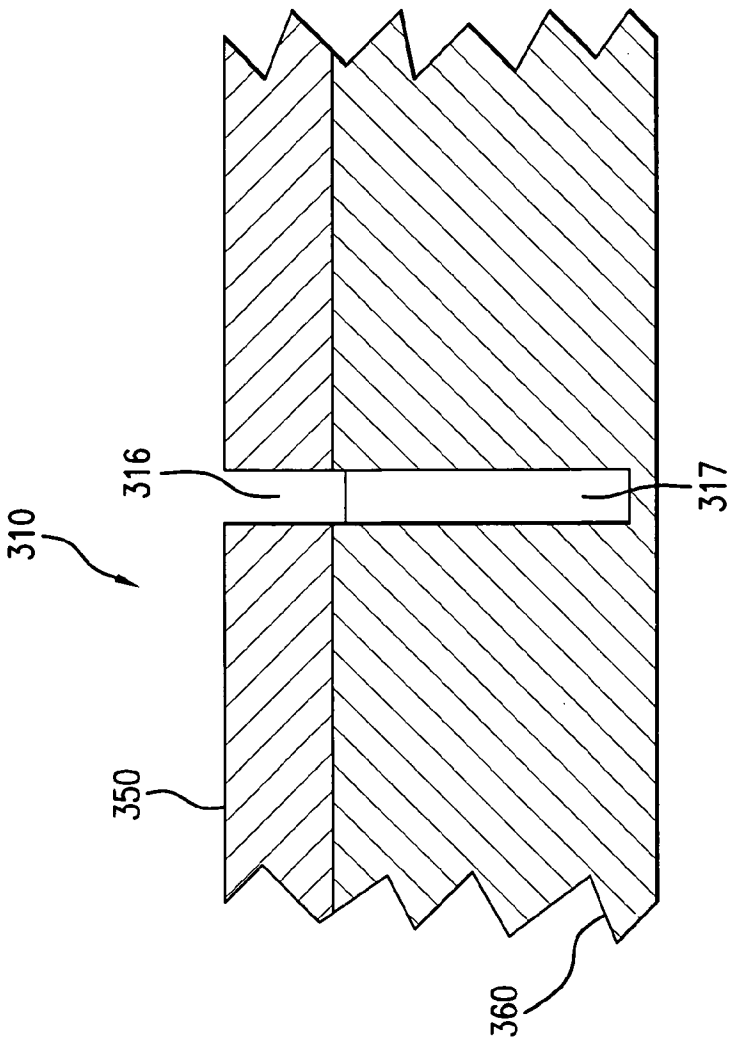

FIG.5D

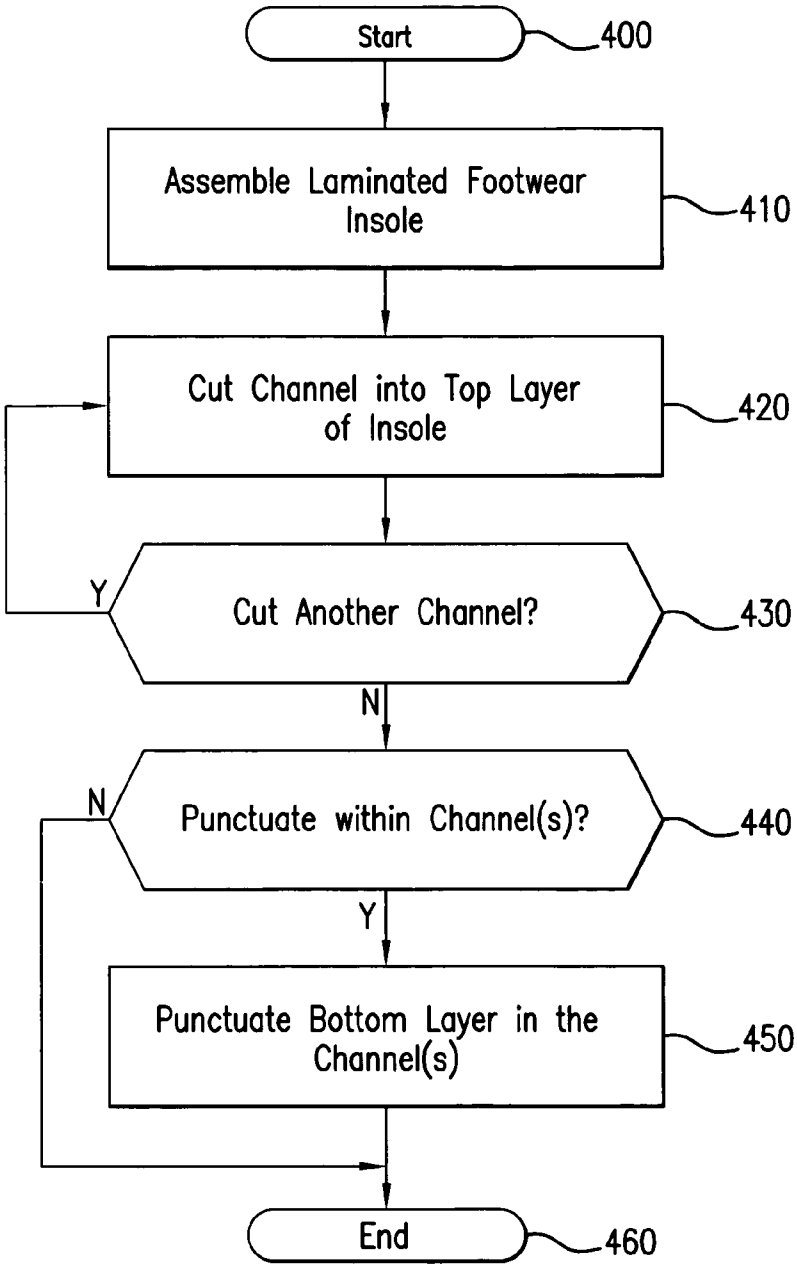
Start
400
Assemble Laminated Footwear Insole
410
Cut Channel into Top Layer of Insole
420
Y
Cut Another Channel?
430
N
N
Punctuate within Channel(s)?
440
Y
Punctuate Bottom Layer in the Channel(s)
450
End
460

FIG.6

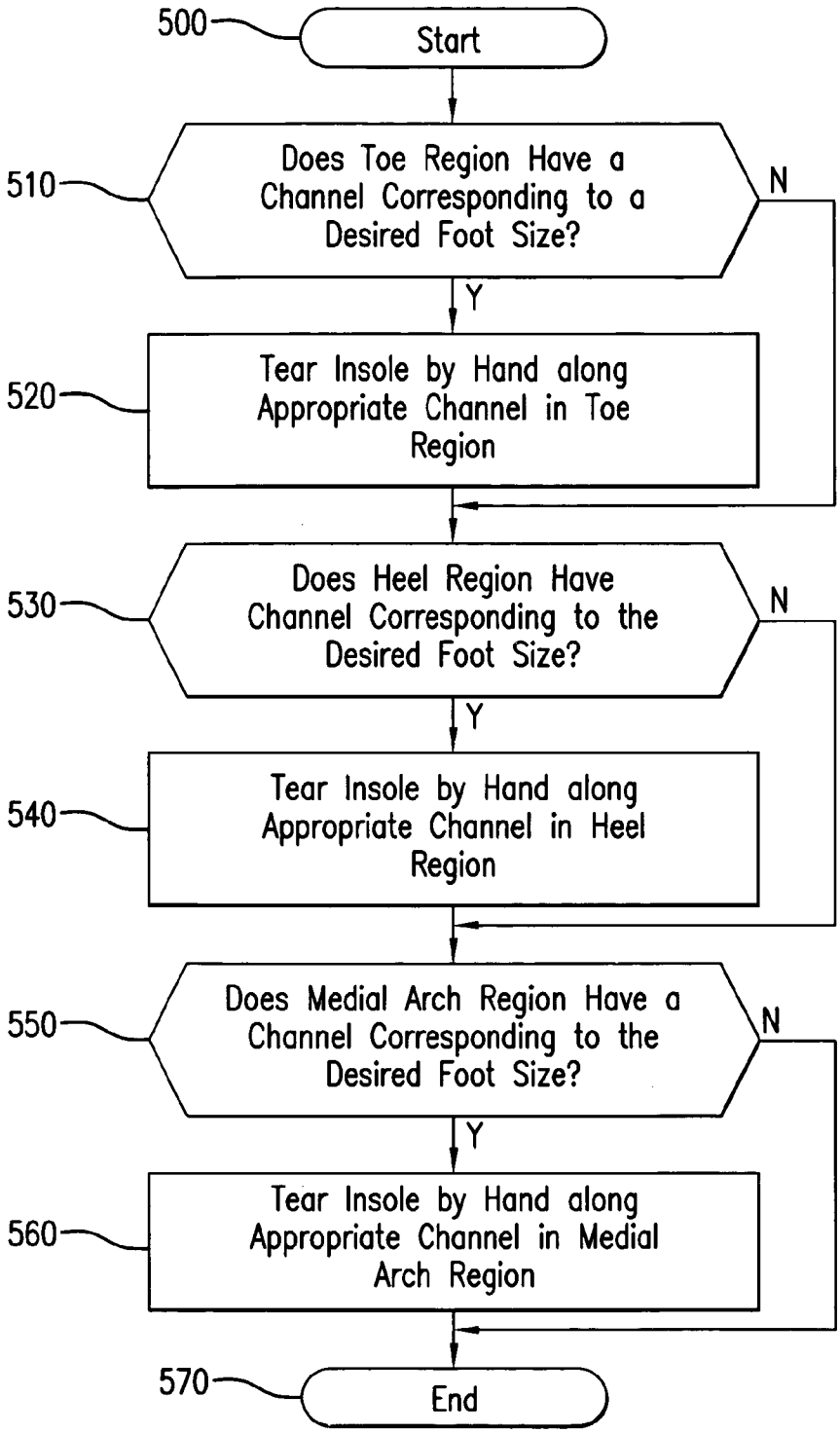
500
Start
510
Does Toe Region Have a Channel Corresponding to a Desired Foot Size?
N
Y
520
Tear Insole by Hand along Appropriate Channel in Toe Region
530
Does Heel Region Have Channel Corresponding to the Desired Foot Size?
N
Y
540
Tear Insole by Hand along Appropriate Channel in Heel Region
550
Does Medial Arch Region Have a Channel Corresponding to the Desired Foot Size?
N
Y
560
Tear Insole by Hand along Appropriate Channel in Medial Arch Region
570
End

FIG.7

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/059186

A. CLASSIFICATION OF SUBJECT MATTER
INV. A43B3/26

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A43B

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/265903 A1 (STRONG VONDA M [US]) 30 November 2006 (2006-11-30) paragraph [0022]; claims 11,12; figures	1-19
X	US 3 925 914 A (MARCOUX EMERY) 16 December 1975 (1975-12-16) cited in the application claims; figures	1-19
X	US 6 526 676 B1 (LEDERGERBER GREGG [US]) 4 March 2003 (2003-03-04) cited in the application claims; figures	1-19

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 December 2009	28/12/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Fax: (+31–70) 340–3016	Claudel, Benoît

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2009/059186

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006265903 A1	30-11-2006	NONE	
US 3925914 A	16-12-1975	CA 980566 A1	30-12-1975
US 6526676 B1	04-03-2003	NONE	