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(54) Sandwich-type footwear stiffening element of rigid or at least semi-rigid behaviour, usable as part of the sole unit or insole

(57) For a lower part (4) of footwear (2, 3), an element of rigid or semi-rigid behaviour suitable for use as the sole unit or as an insole or internal foot support for the footwear, this latter comprising a vamp (7) associated with the lower portion (4) of the footwear. Said element (1) comprises at least three mutually associated layer portions (13, 14, 15) defining a sandwich structure (1A); the outer portions (13, 14) having greater rigidity than the inner portion (15), these portions being stably joined together to form a single body (1A).

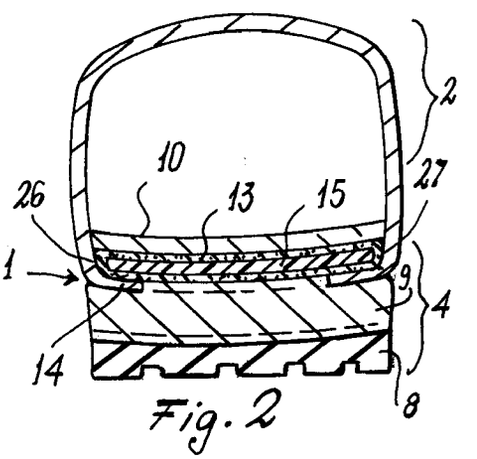

Fig. 2

EP 0 931 470 A2

Description

[0001] This invention relates to a footwear element of rigid or semi-rigid behaviour, in accordance with the introduction to the main claim.

[0002] As is well known, for certain footwear, and in particular sports footwear, the sole unit must behave rigidly or at least semi-rigidly. This is for example the case in mountain shoes or boots, cycle shoes and boots for roller skates (both of traditional type and with in-line wheels), or in footwear used for certain athletics specialities. This sole unit behaviour is required in order to achieve better foot support and/or to enable the user or athlete to transfer the greatest possible force to the ground or to the vehicle on which he moves (for example a bicycle), in order to achieve improved performance.

[0003] Usually, to achieve a greater or lesser rigidity of the sole unit (traditionally of leather or rubber, or of rubber and/or synthetic polymer mixtures), two different methods are used, namely by inserting into the shoe vamp an insole constructed of more rigid materials than those used for the sole unit, such as wood, leather, cellulose conglomerates (such as that known by the commercial name of Texon), or of synthetic polyurethane resins, polypropylene, nylon or the like, or by metal blade or bar inserts; or by using rigid materials for the sole unit itself, such as leather, wood or synthetic resins of the aforesaid type. The first method (insole) is used for example for mountain shoes or boots, and the second method for example for clogs.

[0004] These solutions only partly achieve the desired object, ie they achieve only a limited sole or insole rigidity.

[0005] Footwear has recently appeared on the market having the sole unit or insole (and in particular the whole or part of the sole unit) constructed of composite materials combining fabrics or fibres of light materials having a high elastic modulus (such as carbon, aramid, glass or synthetic resin fibres) embedded in a resin acting as a binder. Such solutions and constructional methods result in components (soles or insoles) having a considerable rigidity/weight ratio, making them advantageous over components obtained by the two aforesaid methods. However these components have a higher cost than that achieved by the other said known methods. This derives from the high cost of certain fibres (such as carbon fibres) and of the production process, which is usually slower and more delicate than those involved in the production of components constructed only of synthetic resins or by the other aforesaid known methods.

[0006] An object of this invention is to provide a footwear element of rigid or semi-rigid behaviour for use in footwear as a sole unit or part of the sole unit or as an insole which, although providing the footwear with the required rigidity, is of very low constructional cost.

[0007] This and further objects which will be apparent to the expert of the art are attained by a footwear element in accordance with the characterising part of the main claim.

[0008] The invention will be more apparent from the accompanying drawing, which is provided by way of non-limiting example and on which:

Figure 1 is an exploded view of a mountain boot provided with the element of the invention;
Figure 2 is a section on the line 2-2 of Figure 1;
Figure 3 is a cross-section through a cycling shoe provided with the element of the invention;
Figure 4 is an exploded view of a different embodiment of the invention;
Figure 5 is a perspective view of a further embodiment of the invention;
Figures 6A, 6B, 6C are sections through that portion of the element of the invention indicated by K in Figure 4;
Figures 7A, 7B, 7C are sections on the line 7-7 of Figure 4 showing different forms of the element of the invention;
Figure 8 shows a further embodiment of the invention;
Figures 8A, 8B and 8C are sections on the lines 8A-8A, 8B-8B and 8C-8C of Figure 8 respectively;
Figure 9 shows a further variant of the invention; and
Figures 9A, 9B and 9C are sections on the lines 9A-9A, 9B-9B and 9C-9C of Figure 9 respectively.

[0009] Said figures show an element 1 for footwear such as a mountain boot 2 or a cycle shoe 3, said element being arranged to stiffen a lower part 4 of said footwear, which comprises a vamp 7 associated with said part 4. In one embodiment of the footwear, shown in Figures 1 and 2, this lower part 4 comprises a sole unit 8 of rubber or similar material, on which the rigid or semi-rigid element 1 is positioned and fixed to act as an insole. Between the element 1 and sole unit 8 there can be provided a damping intersole 9 of expanded polyurethane or expanded ethylvinylacetate (EVA). On the element 1 there is placed a usual removable anatomic insole 10. Consequently in these figures, the element 1 stiffens the part 4, and is fixed to the sole unit by gluing or the like.

[0010] In contrast, in Figure 3 the element 1 acts as the actual sole unit, and is joined to the vamp in the usual manner, for example by gluing. The removable insole 10 is placed on the element 1 as in the footwear embodiment of Figures 1 and 2, added pieces of rubber 11 (or other like material) possibly being applied externally to the lower side of said element and fixed to this element in known manner, for example by gluing.

[0011] The element 1 is of layered type and comprises (see Figures 6A, 6B and 6C) three layers mutually superposed to form a one-piece sandwich. The outer layers 13 and 14 are of a material having greater rigidity

than the inner layer 15, the thickness of this latter being however greater than the individual layers 13 and 14. Preferably the layers 13 and 14 (connected together laterally, at the edges or side walls 26 and 27 of the element 1, so as to enclose the layer 15 within them), are constructed of the same material, and in particular of artificial plastic or synthetic resin, or of nylon, polyurethane or polypropylene, or of composite material comprising synthetic resins and fabrics or fibres of carbon aramid, glass or other synthetic resins. The layer 15, acting as the core of the layered structure 1A of the element 1, is constructed of a lighter material than the constituent material of the layers 13 and 14, such as artificial plastic foam or expanded resin (shown in Figure 6C), cellular materials of natural origin (such as light wood, shown in Figure 6A), or cavity-containing materials (Figure 6B) formed from touching cylindrical plastic elements 17 of equal or different circular cross-sections or of elliptical or polygonal cross-sections. The elements 17 can be solid or hollow and define a honeycomb structure.

[0012] As stated, the various layers 13, 14 and 15 are joined together to form a one-piece structure 1A which cannot be separated into its various components. The various components (layers) of the structure 1A are integrated in various ways: for example by polymerizing the epoxy resin with which the layers 13 and 14 have been preimpregnated, if thermoplastic materials are used; by softening the resin defining the core (Figure 6C) until fusion, if thermoplastic materials are used for the layers 13 and 14; or by gluing the various layers together, this method being suitable whether the layers 13 and 14 are of thermosetting or thermoplastic materials.

[0013] A stiffening element 1 obtained in accordance with the invention is of lower cost than a known equal-thickness similar element obtained from composite materials, however its rigidity is comparable to these. The element 1 is very light in weight compared with analogous known elements, while having at least a comparable rigidity to these layer. It is preferably used along the entire extent of the lower part 4 of the footwear 2 or 3 (ie along the entire foot of the user) and can comprise a plurality of portions of constant or variable cross-section 20, 21, 22 (Figure 5 but again in layer form) with different flexibilities on the basis of their position relative to the user's foot (for example with greater flexibility at the forefoot). This different flexibility can also be obtained by constructing the element 1 in one piece (but again of layer form) with different thicknesses, decreasing towards the front end 23 of the element 1 (with reference to the foot shape of the user wearing the footwear 2 or 3), as shown in Figures 4 and 5. Alternatively, the thickness of the element 1 can be greater in the forefoot portion or region 20 and decrease towards the heel region 22, or be constant along its entire longitudinal axis A, as shown in Figure 1. Furthermore, the cross-section of the element 1 can be constant (Figure 7A), variable (Figure 7B) and decreasing towards its lateral edges 26 and 27, or comprise ribs 28 (Figure 7C) for further stiffening.

[0014] Alternatively, to achieve differential rigidity for the element 1, it can comprise differently ribbed portions (as in the embodiment of Figure 8 to 8C). For example the front portion or forefoot 20 can comprise at least one pair of lower parallel ribs 33, with no ribs on the arch portion, and with the heel or ankle portion 22 comprising only one central rib 34.

[0015] In a further variant of the invention (see Figures 9 to 9C), at least the lower part (with reference to the figures under examination) can be clad with a film 36 of thermoplastic material (such as that known by the commercial name of PEBAX) able to protect that element. As shown in Figure 9, the film 36 can also cover at least a portion of the upper part of the insert, in its forefoot region 20, and in that case also wrap the lateral part of the corresponding element 1 (see Figure 9A). This film is associated with the element 1 for example during the polymerization of the aforedescribed resin, or otherwise during the assembly (moulding) of the various portions of said element. During this stage, a layer 44 of fibrous material, such as felt or non-woven fabric, can also be associated with the underside of the element 1 (see Figures 9 to 9C). This facilitates the subsequent fixing of this element into the sole unit or onto the intersole (or equivalent element) when this element is finally positioned, as a foot support, within the relative footwear (for example the boot 2).

[0016] Other variants of the invention can be devised in the light of the aforegoing description, and are to be considered as falling within the scope of this document.

Claims

1. An element of rigid or at least semi-rigid behaviour for stiffening a lower part or portion (4) of footwear (2, 3), and suitable for use as the sole unit or as an insole or internal foot support for the footwear, this latter comprising a vamp (7) associated with the lower portion (4) of the footwear, characterised in that said element (1) presents a layered body (1A) comprising at least three mutually associated superposed portions (13, 14, 15) defining a sandwich structure, the outer portions (13, 14) having greater rigidity than the inner portion (15), these portions being stably joined together to form a single body (1A).

2. A stiffening element as claimed in claim 1, characterised by being positioned on a sole unit (8) and acting as an assembly foot support.

3. A stiffening element as claimed in claim 1, characterised by being positioned on the outside of the footwear (3) to act as a sole unit.

4. A stiffening element as claimed in claim 1, characterised by being positioned along the entire plantar arch by the user who wears the footwear.

5. A stiffening element as claimed in claim 1, characterised by comprising portions of differential flexibility, preferably with greater flexibility at its front end (23).

6. A stiffening element as claimed in claim 5, characterised in that said portions are well defined parts (20, 21, 22) of its body (1A).

7. A stiffening element as claimed in claim 5, characterised in that said portions are defined by a variation in the thickness of the body (1A) of the element (1), this thickness decreasing at the front end (23) of said body.

8. A stiffening element as claimed in claim 1, characterised by being of constant cross-section.

9. A stiffening element as claimed in claim 5, characterised in that the thickness of the portions (20, 21, 22) of its body (1A) decrease along the longitudinal axis (A) of said body in passing from the forefoot portion (20) to the heel portion (21).

10. A stiffening element as claimed in claim 1, characterised by a tapered cross-section in correspondence with its lateral edges (25, 27).

11. A stiffening element as claimed in claim 1, characterised by comprising surface projections (28) extending from a free face thereof.

12. A stiffening element as claimed in claim 1, characterised by comprising at least one stiffening rib (33, 34) along at least a part of that surface facing the lower part of the footwear (2, 3) with which it is associated.

13. A stiffening element as claimed in claim 1, characterised in that the outer portions or layers (13, 14) of its layered body (1A) are joined together at the lateral edges (26, 27) of said body, said portions enclosing the central portion or core (15).

14. A stiffening element as claimed in claim 13, characterised in that the outer portions (13, 14) of its layered body (1A) are of an artificial plastic material of at least relatively high rigidity.

15. A stiffening element as claimed in claim 14, characterised in that the outer portions (13, 14) are of polyurethane.

16. A stiffening element as claimed in claim 14, characterised in that the outer portions (13, 14) are of polypropylene.

17. A stiffening element as claimed in claim 14, characterised in that the outer portions (13, 14) are of nylon.

18. A stiffening element as claimed in claim 14, characterised in that the outer portions (13, 14) are of composite material.

19. A stiffening element as claimed in claim 18, characterised in that the composite material comprises a carbon, aramid, glass or similar fibre fabric.

20. A stiffening element as claimed in claim 18, characterised in that the composite material comprises carbon, aramid, glass or similar fibres.

21. A stiffening element as claimed in claim 1, characterised in that the inner portion or core (15) is of plastic foam or expanded resin.

22. A stiffening element as claimed in claim 1, characterised in that the inner portion or core (15) is of cellular material of natural origin.

23. A stiffening element as claimed in claim 1, characterised in that the inner portion or core (15) is of honeycomb material.

24. A stiffening element as claimed in claim 1, characterised in that the inner portion (15) comprises cylindrical elements positioned between the outer layers (13, 14).

25. A stiffening element as claimed in claim 1, characterised by being clad, at least on one of its faces, with a protection film (36).

26. A stiffening element as claimed in claim 25, characterised in that the protection film (36) is of thermoplastic material.

27. A stiffening element as claimed in claim 1, characterised by being clad, at least on one of its faces, with a fibrous material layer (44).

28. A stiffening element as claimed in claim 1, characterised in that the various portions (13, 14, 15) of the layered body are joined together by gluing.

29. A stiffening element as claimed in claim 1, characterised in that the various portions (13, 14, 15) of the layered body (1A) are joined together by polymerizing the resinous material defining the outer layers of said body.

30. A stiffening element as claimed in claim 1, characterised in that the various portions (13, 14, 15) of the layered body (1A) are joined together by fusing the inner layer (15).

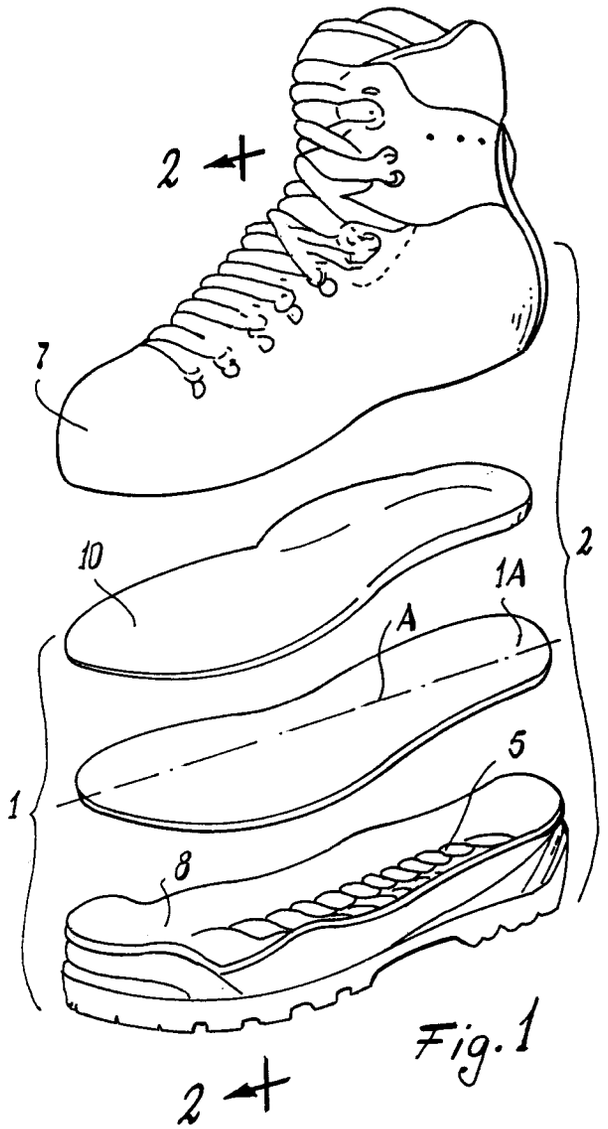

Fig. 1

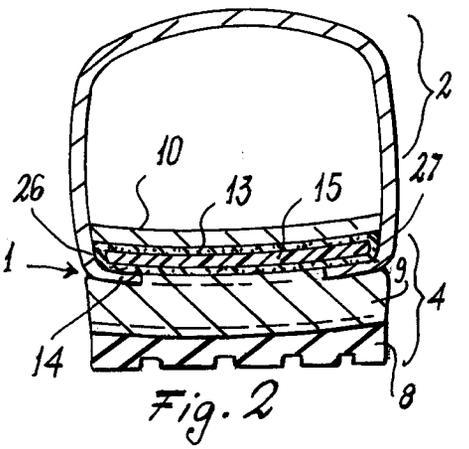

Fig. 2

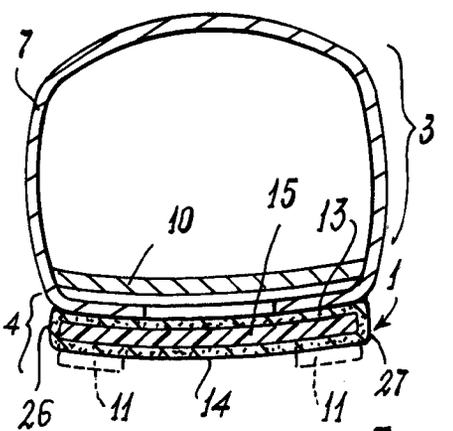

Fig. 3

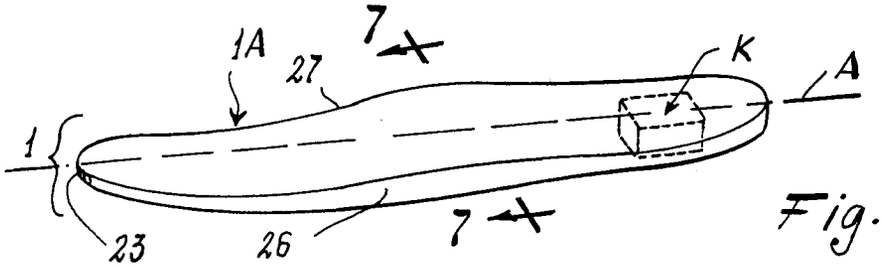

Fig. 4

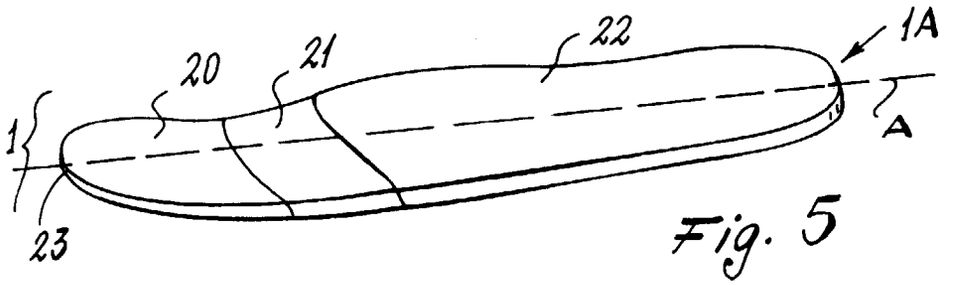

Fig. 5

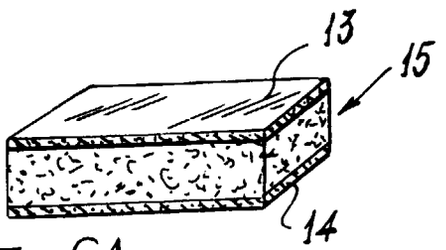

Fig. 6A

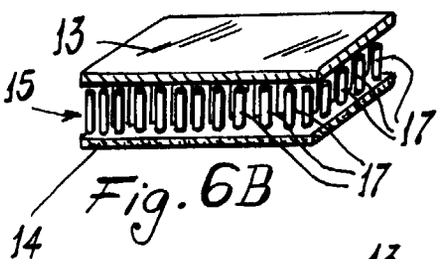

Fig. 6B

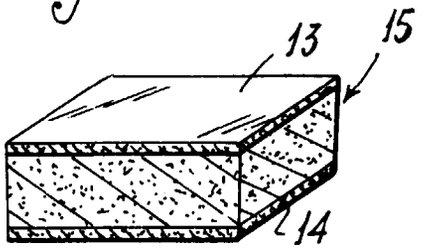

Fig. 6C

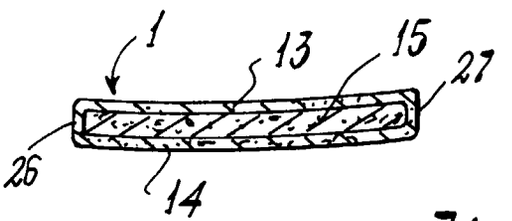

Fig. 7A

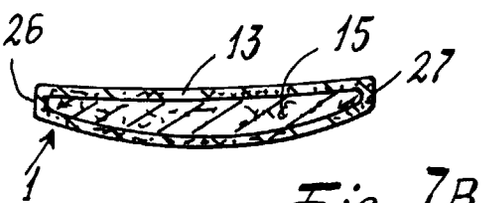

Fig. 7B

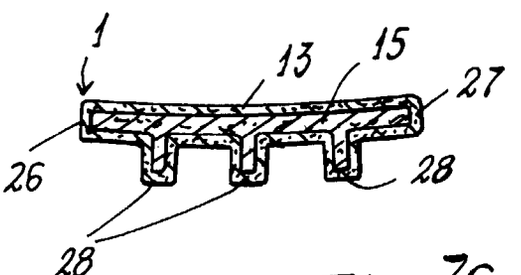

Fig. 7C

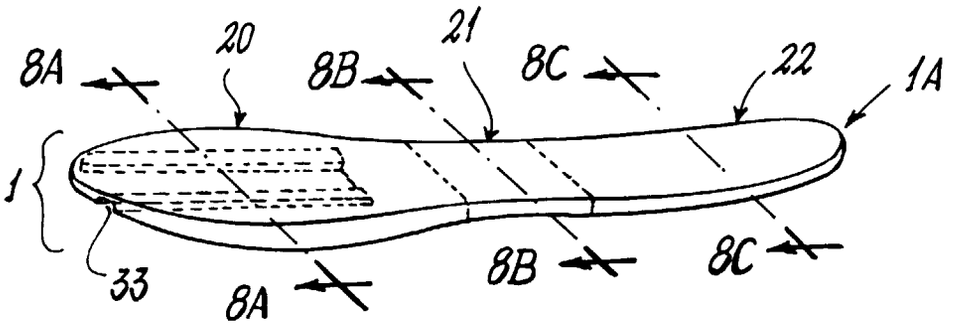

Fig. 8

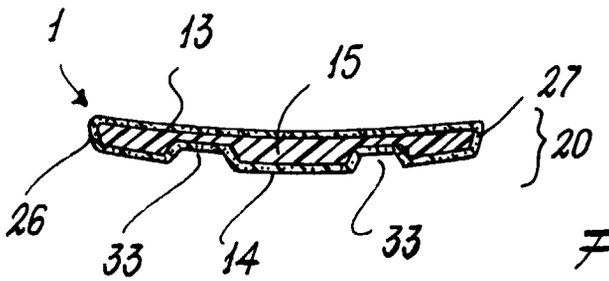

Fig. 8A

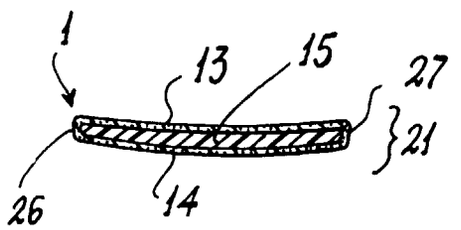

Fig. 8B

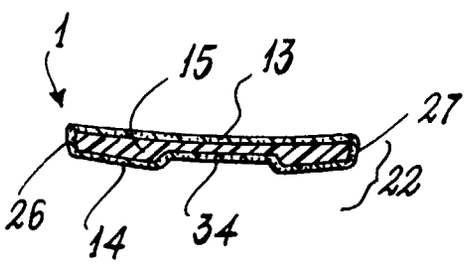

Fig. 8C

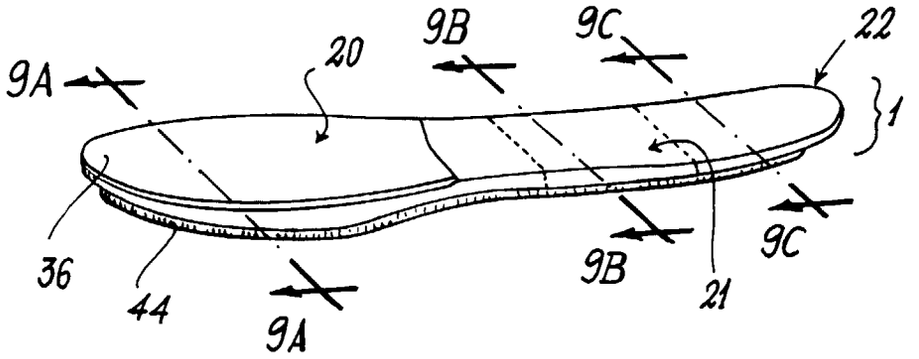

Fig. 9

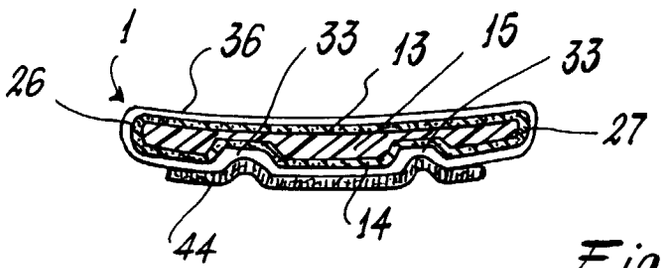

Fig. 9A

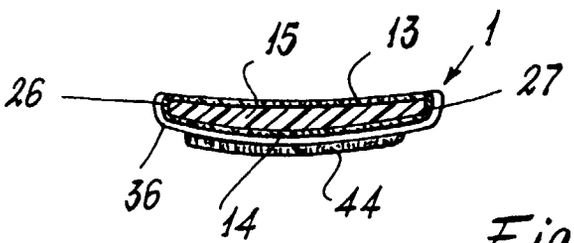

Fig. 9B

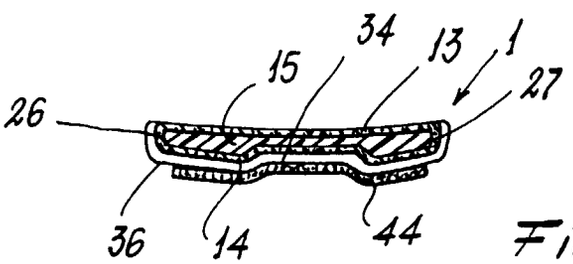

Fig. 9C