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(54) Shoe and sole structure with fluid filled inserts.

(57) A shoe is comprised of an upper and a sole structure attached to the upper. The sole structure has an outsole and a midsole. The outsole has an upper surface, a lower surface and sidewalls extending upwardly from at least a portion of the upper surface. The sidewalls and the portion of the outsole extending between the sidewalls are made of a clear material, and the midsole includes a fluid-filled insert, which is positioned in alignment with the clear material to provide visibility of the bottom and sides of the fluid-filled insert. The fluid-filled insert is positioned by a series of longitudinally and transversely extending grooves formed in the upper surface of the outsole, with lands positioned between the transversely extending grooves which engage with corresponding recesses formed on the lower surface of the insert.

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TECHNICAL FIELD

The present invention relates to shoes and more particularly to a sole structure for shoes. The sole structure includes a fluid-filled insert secured within it in a manner which maximizes the effectiveness and visibility of the insert.

BACKGROUND OF THE INVENTION

The sole of a shoe must provide traction, protection, and a durable wear surface. The considerable forces generated by running require that the sole of a running shoe provide enhanced protection and shock absorption for the foot and leg. It is also desirable to have enhanced protection and shock absorption for the foot and leg in all types of footwear. Accordingly, the sole of a running shoe typically includes several layers, including a resilient, shock absorbent material as a midsole and a ground contacting outer sole or outsole, which provides both durability and traction. This Is particularly true for training or jogging shoes designed to be used over long distances and over a long period of time. The sole also provides a broad, stable base to support the foot during ground contact.

The typical midsole uses one or more materials or components which affect the force of impact in two important ways, i.e. through shock absorption and energy absorption. Shock absorption involves the attenuation of harmful impact forces. A midsole with high shock absorbing characteristics thus can provide enhanced foot protection, assuming other factors such as stability are not compromised. Energy absorption is simply the general soaking up of both impact and useful propulsive forces. Thus, a midsole with high energy absorbing characteristics has relatively lower resiliency, and generally does not return much of the energy placed into a midsole at foot impact. This results in less efficiency in foot motion and a "flat" feel. Conversely, a midsole with low energy absorbing characteristics has relatively higher resiliency, and generally returns more of the energy placed into a midsole at foot impact. The terms energy absorbing and shock absorbing have been used in the past without precise delineation between these effects, i.e., at times referring to one or the other of these effects and at other times referring to the combination of these effects. Since both of these effects relate to independent actions of a midsole operating on the forces of foot impact, the term impact response will be used herein to describe the combination of these effects; and the term cushion or cushioning will be used as a convenient way of describing the accomplishment of these two effects by a sole unit or structure of the present invention.

It is desirable to design a sole unit with proper impact response wherein both adequate shock absorption and resiliency are taken into account. Fluid filled inserts of the type disclosed In U.S. patent Nos. 4,183,156 and 4,219,945 to Marion F. Rudy provide a cushioning effect for the foot which is superior to foamed polymeric materials that have been used in the past as cushioning materials. The inserts disclosed in the '156 and '945 patents provide an appropriate balance of shock absorption and resiliency. Another advantage of these inserts is that they exhibit good hysteresis, i.e., can be deformed and still come back to their original shape. Even though the deforming of the insert occurs repeatedly, the insert will still return to its original shape. This is superior to foamed polymeric materials such as polyurethane (PU) and ethyl vinyl acetate (EVA) foams, as well as solid plastics such as HYTREL®, which are currently used in athletic shoes, since these materials may not return to their original shape after prolonged compressive use.

The sole structure in the '156 and '945 patents forms a fluid-filled insert or insole barrier member of an elastomer material having a multiplicity of preferably intercommunicating, fluid-containing chambers inflated to a relatively high pressure by a gas having a low diffusion rate through the elastomer material, the gas being supplemented by ambient air diffusing through the elastomer material into the chambers to increase the pressure therein, the pressure remaining at or above its initial value over a period of years. The fluid-filled insert is incorporated into the insole structure, in the '156 patent, by placement within a cavity below the upper, e.g. on top of a midsole layer and within sides of the upper or midsole layer. A ventilated moderator formed of a sheet of semi-flexible material is placed over the fluid-filled insert.

A different technique is used in the '945 patent for incorporating the fluid-filled insert into the shoe. In this patent, the insert is encapsulated within a yieldable foam material, which functions as a bridging moderator filling in irregularities of the insert, providing a substantially smooth and contoured surface for supporting the foot and forming an easily handled structure for attachment of an upper. The encapsulating foam material also functions to hold the fluid-filled insert in position with the midsole. When the insert is used in combination with an encapsulating foam, the impact response characteristics of the sole structure formed by the combination is determined or set by the combined effects of the two elements. Factors such as the relative volume of the two elements, the type and density of foam material used, and the pressure of the gas contained in the insert, varies the amount each element contributes to the impact response

function of the sole structure.

Parker et al., U.S. Patent No. 4,817,304, discloses a shoe which uses the combination of a fluid-filled insert and encapsulating foam material, as disclosed in the '945 Rudy patent, but which provides a mechanism for adjusting the impact response of this combination. The adjustment mechanism includes a gap formed on at least one side of the insert to allow the fluid-filled insert to expand. This expansion allows the effect of the insert to dominate the impact response of the sole structure in the area adjacent the gap. While such localized impact response dominance is important to adjusting the impact response of the sole structure, in view of the advantageous characteristics of the '945 patent fluid-filled inserts, it would be desirable to have the impact response of the inserts dominate over a broader area. One aspect of the sole structure in accordance with the present invention is directed to this objective.

Another aspect of the sole-structure disclosed in the '304 Parker et al. patent is directed to the visibility of the fluid-filled insert through the gap, as well as of internal portions of the sole through the transparent material of the fluid-filled insert. The degree of visibility is limited by the size of the gap, which itself is limited since the foam material of the midsole must perform the function of positioning and holding the fluid-filled insert within the sole structure. Visibility of the internal portions of a sole structure allows a person to see how a midsole functions. Internal visibility is particularly desirable when fluid-filled inserts are used in the sole structure. Millions of athletic shoes have been sold commercially with fluid-filled inserts of the type disclosed in the '945 and '304 patents, and failures of the inserts in these shoes have been extremely rare. Nevertheless, the ability of a user to see that no leaks, aneurysms or other defects have formed in the insert enhances the confidence of the user in the performance of the shoe. The gap used in the midsole of the '304 Parker et al. patent provides a degree of such visibility, however, the sole structure of the present invention greatly enhances internal visibility.

Sole structures which allow internal visibility are disclosed in other patents such as U.S. Patent No. 4,391,048 to Lutz and U.S. Patent No. 4,845,863 to Yung-Mao. In Lutz '048 visibility is provided through a small window in the bottom of an outsole formed of a transparent or translucent insert, or of a section of smaller thickness in an at least partially translucent outsole. Very limited visibility is provided through such a small window. In Yung-Mao '863 visibility is provided through a relatively small aperture formed in either the bottom of the outsole or the side of the midsole. The viewing aperture is filled in with a transparent material. One potential disadvantage of providing visibility through an aperture in the sole structure is that removal of the material of the sole structure for the aperture weakens the sole structure. This is not the case with shoes made according to the teachings of the '304 Parker et al. patent, since a fluid-filled insert with superior cushioning capability fills at least a portion of the aperture. However, in other systems where the aperture remains unfilled, or is filled with a rigid or semi-rigid transparent plastic material, the cushioning capability of the sole can be adversely effected. Another aspect of the sole structure in accordance with the present invention is to provide a broad degree of visibility of internal portions of the sole without the use of apertures and without adversely affecting the cushioning characteristics of the midsole.

SUMMARY OF THE INVENTION

The present invention relates to a shoe which incorporates an improved sole structure. The sole structure has a configuration which permits a fluid-filled insert to dominate the impact response characteristics of the sole structure in the area of the insert. The sole structure also provides for a broad degree of visibility of internal portions of a midsole.

The sole structure includes an outsole and a fluid-filled insert. The outsole has a lower surface with a tractive surface for producing frictional contact and an upper surface. The outsole upper surface has a mechanism for positioning the fluid-filled insert in the sole structure, and the fluid-filled insert has a mechanism for cooperating with the positioning mechanism.

In a preferred embodiment, the positioning mechanism includes a plurality of projections extending from the upper surface of the outsole with corresponding or mating recesses in the bottom surface of the fluid-filled insert cooperating with the projections. A preferred configuration of the projections are lands extending between a series of transversely extending grooves along the upper surface of the outsole. The positioning mechanism may also preferably include a pair of longitudinally extending grooves on either side of the transversely extending grooves, and an upwardly extending side wall. By utilizing the positioning mechanism of the present invention, the lower surface of the fluid-filled insert can be placed in direct contact with the upper surface of the outsole. The impact responsiveness of the fluid-filled insert is thus attained more directly than if a foam material were interposed between the outsole and the fluid-filled insert. Furthermore, since the fluid-filled insert is secured in position by the positioning mechanism on the outsole, foam material is not required for this function. The fluid-filled insert thus can occupy

a major portion of the volume of the sole structure in the area where the insert is located, thereby dominating the impact response of the sole structure in that area.

The outsole is formed as an integral one-piece outsole, and a section of the outsole is formed of a clear material. The clear material preferably extends along the bottom and around a portion of two sides of the sole structure. In this manner, the bottom and both sides of the midsole surrounded by the clear section of the outsole are visible. The visible section of the midsole is preferably the fluid-filled insert which is thus visible over a 180° extent. The fluid-filled insert is also preferably formed of a flexible fluid-containing wall made of a clear material. Visibility over this broad area is accomplished by utilizing a single-piece integral outsole with a clear section of material, and not by forming an aperture in the sole structure, which tends to weaken the sole structure and limit the area of visibility.

Various advantages and features of novelty which characterize the invention are pointed out with particularity in the claims annexed hereto and forming a part hereof. However, for a better understanding of the invention, its advantages, and objects obtained by its use, reference should be had to the drawings which form a further part hereof, and to the accompanying descriptive matter, in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a side view of an athletic shoe embodying the present invention;

Figure 2 is a bottom view of a portion of the sole structure;

Figure 3 is an exploded view showing the heel portion of the sole structure with the outsole and insert separated; and

Figure 4 is a sectional view of the sole structure taken generally along line 4-4 of Figure 2.

DETAILED DESCRIPTION

Referring to the drawings, wherein like reference numerals indicate like elements, an article of footwear in accordance with the present invention, such as a running shoe, is generally shown as 10 in Figure 1. Shoe 10 includes a sole structure 12 and an upper 14 attached thereto. Upper 14 can be of any conventional design, while sole structure 12 incorporates the features of the present invention. Sole structure 12 includes a force absorbing or cushioning midsole 16 and a flexible, wear resistant outsole 18. Midsole 16 includes an inner member or insert 20 and an outer member 22.

Outsole 18 is preferably made of a conventional solid natural or synthetic rubber with a density typically greater than 1. The material of outsole 18 should have a hardness greater than that of a typical prior art foam midsole, and should also be abrasion resistant. Outsole 18 is also relatively thinner, e.g., one-quarter inch or less, than a typical cushioning midsole in the heel area, which can have a thickness between one-half and one inch. While the construction of shoe 10 is shown as that of a typical running shoe, sole structure 12 could be used with other types of shoes, for example, tennis, basketball or walking shoes.

Outer member 22 is formed of a cushioning foam material and extends over the upper surface of outsole 18 in the area where insert 20 is not located. As seen in Figure 4, the foam material of outer member 22 extends over only the top surface of insert 20 and fills In valleys or grooves 27 along the top surface.

Referring to Figure 3, insert 20 has a sealed perimeter and is inflated with a fluid, preferably gaseous, medium, thereby being compliant and resilient. Insert 20 is thus preferably a fluid-filled insert. Insert 20 has an upper surface 24, a lower surface 26, side surfaces 28, 30, a front surface 32 and a back surface 34 all spaced from one another when insert 20 is inflated. Upper surface 24 is connected to the lower surface 26 at preselected areas 41 within the perimeter of insert 20, which when inflated with gas takes on the configuration illustrated in Figure 3, wherein a plurality of chambers are formed. The chambers include lengthwise or longitudinally extending tubes 21, 23 adjacent each of the lateral and medial sides, with transverse tubes 25 connecting the longitudinal tubes. Positioned between the transverse tubes 25 are grooves 27, the base of which is defined by connection areas 41. The function of grooves 27 will be more fully explained herein below.

In a preferred form of the invention, insert 20 is formed of a material as disclosed in U.S. Patent Nos. 4,183,156 and 4,219,945 to Marion F. Rudy and the gas that fills the insert is selected from the group of gases likewise mentioned in the Rudy patents, the disclosures of which are hereby incorporated by reference. That is, the wall material of the insert can be selected from the following materials: polyurethane, polyester elastomer, fluoroelastomer, chlorinated polyethylene, polyvinyl chloride; chlorosulfonated polyethylene, polyethylene/ethylene vinyl acetate copolymer, neoprene, butadiene acrylonitrile rubber, butadiene styrene rubber, ethylene propylene polymer, natural rubber, high strength silicone rubber, low density polyethylene, adduct rubber, sulfide rubber, methyl rubber, thermo-plastic rubbers.

One of the above materials which has been

found to be particularly useful in manufacturing the inflated insert is polyurethane film.

Gases, also as disclosed in the Rudy patent, which have been found to be usable in the pressure retention within the chambers are as follows: hexafluoroethane, sulfur hexafluoride, perfluoropropane, perfluorobutane, perfluoropentane, perfluorohexane, perfluoroheptane, octafluorocyclobutane, perfluorocyclobutane, hexafluoropropylene, tetrafluoromethane, monochloropentafluoroethane, 1,2-dichlorotetrafluoroethane, 1,1,2 trichloro-1,2,2 trifluoroethane, chlorotrifluoroethylene, bromotrifluoromethane, and monochlorotrifluoromethane. These gases may be termed supergases.

The two most desirable gases for use in the insert are hexafluorolethane and sulfur hexafluoride.

Various foam materials are used to make up the balance of the midsole 16, i.e., outer member 22. These foam materials, also as disclosed in the Rudy patents, include the following: polyether urethane, polyester urethane, ethylene-vinylacetate/polyethylene copolymer, polyester elastomer (Hytrel), ethylenevinylacetate/polypropylene copolymer, polyethylene, polypropylene, neoprene, natural rubber, dacron/polyester, polyvinylchloride, thermoplastic rubbers, nitrile rubber, butyl rubber, sulfide rubber, polyvinyl acetate, methyl rubber, buna N., buna S., polystyrene, ethylene propylene, polybutadiene, polypropylene, silicone rubber.

The most satisfactory of the above-identified elastic foam materials are the polyurethane, ethylenevinylacetate/polyethylene copolymer, ethylene vinylacetate/polypropylene copolymer, neoprene and polyester.

Outsole 18 is provided with an outer surface having a series of tractive elements 15 positioned thereon, Figures 1 and 2, and on the upper surface having a series of transverse recesses or grooves 17 and transverse projections or lands 19 positioned between the grooves 17, Figures 3 and 4. A pair of lengthwise or longitudinally extending grooves 13 are formed on the outer sides of the upper surface of the sole and connect with the transverse extending grooves 17. These grooves 13, 17 and lands 19 correspond in shape to the outer surface of tubes 21, 23 and 25 and grooves 27 created along the bottom surface of insert 20 when it is inflated with a gaseous medium. The cooperation or mating between the grooves 13, 17 and lands 19 of outsole 18 with tubes 21, 23 and 25 and grooves 27 of insert 20 help to position and hold insert 20 within the sole structure during the manufacturing process and also during use of the shoe. While one specific configuration of mating grooves and projections in the insert and outsole are shown, other configurations of insert and outsole with mating recesses and projections could be used. For example, an insert formed with dot connections as disclosed in the '156 Rudy patent could be used. Also, while inserts of the type disclosed in the '156 and '945 Rudy patents are preferred because of their advantageous cushioning properties other types of liquid or gas filled inserts, or other midsole inserts, could be used. This is particularly true where the visibility aspect of the present invention takes precedence over the cushioning aspect.

Two sidewalls 11, designed to cooperate with fluid-filled insert 20, extend from the upper side surfaces of outsole 18. Sidewalls 11, thus, have interior surfaces which correspond or mate with the exterior surfaces of the longitudinal sides of insert 20 along tubes 21 and 23. The combination of sidewalls 11, grooves 13 and 17 and lands 19 allows insert 20 to be firmly secured in sole structure 12 without surrounding substantially all of the insert with an encapsulating foam material. Only a small amount of foam material 22 covers the top surface of insert 20. The size of insert 20, as a portion of the overall height and width, i.e., volume, of the areas of sole structure 12 within which it is located, can thus be maximized. For example, as seen in Figure 4, insert 20 in its area of maximum thickness along tubes 25 occupies greater than approximately eighty percent (80%) of the overall thickness of sole structure 12. Insert 20 should, at its maximum thickness, occupy at least fifty percent (50%) of the overall thickness of the sole structure, and preferably eighty percent or more. In terms of volume, insert 20 should occupy greater than fifty percent (50%) of the volume of sole structure 12 in the area of insert 20, and preferably eighty percent (80%) or greater of the volume. In this manner, the insert 20 will dominate the impact response of the sole structure over the entire area in which it is located.

In prior art sole structures, which encapsulate fluid-filled inserts in foam midsole material, the relative volume of the insert is limited. This limitation results from the need to surround substantially all of the insert in foam material in order to securely hold the insert in the sole structure and to provide sufficient attachment surfaces for securing the midsole to the outsole and the upper. Thus, such fluid-filled inserts have been limited to occupying a maximum of approximately fifty percent (50%) of the volume of the sole structure in the area where the inserts are located.

Another advantage of having insert 20 in direct contact with the upper surface of outsole 18 is the cushioning effect of fluid-filled insert 20 is not moderated by foam material interposed between the ground on which the shoe impacts and the insert. Rather, a relatively hard, relatively thin layer

of outsole material is the only material located between the ground and the fluid-filled insert.

Another aspect of sole structure 23 relates to maximizing the visibility of insert 20 through outsole 18. This is accomplished by forming sidewalls 11 and at least the bottom portion of outsole 18 which extends between sidewalls 11 of a clear (either transparent or translucent) elastomeric material. The remaining portion of outsole 18 could also be made of the clear elastomeric material, however, it is preferred to form the remaining portion of an opaque elastomer. In Figure 2, the demarcation of opaque sections 51 and 53 of outsole 18 from clear section 55 is indicated by curved lines 47 and 49 at the front and rear edges of clear section 55. Since clear section 55 extends around both the sides and bottom of insert 20, it can be viewed over a 180° extent. Insert 20 is preferably formed of a clear material (e.g. transparent) polyurethane, so that the insert can also be viewed through. Foam material 22 in valleys 27 is thus visible from the bottom and sides of sole structure 12 through the clear materials of outsole section 55 and insert 20.

Clear section 55 of outsole 18 is formed as part of a single-piece integral outsole with the surrounding opaque sections 51, 53. This is accomplished by curing the clear and opaque elastomers in a mold at the same time. The clear and opaque, uncured elastomers are placed in a mold at the proper locations and then heated and cured in the mold. A thermal bond is thus formed between the sections 55 and sections 51,53. Figure 4 diagrammatically illustrates the thermal bond between the opaque and clear sections. A blending of the materials forming sections 51 and 55 is shown on the left of Figure 4, while a blending of the materials of sections 53 and 55 is shown on the right of Figure 4.

Clear section 55 can be formed from any elastomeric material that can be formulated to provide a clear product. This clear elastomer can be based on either thermoplastic or thermosetting resin systems. Thermosetting systems are generally preferred because of compatibility of processing techniques and better physical properties. Suitable elastomeric material include synthetic elastomers based on homo and copolymer systems such as polycondensation polymers (e.g. polyurethanes), ethylene-propylene based copolymers (e.g. EPDM) other synthetic rubber materials, (e.g. SBR, neoprene etc.) vinyl-based polymers (e.g. poly vinyl chloride), polyacrylate copolymers and the like.

The preferred class of clear elastomeric materials is polyurethanes which can be cured for example by peroxide curing systems. Preferred polyurethane materials include millable polyurethanes such as MILLATHANE 88 (a polyether-based polyurethane available from TSE Industries).

As will be appreciated by one skilled in the art, the selection of a clear elastomeric material will be guided by the need to provide (1) compatibility with the opaque materials, i.e. ability to bond to each other and (2) acceptable physical properties of the final sole material. In this regard the clear elastomer should possess properties that approximate those of conventional opaque soling materials, e.g. good flexibility, durability, abrasion resistance, traction and the like. In addition the clear elastomeric material should be formulated to provide resistance to discoloration by oxidation or UV light. In this regard a preferred elastomic composition suitable for use according to this invention may include conventional additives such as fillers, UV light stabilizers, antioxidants, curing agents and the like. In general, additives which do not adversely effect the clear nature or physical properties of the elastomeric material can be used.

Numerous characteristics, advantages, and embodiments of the invention have been described in detail in the foregoing description with reference to the accompanying drawing. However, the disclosure is illustrative only and the invention is not limited to the precise illustrated embodiments. Various changes and modifications may be effective therein by one skilled in the art without departing from the scope or spirit of the invention.

Claims

1. A shoe comprising an upper and a sole, said sole comprising an integral one-piece outsole and a cushioning midsole, said outsole having an upper surface and a lower surface for providing traction with a surface on which the shoe is used, said outsole including a clear section extending along the bottom and around both sides of said midsole to permit visual inspection of interior portions of said midsole along the bottom and both sides of the midsole.

2. The shoe recited in claim 1 wherein said midsole includes a fluid-filled insert overlying the upper surface of said clear section of said outsole, said insert including a flexible, fluid-containing wall.

3. The shoe recited in claim 2 wherein said fluid-containing wall is formed of a clear material.

4. The shoe recited in claim 3 wherein said fluid-filled insert includes recesses formed in at least a top surface of said insert, and said midsole includes an elastomeric foam material extending over the top surface of said insert

and substantially filling in the recesses along the top surface of said insert, said filled in areas of said recesses being visible through the sides and bottom of said clear section of said outsole and through the clear material of said insert.

5. The shoe recited in claim 3 or 4 wherein said fluid-filled insert includes positioning recesses along its bottom surface, and said clear section of said outsole includes projections extending upward from its upper surface to mate with said positioning recesses of said fluid-filled insert.

6. The shoe recited in claim 5 wherein said fluid containing wall includes opposite transverse sides, and the portions of said clear section of said outsole which extend around the sides of said midsole having interior surfaces mating substantially with said transverse sides of said fluid containing wall.

7. The shoe recited in claim 2 or 3 wherein said insert is filled with a gaseous medium comprising an inert, non-polar, large molecule gas having a low solubility coefficient, said flexible wall having characteristics of relative low permeability with respect to said gas to resist diffusion of said gas therethrough from said insert and of relatively high permeability with respect to the ambient air surrounding said insert to permit diffusion of said ambient air through said flexible wall into said inflated insert to provide a total pressure in said insert which is the sum of the partial pressure of the gas in said insert and the partial pressure of the air in said insert, the diffusion rate of said gas through said flexible wall being substantially lower than the diffusion rate of nitrogen through said flexible wall.

8. the shoe recited in claim 1,2 or 3 wherein said integral one-piece outsole includes at least one opaque section.

9. A sole structure for use in a shoe having an outsole and a sealed fluid-filled insert, said outsole having a lower surface having a tractive surface for producing frictional contact and an upper surface;

said outsole upper surface having means for positioning said fluid-filled insert in said sole structure and said fluid-filled insert having a means for cooperating with said means for positioning said fluid-filled insert.

10. The sole structure recited in claim 9 wherein said positioning means comprises a series of transversely extending grooves.

11. The sole structure recited in claim 10 further comprising lengthwise extending grooves that are adjoined to said transversely extending grooves.

12. The sole structure recited In claim 10 wherein said positioning means further includes projections that extend upwardly from the upper surface of the outsole to engage corresponding recesses in the fluid-filled insert.

13. The sole structure recited in claim 10, 11, or 12 wherein said positioning means further comprises said outsole having sidewalls extending upwardly along a portion of each side of the sole structure for contacting at least a portion of the sides of said fluid-filled insert.

14. The sole structure recited in claim 13 wherein the interior surface of said outsole sidewalls mates with the exterior surface of said portions of the sides of said fluid-filled insert.

15. The sole structure recited in claim 9 wherein said insert includes a flexible fluid-containing wall.

16. The sole structure recited in claim 15 wherein said insert is filled with a gaseous medium comprising an inert, non-polar, large molecule gas having a low solubility coefficient, said flexible wall having characteristics of relative low permeability with respect to said gas to resist diffusion of said gas therethrough from said insert and of relatively high permeability with respect to the ambient air surrounding said insert to permit diffusion of said ambient air through said flexible wall into said inflated insert to provide a total pressure in said insert which is the sum of the partial pressure of the gas in said insert and the partial pressure of the air in said insert, the diffusion rate of said gas through said flexible wall being substantially lower than the diffusion rate of nitrogen through said flexible wall.

17. The shoe recited in claim 9 wherein the section of said outsole underlying said fluid-filled insert is made of a clear material.

18. The shoe recited in claim 13 wherein said sidewalls and the section of said outsole underlying said fluid-filled insert are made of a clear material.

19. The shoe recited in claim 17 wherein said outsole includes at least one opaque section of material.

20. A shoe sole structure comprising an outsole and a fluid-filled insert, said outsole having a lower surface with a tractive surface and an upper surface having upwardly extending sidewalls, said upwardly extending sidewalls contacting the sides of, and supporting, said fluid-filled insert within said sole structure.

21. The shoe sole structure as recited in claim 20 wherein said fluid-filled insert occupies greater than 50% of the overall volume of the sole structure in the area of the sole structure where the insert is located.

22. The shoe sole structure as recited in claim 20 wherein said fluid-filled insert occupies greater than 80% of the overall volume of the sole structure in the area of the sole structure where the insert is located.

23. The shoe sole structure as recited in claim 20 wherein said upwardly extending sidewalls are clear.

24. The shoe sole structure as recited in claim 20 wherein said sidewalls and the bottom portion of the outsole connecting the sidewalls are clear.

25. The shoe sole structure as recited in claim 20 wherein said sole structure is attached to a shoe upper.

26. The shoe sole structure as recited in claim 20 further comprising means for positioning said fluid-filled insert between said sidewalls to prevent lateral movement.

27. The shoe sole structure as recited in claim 26 wherein said means for positioning said fluid-filled insert comprises a series of lands and grooves with said fluid-filled insert having corresponding cooperating lands and grooves.

28. The shoe sole structure as recited in claim 26 or 27 including an elastomeric foam material extending over the fluid-filled insert and the portion of the upper surface of said outsole not covered by said fluid-filled insert.

29. The shoe sole structure as recited in claim 20 wherein said insert includes a flexible fluid-containing wall.

30. The shoe sole structure recited in claim 29 wherein said insert is filled with a gaseous medium comprising an inert, non-polar, large molecule gas having a low solubility coefficient, said flexible wall having characteristics of relative low permeability with respect to said gas to resist diffusion of said gas therethrough from said insert and of relatively high permeability with respect to the ambient air surrounding said insert to permit diffusion of said ambient air through said flexible wall into said inflated insert to provide a total pressure in said insert which is the sum of the partial pressure of the gas in said insert and the partial pressure of the air in said insert, the diffusion rate of said gas through said flexible wall being substantially lower than the diffusion rate of nitrogen through said flexible wall.

31. The shoe sole structure received in claim 24 wherein said outsole includes a portion formed of an opaque material.

32. A shoe comprising:

an upper and a sole structure attached to said upper;

said sole structure having an outsole and a midsole, said outsole having an upper surface, a lower surface and sidewalls extending upwardly from at least a portion of the upper surface, said sidewalls and the portion of the outsole extending between said sidewalls being made of a clear material, said midsole including a fluid-filled insert;

means for positioning said fluid-filled insert within the upper surface of the outsole in alignment with the clear material to provide visibility of the bottom and sides of the fluid-filled insert;

said means for positioning said fluid-filled insert comprising a plurality of projections extending from the upper surface of said outsole and a plurality of corresponding recesses formed on the bottom surface of said fluid-filled insert.

33. The shoe recited in claim 32 wherein said fluid-filled insert includes a fluid containing wall formed of a clear material.

34. The shoe recited in claim 33 wherein said fluid-filled insert includes recesses formed in the top surface of said insert, and said midsole includes an elastomeric foam material extending over the top surface of said insert and substantially filling in the recesses along the top surface of said insert, said filled-in areas of said recess being visible through the sides and bottom of said clear portion of said outsole and

through the clear material of said insert.

35. The shoe recited in claim 32, 33 or 34 wherein said fluid-filled insert occupies greater than 80% of the overall sole structure volume in the area where the insert is located.

36. The shoe recited in claim 32 wherein said projections are formed as lands positioned between transversely extending grooves in the upper surface of said outsole.

37. The shoe recited in claim 33 wherein said insert is filled with a gaseous medium comprising an inert, non-polar, large molecule gas having a low solubility coefficient, said flexible wall having characteristics of relative low permeability with respect to said gas to resist diffusion of said gas therethrough from said insert and of relatively high permeability with respect to the ambient air surrounding said insert to permit diffusion of said ambient air through said flexible wall into said inflated insert to provide a total presere in said insert which is the sum of the partial pressure of the gas in said insert and the partial pressure of the air in said insert, the diffusion rate of said gas through said flexible wall being substantially lower than the diffusion rate of nitrogen through said flexible wall.

38. The shoe recited in claim 32 wherein said outsole includes at least one portion formed of an opaque material.

FIG. 1

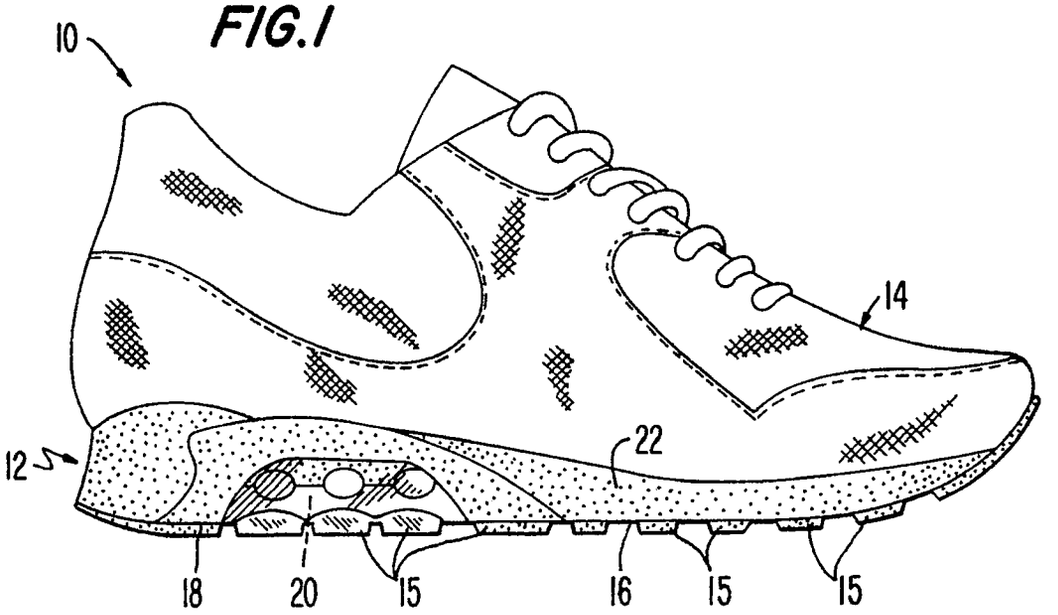
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FIG. 2

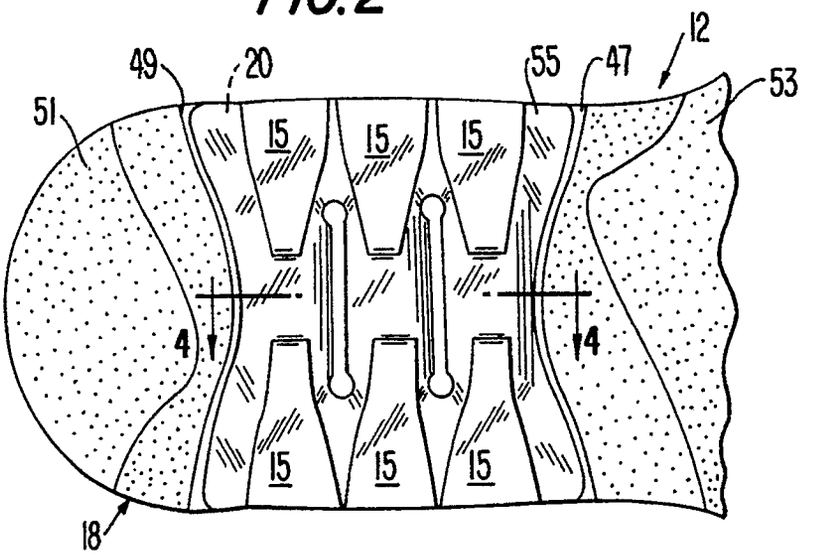
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FIG.3

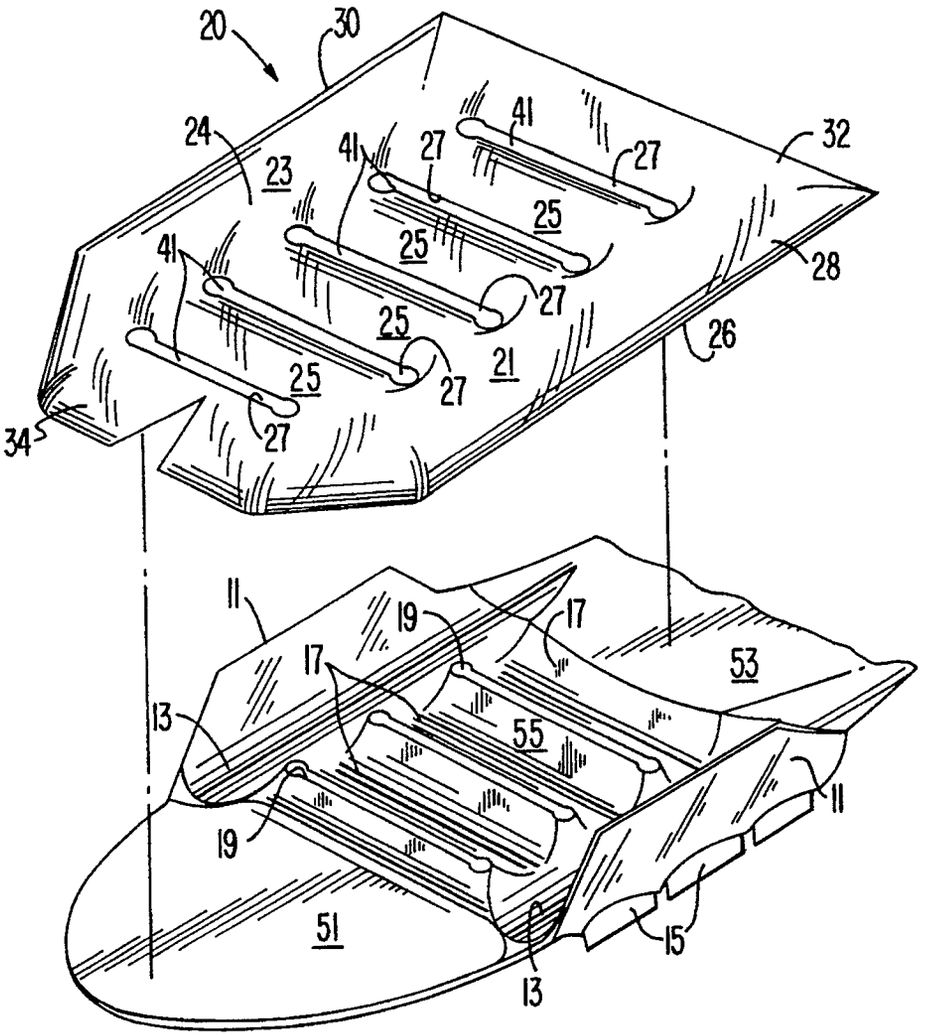
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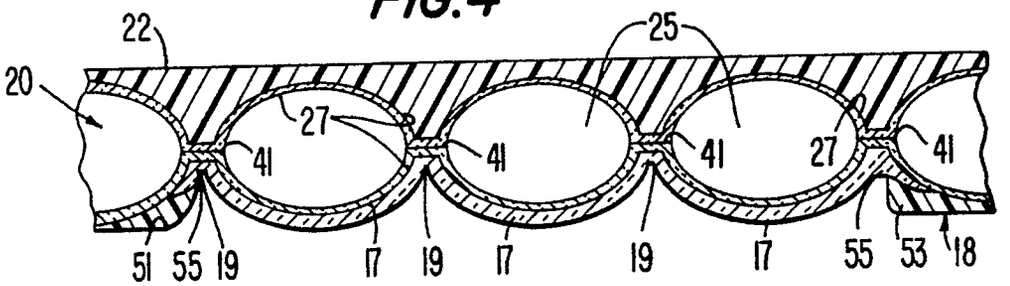
FIG.4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