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(54) **INSOLE**

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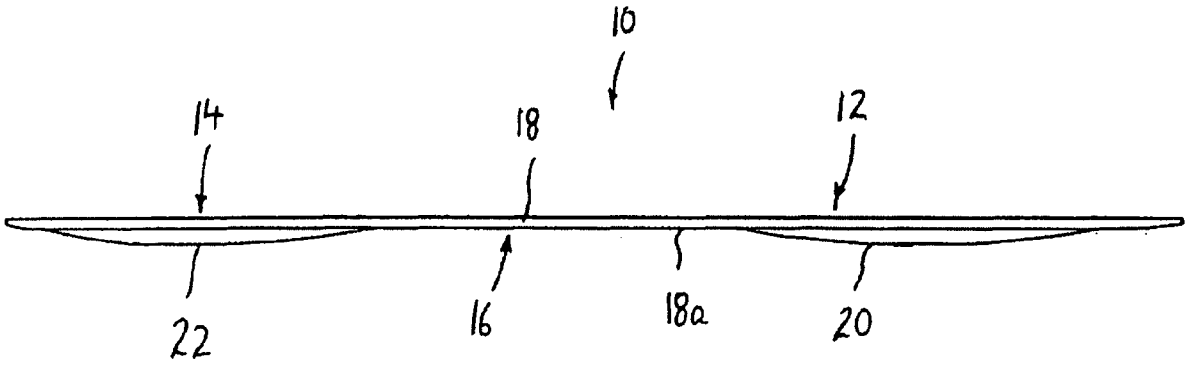
(57) **ABSTRACT**

A removable full length insole for insertion into open style footwear, includes a forefoot portion, a heel portion and a mid-foot portion connecting together the forefoot portion and the heel portion; a uniform thickness cushioning layer of a resilient material extending through the forefoot portion, heel portion and mid-foot portion; a substantially dome shaped pillow extending down from the cushioning layer at the forefoot portion and heel portion; and an arrangement for maintaining the insole in position in the footwear during a gait.



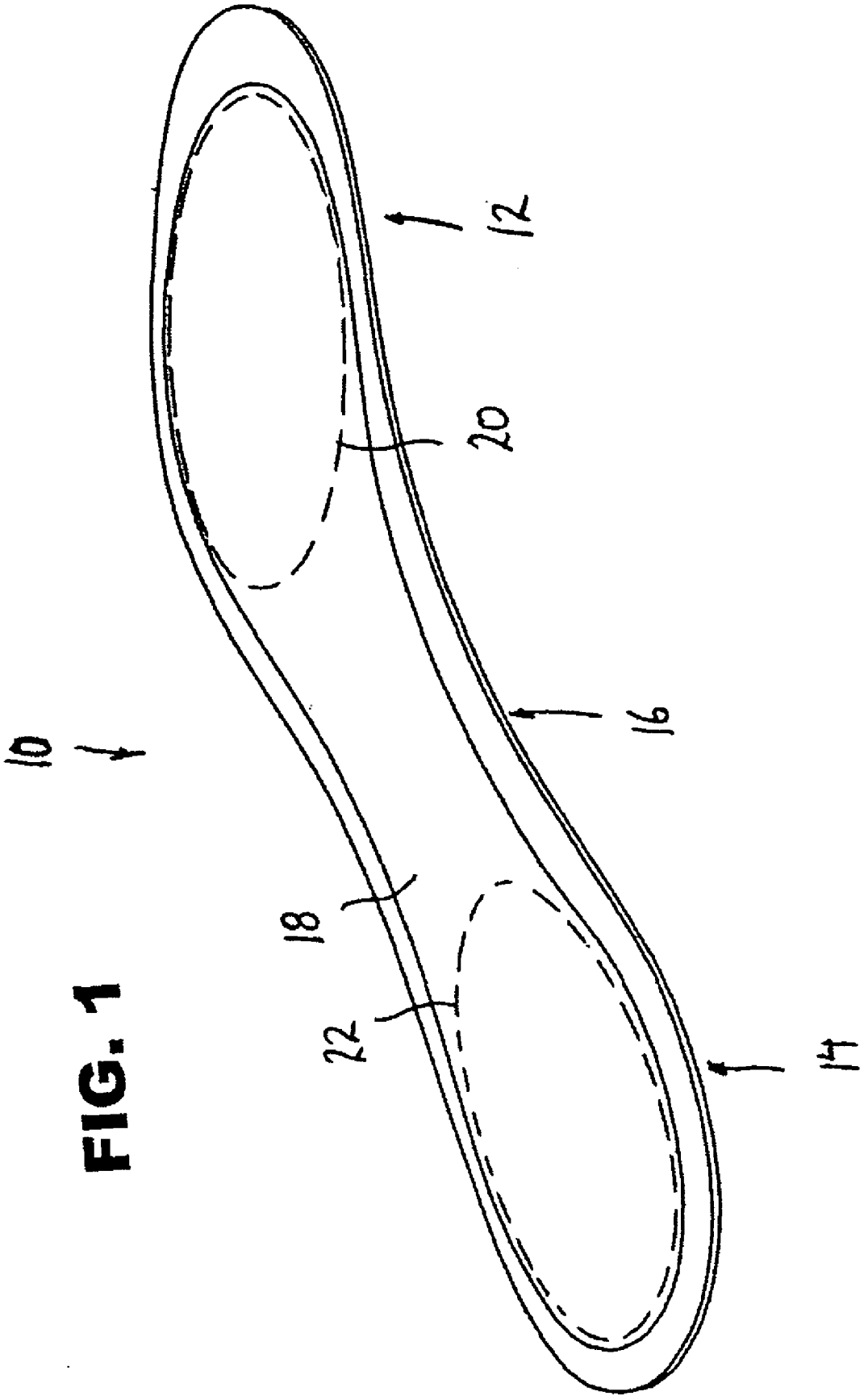


FIG. 1

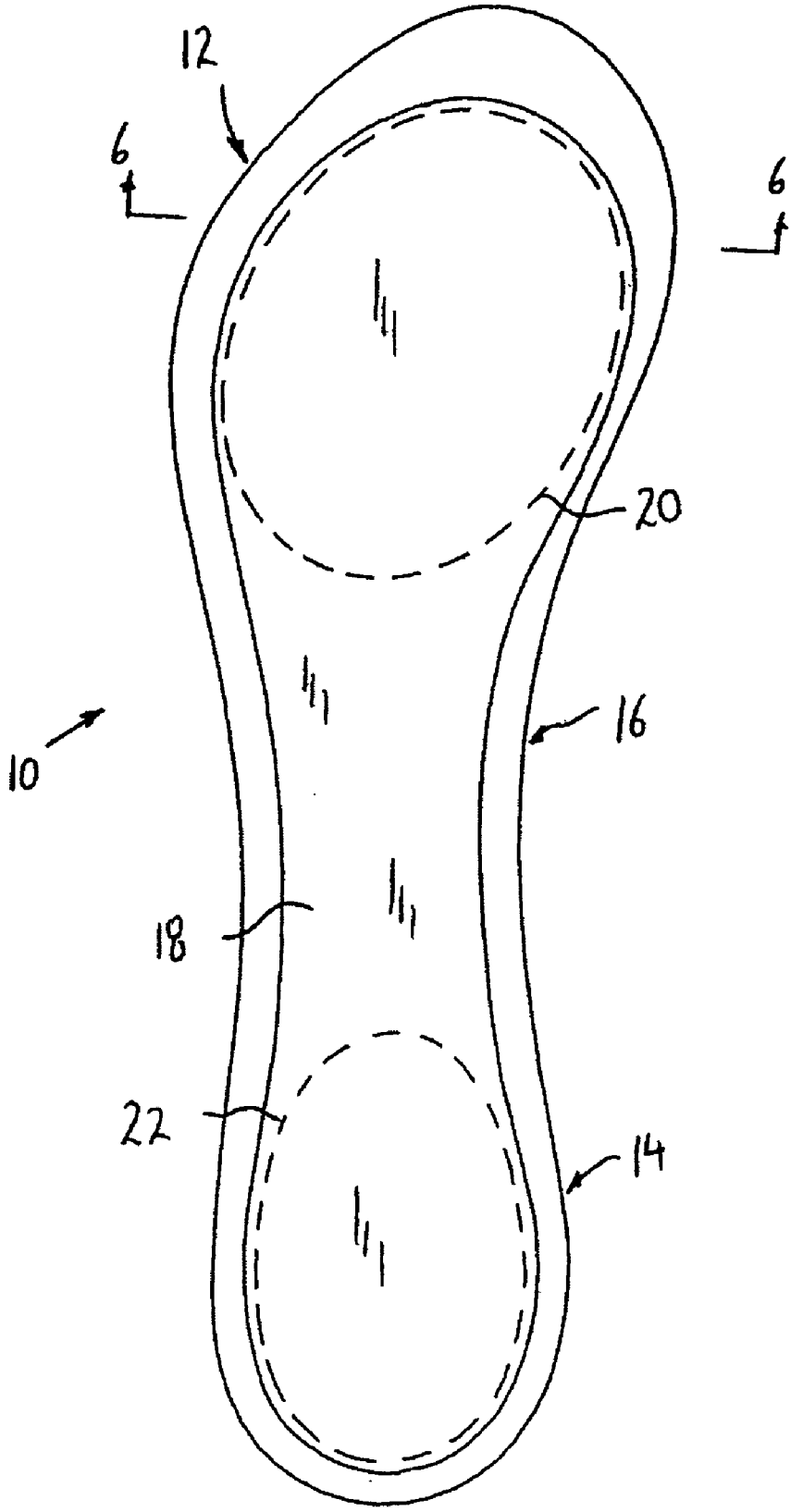


FIG. 2

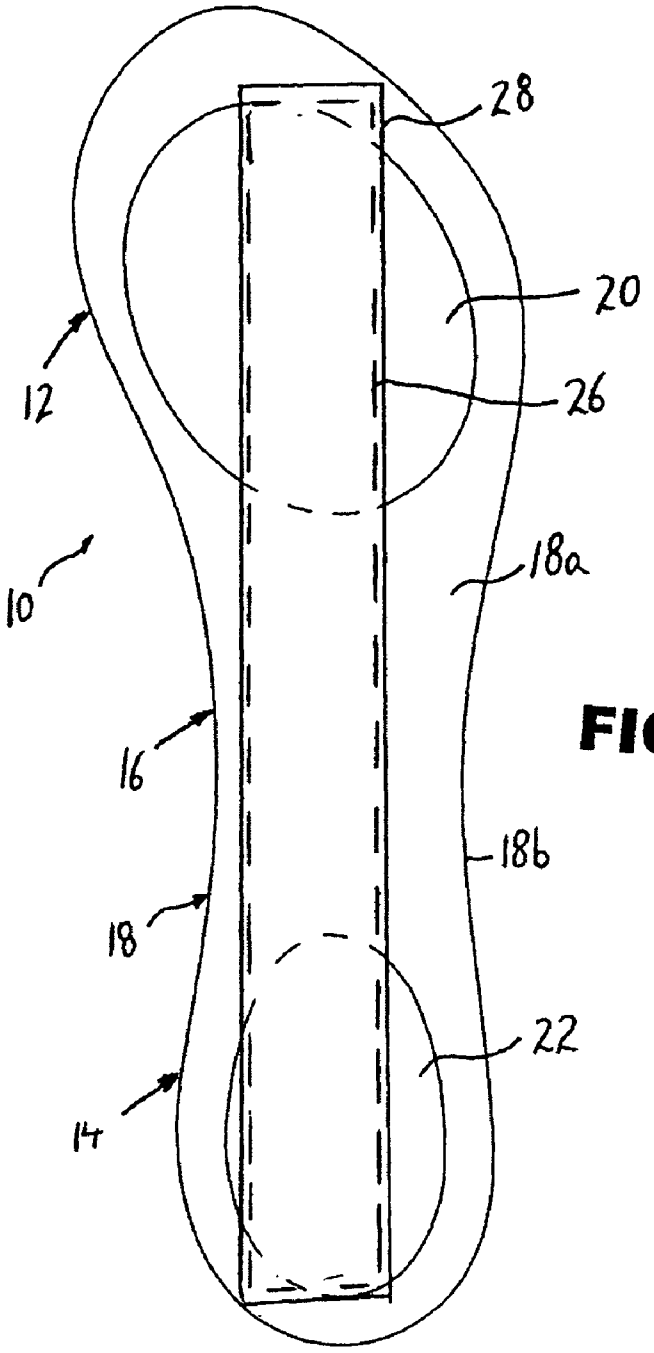


FIG. 3

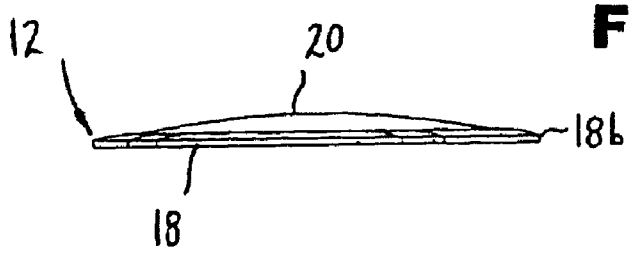


FIG. 4

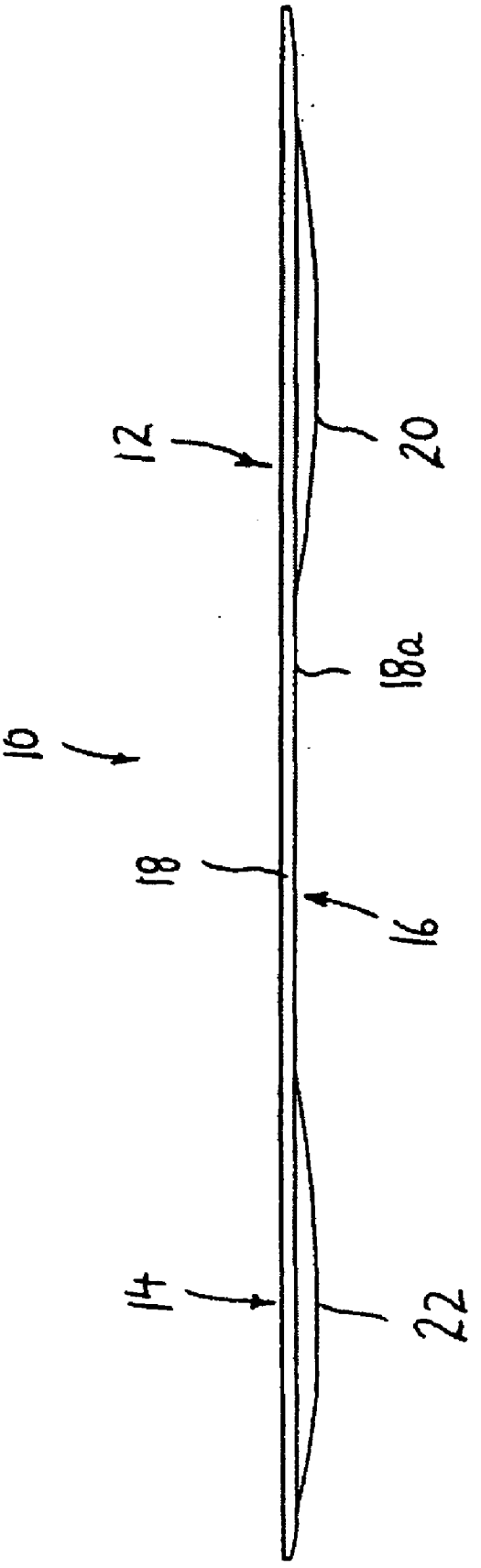


FIG. 5

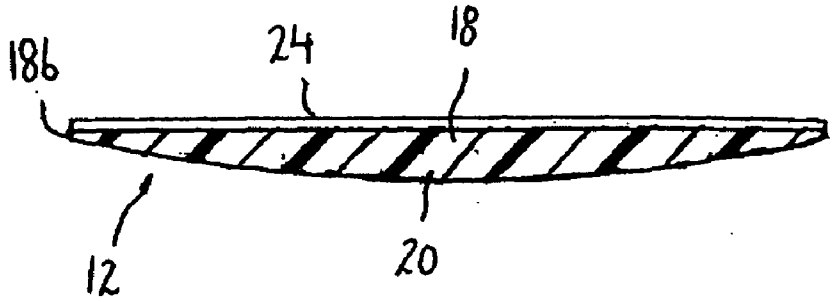


FIG. 6

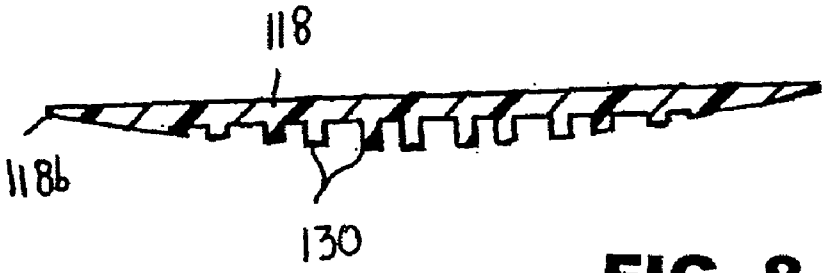


FIG. 8

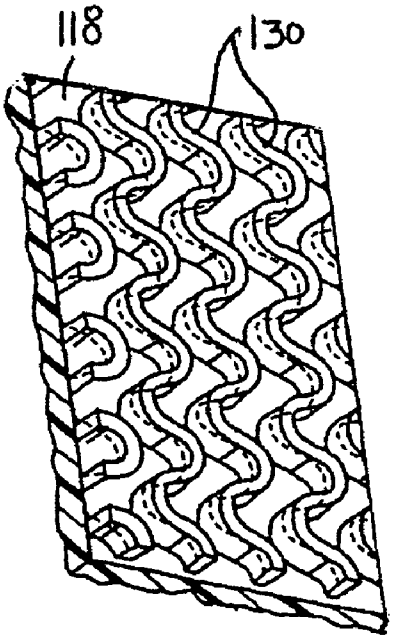


FIG. 9

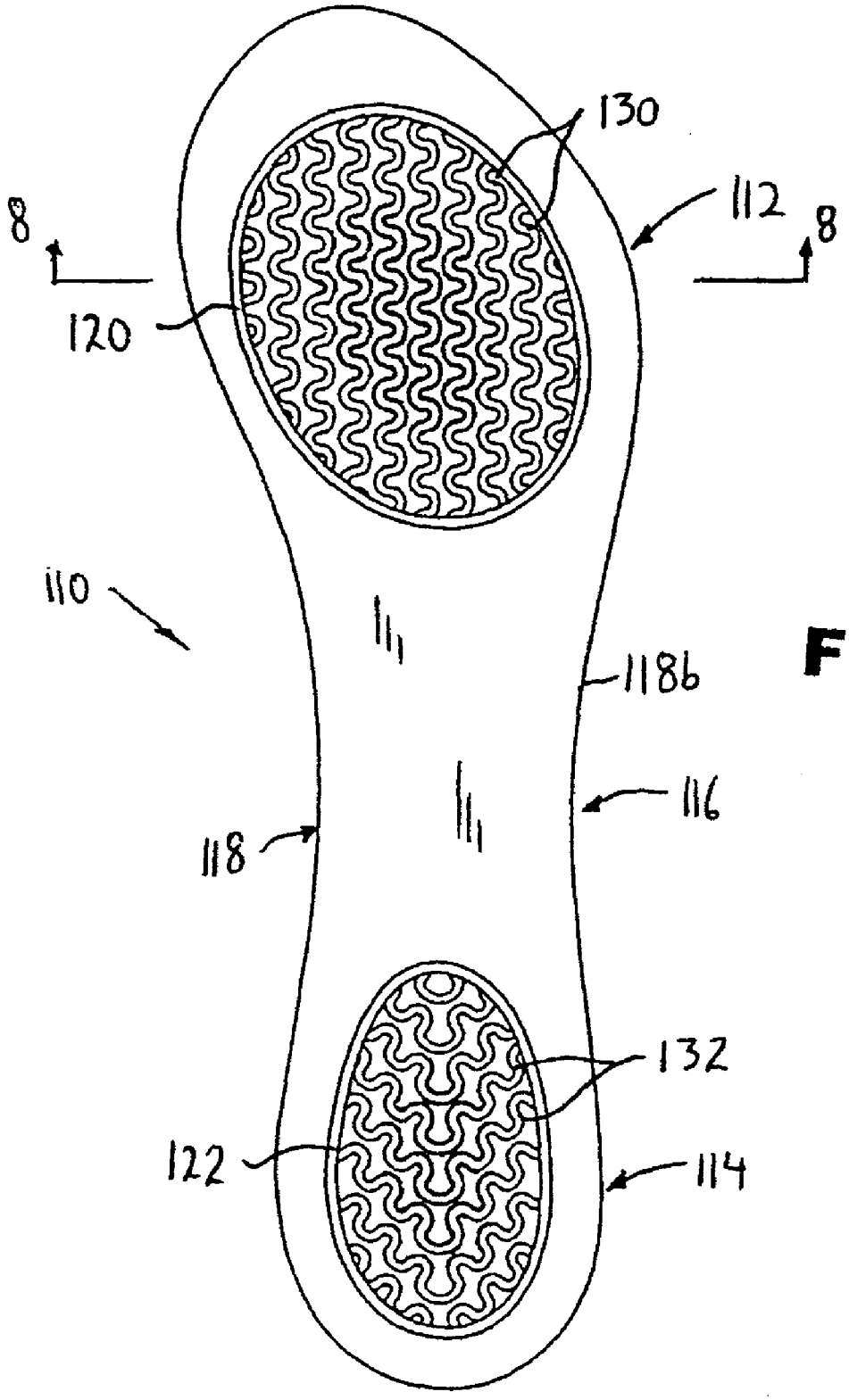


FIG. 7

INSOLE

BACKGROUND OF THE INVENTION

[0001] The present invention relates generally to shoe insoles or inserts, and more particularly, to insoles particularly adapted to be used with open style footwear.

[0002] Various types of insoles are known which fit within shoes in order to correct various foot problems, alleviate pain and otherwise provide more comfort to the wearer. Examples of such insoles are those sold by the assignee of the present invention under the trademark Dr. SCHOLL'S®.

[0003] However, when wearing open style footwear where the perimeter of the footwear is exposed, such as sandals, clogs, slides, slingbacks and the like, the boundary of the footwear is not sufficient to hold the insole in position during a normal gait. As a result, such insoles cannot be used with open style footwear.

[0004] Further, with conventional shoes, the wearer's foot is restricted by the upper which is connected to the outer and/or inner sole. As a result, any insole placed therein is also limited by the same upper. This means that the edges of the insole can be relatively thick, since the wearer will not notice such thickness at the edges. However, this is not true with open style footwear in which the wearer's foot is given greater freedom of movement. As a result, the wearer may notice a step between the relatively thick edge of the insole and the inner sole of the footwear, causing discomfort to the wearer.

SUMMARY OF THE INVENTION

[0005] Accordingly, it is an object of the present invention to provide an insole that overcomes the problems with the aforementioned prior art.

[0006] It is another object of the present invention to provide an insole that can be worn with open style footwear.

[0007] It is still another object of the present invention to provide an insole that remains in place in the open style footwear during use.

[0008] It is yet another object of the present invention to provide an insole that provides cushioning at the forefoot and heel areas.

[0009] It is a further object of the present invention to provide an insole that tapers in thickness toward the peripheral edges thereof.

[0010] It is a yet further object of the present invention to provide an insole that is easy and economical to make and use.

[0011] In accordance with an aspect of the present invention, an insole for insertion into footwear, includes at least one of a forefoot portion and a heel portion; at least one of the forefoot portion and heel portion being formed by a cushioning layer of a resilient material which provides a cushioning function, and a substantially dome shaped pillow extending down from the cushioning layer; and an arrangement for maintaining the insole in position in the footwear during a gait.

[0012] Preferably, the insole is a full length insole formed from the forefoot portion, the heel portion and a mid-foot portion connecting together the forefoot portion and the heel portion. More preferably, the cushioning layer extends through the forefoot portion, heel portion and mid-foot portion, and each of the forefoot portion and heel portion includes a substantially dome shaped pillow extending down from the cushioning layer thereat.

[0013] The cushioning layer and the pillow are formed from the same material as a unitary, one-piece structure.

[0014] In one embodiment, the cushioning layer and pillow are formed from a foam material. In such case, the arrangement for maintaining the insole in position can include either an adhesive at a lower surface of the insole, or for example, a non-permanent adhesive that permits removal of the insole from the footwear and repositioning the insole in the footwear, or alternatively, a high friction lower surface of the insole.

[0015] In another embodiment, the cushioning layer and pillow are formed from a viscoelastic gel material. In such case, the arrangement for maintaining the insole in position includes either a non-permanent adhesive at the lower surface, or a tackifier added to the gel material. Preferably, the gel material under the dome shaped pillow is formed by a plurality of spaced apart spring walls formed from the viscoelastic gel, the spring walls extending from a lower surface of the cushioning layer. The spring walls each have a height which is greatest at a center of the pillow and which tapers in height toward edges of the pillow. Preferably, each of the spring walls is formed in a generally sinusoidal wave shape.

[0016] Preferably, the cushioning layer has a substantially uniform thickness of about 2 mm and the pillow has a height less than about 3 mm above the uniform layer, and the cushioning layer tapers in thickness toward a periphery of the insole.

[0017] A top cover can also be secured to an upper surface of the cushioning layer.

[0018] The above and other features of the invention will become readily apparent from the following detailed description thereof which is to be read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] **FIG. 1** is a perspective view of a left insole according to a first embodiment of the present invention;

[0020] **FIG. 2** is a top plan view of the left insole;

[0021] **FIG. 3** is a bottom plan view of the left insole according to one embodiment;

[0022] **FIG. 4** is a front elevational view of the left insole **FIG. 4**;

[0023] **FIG. 5** is a right side elevational view of the left insole;

[0024] **FIG. 6** is a cross-sectional view of the left insole, taken along line **6-6** of **FIG. 2**;

[0025] **FIG. 7** is a bottom plan view of a left insole according to a second embodiment of the present invention;

[0026] **FIG. 8** is a cross-sectional view of the left insole of **FIG. 7**, taken along line **8-8** thereof; and

[0027] **FIG. 9** is a perspective view of a portion of the left insole of **FIG. 7**.

DETAILED DESCRIPTION

[0028] Referring to the drawings in detail, and initially to **FIGS. 1-6** thereof, a left insole **10** according to a first embodiment of the present invention is adapted to be placed in an article of footwear, as is well known. A right insole (not shown) is identical to left insole **10** and is a mirror image thereof.

[0029] Insole **10** was designed to fit the shape of a human left foot and therefore includes a curved toe or forefoot portion **12**, a heel portion **14**, and a mid-foot portion **16** which connects forefoot portion **12** and heel portion **14** together.

[0030] Insole **10** is formed by a generally planar cushioning layer **18**, having a generally dome shaped, lower pillow **20** extending from the lower surface of cushioning layer **18** at forefoot portion **12** and a generally dome shaped, lower pillow **22** extending from the lower surface of cushioning layer **18** at heel portion **14**.

[0031] In one embodiment, layer **18** and pillows **20** and **22** are formed as a unitary, one-piece layer of the same material, which is preferably a polyurethane foam. Specifically, in the first embodiment, insole **10** formed by cushioning layer **18** and pillows **20** and **22** is made from a resilient foam material that provides a conventional cushioning function. In effect, cushioning layer **18** and pillows **20** and **22** are a typical foam mechanical spring, shock absorption layer that cushions the foot, in order to decrease pressure.

[0032] Cushioning layer **18** and pillows **20** and **22** can be made from any suitable material including, but not limited to, any flexible material which can cushion and absorb the shock from heel strike on the insole. Suitable shock absorbing materials can include any suitable foam, such as but not limited to, cross-linked polyethylene, poly(ethylene-vinyl acetate), polyvinyl chloride, synthetic and natural latex rubbers, neoprene, block polymer elastomer of the acrylonitrile-butadiene-styrene or styrene-butadienestyrene type, thermoplastic elastomers, ethylenepropylene rubbers, silicone elastomers, polystyrene, polyurea or polyurethane; most preferably a polyurethane foam made from flexible polyol chain and an isocyanate such as a monomeric or prepolymerized diisocyanate based on 4,4'-diphenylmethane diisocyanate (MDI) or toluene diisocyanate (TDI). Such foams can be blown with freon, water, methylene chloride or other gas producing agents, as well as by mechanically frothing to prepare the shock absorbing resilient layer. Such foams advantageously can be molded into the desired shape or geometry. Non-foam elastomers such as the class of materials known as viscoelastic polymers, or silicone gels, which show high levels of damping when tested by dynamic mechanical analysis performed in the range of −50 degrees C. to 100 degrees C. may also be advantageously employed. A resilient polyurethane can be prepared from diisocyanate prepolymer, polyol, catalyst and stabilizers which provide a waterblown polyurethane foam of the desired physical attributes. Suitable diisocyanate prepolymer and polyol components include polymeric MDI M-10 (CAS 9016-87-9) and Polymeric MDI MM-103 (CAS 25686-28-6), both available from BASF, Parsippany, N.J.; Pluracol 945 (CAS 9082-00-2) and Pluracol 1003, both available from BASF, Parsippany, N.J.; Multrinol 9200, available from Mobay, Pittsburgh, Pa.; MDI diisocyanate prepolymer XAS 10971.02 and polyol blend XUS 18021.00 available from the Dow Chemical Company, Midland, Mich.; and Niax 34-28, available from Union Carbide, Danbury, Conn. These urethane systems generally contain a surfactant, a blowing agent, and an ultra-violet stabilizer and/or catalyst package. Suitable catalysts include Dabco 33-LV (CAS 280-57-9, 2526-71-8), Dabco X543 (CAS Trade Secret), Dabco T-12 (CAS 77-58-7), and Dabco TAC (CAS 107-21-1) all obtainable from Air Products Inc., Allentown, Pa.; Fomrez UL-38, a stannous octoate, from the Witco Chemical Co., New York, N.Y. or A-1 (CAS 3033-62-3) available from OSI Corp., Norcross, Ga. Suitable stabilizers include Tinuvin 765 (CAS 41556-26-7), Tinuvin 328 (CAS 25973-55-1), Tinuvin 213 (CAS 104810-48-2), Irganox 1010 (CAS 6683-19-8), Irganox 245 (CAS 36443-68-2), all available from the Ciba Geigy Corporation, Greensboro, N.C., or Givsorb UV-1 (CAS 057834-33-0) and Givsorb UV-2 (CAS 065816-20-8) from Givaudan Corporation, Clifton, N.J. Suitable surfactants include DC-5169 (a mixture), DC190 (CAS68037-64-9), DC197 (CAS69430-39-3), DC-5125 (CAS 68037-62-7) all available from Air Products Corp., Allentown Pa. and L-5302 (CAS trade secret) from Union Carbide, Danbury Conn. Alternatively, lower layer **18** can be a laminate construction, that is, a multilayered composite of any of the above materials. Multilayered composites are made from one or more of the above materials such as a combination of polyethylene vinyl acetate and polyethylene (two layers), a combination of polyurethane and polyvinyl chloride (two layers) or a combination of ethylene propylene rubber, polyurethane foam and ethylene vinyl acetate (3 layers).

[0033] Preferably, cushioning layer **18** and pillows **20** and **22** are made from a urethane molded material, and more preferably, a polyurethane elastomer material.

[0034] The materials of cushioning layer **18** and pillows **20** and **22** can be prepared by conventional methods such as heat sealing, ultrasonic sealing, radio-frequency sealing, lamination, thermoforming, reaction injection molding, and compression molding and, if necessary, followed by secondary die-cutting or in-mold die cutting. Representative methods are taught, for example, in U.S. Pat. Nos. 3,489, 594; 3,530,489 4,257,176; 4,185,402; 4,586,273, in the Handbook of Plastics, Herber R. Simonds and Carleton Ellis, 1943, New York, N.Y., Reaction Injection Molding Machinery and Processes, F. Melvin Sweeney, 1987, New York, N.Y., and Flexible Polyurethane Foams, George Woods, 1982, New Jersey, whose preparative teachings are incorporated herein by reference. For example, the innersole can be prepared by a foam reaction molding process such as taught in U.S. Pat. No. 4,694,589.

[0035] Pillows **20** and **22** extend downwardly below the lower surface **18***a* of cushioning layer **18** to provide extra cushioning at the ball of the foot area of forefoot portion **12** and at heel portion **14**. Preferably, cushioning layer **18** has a constant thickness throughout, although cushioning layer **18** preferably tapers in thickness toward the peripheral edge **18***b* of insole **10** in order to prevent a user from feeling an edge drop-off. For example, cushioning layer **18** can have a thickness of about 2 mm which tapers down to a thickness of about 1 mm at the peripheral edge **18***b* of insole **10**, and with the combined thickness of cushioning layer and either pillow **20** or **22** having a thickness of about 5 mm.

[0036] A top cover layer **24** can be secured to the upper surface of cushioning layer **18**, although such a top cover layer **24** is not required. In such case, top cover layer **24** can be made from any suitable material including, but not limited to, fabrics, leather, leatherboard, expanded vinyl foam, flocked vinyl film, coagulated polyurethane, latex foam on scrim, supported polyurethane foam, laminated polyurethane film or in-mold coatings such as polyurethanes, styrene-butadiene-rubber, acrylonitrile-butadiene, acrylonitrile terpolymers and copolymers, vinyls, or other acrylics, as integral top covers. Desirable characteristics of top cover layer **24** include good durability, stability and visual appearance. It is also desirable that top cover layer **24** have good flexibility, as indicated by a low modulus, in order to be easily moldable. The bonding surface of top cover layer **24** should provide an appropriate texture in order to achieve a suitable mechanical bond to the upper surface of cushioning layer **18**. Preferably, the material of top cover layer **24** is a fabric, such as a brushed knit laminate top cloth (brushed knit fabric/urethane film/non-woven scrim cloth laminate) or a urethane knit laminate top cloth. Preferably, top cover layer **24** is made from a polyester fabric material, and preferably has a thickness of about 0.02 inch.

[0037] It will be appreciated that insole **10** is preferably a full length insole, that is, extends along the entire foot. Typically, insole **10** would be sized corresponding to shoe sizes and would be provided in sized pairs. Alternatively, insole **10** may be trimmed to the requirements of the user. In this regard, arcuate pattern trim lines (not shown) may be formed on the lower surface of forefoot portion **12** of insole **10**, which are representative of various sizes of the human foot. The pattern trim lines may be imprinted by conventional printing techniques, silkscreening and the like. As an alternative, the pattern trim lines may be formed as shallow grooves, or be perforated, so that a smaller size insole may be separated by tearing along the appropriate trim lines, which tearing operation is facilitated by the inclusion of perforations. Thus, forefoot portion **12** can be trimmed so that forefoot portion **12** fits within the toe portion of open style footwear.

[0038] Alternatively, a pattern trim line can be provided on the lower surface of cushioning layer **18** to cut around the thong of some types of open style footwear, if necessary.

[0039] Alternatively, insole **10** may be a ¾ length insole designed to fit a range of shoe sizes without the need of trimming. In this regards, insole **10** extends along the approximately ¾ of the foot, from the heel to the ball of the foot.

[0040] In order to secure insole **10** to the open style footwear, an area of adhesive **26**, for example, by a double sided adhesive tape, is formed along the length of the lower surface of cushioning layer **18**, and is covered by a release sheet **28**. In this manner, a user merely removes release sheet **28** and adheres insole **10** to the footwear. Adhesive **26** can be a permanent adhesive or a release adhesive that permits removal and reapplying or repositioning of insole **10** in the footwear.

[0041] Alternatively, lower surface **18***a* of cushioning layer **18** can be provided as a high friction surface to maintain insole **10** in position in the footwear. For example, synthetic rubber adhesive coating (not shown) can be added to lower surface **18***a* of cushioning layer **18** for this purpose.

[0042] Accordingly, with insole **10**, cushioning pillows **20** and **22** are provided at the ball of the foot area of forefoot portion **12** and at heel portion **14** where most of the impact and forces occur during a gait. Further, such insole **10** fits within open style footwear, and will remain in position in such open style footwear during wearing by the user. At the same time, however, the wearer, because of the taper at the peripheral edge thereof, does not feel any edge drop-off, thereby enhancing comfort to the wearer.

[0043] Referring now to **FIGS. 7-9**, a left insole **110** according to a second embodiment of the present invention will now be described. A right insole (not shown) is identical to left insole **110** and is a mirror image thereof.

[0044] Insole **110** has the same shape as insole **10** of **FIGS. 1-6**, and therefore includes a curved toe or forefoot portion **112**, a heel portion **114**, and a mid-foot portion **116** which connects forefoot portion **112** and heel portion **114** together.

[0045] Insole **110** is formed by a generally planar cushioning layer **118**, having a generally dome shaped, lower pillow **120** extending from the lower surface of cushioning layer **118** at forefoot portion **112** and a generally dome shaped, lower pillow **122** extending from the lower surface of cushioning layer **118** at heel portion **114**.

[0046] In this embodiment, layer **118** and pillows **120** and **122** are formed as a unitary, one-piece layer of a gel material. The gel material can be of the same general type described in U.S. Pat. No. 6,598,321 to the same assignee herein, and the entire disclosure of which is incorporated herein by reference.

[0047] Thus, gel layer **118** and pillows **120** and **122** can be made from a non-foam elastomer such as the class of materials known as viscoelastic polymers or silicone gels, which show high levels of damping when tested by dynamic mechanical analysis performed in the range of −50 degree Celsius to 100 degrees Celsius. Because the mechanical properties of the gel are more viscous than elastic, the gel provides a high energy absorption. Gels that can be used according to the present invention are thermoplastic elastomers (elastomeric materials), such as materials made from many polymeric families, including but not limited to the Kraton family of styrene-olefin-rubber block copolymers, thermoplastic polyurethanes, thermoset polyurethanes, thermoplastic poly olefins, polyamides, polyureas, polyesters and other polymer materials that reversibly soften as a function of temperature. The preferred elastomers are a Kraton block copolymer of styrene/ethylene-co-butylene/styrene or styrene/butadiene/styrene with mineral oil incorporated into the matrix as a plasticizer, or polyurethane gels.

[0048] Insole **110** can be secured to the open style footwear by using the tack properties of the gel. In this regard, it is preferred that the tack of the gel is enhanced by incorporating a tackifier into the gel composition to increase the friction/tack of the gel surface. Suitable tackifiers include a petroleum hydrocarbon resin sold under the designation I-Mark V by Idemitsu Kosan Co., Ltd. of Tokyo, Japan; the rosin sold under the trademark ASYLVALITE® under designation RE 80 for SEBS gels; and phenolsulfonic acid ester sold under the trademark AMESAMOLL® for a polyurethane (PU) gel. The desired tack is preferably between 120 and 250 grams, as determined by a probe tack tester sold under the trademark APOLYKEN®, at one second contact time.

[0049] Preferably, dome shaped pillows **120** and **122** are formed by thin and spaced apart elastic and resilient spring walls **130** and **132** which are formed integrally as one piece with cushioning layer **118** in a repeating order, extending down from the lower surface of layer **118** at forefoot portion **112** and heel portion **114**.

[0050] Thin spring walls **130** extend substantially in the lengthwise direction of insole **110** from the forward end to the rearward end of pillow **120**. The height of spring walls **130** extends down such that spring walls **130** located toward the center of pillow **120** have a greater height than spring walls **130** located toward the edges of pillow **120**, with spring walls **130** therebetween tapering down, as shown best in **FIG. 7**. In this manner, the lower ends of spring walls **130** in pillow **120** form a substantially dome shape. The overall thicknesses or heights of cushioning layer **118** and pillows **120** and **122** are similar to those of cushioning layer **18** and pillows **20** and **22**, as described above. As a result, the height of spring walls **130** at the center of each pillow can reach a height of about 2-3 mm above the uniform layer, and the constant or uniform thickness or height of cushioning layer **118** can be about 2 mm.

[0051] In like manner, thin elastic and resilient spring walls **132** are formed in a V-shaped pattern in pillow **122** at heel portion **114**. Spring walls **132** are formed with the same varying height as spring walls **130**. Thus, the heights of spring walls **132** extend down such that spring walls **132** located toward the center of pillow **122** have a greater height than spring walls **132** located toward the edges of pillow **122**, with spring walls **132** therebetween tapering down. In this manner, the lower ends of spring walls **132** in pillow **122** form a substantially dome shape. The overall thicknesses or heights of cushioning layer **118** and pillows **120** and **122** are similar to those of cushioning layer **18** and pillows **20** and **22**, as described above. As a result, the heights of spring walls **132** at the center of each pillow can reach a height of about 2-3 mm, and the constant or uniform thickness or height of cushioning layer **118** can be about 2 mm.

[0052] In the embodiment of **FIGS. 7-9**, thin, spaced apart spring walls **130** and **132** are formed as parallel, spaced apart, sinusoidal shaped wave patterns. However, the present invention is not so limited, and can be formed as any of the embodiments described in U.S. Pat. No. 6,598,321. Further, the spacing between thin spring walls **130**, **132**, the number of spring walls **130**, **132**, the pitch of the sinusoidal wave patterns in the spring walls **130**, **132**, etc. may also be varied.

[0053] As with cushioning layer **18**, cushioning layer **118** preferably tapers in thickness toward the peripheral edge **118***b* of insole **110** in order to prevent a user from feeling an edge drop-off. For example, cushioning layer **118** can have a uniform thickness of 2 mm which tapers down to a thickness of about 1 mm at the peripheral edge **118***b* of insole **110**.

[0054] A top cover layer (not shown), which is the same as top cover layer **24**, can be secured to the upper surface of cushioning layer **118**, although such a top cover layer is not required.

[0055] Although the present invention uses the term insole, it will be appreciated that the use of other equivalent or similar terms such as innersole or insert are considered to be synonymous and interchangeable, and thereby covered by the present claimed invention.

[0056] The present invention is also applicable to insoles other than full length insoles, such as heel cushions and ball of foot cushions.

[0057] Further, although the present invention has been discussed in relation to a removable insole, it can be incorporated as a permanent inner sole in footwear, such as a shoe or the like.

[0058] Having described specific preferred embodiments of the invention with reference to the accompanying drawings, it will be appreciated that the present invention is not limited to those precise embodiments and that various changes and modifications can be effected therein by one of ordinary skill in the art without departing from the scope or spirit of the invention as defined by the appended claims.

What is claimed is:

1. An insole for insertion into footwear, comprising:

a) at least one of:

i) a forefoot portion, and

ii) a heel portion;

b) at least one of said forefoot portion and heel portion being formed by:

i) a cushioning layer of a resilient material which provides a cushioning function, and

ii) a substantially dome shaped pillow extending down from said cushioning layer; and

c) an arrangement for maintaining said insole in position in said footwear during a gait.

2. An insole according to claim 1, wherein said insole is a full or ¾ length insole formed from said forefoot portion, said heel portion and a mid-foot portion connecting together said forefoot portion and said heel portion.

3. An insole according to claim 2, wherein said cushioning layer extends through said forefoot portion, heel portion and mid-foot portion, and each of said forefoot portion and heel portion includes a said substantially dome shaped pillow extending down from said cushioning layer thereat.

4. An insole according to claim 1, wherein said cushioning layer and said pillow are formed from the same material as a unitary, one-piece structure.

5. An insole according to claim 1, wherein said cushioning layer and pillow are formed from a foam material.

6. An insole according to claim 5, wherein said arrangement for maintaining said insole in position includes an adhesive at a lower surface of the insole.

7. An insole according to claim 6, wherein said adhesive is a release adhesive that permits removal of the insole from the footwear and repositioning the insole in the footwear.

8. An insole according to claim 5, wherein said arrangement for **10** maintaining said insole in position includes a high friction lower surface of the insole.

9. An insole according to claim 1, wherein said cushioning layer and pillow are formed from a viscoelastic gel material.

10. An insole according to claim 9, wherein said arrangement for maintaining said insole in position includes a tackifier added to said gel material.

11. An insole according to claim 9, wherein said gel material is formed by a plurality of spaced apart spring walls formed from said viscoelastic gel, said spring walls extending from a lower surface of said cushioning layer.

12. An insole according to claim 11, wherein said spring walls each have a height which is greatest at a center of said pillow and which tapers in height toward edges of said pillow.

13. An insole according to claim 11, wherein each of said spring walls is formed in a generally sinusoidal wave shape.

14. An insole according to claim 1, wherein said cushioning layer has a substantially uniform thickness of about 2 mm and said pillow has a height less than about 3 mm.

15. An insole according to claim 1, wherein said cushioning layer tapers in thickness toward a periphery of said insole.

16. An insole according to claim 1, further comprising a top cover secured to an upper surface of said cushioning layer.

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