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(71) Applicant and

(72) Inventor: **HOTTINGER, Michael** [US/US]; 8874 Garden Lane, Greendale, Wisconsin 53129 (US).

(74) Agent: **GEHRKE, Lisa, M.**; GEHRKE & ASSOCIATES, S.C., 123 N. 86th St., Wauwatosa, Wisconsin 53226 (US).

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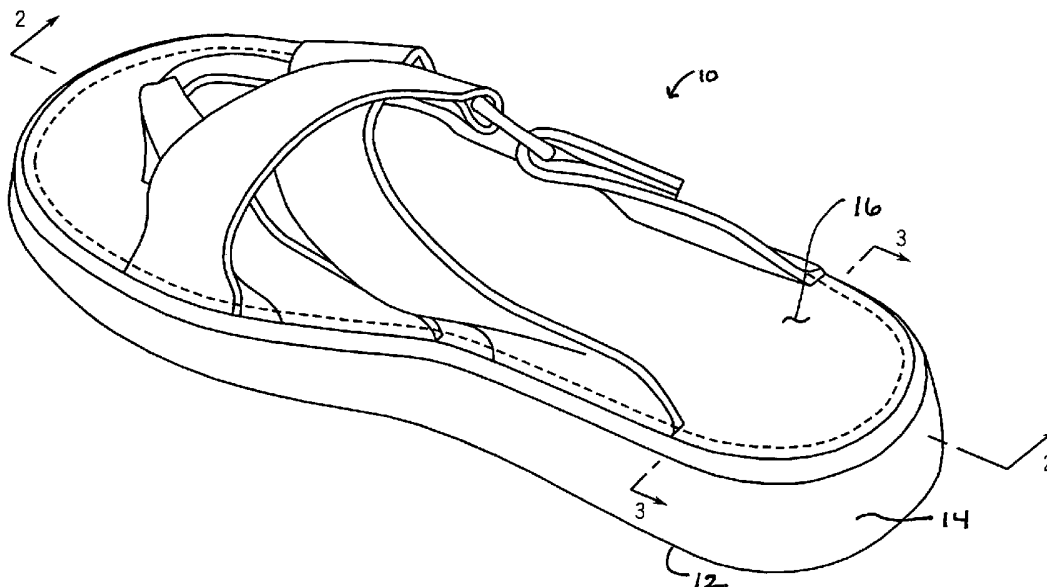
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(54) Title: SHOE SOLE WITH LOOSE FILL COMFORT AND SUPPORT SYSTEM



(57) Abstract: A shoe is provided with an outsole which contacts the ground, an insole upon which a foot rests, and a midsole located between the outsole and the insole, wherein the midsole absorbs impact by providing a loose fill material throughout the midsole of the shoe to cushion any force exerted upon the shoe, wherein the midsole is divided into at least two compartments and each of the compartments is filled with the loose fill material.



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SHOE SOLE WITH A LOOSE FILL COMFORT AND SUPPORT SYSTEM

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates generally to the comfort and support in the sole of a shoe. In particular, the present invention relates to a shoe with a sole that is filled with a loose fill material such as crumb rubber for shock absorption, cushionability, energy return, added comfort and stability.

Discussion of the Related Art

Dress, casual and athletic shoes generally include an upper leather portion and an inner lining that cover the top of the foot, a counter placed between the upper leather portion and the lining to provide rigidity at the heel, an insole upon which the foot rests, an outsole which contacts the ground surface and possibly a filler portion that is positioned between the insole and outsole. The midsole of a shoe is a piece of material such as rubber or leather that is often stitched or glued to the inside fabric lining, upper leather portion, and the counter to hold the construction together.

A filler is a material that fills the space formed between the midsole and the outsole when the midsole is glued to the inside lining, upper leather portion and the counter component. This filler is normally glued in position and is manufactured from the same material as the midsole.

The outsole is the bottom portion of the shoe that contacts the ground or floor surface which is usually manufactured from leather, rubber or any of several suitable synthetic materials. The outsole is typically glued to the filler material.

The manufacture of shoes using conventional construction methods is a complicated and expensive process. In this regard, improvements are sought to simplify the construction process that corresponding decrease the cost of manufacturing the shoe, while maintaining all of the functionality of the shoe.

In the prior art, most improvements in shoe design have focused on the midsole. The midsole is a shoe's main cushioning system. An argument could be made that no part of the shoe has benefited from science more and affects performance more than the midsole. In early athletic shoes, especially in running shoes, midsoles really did not exist. Early basketball shoes had some rubber cushioning inside them, but nothing advanced and

innovative as the modern midsole found in every type of shoe from walking shoes to basketball shoes. These innovations range from improved foam midsoles to very complicated air and fluid systems. While these increasingly complicated midsoles may improve performance, the cost to manufacture these shoes has increased exponentially.

Thus, there is a need in the art for a shoe having a simplified midsole construction with softer density while providing adequate cushioning and stability for every type of shoe or boot.

What is needed, therefore, is a shoe with fill material that provides the cushioning and support of a traditional midsole.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a shoe including an outsole which contacts the ground, an insole upon which a foot rests, and a midsole located between the outsole and the insole, wherein the midsole absorbs impact by providing a loose fill material throughout the midsole of the shoe to cushion any force exerted upon the shoe.

It is yet another object of the present invention to provide a shoe including an outsole which contacts the ground, an insole upon which a foot rests, and a midsole located between the outsole and the insole, wherein the midsole absorbs impact by providing a loose fill
10 material throughout the midsole of the shoe to cushion any force exerted upon the shoe, wherein the loose fill material is bound together with an adhesive.

Still yet another object of the present invention is to provide a shoe including an outsole which contacts the ground, an insole upon which a foot rests, and a midsole located between the outsole and the insole, wherein the midsole absorbs impact by providing a loose fill material throughout the midsole of the shoe to cushion any force exerted upon the shoe, wherein the midsole is divided into at least two compartments and each of the compartments is filled with the loose fill material.

BRIEF DESCRIPTION OF THE DRAWINGS

A clear understanding of the various advantages and features of the present invention, as well as the construction and operation of conventional components and mechanisms associated with the present invention, will become more readily apparent by referring to the exemplary, and therefore non-limiting, embodiments illustrated in the following drawings which accompany and form a part of this patent specification.

FIGURE 1 is a perspective view of a shoe with loose fill support according to the preferred embodiment of the present invention;

FIGURE 2 is a cross-sectional view of the shoe with loose fill support along line 2-2
10 of FIGURE 1 according to the preferred embodiment of the present invention;

FIGURE 3 is a cross-sectional view of the heel of a shoe with loose fill support along line 3-3 of FIGURE 1 according to the preferred embodiment of the present invention;

FIGURE 4 is a cross-sectional view of the midsole of a shoe with compartments to contain the fill in the shoe according to an alternative embodiment of the present invention;

FIGURE 5 is a cross-sectional view along line 5-5 of FIGURE 4 according to the preferred embodiment of the present invention; and

FIGURE 6 is a cross-sectional view along line 6-6 of FIGURE 4 according to the preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGURE 1, the present invention includes generally a shoe 10 having an outsole 12, a midsole 14, and an insole 16. In the preferred embodiment of the present invention, shoe 10 is any shoe including but not limited to an athletic shoe, a casual shoe, a boot, a sandal, a dress shoe, etc.

Outsole 12 of shoe 10 is commonly made from a variety of materials including elastomer styrene-butadiene rubber or a carbon fiber rubber. Lying on the bottom side of shoe 10, outsole 12's main purpose is to provide friction and durability. Different treads on outsoles 12 define shoe 10's purpose. For example, on an athletic shoe, waffle-studded treads act like support columns to absorb and dissipate impact.

Just above outsole 12 is midsole 14. Midsole 14 absorbs impact by cushioning but also returns energy to the person wearing shoe 10 (e.g., a runner). The most common material used in the manufacturing of midsoles is a plastic foam consisting of ethylene, vinyl, and acetate. Known in the field as polymer EVA, it contains the properties of mouldability, resilience, flexibility, and strength. It is, however, increasingly expensive to manufacture various midsoles that strive to incorporate the latest innovations including air and water cushioning devices.

Above midsole 14 is insole 16. Insole 16 is commonly made from a polymer foam lined with a fabric cover. The main purpose of insole 16 is to provide comfort and shock absorption at impact, largely in the heel section of shoe 10. The cheap cost of the polymer makes it easily replaceable. In the prior art, manufacturers have developed an entire product line of additional supports which can be inserted into insole 16 of shoe 10.

Referring to FIGS. 2-3, midsole 14 of shoe 10 serves a variety of purposes including stability, flexibility, cushioning and durability.

Flexibility - As the importance of cushioning systems became the central focus of midsole research and design in the prior art (especially related to athletic shoe research and development), the midsole's contribution to overall foot and ankle stability was somewhat ignored. This was driven by the boom in the running movement, by people's in-store perception of what a good cushioning system "felt" like, and by surveys in running magazines as to the "best" cushioning offered in shoes.

The challenge is to try to find a cushioning system that is soft enough to satisfy a person's perception of a soft shoe when trying a shoe on in a store and, in turn would pass the tests set up by sport research labs under contract to running magazines to measure cushioning in a shoe which often resulted in a shoe that was so soft that it provided minimal stability and contributed to over pronation or supination and therefore other injuries.

The solution to this problem is to pay attention to cushioning as well as modifying parts of the midsole to enhance stability. Support structures like heel collars that are extensions of the midsole that, in many cases are integrated with the upper, is one innovation to midsoles that provides general stability and cushioning. These types of systems, however,
10 are increasingly expensive to manufacture.

Flexibility - Like stability, flexibility is directly related to the cushioning system used. As the design of full length midsoles progresses, flexibility tends to be compromised. As researchers start to define the nature of cushioning needs by purpose and type of person, they in turn start to pay attention to the need to provide flexibility to the regions of the foot where flexible joints are found.

Most midsole designs now incorporate some type of flex line in the midsole located near where the foot flexes naturally. This flex line is closely aligned and integrated with the outsole's flex lines.

Cushioning - As mentioned earlier, this is the main focus of the midsole system. The
20 need to deal with the impact forces that a person encounters (especially an athlete participating in a sport activity), is of paramount importance when designing a midsole unit. For example, in basketball an athlete's midsole must absorb over seven times the body weight of the athlete. A midsole spreads out the force of impact so that it is not delivered full force straight to the foot and legs of the person.

In the case of an athletic shoe, the cushioning needs of an athlete are closely tied to an individual's biomechanics as well as to the specific sport the athlete is participating in. For example, a person's biomechanics (as defined by the bones, muscles, ligaments and tendons) might be such that they are a heel striker rather than a forefoot striker when running. In general, a heel striker exhibits a key, potentially injurious, impact force at the beginning of a
30 stride cycle that is not seen in the impact record of a forefoot striker. Therefore, the design

for a midsole system for a heel striker must pay particular attention to cushioning in the heel area.

In turn, the cushioning system also plays a key role in the overall energy consumption of an athlete during an event. The natural cushioning system of the body is the musculoskeletal system--the bones, muscles, ligaments and tendons, of the foot and leg. The fat pads in the foot also play a major role in protecting the foot from sudden and repeated impact. Operating this system requires the use of the body's stored energy as it is dependent on muscles contracting to help deal with the impact going through the system. This works fine under normal conditions, like relaxed walking over soft surfaces. When an athlete asks
10 more of this system by increasing the frequency and force of impacts through training and participation in athletic events, more energy is needed to help maintain performance. A shoe's cushioning system can help by improving the efficiency of, or reducing, the energy needs of the athlete.

A midsole design should provide some type of energy return to the body when compressed. This energy return, or spring gives lift to the foot and leg that normally would require muscular contraction, and therefore cost the athlete in terms of energy.

Durability - In midsoles, traditional cushioning systems based on rubber or foam materials tend to break down, or compact, over time. As they break down they lose their ability to cushion and provide energy return. The way these materials break down is related
20 to how they are constructed. Basically, the way to increase the cushioning characteristic in a rubber or foam based midsole is to increase the amount of air blown into the material. This air produces bubbles. The larger the bubbles, the thinner the walls surrounding them. The thinner the walls the shorter amount of time needed to break them down.

Durability in midsoles is desirable since losing the cushioning properties, as happens as traditional midsole materials compact, can lead to injury. Many athletic shoes address this need by introducing some type of hybrid midsoles that integrate pressurized air, or liquid systems that do not lose their cushioning characteristics over time.

Not all shoes, however, require these elaborate midsole constructions in order to achieve stability, flexibility, cushioning and durability. In many instances, only the highly
30 trained athlete requires the complex fluid and pressurized air systems found in the midsoles of some of the athletic shoes on the market. In order to drastically reduce manufacturing

costs associated with these complex systems, midsole 14 in the preferred embodiment of the present invention includes a loose fill material 18 instead of a continuous section of material normally found in midsole 14.

Loose fill 18 extends throughout midsole 14 from a front section 20 of shoe 10 to a back section 22 of shoe 10.

In the preferred embodiment of the present invention, material 18 is a crumb rubber, although other materials with stability and cushioning properties may be used in place of this material. From an engineering point of view, crumb rubber has a number of special thermo-mechanical and chemico-physical properties.

10 Crumb rubber is made by shredding scrap tires and as such, it is a particulate material free of fiber and steel. It is generally made commercially available in 50-pound bags or 2000-pounds bulk bags. The size of the rubber particles is graded. The finest one can be as small as about 0.2mm (Mesh #80) and below. The gradation commonly used in rubberized asphalt pavement is between about 2.0 mm to 0.5 mm (Mesh #10 to Mesh #40). Crumb rubber is light in weight and is durable. From the safety consideration, crumb rubber is a non-toxic and inert material.

In addition to crumb rubber fill material 18 being inexpensive to use in the manufacturing of shoe 10, another important fact is that crumb rubber is a recycled material, so that as more is consumed, the greater the proportionate reduction in scrap tires.

20 Crumb rubber is traditionally used in playground and landscaping mulch for its shock absorbing capabilities. In the present invention, the cushioning and shock absorbing properties are integrated into midsole 14 to provide a person with maximum comfort while drastically reducing the cost of manufacture of shoe 10.

There has been an enormous growth in the demand for recycled tire rubber — *crumb rubber* — since the early 1990s, particularly in North America. These newly rubberized products are often superior to similar products made of conventional materials, and using recycled rubber over virgin rubber further reduces manufacturing costs.

FIGURES 4-6 illustrate an alternative embodiment of the present invention that includes a first compartment 24 defined by a wall 26 and a wall 28, a second compartment 30 defined by a wall 32 and a wall 34, a third compartment 36 defined by a wall 38 and a wall 40, and a fourth compartment 42 defined by a wall 44 and a wall 46. Therefore, a first

divider 48 traverses the length of shoe 10 from front section 20 to back section 22. Divider 48 includes walls 26, 34, 38 and 46. Similarly, a second divider 50 traverses the width of shoe 10. Divider 50 includes walls 28, 32, 40 and 44.

Compartments 24, 30, 36 and 42 ensure the even distribution of fill material 18 throughout the length of midsole 14 and guard against uneven compaction of material 18. To further guard against uneven distribution of material 18, fill material 18 may include an adhesive that binds the loose crumb rubber 18 together to some extent.

The scope of the application is not to be limited by the description of the preferred embodiments described above, but is to be limited solely by the scope of the claims that follow. For example, a composite sheet of crumb rubber including a binding adhesive may be used in place of loose fill crumb rubber to fill midsole 14 of shoe 10 without departing from the scope of the preferred embodiment of the present invention.

WHAT IS CLAIMED IS:

1. A shoe comprising:
 - an outsole which contacts the ground;
 - an insole upon which a foot rests; and
 - a midsole located between the outsole and the insole, wherein the midsole absorbs impact by providing a loose fill material throughout the midsole of the shoe to cushion any force exerted upon the shoe.
2. A shoe according to claim 1, wherein the loose fill material is derived from rubber tires.
3. A shoe according to claim 2, wherein the loose fill material is crumb rubber.
4. A shoe according to claim 3, wherein a portion of the loose fill material is adhesively bound together to form a composite layer of crumb rubber.
5. A shoe according to claim 1, wherein the midsole is divided into at least two compartments.
6. A shoe according to claim 5, wherein each of the compartments is filled with the loose fill material.
7. A shoe according to claim 6, wherein the loose fill material is crumb rubber.
8. A shoe according to claim 1, wherein the shoe includes an athletic shoe, a casual shoe, a boot, a sandal or a dress shoe.
9. A shoe according to claim 1, wherein the insole is a polymer foam lined with a fabric cover.

10. A shoe according to claim 1, wherein the outsole is manufactured from elastomer styrene-butadiene rubber, leather, or synthetic material.
11. A shoe comprising:
 - an outsole which contacts the ground;
 - an insole upon which a foot rests; and
 - a midsole located between the outsole and the insole, wherein the midsole absorbs impact by providing a loose fill material throughout the midsole of the shoe to cushion any force exerted upon the shoe, wherein the loose fill material is bound together with an adhesive.
12. A shoe according to claim 11, wherein the loose fill material is derived from rubber tires.
13. A shoe according to claim 12, wherein the loose fill material is crumb rubber.
14. A shoe according to claim 13, wherein the loose fill material forms a composite layer of crumb rubber.
15. A shoe according to claim 11, wherein the midsole is divided into at least two compartments.
16. A shoe according to claim 15, wherein each of the compartments is filled with the loose fill material.
17. A shoe according to claim 16, wherein the loose fill material is crumb rubber.
18. A shoe according to claim 11, wherein the shoe includes an athletic shoe, a casual shoe, a boot, a sandal or a dress shoe.

19. A shoe comprising:
- an outsole which contacts the ground;
 - an insole upon which a foot rests; and
 - a midsole located between the outsole and the insole, wherein the midsole absorbs impact by providing a loose fill material throughout the midsole of the shoe to cushion any force exerted upon the shoe, wherein the midsole is divided into at least two compartments and each of the compartments is filled with the loose fill material.
20. A shoe according to claim 19, wherein the loose fill material is crumb rubber.

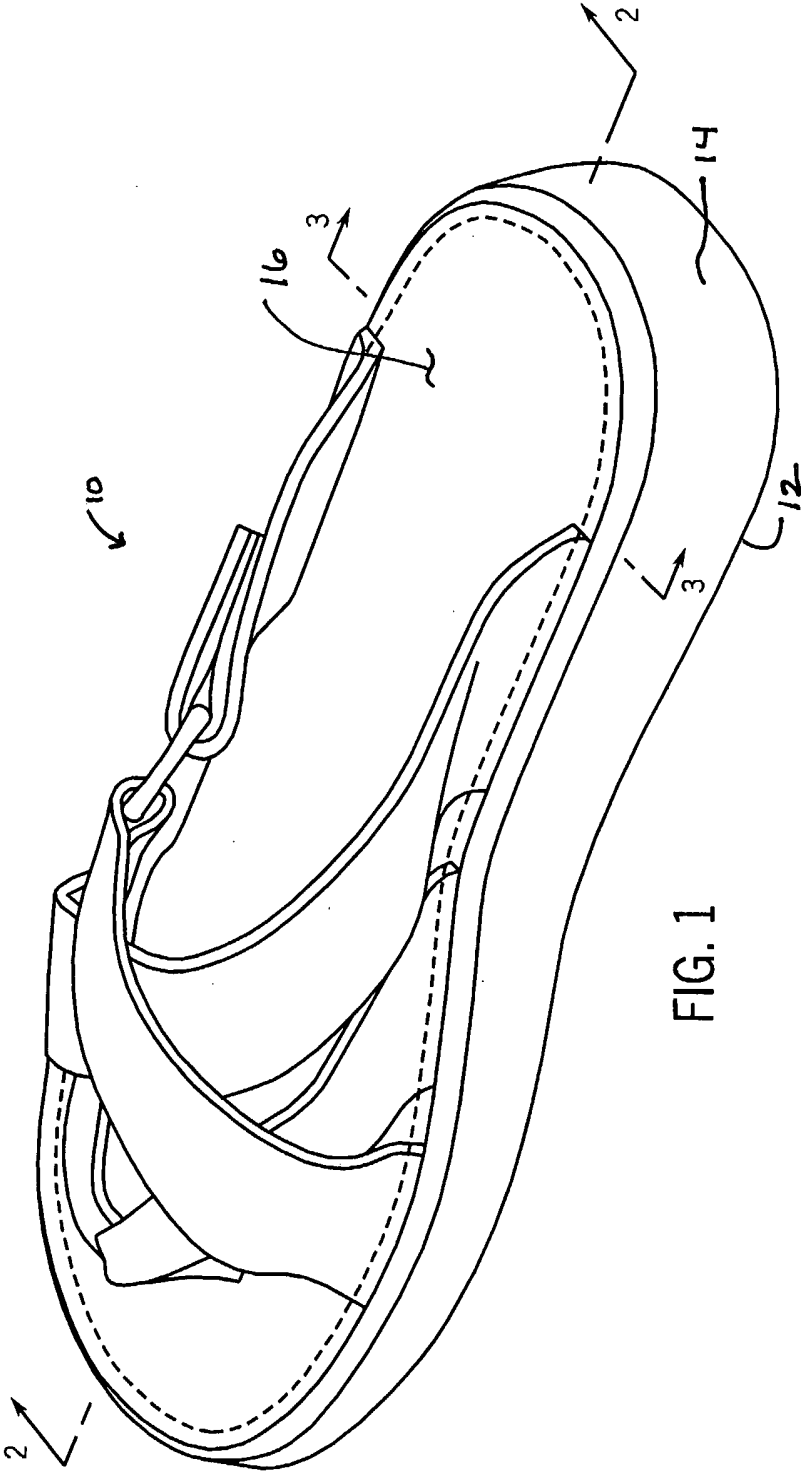


FIG. 1

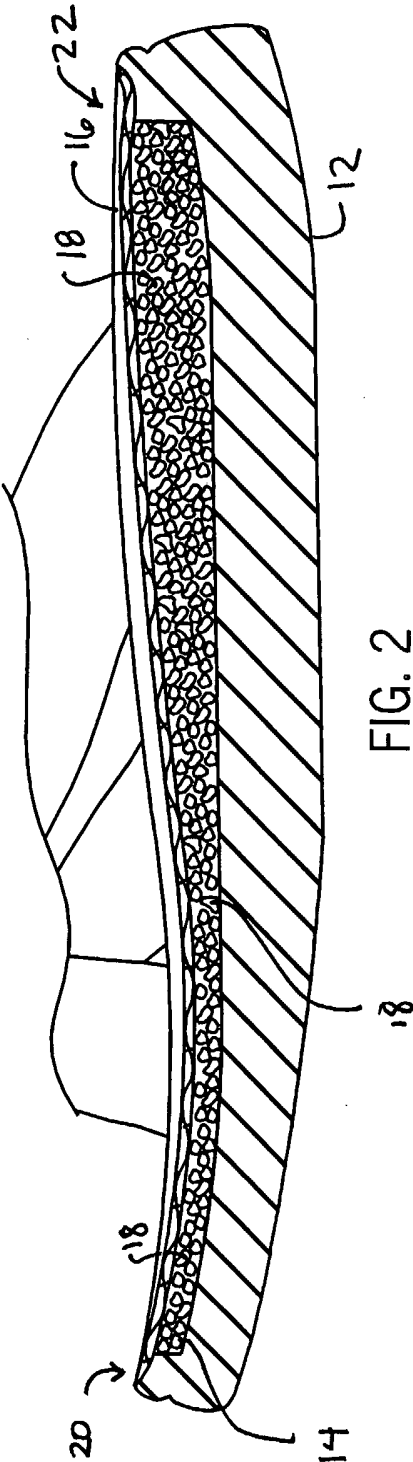


FIG. 2

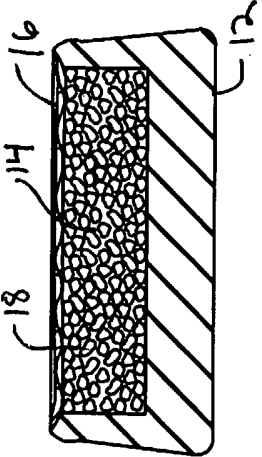


FIG. 3

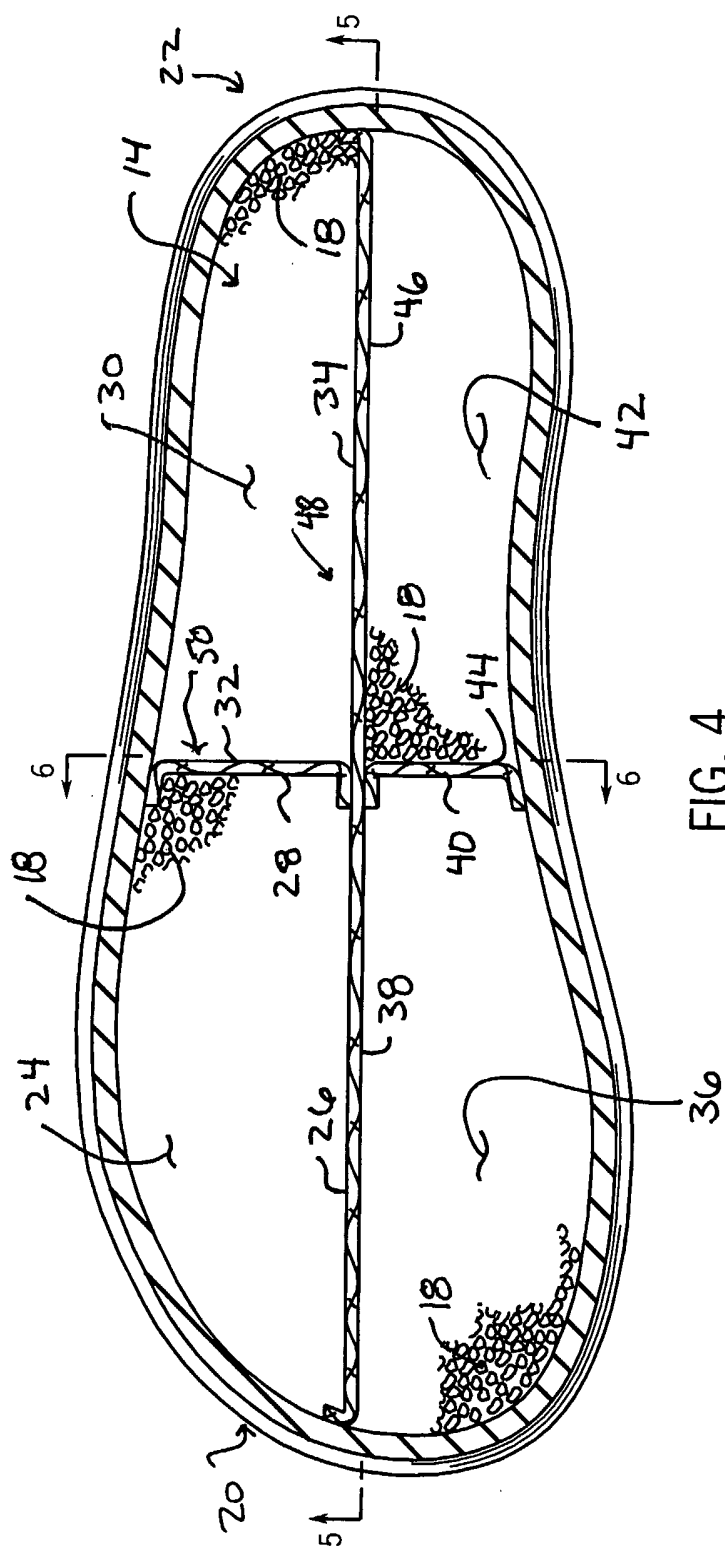


FIG. 4

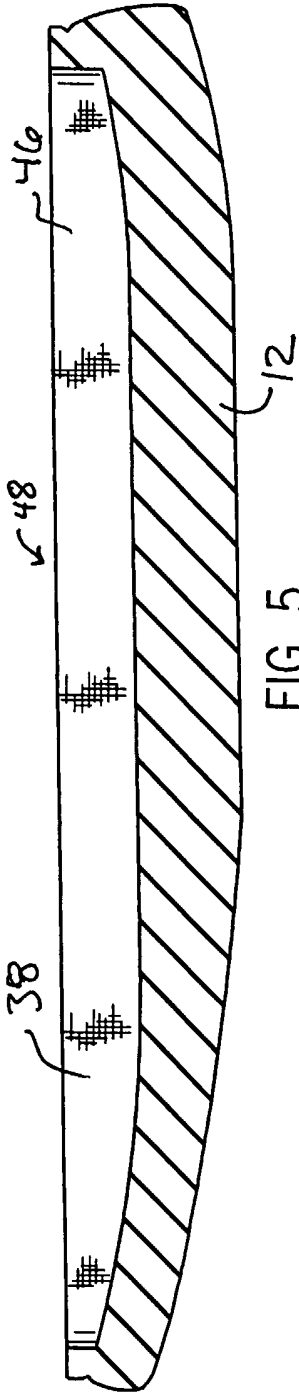


FIG. 5

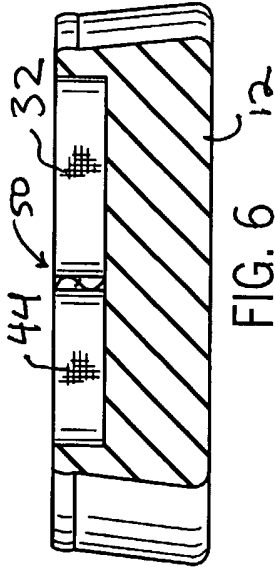


FIG. 6