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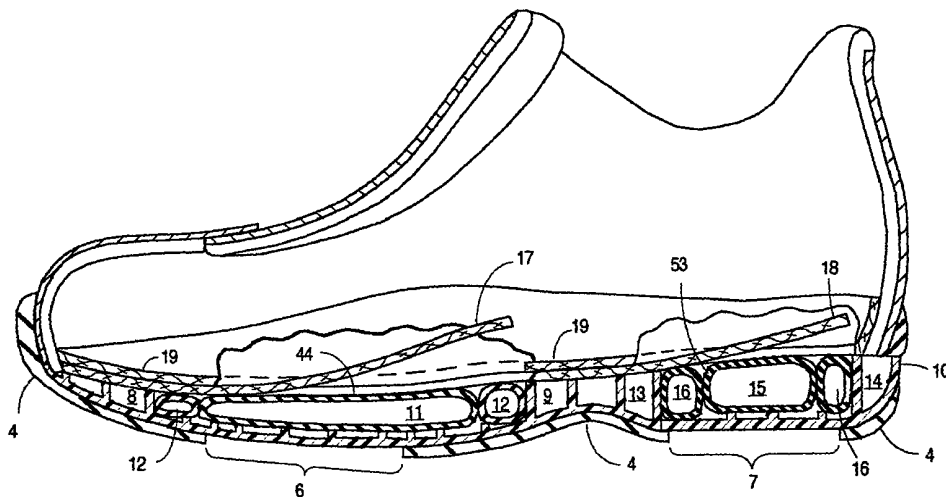
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(54) Title: FOOTWEAR WITH VISIBLE, REPLACEABLE CUSHIONING CASSETTE



(57) Abstract: Footwear, particularly an athletic or sport shoe, having a sole (2) with a visible, replaceable cushioning cassette (44, 53), and method for modifying impact response capacity or color pattern by removing and replacing the cushioning cassette (44, 53). The invention also provides footwear, comprising a sole (2); and an upper (3) connected to the sole, the sole comprising an outsole (4); and a midsole (5), the midsole comprising a midsole section wherein walls of a periphery of cells form in the midsole section (10) at least one cavity for receiving a cushioning cassette (44, 53), which, when within the cavity, is visible through clear material of the sole when viewed from outside of the footwear.



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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

DESCRIPTION**FOOTWEAR WITH VISIBLE, REPLACEABLE CUSHIONING CASSETTE****BACKGROUND OF THE INVENTION**

5 The visual appeal of shoe components, particularly the appeal of color in visible shoe components, is an important aesthetic consideration in shoe design. Visible shoe components--including laces, tongues, vamp sections, and other components of uppers--form a color pattern that often is integral, for example, to an overall color pattern of a schema for uniform dress of a team, a band, or a cheerleading squad.

10 While color characteristics of uppers are of primary importance for a shoe's visual appeal, color characteristics of soles and sole components may also be of importance for a shoe's visual appeal. However, soles, including those of athletic or sport shoes, are designed primarily to mediate impacts between the feet of a wearer and a surface on which the wearer treads.

15 The impact response capacity of a shoe is critical for a shoe's practical utility. Significant force is often placed on the front and heel regions of a shoe sole when a wearer walks, runs, or jumps. Such force may be particularly strong and recurrent when a wearer walks, runs, or jumps during the fray of athletic competition or other sporting activity.

20 The impact response capacity of a shoe is tied closely to the cushioning capacity of the shoe's sole. Cushioning capacity of a sole, i.e., its capacity to mediate impacts between a wearer's foot and a surface, has two component capacities: (1) shock absorption capacity, and (2) resilience capacity. Achieving a balance in shock absorption and resilience capacities is advantageous for optimizing the impact response
25 capacity of a shoe.

 While soles of some shoes may be unitary, and others may comprise two layers (e.g., outsole and midsole), soles of athletic or sport shoes typically comprise three layers: outsole, midsole, and insole. Furthermore, while each of these layers typically has a role in mediating a shoe's impact response capacity, the role of the midsole is
30 usually primary, in either a shoe having a sole comprising two layers or a shoe having a sole comprising three layers. Consistent with this primary role of the midsole, some

shoe designs provide midsole elements that may be interchanged in order to facilitate modifying a shoe's impact response capacity.

Certain air-bladder inserts for midsoles, which are cemented in a sole, have been developed to facilitate production of shoes with varying impact response capacities. Since these air-bladder inserts are cemented in a sole, their visibility is restricted, even though, in some shoe designs, transparent areas in a shoe's heel region may allow air-bladder inserts to be viewed from below the sole. In addition, since these air-bladder inserts are cemented into place during shoe manufacture, they do not permit either a shoe's impact response capacity or a shoe's color pattern to be readily modified.

10

SUMMARY OF THE INVENTION

The present invention relates to footwear. More particularly, the present invention relates to an athletic or sport shoe having a sole with a visible, replaceable cushioning cassette.

Accordingly, the present invention provides footwear having a sole with a visible cushioning cassette which may be conveniently removed and replaced in order to allow either impact response capacity or color pattern of an individual piece of footwear to be readily modified. In order to modify impact response capacity, replacement is accomplished with a visible cushioning cassette having a different cushioning capacity, while in order to modify color pattern, replacement is accomplished with a visible cushioning cassette of a different color.

In particular, the present invention provides footwear, particularly an athletic or sport shoe, comprising a sole and an upper connected to the sole, the sole having at least one cavity therein for receiving a cushioning cassette, the cavity being accessible to permit removal and replacement of the cassette, which, when within the cavity, is visible through clear (such as transparent or translucent) material of the sole when viewed from outside of the footwear. In preferred embodiments, the invention provides footwear, particularly an athletic or sport shoe, comprising a sole and an upper connected to the sole, the sole comprising an outsole; and a midsole, the midsole comprising a midsole section having at least one cavity therein for receiving a cushioning cassette, the cavity being accessible to permit removal and replacement of the cassette, which, when within

the cavity, is visible through clear (such as transparent or translucent) material of the sole when viewed from outside of the footwear. In other related preferred embodiments, the present invention provides such footwear, wherein the midsole section is made largely of clear material.

5 Embodiments of footwear as provided by the present invention include those having soles with other structures that address practical needs for lightness, durability, and structural integrity in the soles. Use of sole structures composed of cells arranged in reticulated or honeycomb-like patterns (i.e., use of reticulated wall structures) lessens sole mass, in comparison with soles that lack such cells. Furthermore, use of such
10 reticulated wall structures in sole layers may provide strength and stabilize soles against lateral collapse. Consequently, the use of such reticulated wall structures in soles is particularly suitable for athletic or sport shoes, since both low sole mass and high sole strength are generally desired in athletic or sport shoes.

 Accordingly, the present invention also provides other preferred embodiments
15 of such previously noted footwear wherein a cavity for a cushioning cassette is formed by walls of cells in a midsole section, wherein walls of these cells also form a reticulated wall structure in the midsole section. The present invention also provides other preferred embodiments of such footwear wherein the midsole section is largely made of clear material. The present invention also provides other preferred embodiments of such
20 footwear (wherein the midsole section is, or is not, largely made of clear material, but wherein a cavity for a cushioning cassette is formed by walls of cells, and wherein walls of these cells also form a reticulated wall structure in the midsole section) wherein a bottom of the cavity for the cushioning cassette also comprises a reticulated wall structure.

25 In other preferred embodiments, the invention provides all such previously noted footwear having a sole comprising an outsole and a midsole, but wherein the sole additionally comprises an insole, so that the sole comprises an outsole; a midsole, the midsole comprising a midsole section having at least one cavity therein for receiving a cushioning cassette, the cavity being accessible to permit removal and replacement of
30 the cassette, which, when within the cavity, is visible through clear material of the sole when viewed from outside of the footwear; and an insole. In various embodiments of

such footwear, the midsole section is (or is not) largely made of clear material, and a cavity for a cushioning cassette is (or is not) formed by walls of cells in the midsole section, wherein walls of the cells also form a reticulated wall structure in the midsole section.

5 The present invention also provides method for modifying color pattern (or impact response capacity) of footwear having a sole with a visible, replaceable cushioning cassette, the method comprising removing the cassette from the sole, and replacing the cassette with another of a different color (or different cushioning capacity). In embodiments where a cushioning cassette in a cavity of a midsole section is
10 accessible without removing an area of the insole, the present invention also provides method for modifying color pattern (or impact response capacity) of footwear, the method comprising removing the visible cushioning cassette, and replacing the visible cushioning cassette with another of a different color (or different cushioning capacity). In embodiments where a cushioning cassette in a cavity of a midsole section is
15 accessible through an insole, the present invention also provides method for modifying color pattern (or impact response capacity) of footwear, the method comprising lifting an insole area above the cavity, removing the visible cushioning cassette, and replacing the visible cushioning cassette with another of a different color (or different cushioning capacity).

20 The present invention may also be embodied in articles of manufacture other than footwear. In particular, the visible, replaceable cushioning cassette, as provided by the present invention, may be utilized, without limitation, in grips and gripping elements of all kinds (including, for example, handles for suitcases or levers for furniture and appliances), pads or padding elements of all kinds (including, for
25 example, bottom units for feet of chairs, stools, or stands; or seat units for furniture, buses, or airplanes), cushioning components of all kinds (including, for example, packaging pads and automotive or aerospace cushioning devices), and the like.

Other features and advantages of the invention will be apparent from the following description of the preferred embodiments thereof, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of footwear having a sole with a visible, replaceable cushioning cassette in a front-region cavity and another in a heel-region cavity.

FIG. 2 is a side view of a longitudinal cross-section of the footwear of **FIG. 1** taken along section lines 2-2 of **FIG. 1**.

FIG. 3 is a top plan view of a toe-to-heel midsole section having a cavity for a cushioning cassette in both front and heel regions.

FIG. 4 is a side plan view of the toe-to-heel midsole section of **FIG. 3**.

FIG. 5 is bottom plan view of a toe-to-heel midsole section of **FIG. 3**.

FIG. 6 is a top plan view of a front midsole section having a cushioning cassette in its cavity.

FIG. 7 is a side view of a longitudinal cross-section of the front midsole section of **FIG. 6** taken along section lines 7-7 of **FIG. 6** with a cushioning cassette in the cavity.

FIG. 8 is a front view of the front midsole section of **FIG. 6**.

FIG. 9 is a perspective view of a cushioning cassette.

FIG. 10 is a top view of a heel midsole section with a cushioning cassette in its cavity.

FIG. 11 is a side view of the heel midsole section of **FIG. 10** with a cushioning cassette in the cavity.

FIG. 12 is a front view of the heel midsole section of **FIG. 10**; hidden lines indicate side, ceiling, and bottom walls of closed cells on the front side of the heel midsole section.

FIG. 13 is a side view of a longitudinal cross-section of the heel midsole section of **FIG. 10** taken along section lines 13-13 of **FIG. 10**; a cushioning cassette is not present.

FIG. 14 is a perspective view of a cushioning cassette.

FIG. 15 is a transverse cross-sectional view of the cushioning cassette of **FIG. 14** taken along section lines 15-15 of **FIG. 14**.

FIG. 16 is a side view of a longitudinal cross-section of the heel midsole section of FIG. 17 taken along section lines 16-16 of FIG. 17; a column-like cushioning cassette is in the front cavity.

FIG. 17 is a perspective view of two column-like cushioning cassettes that are to be inserted into side openings of corresponding cavities in a heel midsole section.

FIG. 18 is a perspective view of two column-like cushioning cassettes having notches; both are to be inserted into side openings of corresponding cavities in a heel midsole section.

FIG. 19 is a perspective view of a heel midsole section having one cavity with four circular inward-oriented notches for holding a side-inserted box-like cushioning cassette.

FIG. 20 is a side view of a longitudinal cross-section of the heel midsole section of FIG. 19 taken along section lines 20-20; a box-like cushioning cassette in its cavity.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1, one embodiment of footwear (i.e., a shoe) comprising sole 2 and upper 3 connected to sole 2 is identified by the number 1. Sole 2 comprises opaque outsole 4; midsole 5; and an insole (not visible in FIG. 1). In other embodiments, sole 2 may comprise an outsole and a midsole, the outsole being provided to contact a surface, while the midsole directly contacts a wearer's foot, so that no insole is present. While a left-foot shoe is depicted in FIG. 1, it is to be understood that similar elements, differing in enantiomeric configuration, are also present in embodiments of a right-foot shoe. It is to be understood that all elements of the present invention may apply to embodiments of either right-foot or left-foot footwear.

Referring to FIGS. 1 and 2, midsole 5 comprises toe-to-heel midsole section 10, which is made entirely of clear (i.e., translucent or transparent) material. Sidewalls extending upward from opaque outsole 4 cover some of the side areas of midsole section 10 along the front region and, partially, heel region of sole 2, blocking through these side areas visibility of cushioning cassettes 44 and 53 in the cavities of midsole section 10. However, in this particular embodiment, opening 6 in outsole 4 provides

visibility of cushioning cassette 44 in the front-region cavity, while opening 7 provides visibility of cushioning cassette 53 in the heel-region cavity, through lower clear surfaces of toe-to-heel midsole section 10.

Referring to FIG. 2, a front-region cavity (between open cells 8 and 9) holding two-chambered cushioning cassette 44 (having inner chamber 11 and outer chamber 12) and a heel-region cavity (between open cells 13 and 14) holding thicker cushioning cassette 53 (having inner chamber 15 and outer chamber 16) are each formed by interior side walls of a periphery of open cells in midsole section 10. The front-region cavity is accessible by lifting insole area 17 to permit removal and replacement of cushioning cassette 44, while the heel-region cavity is accessible by lifting insole area 18 to permit removal and replacement of thicker cushioning cassette 53. In either case, the lifting of sock liner 19 occurs with the lifting of insole areas 17 or 18. When within a cavity, each cushioning cassette is visible through clear material of the sides of midsole section 10, as well as through the lower clear surfaces of toe-to-heel midsole section 10 above openings 6 and 7 in outsole 4.

In other embodiments of the insole, insole areas 17 and 18, over cushioning cassettes 44 and 53, respectively, may be free of attachment to other areas of the insole. That is, insole area 17 and insole area 18 may simply be separate pads over cushioning cassette 44 and cushioning cassette 53, respectively. However, in such embodiments of the insole, insole area 17 and insole area 18 may be attached to the lower surface of sock liner 19, so that the lifting of sock liner 19 again occurs with the lifting of insole areas 17 or 18.

Referring to FIG. 3, a toe-to-heel midsole section for a right-foot shoe is identified by the number 20. Toe-to-heel midsole section 20 is like toe-to-heel midsole section 10 of FIGS. 1 and 2 except for being of a right-foot shoe rather than a left-foot shoe. Other views of toe-to-heel midsole section 20 are depicted in FIGS. 4 and 5. Toe-to-heel midsole sections 10 (of FIGS. 1 and 2) and 20 (of FIGS. 3 - 5) are made of a clear elastomeric material (as are front midsole section 40 of FIGS. 6 - 8 and heel midsole sections 50 of FIGS. 10 - 13, 70 of FIGS. 16 - 17, 80 of FIG. 18, and 90 of FIGS. 19 - 20). The clear material may be transparent, or translucent, though, in either case, the color of a cushioning cassette is visible through the clear material of a sole

when viewed from outside of the footwear.

The clear material, which can be based on either thermoplastic or thermosetting resin systems, can be formulated from any elastomeric material that can be made into a clear product with a combination of sufficient strength, flexibility, and durability. As noted in EP Publication No. 0 456 434 A2 (incorporated herein by reference),
5 thermosetting systems are generally preferred because of compatibility of processing techniques and better physical properties. As also noted in EP Publication No. 0 456 434 A2, suitable elastomeric materials include synthetic elastomers based on homo and copolymer systems such as polycondensation polymers (e.g., polyurethanes), ethylene-
10 propylene based copolymers (e.g., EPDM), other synthetic rubber materials (e.g., SBR, neoprene, etc.), vinyl-based polymers (e.g., polyvinyl chloride), polyacrylate copolymers, and the like.

Referring to **FIGS. 3 and 5**, cavity **22** is formed in the front region of toe-to-heel midsole section **20** by interior side walls of a periphery of open cells, like open cells **23**,
15 **24, 25, and 26**. An open cell--like any one of cells **23, 24, 25, and 26**--has no ceiling that joins with side walls to form a closed cell.

Referring again to **FIG. 3**, interior side walls of open cells form cavity **22** having a shape that is approximately that of an equatorially-squeezed marshmallow section for receiving cushioning cassette **44** of (**FIGS. 1, 2, 6, 7, and 9**). In other
20 embodiments of the present invention, the shape of cavity **22** could greatly vary.

The bottom of cavity **22** is lined with shorter reticulated wall structure for supporting cushioning cassette **44**. In other embodiments, the shorter reticulated wall structure could be in a honeycomb-like arrangement of open cells, each having a largely uniform size. In other embodiments, the reticulated wall structures could be webbed in
25 other dimensions. Walls of open cell **27**, which typify walls on cavity **22**'s bottom, are less than about one-third the height of walls like those of open cells **23, 24, 25, or 26** in this particular embodiment of toe-to-heel midsole section **20**. In other embodiments, heights of walls of open cells like cells **23, 24, 25, or 26** could vary considerably in comparison to each other and to walls on cavity **22**'s bottom. Furthermore, in other
30 embodiments, the cells could be closed, the walls of cells (closed or open) could be reticulated in other dimensions, or the walls of cells could be arranged in a honeycomb-

like pattern wherein the cells are each of a largely uniform size.

Referring again to **FIGS. 3 and 5**, cavity **28** is formed in the heel region of toe-to-heel midsole section **20** by interior side walls of a periphery of open cells, like open cells **29, 30, 31 and 32**. Walls of open cells--like open cells **29, 30, 31, and 32**--form cavity **28** to be approximately oval in shape, having a diameter between the interior side walls of open cells **29 and 30** that is about one-and-a-half times the diameter between the interior side walls of open cells **31 and 32** in this particular embodiment. In other embodiments of the present invention, the ratio of diameters could greatly differ, as could the shape of the cavity.

With the interior side walls of the open cells that form heel-region cavity **28** being higher than those that form front-region cavity **22**, the cushioning cassette (**53** of **FIG. 14**) that fits within heel-region cavity **28** differs from the cushioning cassette (**44** of **FIG. 9**) that fits within front-region cavity **22** not only in being approximately oval in shape (rather than being shaped as an equatorially-squeezed marshmallow section), but also in being about twice as high or thick, in this particular embodiment.

Cavity **28**, like cavity **22**, has a bottom that also comprises reticulated wall structure for supporting a cushioning cassette. Walls of open cell **33** on the bottom of cavity **28** are about the same height as walls of open cell **27** on the bottom of cavity **22**. For either cavity **22** or cavity **28**, the shorter wall height contributes to causing cushioning cassettes, which are typically not as high or thick as the side walls that form each cavity, to protrude above the plane of the top surface of toe-to-heel midsole section **20** in this particular embodiment. Other embodiments of midsole sections--including other toe-to-heel midsole sections, as well as front midsole sections and heel midsole sections--may contain longer or shorter walls, or no walls at all, to cover a cavity's bottom.

Referring to **FIG. 4**, molded upward extensions, like upward extension **34**, provide surfaces for attaching toe-to-heel midsole section **20** to shoe uppers (like left-foot shoe upper **3** of shoe **1** in **FIG. 1**, except for a right-foot shoe). In **FIG. 4**, dashes or hidden lines **35** along the outsole-adjacent boundary of toe-to-heel midsole section **20** outline height maximums for interiorly-oriented impressions on the lower surface of midsole section **20**.

Referring to **FIG. 5**, toe-to-heel midsole section **20** is made largely of clear material in this particular embodiment. Areas of potential attachment by an outsole on the lower surface of toe-to-heel midsole section **20** may be marked by swellings or molded discontinuities (not visible in **FIG. 5**). Similar swellings or molded discontinuities may also be found near the lower surfaces of other embodiments of midsoles sections (e.g., front midsole sections of **FIGS. 6 - 8** or heel midsole sections of **FIGS. 10 - 13** and **16 - 20**). Hidden lines outline where, on the opposite side of toe-to-heel midsole section **20**, cavities **22** and **28** are located.

Referring to **FIG. 6**, a front midsole section for a left-foot shoe is identified by the number **40**. Interior side walls of open cells, like open cells **47** and **48**, form a cavity, approximately the shape of an equatorially-squeezed marshmallow section, for cushioning cassette **44**, which is in place. Cushioning cassette **44** may fit snugly within the cavity of either a right-foot or left-foot front midsole section, though the bottom side of cassette **44** in a cavity of a front midsole section for a right-foot shoe becomes the top side of cassette **44** in a cavity of a front midsole section for a left-foot shoe, and visa versa. In this particular embodiment, except for sidedness, the dimensions of the cavity are approximately the same as the dimensions of cavity **22** of toe-to-heel midsole section **20** of **FIG. 3**. In this particular embodiment, front midsole section **40** is made entirely of clear material, so that cushioning cassette **44** is visible through both the sides and the lower surface of front midsole section **40**.

Referring to **FIG. 7**, a side view of a cross-section of the front midsole section of **FIG. 6** is again identified by the number **40**. Molded upward extensions, like upward extension **42**, provide surfaces for attaching front midsole section **40** to shoe uppers. Cushioning cassette **44** is in the cavity of front midsole section **40**. Walls of open cells in front midsole section **40** are also depicted. In this particular embodiment, shorter walls, like walls **45** and **46** of open cells beneath cushioning cassette **44** on the cavity's bottom have a height similar to, referring again to **FIG. 3**, the height of the walls of open cell **27** on the bottom of cavity **22**. In other embodiments, the height of cell walls on the bottom of cavities may differ markedly. As noted previously for walls of cells on the bottom of cavities for cushioning cassettes, in other embodiments of front midsole sections, longer or shorter walls, or no walls at all, may be found on a

cavity's bottom.

Referring to **FIG. 8**, a front view of a front midsole section for a left-foot shoe is again identified by the number **40**. Molded upward extensions, like upward extension **41**, provide surfaces for attaching shoe uppers to front midsole section **40**. Hidden lines
5 along the lower surface indicate the position of walls of open cells on the upper or cell-containing side of front midsole section **40**. A cushioning cassette is not present in a cavity of front midsole section **40** in the particular view presented in **FIG. 8**.

Referring to **FIG. 9**, one embodiment of a cushioning cassette is identified by the number **44**. Referring also to **FIGS. 3 and 5**, front-region cavity **22** of left-foot, toe-to-heel midsole section **20** receives, in a snug fit, cushioning cassette **44**. Referring also
10 to **FIGS. 6 and 7**, the cavity of left-foot front midsole section **40** also receives, in a snug fit, cushioning cassette **44**. Again, cushioning cassette **44** may fit snugly within the cavity of either a right-foot or left-foot midsole section, though the bottom side of cassette **44** in a cavity of a midsole section for a right-foot shoe becomes the top side of
15 cassette **44** in a cavity of a midsole section for a left-foot shoe, and visa versa.

Referring again to **FIG. 9**, exteriors of inner chamber **11** and outer chamber **12** (of **FIGS. 2 and 7**) are demarcated by groove **47** in this particular embodiment of cushioning cassette **44**. In other embodiments, cushioning cassette **44** may have but one chamber, or comprise two or more chambers. In brief, in other embodiments the
20 shape and chamber configuration of cushioning cassette **44** may vary greatly. Material of which cushioning cassette **44** is preferably made, as well as the containment of a gaseous medium within cushioning cassette **44**, is as described later for cushioning cassette **53** (of **FIGS. 10 - 12, 14, and 15**)

Referring to **FIG. 10**, one embodiment of a heel midsole section, from a top
25 view, is identified by the number **50**. Other views of heel midsole section **50** are depicted in **FIGS. 11 - 13**; they are also identified by the number **50**.

Referring to **FIGS. 10 - 13**, cavity **52** is formed in heel midsole section **50** by interior side walls of a periphery of closed cells, like closed cells **54, 55, and 56**. These cells are designated closed because a ceiling closes the cells. Interior side walls of a
30 periphery of these closed cells form cavity **52**, in which cushioning cassette **53** snugly fits, to be roughly oval in shape. In this particular embodiment, the dimensions of

cavity **52** are approximately the same as the dimensions of heel-region cavity **28** of toe-to-heel midsole section **20** of **FIG. 3**.

As a ceiling wall forms cells **54**, **55**, and **56** to be closed cells, a ceiling wall may form, in other embodiments, cells of front midsole sections, like section **40** of **FIGS. 6 - 8**, as well as cells of toe-to-heel midsole sections, like section **20** of **FIG. 3**, also to be closed cells

Referring to **FIG. 13**, shorter walls, like walls **58** and **59** of open cells on the bottom of cavity **50**, are similar in height in this particular embodiment to walls **45** and **46** beneath cushioning cassette **44** of **FIG. 7**, as well as to walls of open cell **33** on the bottom of cavity **28** of **FIG. 3**. As noted previously for other midsole sections, these walls on the bottom of the cavity of a heel midsole section may be absent or vary greatly in height. In other embodiments of heel midsole sections, as well as of front midsole sections and toe-to-heel midsole sections, a ceiling wall may also form cells on a cavity's bottom to be closed cells.

Referring to **FIGS. 1 - 13**, all cell walls--i.e., side, bottom, and ceiling walls of closed cells, or, side and bottom walls of open cells, whether outside or within a cavity--in midsole sections are of a similar thickness in these particular embodiments. In other embodiments of the present invention, however, the thickness of all walls may vary greatly within, as well as between, embodiments. For example, the ceiling wall that forms closed cells of cells of heel midsole section **50** (such as closed cells **54**, **55**, and **56**) may be approximately one-fifth as thick as the side and bottom walls of heel midsole section **50** in a preferred embodiment.

Referring to **FIGS. 14** and **15**, one embodiment of a cushioning cassette is identified by the number **53**. Referring also to **FIGS. 1 - 3**, **10 - 12**, cushioning cassette **53** is sized to fit snugly within heel-region cavity **28** of toe-to-heel midsole section **20** (of **FIG. 3**) (or as shown in **FIGS. 1** and **2** for toe-to-heel midsole section **10**) or within cavity **52** of heel midsole section **50** (as shown in **FIGS. 10 - 12**). Cushioning cassette **53** also has outer and inner chambers. In a preferred embodiment, oval torus-shaped outer chamber **16** surrounds stretched pillow-shaped inner chamber **15** (shown in **FIGS. 2** and **15**). In this particular embodiment, elastomeric material joins the outer walls of the two chambers so as either to allow, or not to allow, sharing

of gaseous medium between the chambers through a passageway. In preferred embodiments, the same elastomeric material that joins the two chambers also forms the walls of the chambers. Whether sharing of gaseous medium between chambers is allowed or not allowed, the gaseous medium is held in sealed containment within the cassette if elastomeric material prevents escape of gaseous medium.

The elastomeric material of which cushioning cassette **53** is preferably made is a thermoplastic elastomer, such as thermoplastic polyurethane (TPU). The elastomeric material may also be of the following materials, without being limited thereto: adduct rubber, butadiene acrylonitrile rubber, butadiene styrene rubber, chlorinated polyethylene, chlorosulfonated polyethylene, ethylene propylene polymer, fluoroelastomer, high-strength silicone rubber, low-density polyethylene, methyl rubber, natural rubber, neoprene, polyester elastomer, polyether polyurethane, polyethylene/ethylene vinyl acetate copolymer, polyurethane, polyvinyl chloride, sulfide rubber, thermoplastic rubbers, and the like (see U.S. Patent Nos. 4,817,304 and 5,685,090, each incorporated herein by reference, as well as EP Publication No. 0 456 434 A2, previously incorporated herein by reference).

Referring to **FIG. 15**, the gaseous medium that fills chambers **15** and **16** preferably comprises clean ambient air, or, more preferably, one or more elements of clean ambient air having lower oxidizing potentials, such as argon. The gaseous medium that fills chambers of cushioning cassettes for a front-region cavity (such as chambers **11** and **12** of cushioning cassette **44** of **FIG. 9**) also preferably comprises clean ambient air, or, more preferably, one or more elements of clean ambient air having lower oxidizing potentials, such as argon.

By way of example, and not limitation, ambient air for a typical terrestrial location is, by volume, approximately 21% oxygen, 77% nitrogen, 1% argon, and 0.3% carbon dioxide, with 0.97% a mixture of other gases like hydrogen, neon, krypton, helium, ozone, and xenon. The filling of a chamber with ambient air as the gaseous medium, does not require that the ambient air be sealed within the chamber for the cassette to provide cushioning, though sealed containment of ambient air within cushioning cassette **53**, or cushioning cassette **44**, is preferred, whether or not the contained gaseous medium may exchange between chambers **15** and **16** of cassette **53**

(of FIGS. 2 and 15) or chambers 11 and 12 of cassette 44 (of FIGS. 2 and 7). If the elastomeric material of which a cassette is made has a sufficient hysteresis capacity (i.e., a capacity repeatedly to return quickly to an original molded shape despite being repetitively struck or depressed), ambient air (or other gaseous medium) within a cushioning cassette need not be in sealed containment. In other words, if the hysteresis capacity of a cushioning cassette's elastomeric material itself provides sufficient cushioning capacity, requiring that ambient air (or other gaseous medium) be in sealed containment in the elastomeric material of a cushioning cassette may not be necessary.

Referring to FIGS. 11 and 12, while cushioning cassette 53 is shown as being significantly higher than the top of the side wall of the cavity that it occupies, the heights of cushioning cassettes in other embodiments may vary from being near the tops of the side walls (as for cushioning cassette 44 in FIGS. 2 and 7) to being even further above the tops of the side walls than cushioning cassette 53 is in FIGS. 11 and 12. Furthermore, cushioning cassettes of other embodiments may be single-chambered or comprise more than two chambers. In addition, the thickness of chamber walls may vary from being as thin as soap film to being thicker than midsole section walls, for example, thicker than the walls within heel midsole section 50.

In addition to ambient air, other gases, without limitation, that may be used to fill chambers of cushioning cassettes (such as cassettes 44 and 53) in a sealed manner include halogenated alkanes and alkenes such as: bromotrifluoromethane, chlorofluoroethylene, 1,2-dichlorotetrafluoroethane, hexafluoroethane, hexafluoropropylene, monochloropentafluoro-ethane, monochlorotrifluoromethane, octafluorocyclobutane, perfluorbutane, perfluorocyclo-butane, perfluorohexane, perfluoroheptane, perfluoropropane, tetrafluoromethane, 1,1,2-tri-chloro-1,2,2-trifluoroethane, and the like, as well as other gases, including sulfur hexafluoride (see U.S. Patent No 4,817,304 and EP Publication No. 0 456 434 A2, each previously incorporated herein by reference).

Referring to FIGS. 2, 7, 9, 14, and 15, in a preferred embodiment, chambers of cushioning cassettes (such as chambers 11 and 12 of cushioning cassette 44, and chambers 15 and 16 of cushioning cassette 53) are each filled during manufacture with clean ambient air to a fixed pressure level. In this preferred embodiment, cushioning

cassette **53** contains no valve or other mechanical component to adjust the pressure of the gaseous medium of ambient air within each chamber, though pressure within each chamber may be variously set on manufacture of the cushioning cassette. Since clean ambient air is used to fill each chamber in this particular preferred embodiment, release
5 of potentially environmentally damaging gases, such as chlorofluorocarbons (CFCs), is avoided.

Referring to **FIGS. 16 – 20**, embodiments of the present invention are depicted wherein column-like cushioning cassettes--such as cassettes **71** (of **FIG. 17**) or **81** (of **FIG. 18**)--or box-like cushioning cassettes--such as cassette **91** (of **FIG. 20**)--may be
10 removed and replaced through a lateral or medial side of a heel midsole section, such as a heel midsole sections **70** (of **FIGS. 16 and 17**), **80** (of **FIG. 18**), or **90** (of **FIGS. 19 and 20**). In these particular embodiments, the side-inserted cushioning cassettes are single-chambered and also are preferably filled with one or more elements of clean ambient clean air. Like cushioning cassettes described earlier, side-inserted cushioning
15 cassettes in other embodiments may have two or more chambers. In addition, other embodiments of side-inserted cushioning may be filled in a sealed manner with a gaseous medium comprising a halogenated alkane, a halogenated alkene, or sulfur hexafluoride.

Referring to **FIG. 16**, column-like cushioning cassette **71** is within cavity **77** of
20 heel midsole section **70**. Side walls of closed cells, like cells **74** and **75**, form cavity **77** and side walls of other closed cells, like cells **75** and **76**, form cavity **78** of heel midsole section **70**.

Referring to **FIG. 17**, side walls of closed cells--like cells **74**, **75**, and **76**--of heel midsole section **70** form cavities **77** and **78** for receiving side-inserted, column-like
25 cushioning cassettes **71**. Since side walls of closed cells, like cells **74** and **75**, form cavity **77**, and side walls of other closed cells, like cells **75** and **76**, form cavity **78** of heel midsole section **70**, it can be said of these embodiments that interior walls of a periphery of cells form in midsole section **70** at least one cavity for receiving side-inserted cushioning cassette **71**.

Referring to **FIG. 18**, side-inserted, column-like cushioning cassettes contain
30 notches **82** to hold the cassettes to mating, notch-receiving indentations **83** in heel

midsole section 80. Side walls of open cells--like cells 84, 85, and 86--of heel midsole section 80 form cavities 87 and 88 for receiving side-inserted, column-like cushioning cassettes 81.

Referring to FIGS. 19 and 20, side-inserted, box-like cushioning cassette 91
5 contains indentations 92 to receive inward-oriented notches 93 of the cavity of heel midsole section 90. Again, since interior side walls of closed cells, like cells 94 and 95, form in midsole section 90 at least one cavity for receiving side-inserted cushioning cassette 91, it can be said of these embodiments that interior walls of a periphery of cells form in midsole section 90 at least one cavity for receiving side-inserted, box-like
10 cushioning cassette 91.

Referring again to FIG. 2, a method for modifying a color pattern of shoe 1 comprises lifting insole area 18 (sock liner 19 being lifted with insole area 18), removing cushioning cassette 53 from the cavity of the heel region of toe-to-heel midsole section 10 of shoe 1, and replacing removed cassette 53 with another of a
15 different color. Another method for modifying a color pattern of shoe 1 comprises lifting insole area 17 (sock liner 19 being lifted with insole area 17), removing cushioning cassette 44 from the cavity of the front region of toe-to-heel midsole section 10 of shoe 1, and replacing removed cassette 44 with another of a different color.

Referring again to FIG. 2, a method for modifying impact response capacity of
20 shoe 1 comprises lifting insole area 18 (sock liner 19 being lifted with insole area 18), removing cushioning cassette 53 from the cavity of the heel region of toe-to-heel midsole section 10 of shoe 1, and replacing removed cassette 53 with another having a different cushioning capacity. Another method for modifying impact response capacity of shoe 1 comprises lifting insole area 17 (sock liner 19 being lifted with insole area
25 17), removing cushioning cassette 44 from the cavity of the front region of toe-to-heel midsole section 10 of shoe 1, and replacing removed cassette 44 with another having a different cushioning capacity.

Similar methods (for modifying a color pattern or for modifying impact
30 response capacity of footwear), but not including the lifting of an insole area, may be used for embodiments either lacking an insole, or having cassettes in cavities that are accessible without lifting an insole (for example, a cavity amenable to receiving

cassettes inserted from a sole side, as in the heel midsole sections of FIGS. 16 - 20, or a front or a toe-to-heel midsole section having a cavity for a side-inserted cassette in front or heel regions). In embodiments lacking an insole, but having a sock liner, the removing of a cassette from a cavity accessible through an opening under the sock liner
5 also lifts the sock liner so that a cassette (of a different color or a different cushioning capacity) may be placed in the cavity.

With embodiments of the present invention, an article of footwear, and particularly an athletic or sport shoe, may be tailored to display a particular color pattern. In addition, the footwear may be tailored to have an appropriate impact
10 response capacity. Both a particular color pattern and an impact response capacity may be optimized for activities of the wearer of the footwear.

It is also to be understood that the visible, replaceable cushioning cassette apparatus of the present invention may be utilized in other articles of manufacture wherein it is desired to alter the cushioning or pressure resistance of the article or
15 change the color or color pattern of the article. Accordingly, the visible, replaceable cushioning cassette, as provided by the present invention, may be utilized, without limitation, in grips and gripping elements of all kinds (including, for example, handles for suitcases or levers for furniture and appliances), pads or padding elements of all kinds (including, for example, bottom units for feet of chairs, stools, or stands; or seat
20 units for furniture, buses, or airplanes), cushioning components of all kinds (including, for example, packaging pads and automotive or aerospace cushioning devices), and the like.

While footwear of the present invention, i.e., footwear having a sole with a visible, replaceable cushioning cassette, has been described in connection with
25 preferred embodiments, the invention is not intended to be limited to the particular embodiments described. On the contrary, the invention is intended to cover such alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

CLAIMS

1. Footwear, comprising:
 - a sole; and
 - an upper connected to said sole,
- 5 said sole having at least one cavity therein for receiving a cushioning cassette, said cavity being accessible to permit removal and replacement of said cassette, which, when within said cavity, is visible through clear material of said sole when viewed from outside of said footwear.
- 10 2. The footwear of Claim 1, wherein a bottom of said cavity in said sole comprises a reticulated wall structure.
3. The footwear of Claim 1, wherein said sole contains a cassette in said cavity.
- 15 4. The footwear of Claim 3, wherein said cassette is colored.
5. The footwear of Claim 3, wherein said cassette contains at least one chamber that is filled with a gaseous medium in sealed containment within said cassette.
- 20 6. The footwear of Claim 5, wherein said gaseous medium comprises one or more elements of ambient air.
7. The footwear of Claim 5, wherein said gaseous medium comprises a halogenated alkane, a halogenated alkene, or sulfur hexafluoride.
- 25 8. Footwear, comprising:
 - a sole; and
 - an upper connected to said sole,
 - said sole comprising:
 - 30 an outsole; and
 - a midsole,

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said midsole comprising a midsole section having at least one cavity therein for receiving a cushioning cassette, said cavity being accessible to permit removal and replacement of said cassette, which, when within said cavity, is visible through clear material of said sole when viewed from outside of said footwear.

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9. The footwear of Claim 8, wherein said midsole section is made largely of clear material.

10

10. The footwear of Claim 8, wherein in said midsole section is a heel midsole section.

15

11. The footwear of Claim 8, wherein said midsole section is a front midsole section.

12. The footwear of Claim 8, wherein said midsole section is a toe-to-heel midsole section.

20

13. The footwear of Claim 8, wherein said midsole section contains a cassette in said cavity.

14. The footwear of Claim 13, wherein said cassette is colored.

25

15. The footwear of Claim 13, wherein said cassette contains at least one chamber that is filled with a gaseous medium in sealed containment within said cassette.

16. The footwear of Claim 15, wherein said gaseous medium comprises one or more elements of ambient air.

30

17. The footwear of Claim 15, wherein said gaseous medium comprises a halogenated alkane, a halogenated alkene, or sulfur hexafluoride.
18. Footwear, comprising:
- 5 a sole; and
 an upper connected to said sole,
 said sole comprising:
 an outsole;
 a midsole,
10 said midsole comprising a midsole section having
 at least one cavity therein for receiving a
 cushioning cassette, said cavity being accessible
 to permit removal and replacement of said
 cassette, which, when within said cavity, is visible
15 through clear material of said sole when viewed
 from outside of said footwear; and
 an insole.
19. The footwear of Claim 18, wherein said midsole section is made largely of clear
20 material.
20. The footwear of Claim 18, wherein in said midsole section is a heel midsole
section.
- 25 21. The footwear of Claim 18, wherein said midsole section is a front midsole
section.
22. The footwear of Claim 18, wherein said midsole section is a toe-to-heel midsole
section.
- 30 23. The footwear of Claim 18, wherein said midsole section contains a cassette in

said cavity.

24. The footwear of Claim 23, wherein said cassette is colored.

5 25. The footwear of Claim 23, wherein said cassette contains at least one chamber that is filled with a gaseous medium in sealed containment within said cassette.

26. The footwear of Claim 25, wherein said gaseous medium comprises one or more elements of ambient air.

10

27. The footwear of Claim 25, wherein said gaseous medium comprises a halogenated alkane, a halogenated alkene, or sulfur hexafluoride.

28. Footwear, comprising:

15

a sole; and

an upper connected to said sole,

said sole comprising:

an outsole; and

a midsole,

20

said midsole comprising a midsole section,
wherein walls of a periphery of cells form in said
midsole section at least one cavity for receiving a
cushioning cassette, said cavity being accessible
to permit removal and replacement of said
25 cassette, which, when within said cavity, is visible
through clear material of said sole when viewed
from outside of said footwear.

25

29. The footwear of Claim 28, wherein said midsole section is made largely of clear
30 material.

30. The footwear of Claim 28, wherein in said midsole section is a heel midsole section.
31. The footwear of Claim 28, wherein said midsole section is a front midsole section.
32. The footwear of Claim 28, wherein said midsole section is a toe-to-heel midsole section.
33. The footwear of Claim 28, wherein said midsole section contains a cassette in said cavity.
34. The footwear of Claim 33, wherein said cassette is colored.
35. The footwear of Claim 33, wherein said cassette contains at least one chamber that is filled with a gaseous medium in sealed containment within said cassette.
36. The footwear of Claim 35, wherein said gaseous medium comprises one or more elements of ambient air.
37. The footwear of Claim 35, wherein said gaseous medium comprises a halogenated alkane, a halogenated alkene, or sulfur hexafluoride.
38. Footwear, comprising:
- a sole; and
 - an upper connected to said sole,
 - said sole comprising:
 - an outsole;
 - a midsole,
 - said midsole comprising a midsole section,
 - wherein walls of a periphery of cells form in said

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5 midsole section at least one cavity for receiving a
cushioning cassette, said cavity being accessible
to permit removal and replacement of said
cassette, which, when within said cavity, is visible
through clear material of said sole when viewed
from outside of said footwear; and
an insole.

10 39. The footwear of Claim 38, wherein said midsole section is made largely of clear
material.

40. The footwear of Claim 38, wherein in said midsole section is a heel midsole
section.

15 41. The footwear of Claim 38, wherein said midsole section is a front midsole
section.

42. The footwear of Claim 38, wherein said midsole section is a toe-to-heel midsole
section.

20 43. The footwear of Claim 38, wherein said midsole section contains a cassette in
said cavity.

44. The footwear of Claim 43, wherein said cassette is colored.

25 45. The footwear of Claim 43, wherein said cassette contains at least one chamber
that is filled with a gaseous medium in sealed containment within said cassette.

30 46. The footwear of Claim 45, wherein said gaseous medium comprises one or more
elements of ambient air.

47. The footwear of Claim 45, wherein said gaseous medium comprises a halogenated alkane, a halogenated alkene, or sulfur hexafluoride.
48. A method for modifying impact response capacity in footwear of Claim 3,
5 comprising
removing said cassette from said cavity; and
replacing in said cavity a cassette having a different cushioning capacity.
49. A method for modifying color pattern in footwear of Claim 4, comprising
10 removing said cassette from said cavity; and
replacing in said cavity a cassette having a different color.
50. A method for modifying impact response capacity in footwear of Claim 13,
comprising
15 removing said cassette from said cavity; and
replacing in said cavity a cassette having a different cushioning capacity.
51. A method for modifying color pattern in footwear of Claim 14, comprising
removing said colored cassette from said cavity; and
20 replacing in said cavity a cassette having a different color.
52. A method for modifying impact response capacity in footwear of Claim 23,
comprising
lifting said insole;
25 removing said cassette from said cavity; and
replacing in said cavity a cassette having a different cushioning capacity.
53. A method for modifying color pattern in footwear of Claim 24, comprising
lifting said insole;
30 removing said colored cassette from said cavity; and
replacing in said cavity a cassette having a different color.

54. A method for modifying impact response capacity in footwear of Claim 33, comprising
removing said cassette from said cavity; and
5 replacing in said cavity a cassette having a different cushioning capacity.
55. A method for modifying color pattern in footwear of Claim 34, comprising
removing said colored cassette from said cavity; and
replacing in said cavity a cassette having a different color.
10
56. A method for modifying impact response capacity in footwear of Claim 43, comprising
lifting said insole;
removing said cassette from said cavity; and
15 replacing in said cavity a cassette having a different cushioning capacity.
57. A method for modifying color pattern in footwear of Claim 44, comprising
lifting said insole;
removing said colored cassette from said cavity; and
20 replacing in said cavity a cassette having a different color.
58. A cushioning cassette made of elastomeric material, comprising:
a chamber filled with a gaseous medium wherein said cassette is sized to
fit snugly within a cavity of a sole of footwear, is removable from said
25 cavity, and is replaceable in said cavity.
59. The cushioning cassette of Claim 58, wherein said cavity is a cavity of a toe-to-heel midsole section.
- 30 60. The cushioning cassette of Claim 58, wherein said cavity is a cavity of a front midsole section.

61. The cushioning cassette of Claim 58, wherein said cavity is a cavity of a heel midsole section.
- 5 62. The cushioning cassette of Claim 58, wherein said cassette has an equatorially-squeezed marshmallow section shape.
63. The cushioning cassette of Claim 58, wherein said cassette has an oval shape.
- 10 64. The cushioning cassette of Claim 58, wherein said cassette is colored.
65. The cushioning cassette of Claim 58, wherein said gaseous medium comprises one or more elements of ambient air.
- 15 66. The cushioning cassette of Claim 58, wherein said gaseous medium is in sealed containment.
67. The cushioning cassette of Claim 66, wherein said gaseous medium comprises a halogenated alkane, a halogenated alkene, or sulfur hexafluoride.
- 20 68. A cushioning cassette made of elastomeric material, comprising:
an inner chamber; and
an outer chamber, wherein said inner chamber and said outer chamber
are filled with a gaseous medium, and said cassette is sized to fit
25 snugly within a cavity of a sole of footwear, is removable from
said cavity, and is replaceable in said cavity.
69. The cushioning cassette of Claim 68, wherein said cavity is a cavity of a toe-to-heel midsole section.
- 30 70. The cushioning cassette of Claim 68, wherein said cavity is a cavity of a front

midsole section.

71. The cushioning cassette of Claim 68, wherein said cavity is a cavity of a heel midsole section.

5

72. The cushioning cassette of Claim 68, wherein said cassette has an equatorially-squeezed marshmallow section shape.

73. The cushioning cassette of Claim 68, wherein said cassette has an oval shape.

10

74. The cushioning cassette of Claim 68, wherein said cassette is colored.

75. The cushioning cassette of Claim 68, wherein said gaseous medium comprises one or more elements of ambient air.

15

76. The cushioning cassette of Claim 68, wherein said gaseous medium is in sealed containment.

20

77. The cushioning cassette of Claim 76, wherein said gaseous medium comprises a halogenated alkane, a halogenated alkene, or sulfur hexafluoride.

78. The cushioning cassette of Claim 68, wherein said gaseous medium may exchange between said chambers.

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79. The cushioning cassette of Claim 73, wherein said outer chamber has a oval torus shape and said inner chamber has a stretched-pillow shape.

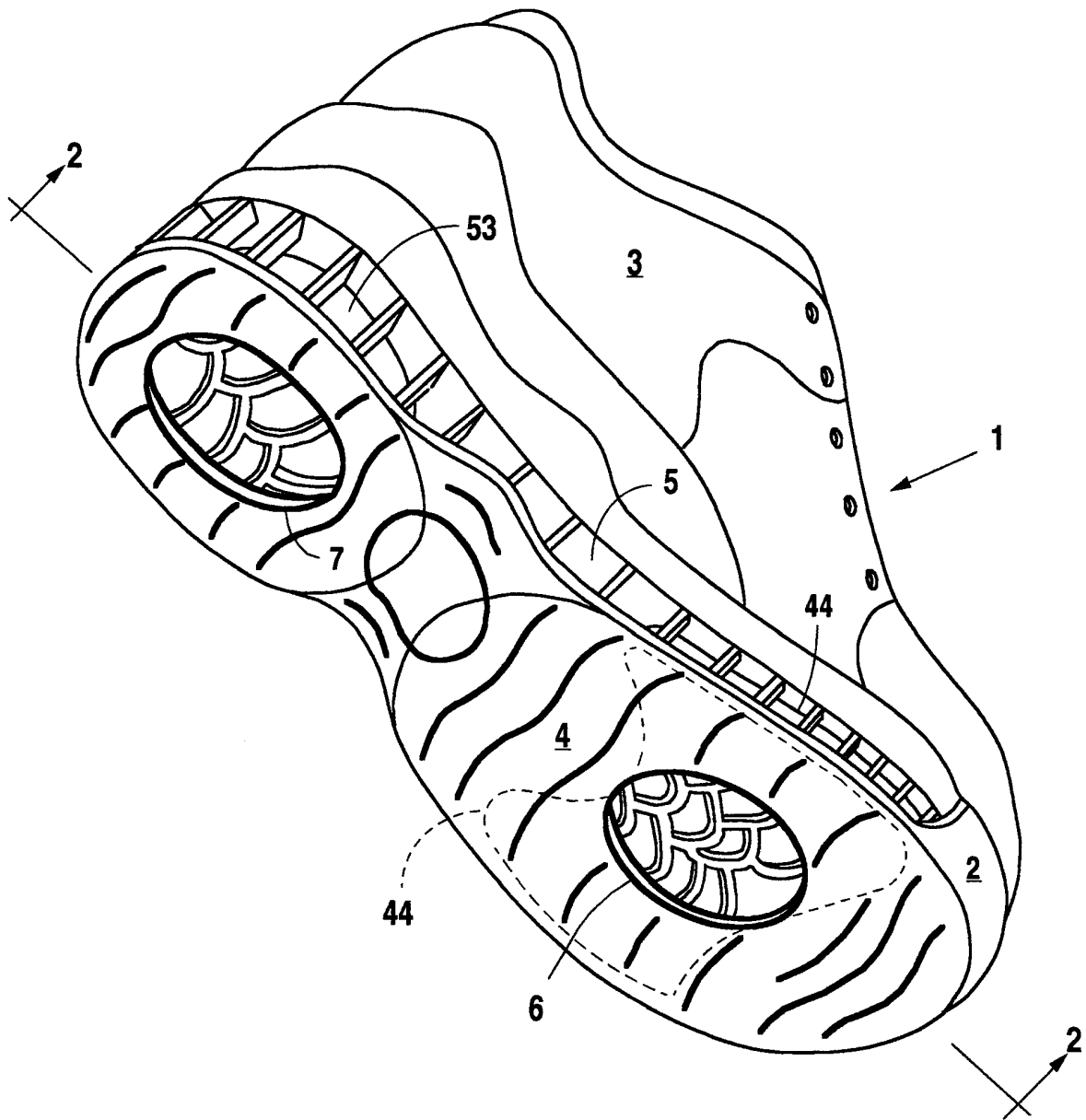


Fig. 1

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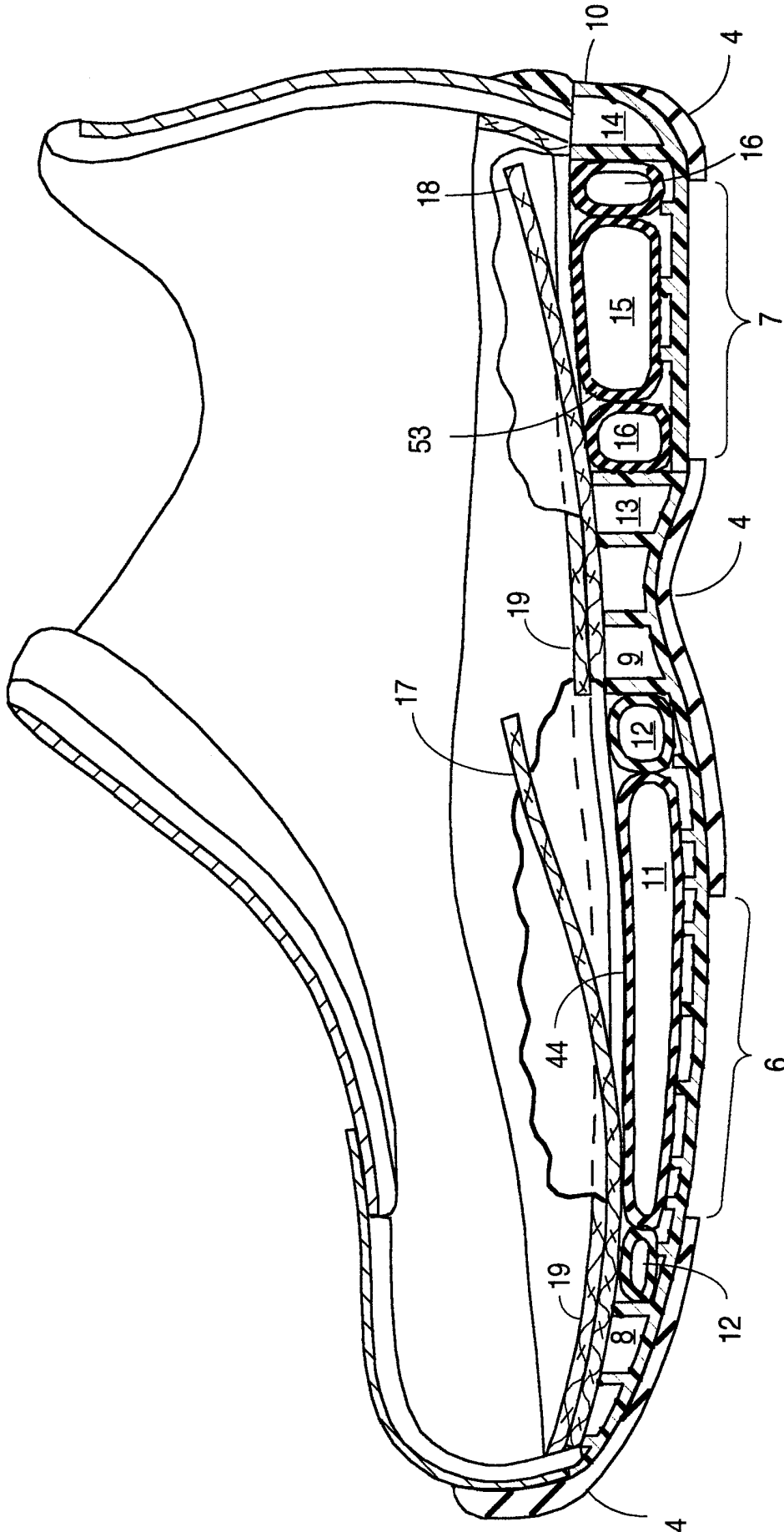


Fig. 2

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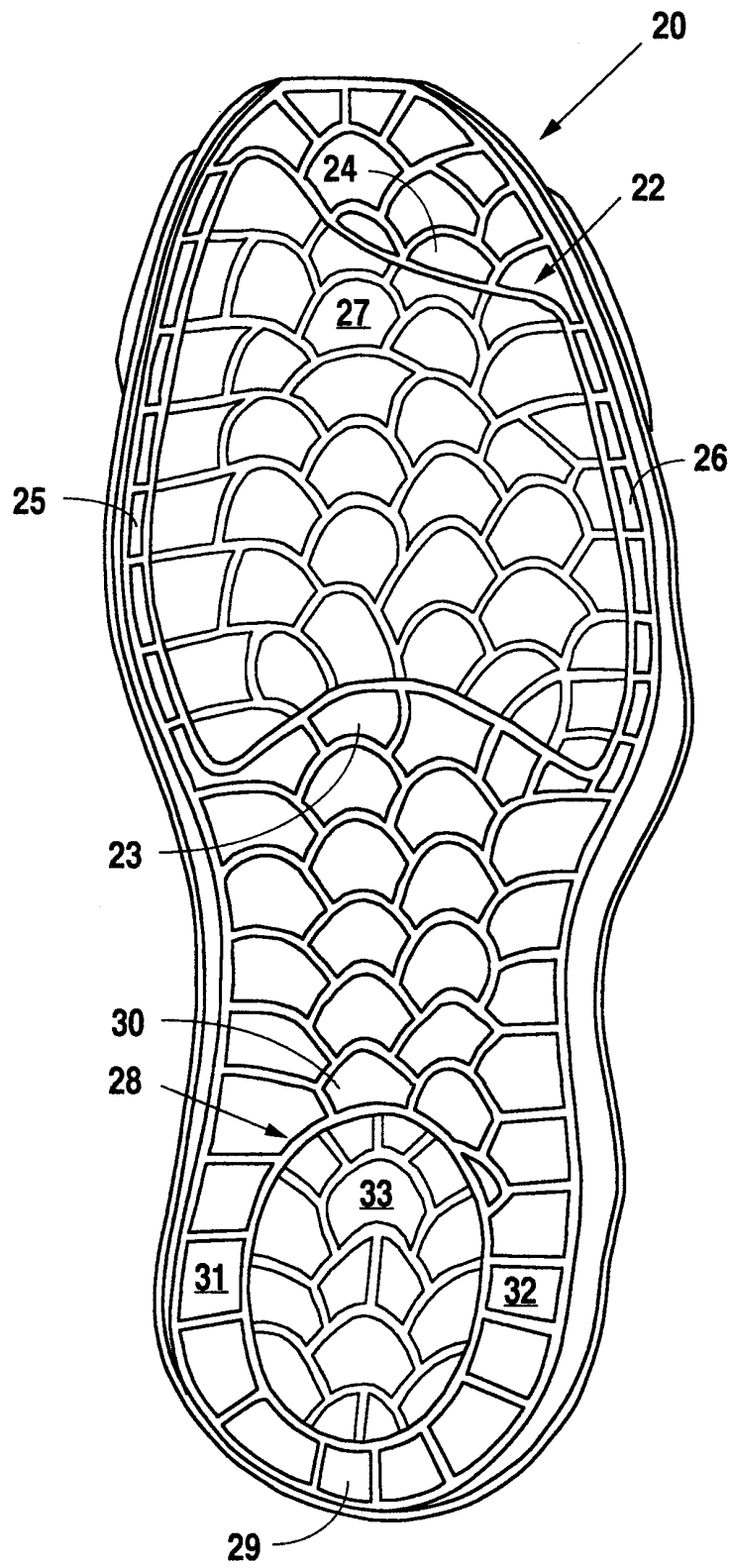


Fig. 3

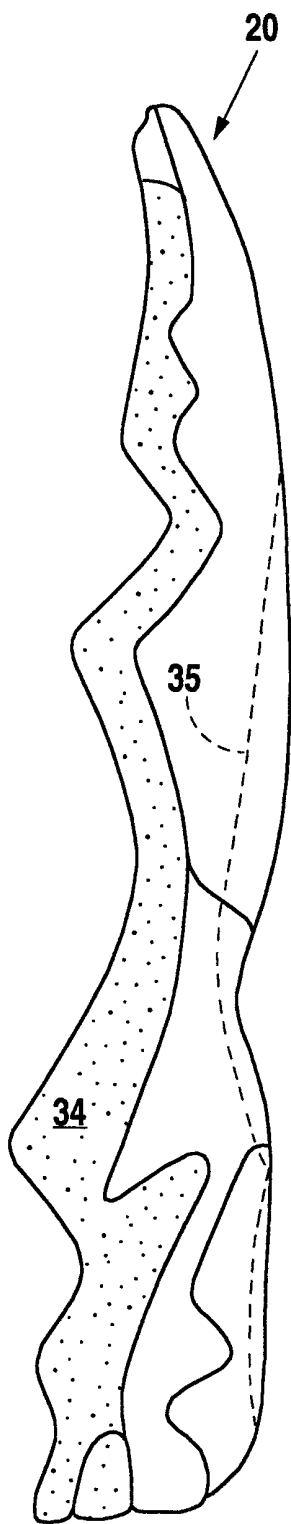


Fig. 4

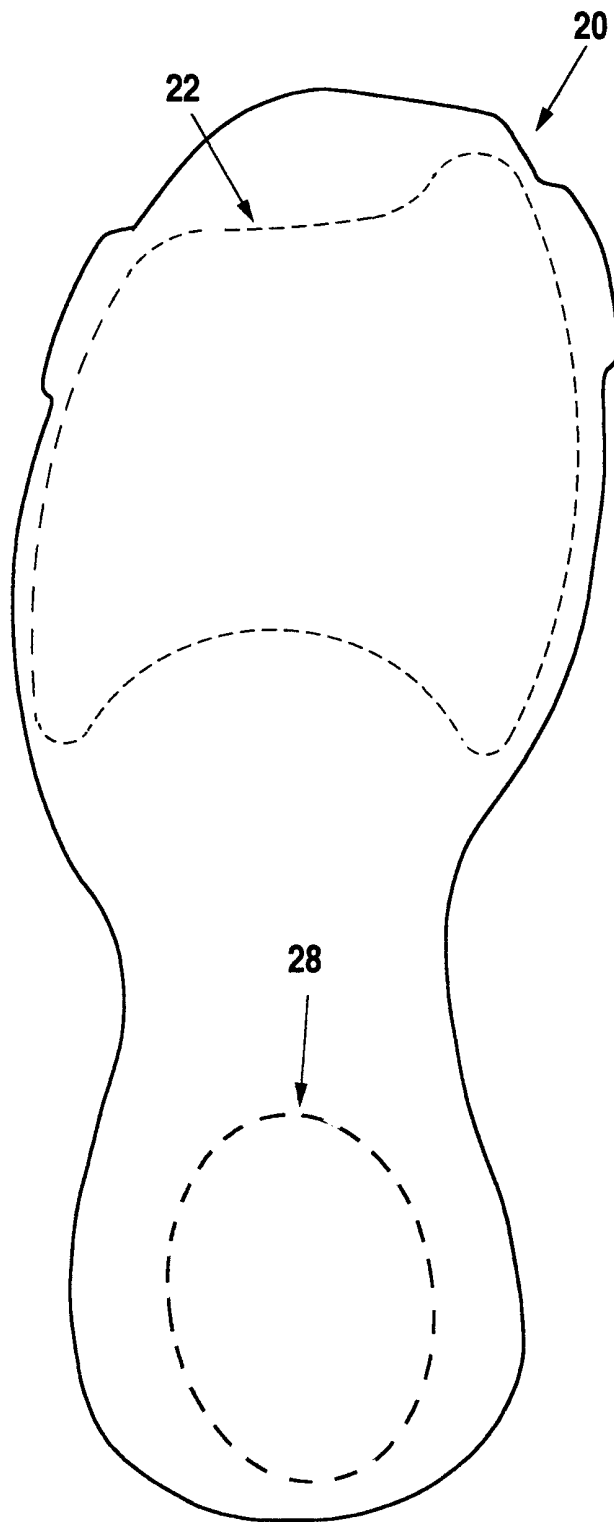


Fig. 5

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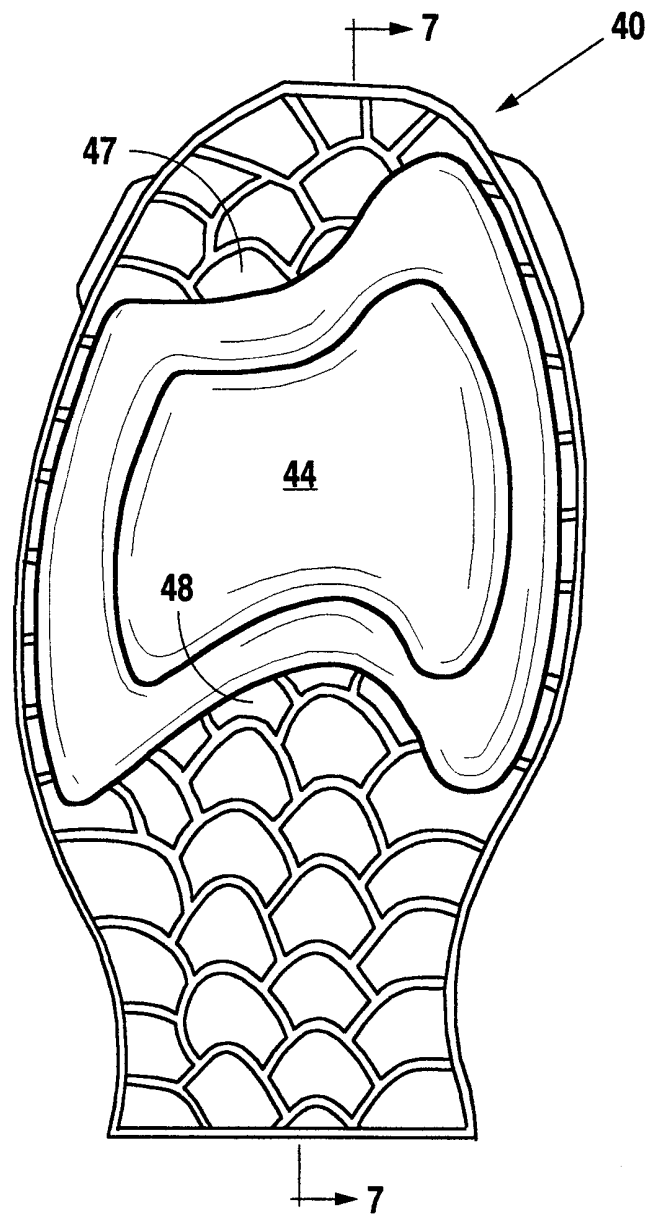


Fig. 6

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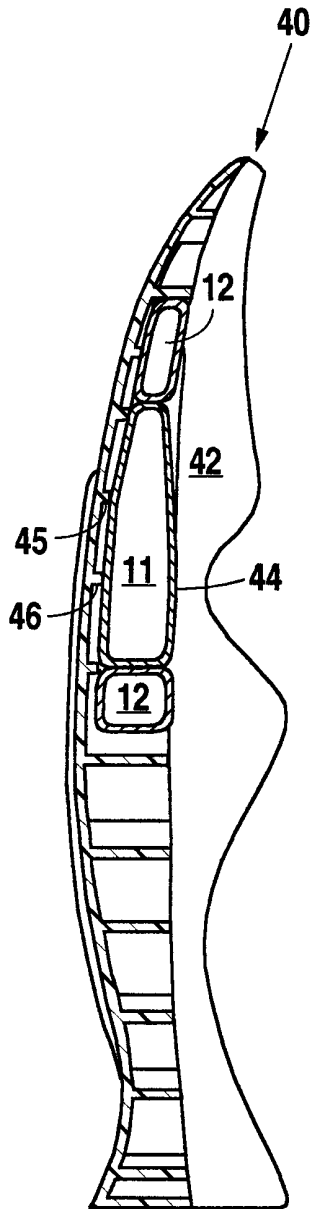


Fig. 7

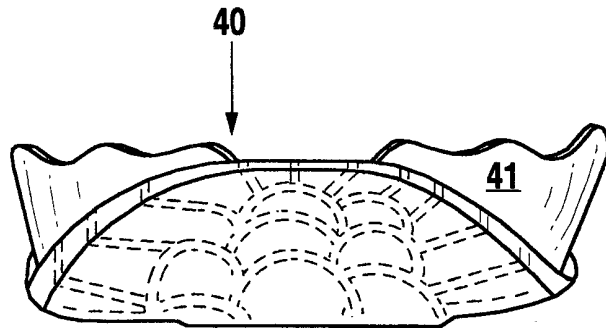


Fig. 8

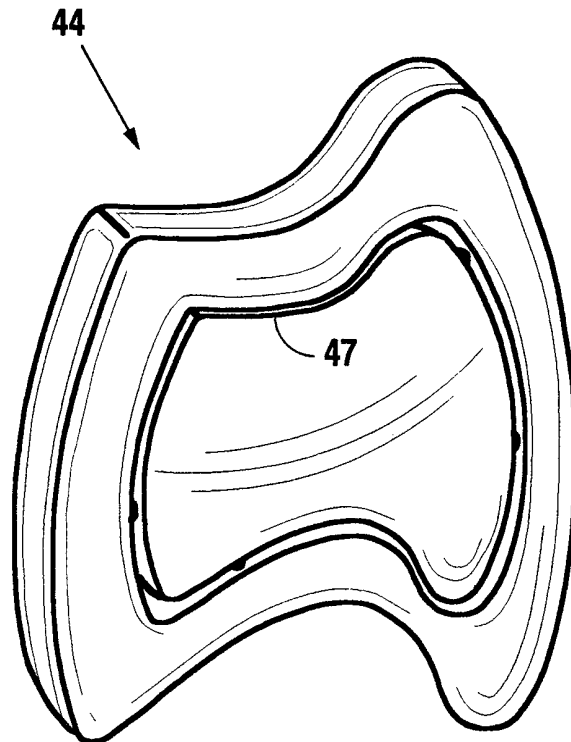


Fig. 9

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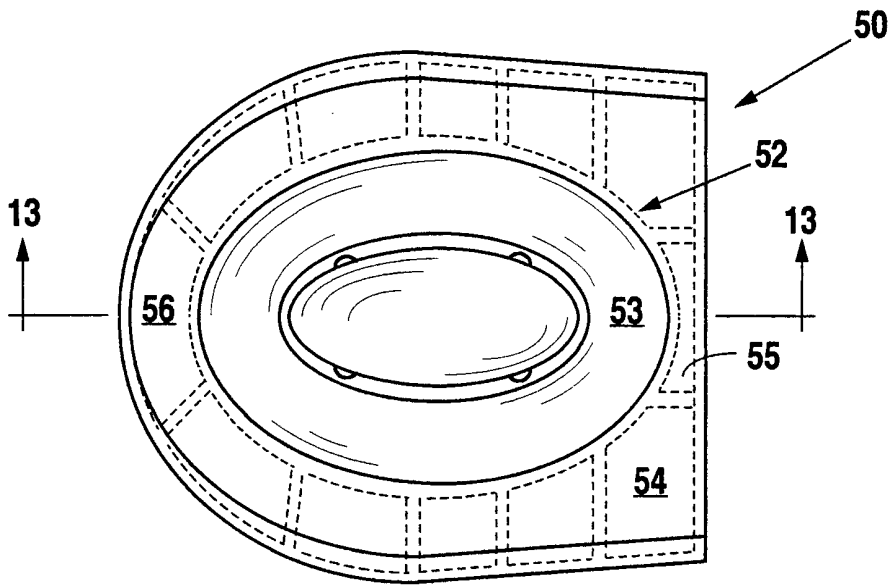


Fig. 10

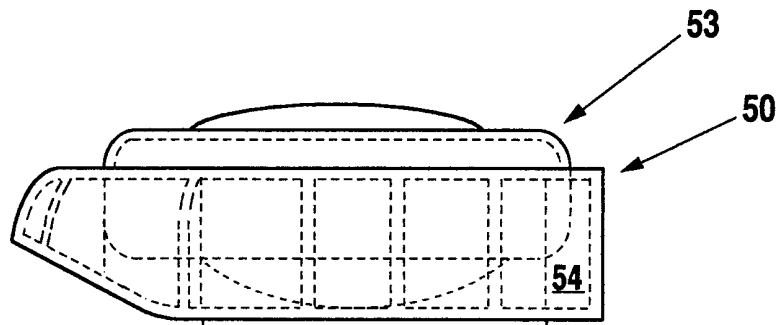


Fig. 11

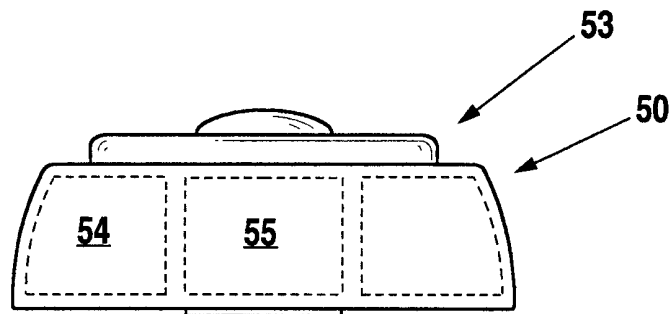


Fig. 12

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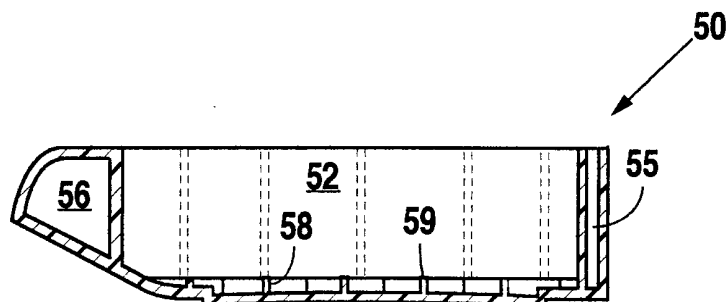


Fig. 13

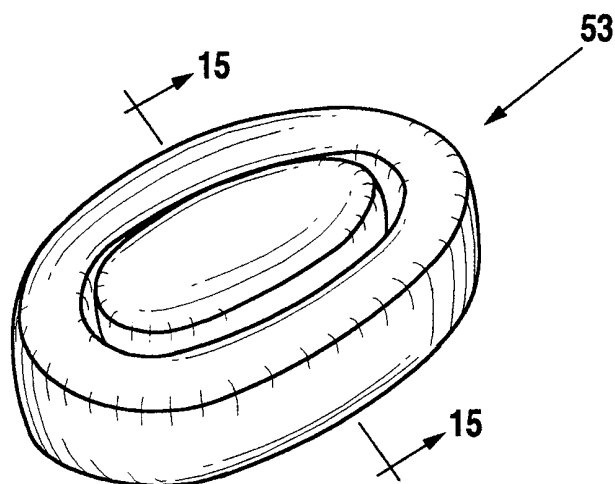


Fig. 14

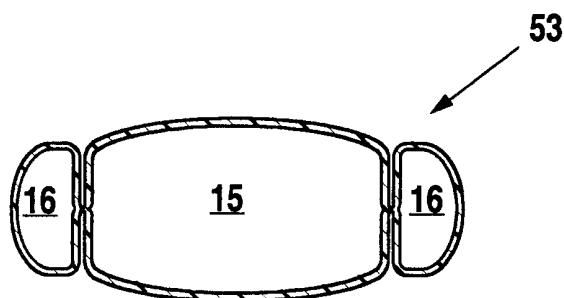


Fig. 15

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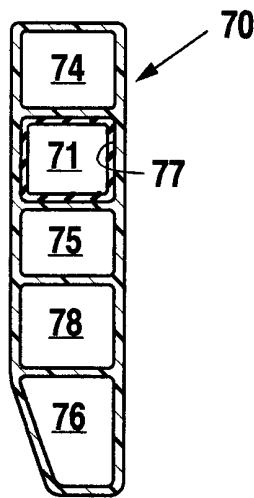


Fig. 16

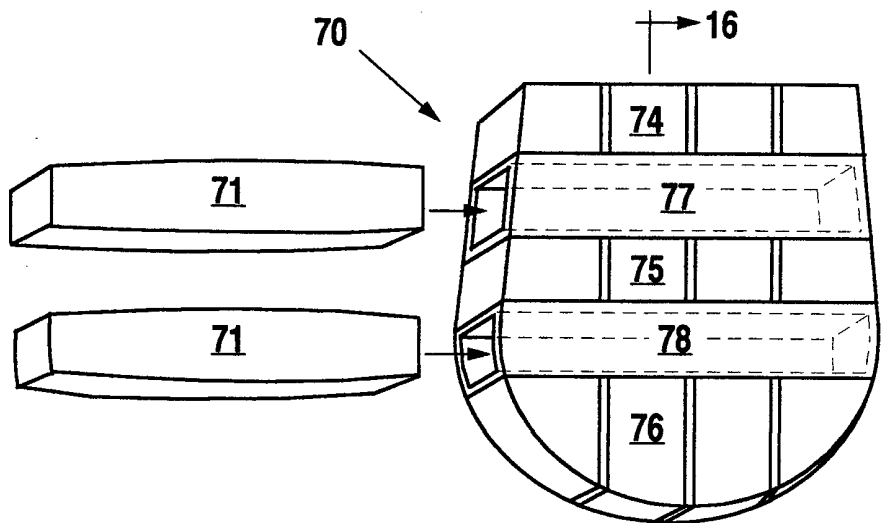


Fig. 17

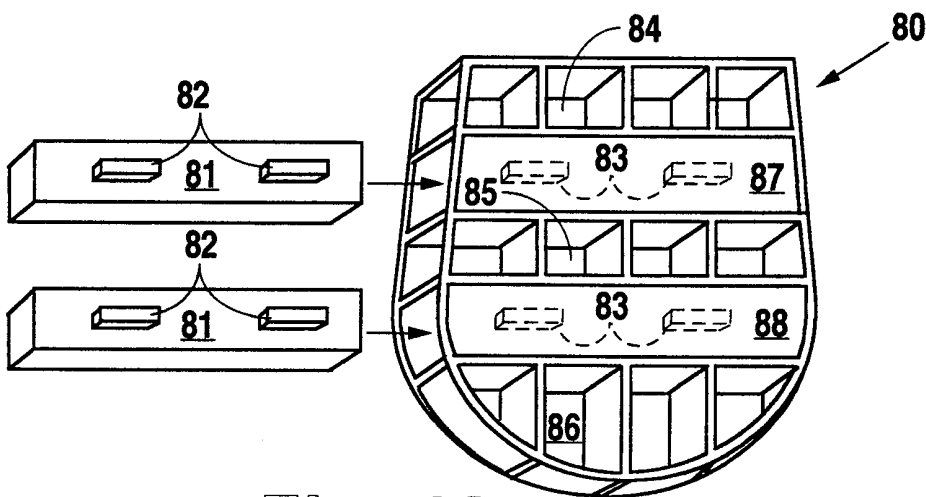


Fig. 18

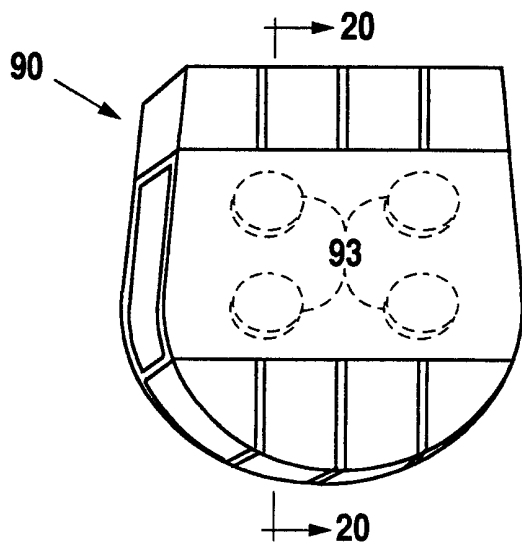


Fig. 19

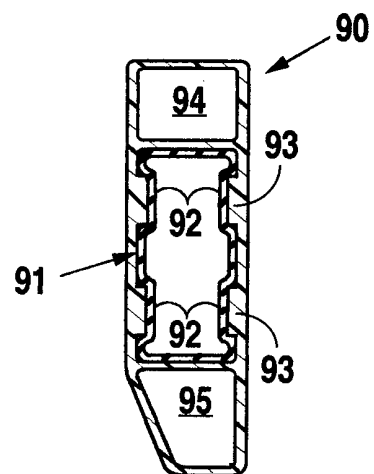


Fig. 20

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/40204

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A43B13/36 A43B21/32 A43B13/20 A43B21/42

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 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, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 174 049 A (FLEMMING UDO) 29 December 1992 (1992-12-29)	1-3,5,6, 8-10,13, 15,16, 18-20, 23,25, 26, 28-30, 33,35, 36, 38-40, 43,45, 46,48, 50,52, 54,56, 58,61, 65,66
Y	column 4, line 62 - line 69	4,7,11, 14,17, 21,24,
	-/--	

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

° Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

15 November 2000

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

Int: International Application No
PCT/US 00/40204

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	<p>column 5, line 41 - line 64 column 6, line 48 - line 64 claims; figure 13</p> <p>-----</p> <p>US 5 815 950 A (WANG SUI-MU) 6 October 1998 (1998-10-06)</p>	<p>27,31, 34,37, 41,44, 47,49, 51,53, 55,57, 60,62, 64,67-79</p>
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
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US 5815950	A	06-10-1998	NONE	
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