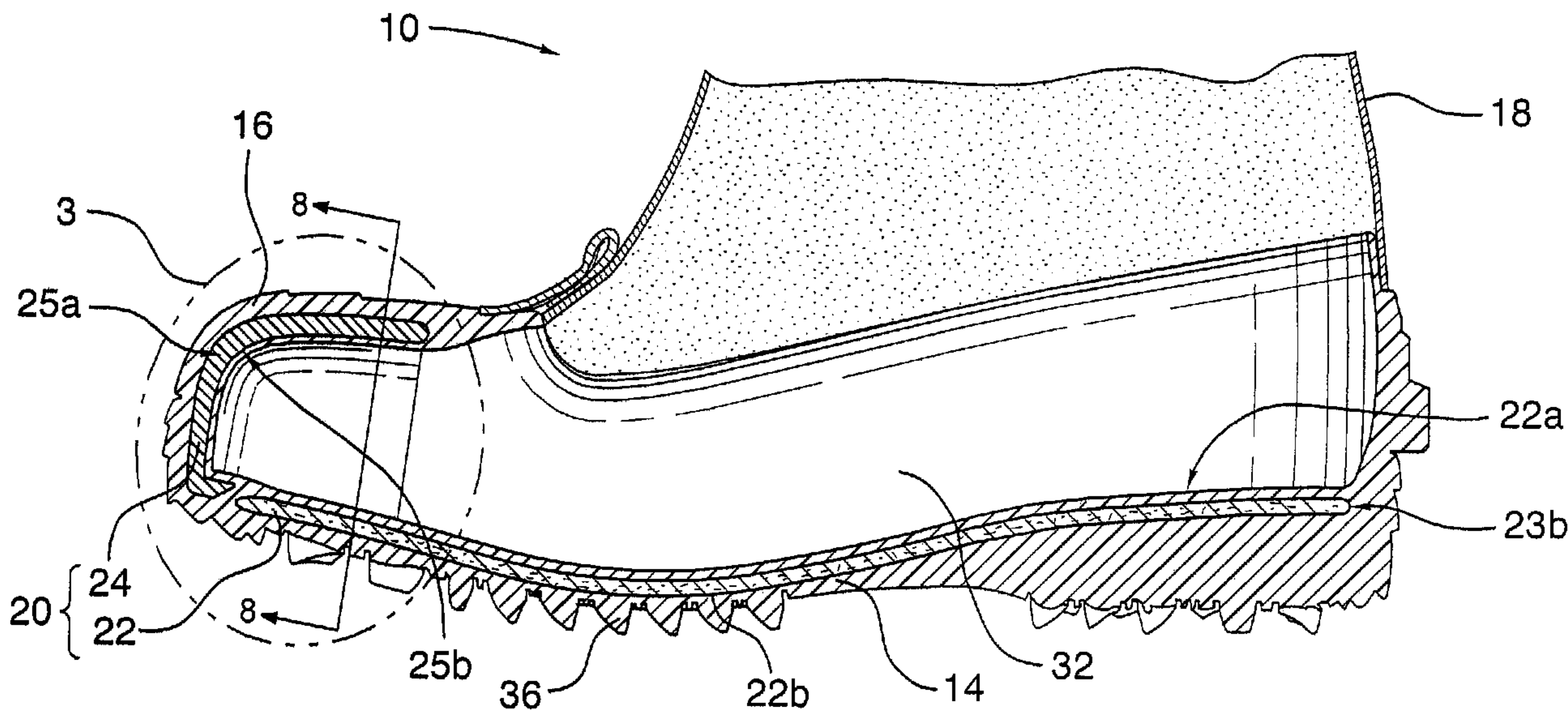




(22) Date de dépôt/Filing Date: 2007/12/11  
(41) Mise à la disp. pub./Open to Public Insp.: 2009/06/11  
(45) Date de délivrance/Issue Date: 2012/05/15

(51) Cl.Int./Int.Cl. *A43B 3/00* (2006.01),  
*A43B 1/14* (2006.01), *A43B 13/14* (2006.01),  
*A43B 23/17* (2006.01)  
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(54) Titre : ARTICLE CHAUSSANT DE PROTECTION  
(54) Title: SAFETY FOOTWEAR



(57) **Abrégé/Abstract:**

In accordance with the present invention there is disclosed safety footwear comprising a unitarily moulded lower member having a sole portion and a toe cap portion. One or more protective elements are embedded in the unitarily moulded lower member so as to prevent breaches thereof.

**ABSTRACT**

In accordance with the present invention there is disclosed safety footwear comprising a unitarily moulded lower member having a sole portion and a toe cap portion. One or more protective elements are embedded in the unitarily moulded lower member so as to prevent breaches thereof.

**FIELD OF THE INVENTION**

[0001] The present invention relates generally to the field of footwear and, more specifically, to improved safety footwear.

**BACKGROUND OF THE INVENTION**

[0002] In many applications, it is necessary for footwear to include features aimed at preventing injury to the wearer. Such footwear is known in the art, and will be referred to herein, as "safety footwear". Features commonly exhibited by such safety footwear include toe boxes, sole plates or other protective elements provided therein at one or more various locations throughout the footwear (e.g., toe, sole, instep). Such elements are designed to, for example, minimize penetration of sharp articles into the safety footwear that may be stepped on by the wearers thereof. Toe box protection is typically aimed at preventing crushing of the toes and/or metatarsals of the wearer, by reinforcing the corresponding region of the safety footwear. One skilled in the art will recognize that modern safety footwear is not limited to boots, but also extends to many types of shoes, clogs, sneakers and other general classes of footwear.

[0003] Metal, and usually rigid metal, is commonly used to construct many of the aforementioned protective elements; however, it is, in many instances, not preferable. For example, in some applications, metals are preferably avoided due to their ability to conduct electricity and/or heat. Moreover, the relatively high weight of most metals is another important factor in limiting their usefulness as a reinforcing material in safety footwear.

[0004] The use of lighter materials (e.g., ceramics, composites, woven fabrics, and the like) is preferable, as it lessens the energy that must be expended by a user to move his or her foot. Of course, this property is advantageous both in applications wherein the footwear is worn by an adult who desires, for example, to be able to perform work with less exertion, and to applications where it is desired that, for example, a child wear safety footwear without excessive strain.

[0005] One of the most common uses of protective elements in safety footwear is designed to combat the penetration of nails, screws or other similarly sharp and rigid objects through the sole of such footwear when the user of the safety footwear steps on such items. One skilled in the art will readily appreciate that, since substantially all of the weight of the wearer may, in such circumstances, be applied via the nail, screw, or other sharp or

rigid object stepped upon, to protective elements located within the sole, one problem associated with safety footwear is the actual displacement of the protective elements within the sole region of the safety footwear.

[0006] Movement of such a protective element within the safety footwear may allow the wearer to be injured. Moreover, the structural integrity of the footwear will be lost, and the footwear will need to be repaired or, more likely, replaced. Such an occurrence would be particularly disadvantageous in instances where the safety footwear is worn in a hazardous environment in which it will be expected to withstand multiple impacts without being rendered useless.

[0007] It is also desirable for safety footwear to be waterproof, and for such a property to be maintained despite minor punctures of the base of the sole of the boot (e.g., a nail that penetrates the lower surface of the sole, but is stopped by a protective element thereabove), or a puncture or cut on the toe. It is thus desirable for waterproofing of safety footwear to survive punctures or slicing on the external side of the protective element. Safety footwear has not been provided that exhibits all of the above advantageous properties.

[0008] Another problem with prior art safety footwear, in terms of waterproofing thereof, has been the highly prevalent use of leather or synthetic leather as the main material for such footwear. While these materials can be treated so as to be waterproof, such treatment is time-consuming, and requires re-application, particularly when safety footwear is used in wet or, for example, snowy and cold environments.

[0009] Moreover, in prior art safety footwear, protective elements have not typically been integral to the footwear itself. For example, sole reinforcement elements have typically been interposed between the sole of the footwear and, for example, an insole or the like. In instances where the protective elements may have been at least partially integral to the safety footwear, the sole and the remainder of the lower of the boot have typically been separate components.

[0010] There have, in many instances, been insufficient means of retaining the position of the sole elements when same is impacted by a sharp object as aforesaid. Furthermore, maintenance of a water-proof state upon penetration of the outer sole is problematic in such a configuration, as a seal is not necessarily effected about the sole plate.

[0011] Such a seal, i.e., as can be achieved by way of, for example, providing elements integral to the safety footwear, and sealed therein, is not necessarily possible in prior art safety footwear, particularly where such safety footwear is constructed from leather and the like.

[0012] In this regard, it is noted that such sealed configurations may be achieved according to the present invention by way of integrally moulding one or more protective elements within a lower member, such as a sole portion, of the safety footwear, which lower member is preferably constructed from polyurethane, due to its advantageous properties, including low weight, mouldability, and water-proof nature.

[0013] It is noted that the use of polyurethane to mould a unitary lower member of safety footwear has not previously been disclosed. In this regard it is further noted that moulding of safety footwear necessitates a plurality of design concerns quite apart from those relevant to the production of non-moulded prior art safety footwear. For example, the exact position of the protective elements must be carefully chosen, as such elements may not be manipulated subsequent to production of the safety footwear.

[0014] Accordingly it is an object of the present invention to obviate and/or mitigate one or more of the foregoing deficiencies of the prior art.

#### **SUMMARY OF THE INVENTION**

[0015] In accordance with the present invention there is disclosed safety footwear comprising a unitarily moulded lower member constructed from polyurethane and having a sole portion and a toe cap portion. One or more protective elements are embedded in the unitarily moulded lower member.

[0016] In accordance with another aspect of the present invention, the protective elements comprise one or more substantially planar shield members embedded in the sole portion.

[0017] In accordance with another aspect of the present invention, the one or more shield members comprise a single shield member spanning substantially the entire length and width of the sole portion.

[0018] In accordance with another aspect of the present invention, the shield member is embedded in the sole portion so as to be fully encased therewithin.

[0019] In accordance with another aspect of the present invention, the shield member is constructed from one or more composite materials.

[0020] In accordance with another aspect of the present invention, the shield member is constructed from pierce resistant fabric selected from the group consisting of: woven steel fibers and woven KEVLAR<sup>®</sup> fibers.

[0021] In accordance with another aspect of the present invention, the protective elements comprise a toe box embedded in the toe cap portion.

[0022] In accordance with another aspect of the present invention, the toe box comprises a convex shell having an inwardly projecting bottom flange portion.

[0023] In accordance with another aspect of the present invention, the toe box is embedded in the toe cap portion during moulding so as to be fully encased therewithin.

[0024] In accordance with another aspect of the present invention, the toe box is constructed from one or more composite materials.

[0025] In accordance with yet another aspect of the present invention, the protective elements comprise one or more shield members embedded in the sole portion, and a toe box embedded in the toe cap portion.

[0026] It is thus an object of this invention to obviate or mitigate at least one of the above mentioned disadvantages of the prior art.

[0027] Other advantages, features and characteristics of the present invention, as well as methods of operation and functions of the related elements of the structure, and the combination of parts and economies of manufacture, will become more apparent upon consideration of the following detailed description and the appended claims with reference to the accompanying drawings, the latter of which is briefly described hereinbelow.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0028] The novel features which are believed to be characteristic of the according to the present invention, as to its structure, organization, use and method of operation, together with further objectives and advantages thereof, will be better understood from the following drawings in which, among other things, a presently preferred embodiment of the invention will now be illustrated by way of example. It is expressly understood, however, that the drawings are for the purpose of illustration and description only, and are not intended as a definition of the limits of the invention. In the accompanying drawings:

[0029] **Figure 1** is a front perspective view from the top left of a first embodiment of safety footwear according to the present invention;

[0030] **Figure 2** is a sectional view of a lower portion of the safety footwear of **Figure 1** along sight line 2-2 of **Figure 1**;

[0031] **Figure 3** is an enlarged view of the encircled area 3 of **Figure 2**;

[0032] **Figure 4** is a sectional view of a lower portion of a second embodiment of safety footwear according to the present invention, with the protective elements shown fully encased in the lower member;

[0033] **Figure 5** is an enlarged view of the encircled area 5 of **Figure 4**;

[0034] **Figure 6** is a rear perspective view from the top left of a toe box;

[0035] **Figure 7** is a front perspective view from the top left of the toe box of **Figure 6**; and

[0036] **Figure 8** is a front perspective view from the top left of a protective element, being a shield member.

#### **DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT**

[0037] Looking to the Figures, there will be seen safety footwear 10 comprising a unitarily moulded lower member 12. The lower member 12, which is formed as a unitary piece by moulding, has a sole portion 14 and a toe cap portion 16, as can be seen in Figures 1 and 2. The lower member 12 is substantially water-proof,

and is constructed from lightweight polyurethane which may be moulded as a foam, and then allowed to cure and solidify. Moreover, polyurethane exhibits relatively low weight, exceptional performance as a mouldable material, and articles formed therefrom are inherently water-proof, all of which properties are advantageous. Formation of the lower member 12 by moulding allows for the lower member 12 to upwardly extend about its periphery without any joints therein (which are susceptible to leakage) and, thus, allows for production of safety footwear 10 that is reliably water-proof up to a higher level from the ground than is typically possible in non-moulded safety footwear. Further advantages of formation of the lower member 12 by moulding will be discussed hereinbelow.

[0038] The safety footwear 10 may, but need not necessarily, also include a flexible upper member 18, that extends upwardly from the lower member 12, as seen in Figure 1, and is desirably, in most instances, also substantially water-proof. The lower member 12 and the upper member 18 may be stitched together, glued together, or may be joined in any other conventional manner. The upper member 18 may be composed of one or more flexible materials, such as, for example, leather, synthetic leather, nylon fabric, combinations of these materials, and the like. The footwear 10 may also comprise an inner liner (not shown) - which liner may or may not be

removable - particularly in instances where the footwear 10 is designed for use in colder environments, which liner serves to have insulative and cushioning effects with respect to the foot (not shown) of a user (not shown). As will be appreciated from a consideration of Figures 2 and 4, the lower member 12 may additionally and advantageously comprise treads 36 integral thereto. Treads constructed from various different materials may be bonded to the lower member 12 in some embodiments, if desired.

[0039] One or more protective elements 20 are embedded in the unitarily moulded lower member 12, as shown in Figures 2 through 5. These protective elements 20 serve to prevent breaches - e.g., punctures, slices, etc. - through the lower member 12. The inclusion of protective elements 20 may be aimed at preventing breaches at various locations throughout the lower member 12; however, some locations may be particularly susceptible to such breaches. For example, the protective elements 20 preferably comprise one or more substantially planar shield members 22, as seen in Figure 8, each embedded in the sole portion 14 of the lower member 12. One skilled in the art will appreciate that protective elements 20 may also be provided in, for example, the toe cap portion 16 and in-step area 32 of the safety footwear 10.

[0040] There may most preferably be provided a single shield member 22 that spans substantially the entire length and width of the sole portion, as will be appreciated from Figure 2, and from a comparison of Figures 1 and 8. In so spanning the length and width of the sole portion 14, the single shield member 22 provides a high degree of protection for substantially the entire lower surface of the foot of the user. In this regard, it is noted that the shield member 22 is embedded within the sole portion 14 such that the single shield member 22 is at least laterally fully surrounded thereby, so as to assist in maintaining the water-proof nature of the safety footwear 10.

[0041] The protective elements 20 may alternatively or additionally, the latter being highly preferable, comprise a toe box 24 embedded in the toe cap portion 16 of the lower member 14, as seen in Figures 2 through 5. As best seen in Figures 6 and 7, the toe box 24 preferably comprises a convex shell 26 having an inwardly projecting bottom flange portion 28. As with the shield member(s) 22, the toe box 24 is embedded completely within the toe cap portion 16 during moulding of the lower member 12.

[0042] The toe box 24 is substantially rigid and can withstand high compressive forces so as to prevent crushing and/or severing of a user's toes, in addition to preventing punctures and slicing

of the toe cap portion 16. Such compressive forces would typically be received by way impact of an object on an upper surface of the toe box 24.

[0043] The nature of embedding of the shield members 22 and the toe box 24 within the lower member 12 can and will vary between embodiments of the invention, and may vary between the different protective elements 20 employed in any particular article of safety footwear 10. In any event, however, embedding of these protective elements 20 in the lower member 12 is made possible by formation of the lower member 12 by way of moulding.

[0044] For example, each protective element 20 may be embedded, as in the case of the toe box 24 and shield member 22 shown in Figures 4 and 5, such that a top surface 22a of the shield member 22, and a rear surface 25b of the toe box 24 are both exposed. One skilled in the art will appreciate that, in such an embodiment, each protective element 20 is sealed into the lower member 12. More particularly, the lower member 12 is moulded around at least a portion of each protective element 20. In the case of the toe box 24, the lower member 12 is moulded around the flange portion 28 thereof and also around at least a portion of the convex shell 26 thereof, as seen in Figures 4 and 5. In the case of the shield member 22, the lower member 12 is moulded around a toe end 23a and

a heel end 23b thereof. In this manner, punctures or slices of the portions of the lower member 12 located adjacent a bottom surface 22b of the shield member or located adjacent the front surface 25a of the toe box 24 do not allow leaks (of air or, for example, water) into the interior of the safety footwear 10 as each protective element 20 remains substantially sealed therein after such punctures or slices of the outer surface of the lower member 12.

[0045] One skilled in the art will readily appreciate that such sealing of the protective elements 20 within the lower member 12 - which is not readily possible in prior art safety footwear constructed by ways other than by moulding, particularly that constructed of, for example and without limitation, leather - also serves to provide resistance to displacement of the protective elements 20 within the lower member 12, which displacement may occur, for example when stepping on a sharp, rigid object (such as a nail).

[0046] The protective element 20 may each preferably be embedded in the lower member so as to be fully encased therewithin, as shown in Figures 2 and 3. Such embodiments (i.e., as in Figures 2 and 3) will exhibit all of the advantageous properties discussed above with respect to the embodiment shown in Figures 4 and 5, and will

do so to a still further degree, given the increased stability of the protective elements 20 within the lower member 12, and the more comprehensive seal accomplished by total encasing of each protective element 20 within the lower member 12.

[0047] One skilled in the art will appreciate that each protective element need not be embedded in the same fashion as any others in the particular article of safety footwear 10. This is, an article of safety footwear 10 could have a toe box 24 embedded as in Figures 2 and 3, and a shield member 22 embedded as in Figures 4 and 5.

[0048] Each shield member 22 and the toe box 24 may be constructed from one or more composite materials. In this specification and the appended claims, the term "composite materials" is defined as follows: composite materials are materials composed of two or more components. One component is typically a fibrous material such as, for example fibre glass, KEVLAR<sup>®</sup>, a carbon fibre, or the like, which may be provided in filamentary or sheet form, and that serves to provide rigidity and tensile strength. The other component is typically a resin (e.g., polyester, epoxy, or cyanate ester), which is typically cured (by way of heat or otherwise), and that serves to bind together the fibrous material. Such composite materials exhibit advantageous

properties in that they are typically very light in weight, particularly when considered relative to their tensile and compressive strength.

[0049] Each shield member 22 may alternatively be constructed from pierce resistant densely woven fabric selected from the group consisting of: woven steel fibers and woven KEVLAR® fibers.

[0050] Other modifications and alterations may be used in the design and manufacture of other embodiments according to the present invention without departing from the spirit and scope of the invention, which is limited only by the accompanying claims.

**THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:**

1. Safety footwear comprising:

(a) a unitarily moulded lower member constructed from polyurethane, wherein said lower member includes a sole portion and a toe cap portion; and,

(b) one or more protective elements embedded in said unitarily moulded lower member;

wherein said unitarily moulded lower member defines an interior cavity, and wherein at least one of said one or more protective elements has a surface exposed to said interior cavity.

2. Safety footwear according to claim 1, wherein said protective elements comprise one or more substantially planar shield members embedded in said sole portion.

3. Safety footwear according to claim 2, wherein said one or more shield members comprise a single shield member spanning substantially the entire length and width of said sole portion.

4. Safety footwear according to claim 3, wherein said shield member is embedded in said sole portion so as to be fully encased therewithin.

5. Safety footwear according to claim 4, wherein said shield member is constructed from one or more composite materials.

6. Safety footwear according to claim 4, wherein said shield member is constructed from pierce resistant fabric selected from the group consisting of: woven steel fibers and woven KEVLAR<sup>®</sup> fibers.

7. Safety footwear according to claim 1, wherein said protective elements comprise a toe box embedded in said toe cap portion.

8. Safety footwear according to claim 7, wherein said toe box comprises a convex shell having an inwardly projecting bottom flange portion.

9. Safety footwear according to claim 8, wherein said toe box is embedded in said toe cap portion during moulding so as to be fully encased therewithin.

10. Safety footwear according to claim 9, wherein said toe box is constructed from one or more composite materials.

11. Safety footwear according to claim 1, wherein said protective elements comprise one or more shield members embedded in said sole portion, and a toe box embedded in said toe cap portion.

12. Safety footwear according to claim 11, wherein said shield members are embedded in said sole portion so as to each be fully encased therewithin.

13. Safety footwear according to claim 11, wherein said toe box is embedded in said toe cap portion so as to be fully encased therewithin.

14. Safety footwear according to claim 11, wherein said shield members are embedded in said sole portion so as to be fully encased therewithin; and, wherein said toe box is embedded in said toe cap portion so as to be fully encased therewithin.

15. Safety footwear according to claim 12, wherein said one or more shield members comprise a single shield member spanning substantially the entire length and width of said sole portion.

16. Safety footwear according to claim 14, wherein said one or more shield members comprise a single shield member spanning substantially the entire length and width of said sole portion.

17. Safety footwear according to claim 11, wherein said toe box comprises a convex shell having an inwardly projecting bottom flange portion.

18. Safety footwear according to claim 11, wherein said protective elements are each constructed from one or more composite materials.

19. Safety footwear according to claim 12, wherein said sole plates are constructed from pierce resistant fabric selected from the group consisting of: woven steel fibers and woven KEVLAR<sup>®</sup> fibers.

20. Safety footwear according to claim 1, further comprising an upper member that is affixed to said unitarily moulded lower member.

21. Safety footwear according to claim 1, wherein said lower member further includes an in-step area, and wherein at least one of said protective elements is embedded in the in-step area of said lower member.

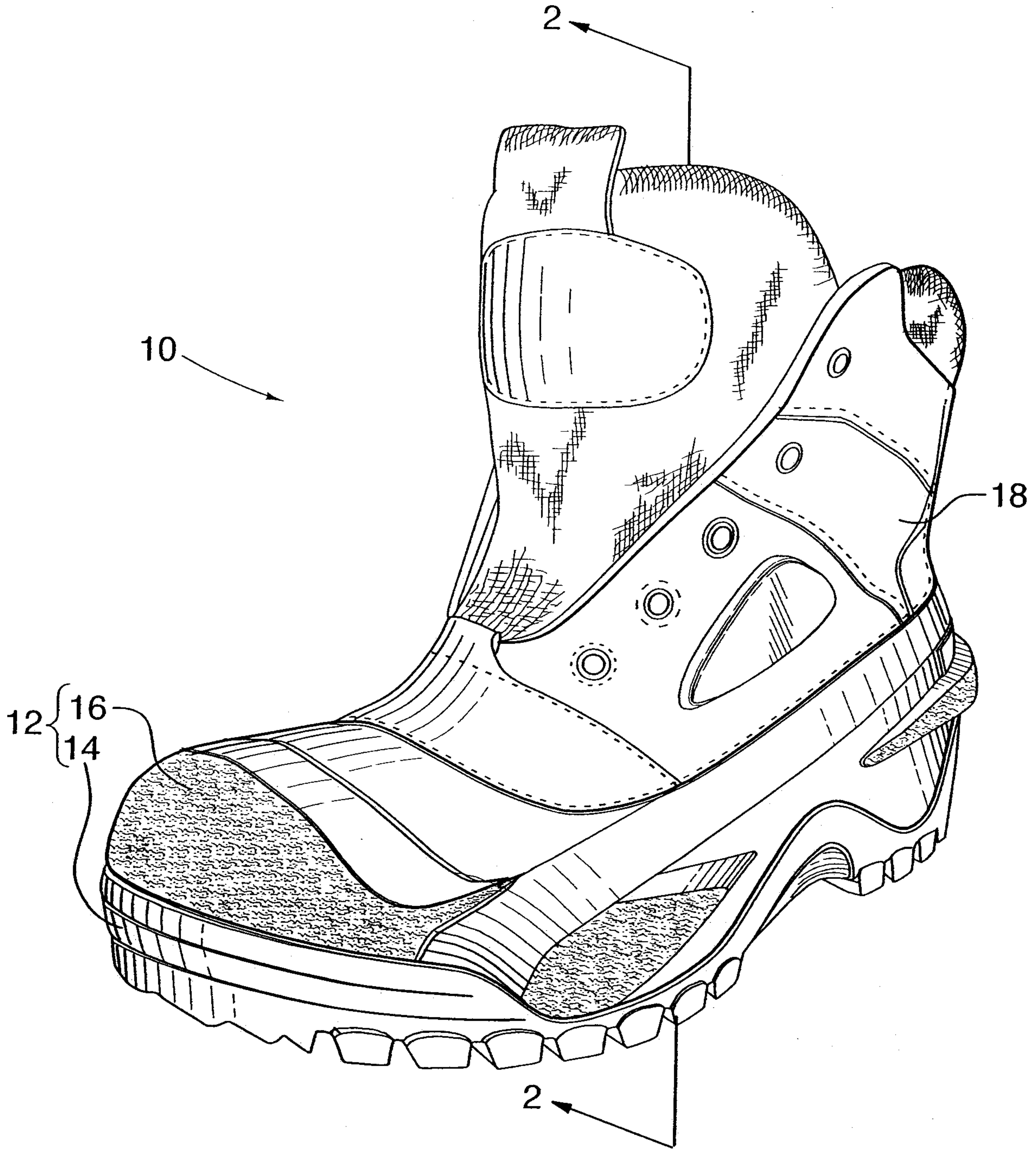


FIG. 1



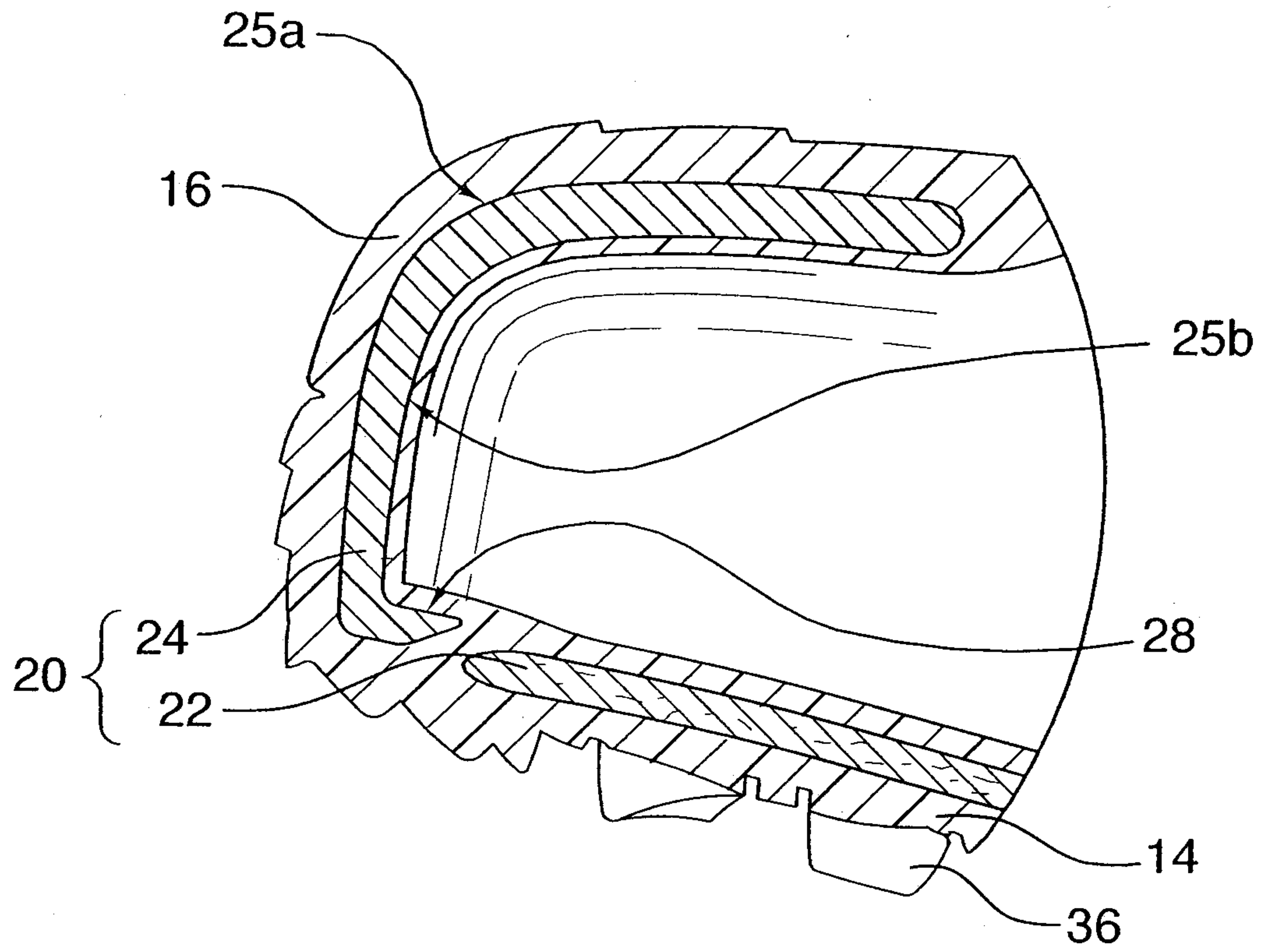


FIG.3

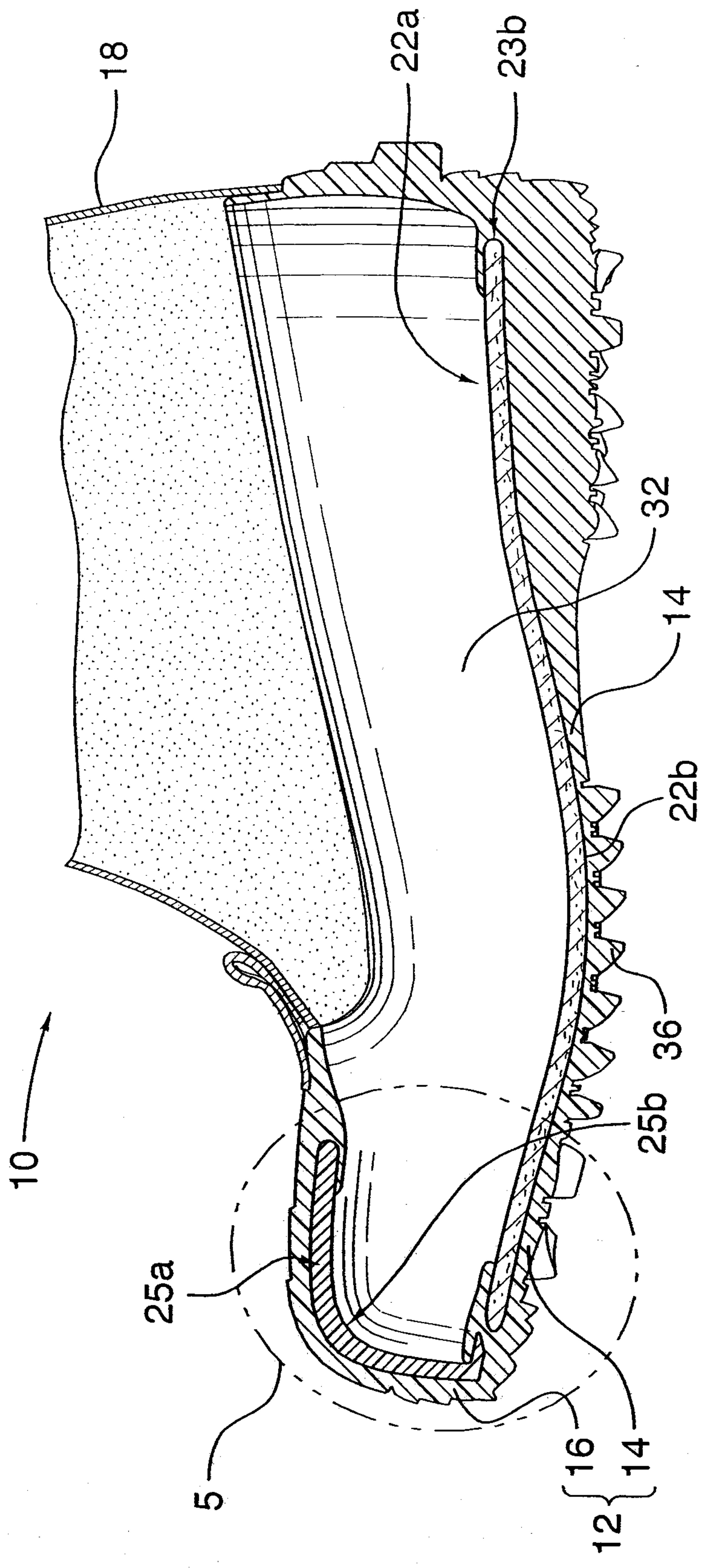


FIG.4

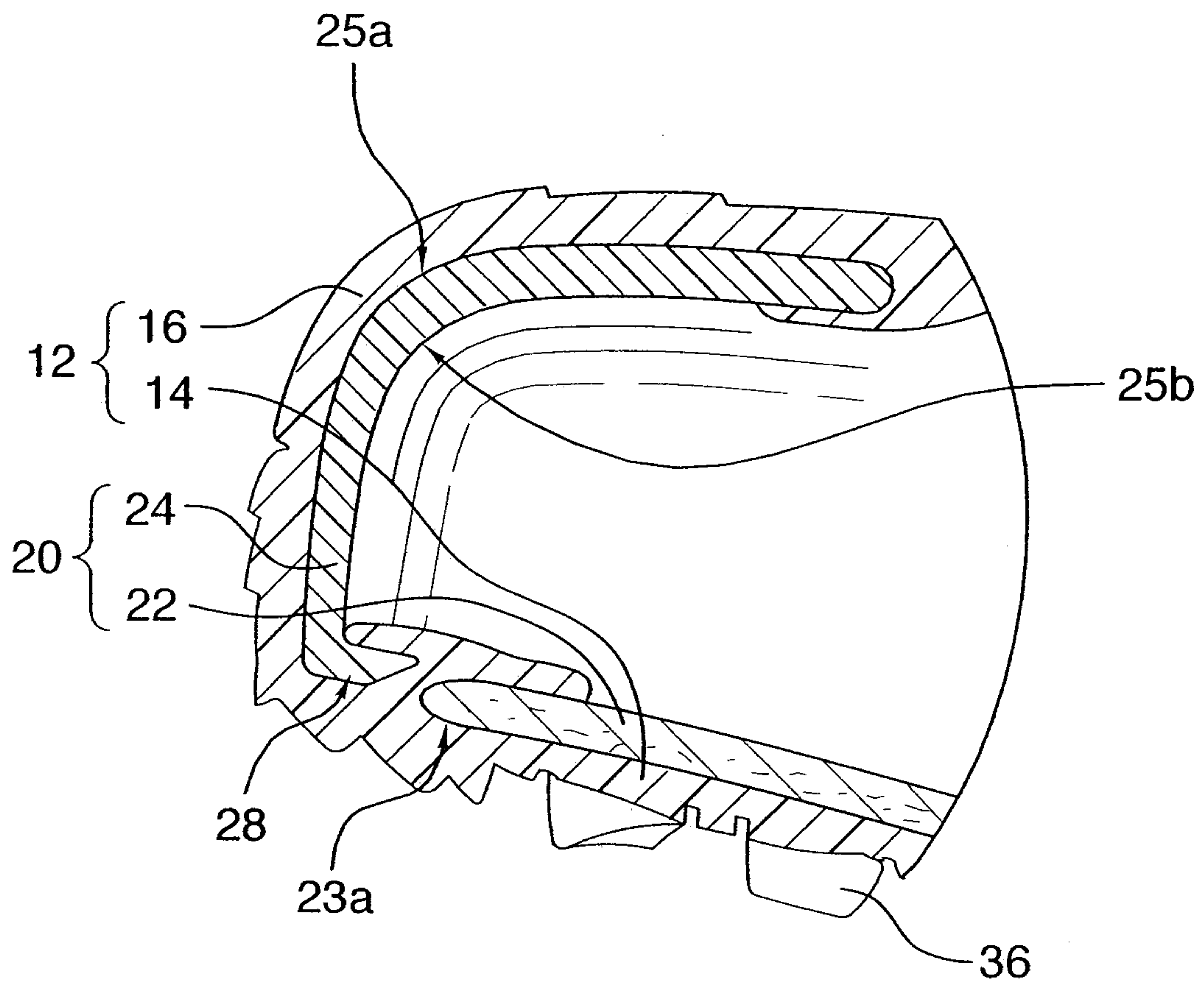


FIG.5

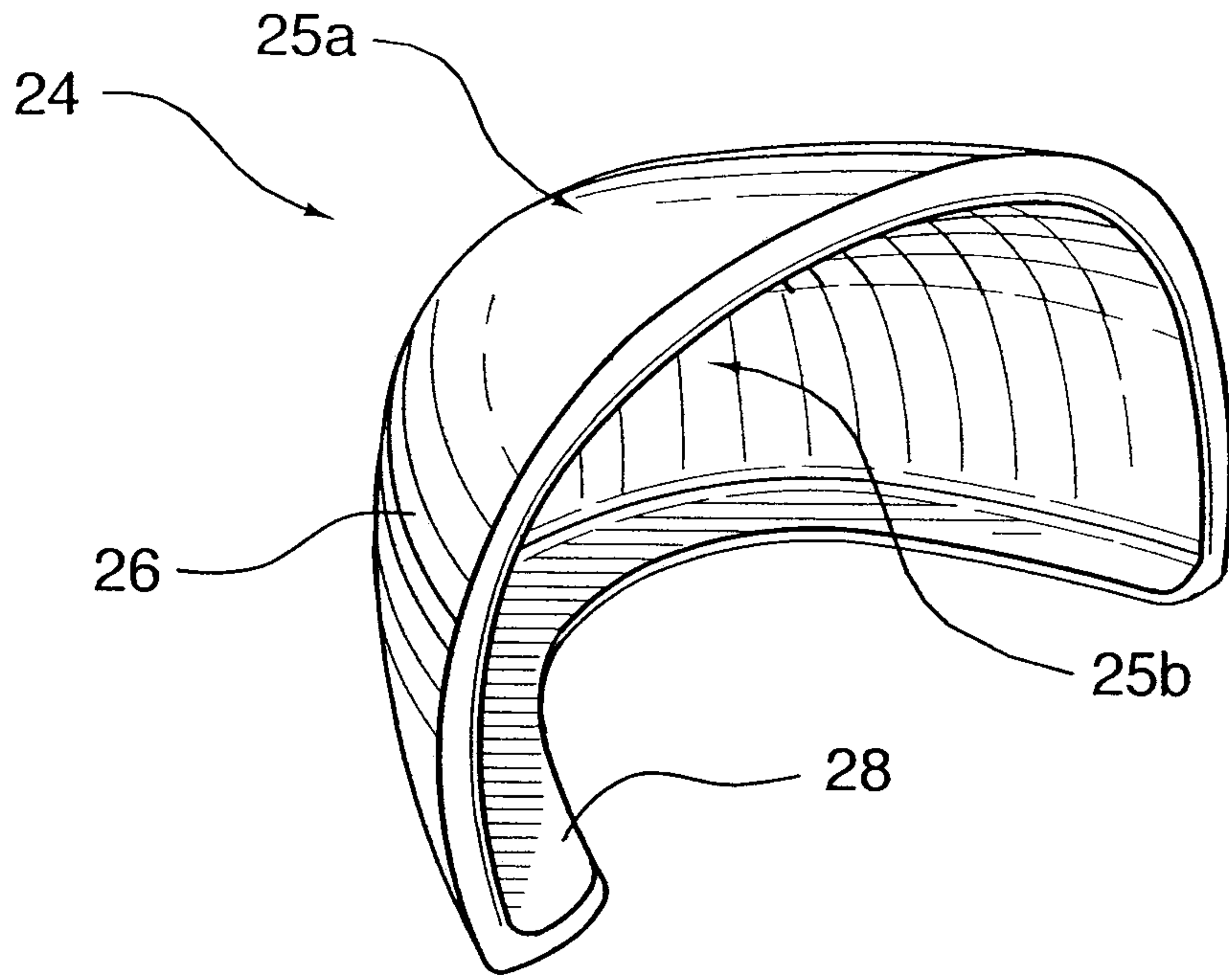


FIG. 6

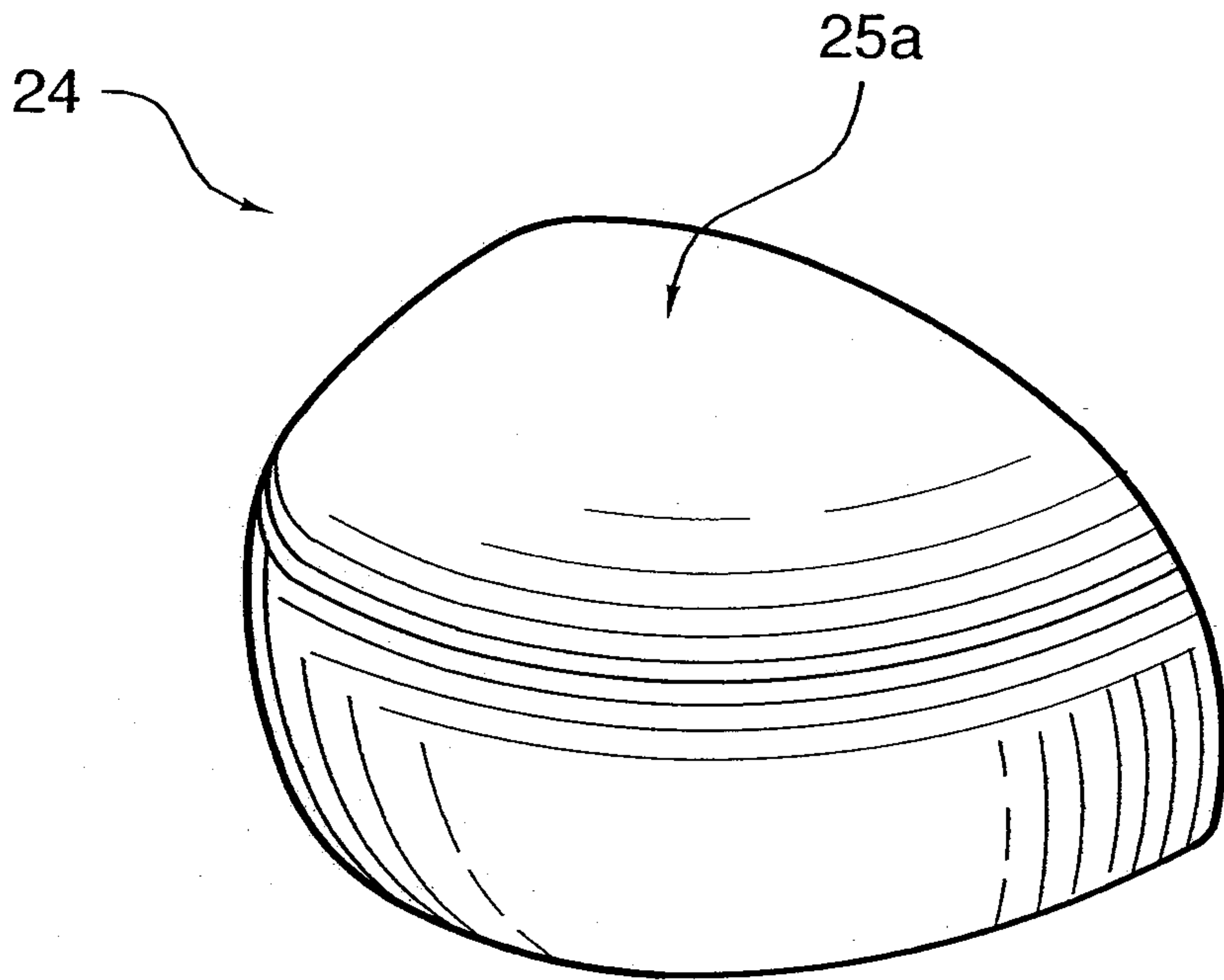


FIG. 7

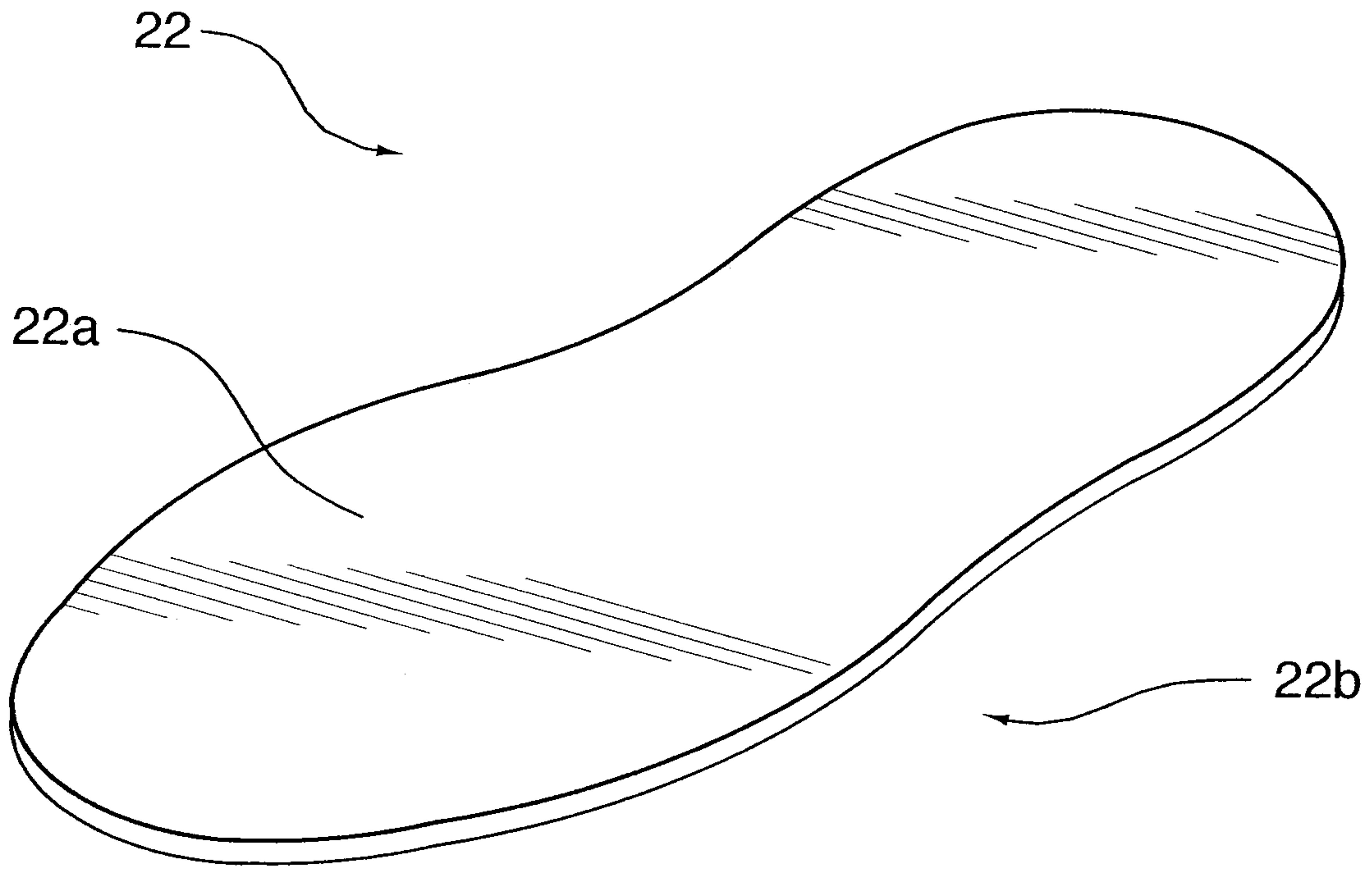


FIG.8

