(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 120 056 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
01.08.2001 Bulletin 2001/31

(51) Int Cl.[7]: **A43B 13/18**

(21) Application number: **01101122.8**

(22) Date of filing: **19.01.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **25.01.2000 IT MI000086**

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(54) Shock-absorbing sole structure

(57) 1. A shock-absorbing sole structure of the type comprising: a sole with tread (1, 1', 1", 1"', 1"") in turn having at least one heel cavity (3, 3', 3", 3"', 3"") and at least one sole cavity (5, 5', 5", 5"', 5"") on the upper surface of the tread (1, 1', 1", 1"', 1""), a heel protuberance and a sole protuberance on the lower surface of the tread (1, 1', 1", 1"', 1"") corresponding to the heel cavity (3, 3', 3", 3"', 3"") and respectively to the sole cavity (5, 5', 5", 5"', 5""); and an element (13, 13', 13", 13"', 13"") for covering the heel cavity (3, 3', 3", 3"', 3"") and the sole cavity (5, 5', 5", 5"', 5"") to be fixed above the upper surface of the tread (1, 1', 1", 1"', 1""), characterised in that elastic shock-absorbing means (11t and 11p, 11't and 11'p, 11"t and 11"p, 11"'t and 11"'p, 11""t and 11""p) are provided in the housings defined by the internal walls of the heel cavity (3, 3', 3", 3"', 3"") and of the sole cavity (5, 5', 5", 5"', 5"") and by the lower wall of said covering element (13, 13', 13", 13"', 13""), said elastic shock-absorbing means (11t and 11p, 11't and 11'p, 11"t and 11"p, 11"'t and 11"'p, 11""t and 11""p) being formed by a solid material with elastic behaviour similar to air.

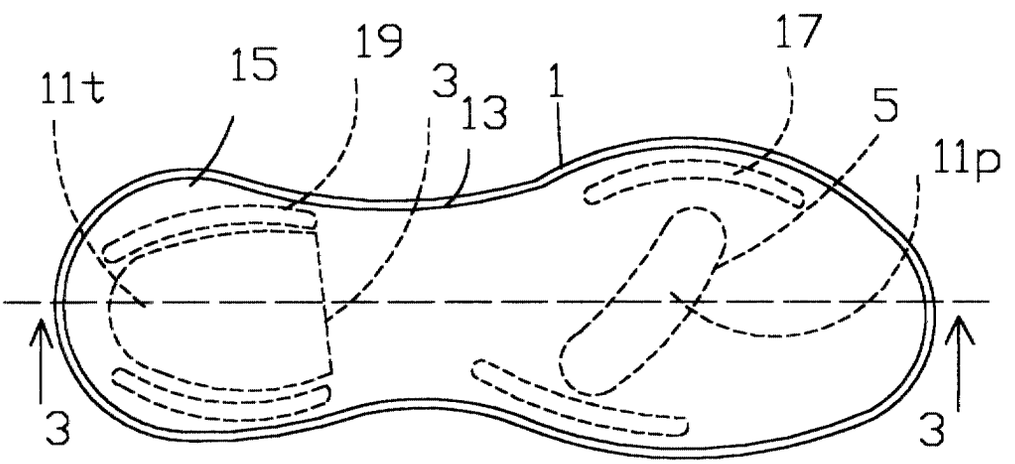

Fig. 1

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Description

[0001] The present invention relates to a shock-absorbing sole structure which can be used in the sector of footwear intended to protect the spine from injury which may occur during walking, or running in the case of sports footwear.

[0002] Footwear has for some time been known which forms on the sole or inside thereof a cushion constituted by a fluid, for example air or gas, to produce the shock-absorbing effect.

[0003] In this footwear the main disadvantage is represented by the fact that the cushion is exposed to the risk of damage by external agents, such as nails, sharp stones or objects which may be on the ground and which may cause puncturing of the cushion with inevitable leakage of the working fluid and total loss of functionality by the same cushion.

[0004] Another disadvantage is represented by the low support effect on the foot by the working fluid in that the latter is provided in the cushion generally at atmospheric pressure, so as to simplify the construction of the sole.

[0005] So as to improve the support effect some traditional shock-absorbing sole structures provide a pressurised fluid inside the cushion, however this means that in any case a compromise has to be reached between the required pressure of the fluid and the complexity of the construction of the sole structure which has to guarantee the hermetic seal of the cushion. Moreover there is a natural leakage in time of the gases, which tend to leak from the walls which contain them, making the stock of footwear unusable.

[0006] Other known creations allow shock absorption by inserting in the sole a complicated mechanical device for damping vibrations.

[0007] The object of the present invention is therefore that of providing a shock-absorbing sole structure, for both classic and sports footwear, which remedies the disadvantages suffered by the known art, and has the requirements of simplicity of filling of the cushions by means of air or gas, yet with sealing of the solid parts.

[0008] More particularly one object of the present invention is that of providing a sole structure without the possibility of damage to the shock-absorbing system, during normal use of the footwear.

[0009] Another object of the present invention is that of creating a shock-absorbing sole structure capable of producing a significant effect of support of the foot without thereby complicating the construction of the sole.

[0010] Yet another object of the present invention is that of providing a simple and economical shock-absorbing sole structure.

[0011] These objects are achieved by a shock-absorbing sole structure of the type comprising: a tread in turn having a heel cavity and a sole cavity on the side of the upper surface of the tread, a heel protuberance and a sole protuberance on the side of the lower surface of the tread, corresponding to the heel cavity and to the sole cavity respectively; and a layer for covering the heel cavity and the sole cavity superimposed and fixed on the upper surface of the tread, characterised in that it comprises elastic shock-absorbing means inserted in the heel cavity and respectively in the sole cavity, in the form of a cushion made in any solid material having an elastic behaviour similar to air.

[0012] Materials suitable for the purpose may be foam rubber or latex foam.

[0013] Advantageously the elastic shock absorption element is formed by a solid material which, unlike an air cushion, is capable of retaining good functionality in the case of puncturing of the heel and/or sole cavity by an external sharp body, and of not losing pressure in time or due to a minor assembly defect of the sole, not visible to the naked eye, but which causes rejection of the entire footwear, with a considerable financial waste.

[0014] The shock absorption system of the present invention on the other hand ensures a higher shock absorption effect than that produced by air, considered as an ideal fluid from the point of view of simplicity, but which does not absorb the waves of impact and the vibrations which instead a solid spongy material can do. The shock absorption system of the present invention therefore has the merit of creating ideal shock absorption as it is made with a material having an elastic behaviour equivalent to air, without having the disadvantages of an air and more generally fluid shock absorption system, given that the shock-absorbing cushion in a solid material of the present invention continues to perform its shock-absorbing effect even in the case of damage to its housing cavity, and in that due to the integration of the solid cushion of the present invention in the sole structure it is not necessary to form a hermetically sealed housing which is instead essential for air and more generally fluid shock-absorbing systems.

[0015] The shock-absorbing sole structure of the present invention is extremely simplified, with only the need to insert and block the solid shock-absorbing cushion between the internal wall of the cavity and the lower surface of the covering layer.

[0016] Equipping a traditional sole with the shock-absorbing system in accordance with the present invention therefore requires low additional costs.

[0017] Another significant advantage of the present invention is that it is possible to regulate the action of support of the foot, designing according to the weight to be supported the density and/or height of the layer of shock-absorbing material and consequently of the relative sole and heel cavity.

[0018] These and other advantages can be made clearer on reading of a preferred embodiment of the invention which refers to the accompanying drawings, in which:

Fig. 1 shows a plan view from above of the preferred embodiment of the shock-absorbing sole structure

of the present invention;

Fig. 2 shows a side view of the sole structure of Fig. 1;

Fig. 3 shows a view sectioned along line 3-3 of the shock-absorbing sole structure of Fig. 1;

Fig. 4 shows a variant of the layer for covering the sole structure of Fig. 3;

Fig. 5 shows a plan view of a tread of the present invention, having the shock-absorbing elements scattered throughout the sole and heel region;

Fig. 6 illustrates a shock-absorbing sole structure in accordance with the present invention, with shock-absorbing elements which can be removed from the tread; and

Fig. 7 illustrates another shock-absorbing sole structure in accordance with the present invention, with removable shock-absorbing elements.

[0019] In Figs. 1-3 the shock-absorbing sole structure comprises a tread 1 provided on the upper surface with a heel cavity 3 and a sole cavity 5 in turn defining on the lower surface of the tread 1 a heel enlargement 7 and a sole enlargement 9.

[0020] The sole cavity 5 has an elongated shape and is arranged immediately behind the metatarsal region of the foot, where the action of the front part of the foot is concentrated.

[0021] The interior of the heel cavity 3 and sole cavity 5 respectively is filled with high density foam rubber 11t and 11p respectively, that is to say a solid shock-absorbing filling material which is preferable due to its elastic behaviour similar to air.

[0022] Naturally all those materials in solid form which have an elastic behaviour similar to air are suitable for the purpose, for example, in addition to foam rubber, latex foam.

[0023] On the tread 1 a covering element 13 is applied which has on the lower surface a layer of adhesive to be applied to the upper surface of the sole 1 in such a way as to restrain the foam rubber cushions 11t and 11p in the respective cavities 5 and 3.

[0024] The covering element 13 has a shape identical to the sole but with slightly smaller dimensions, in such a way as to leave a perimetral strip 15 of tread 1 uncovered for application of the upper (not shown).

[0025] It is also possible to eliminate the use of the adhesive covering element, creating an appropriate joint between the cavities 5 and 3 and the respective cushions 11t and 11p.

[0026] It is not necessary for the shock-absorbing cushion in the heel cavity 11t to be the same as that in the sole cavity 11p, it is merely sufficient for them to be made in a solid material with elastic behaviour similar to air.

[0027] It is also foreseen for the sole structure to be made with a cavity to be filled with elastic material, deep to the extent the load to be damped is high.

[0028] In Fig. 4 the element of covering is a wedge 13' which has a sufficient thickness so that cavities 33 and 55 can be formed, on the side of its lower surface, which face corresponding cavities 3' and 5' on the tread 1' in such a way as to enclose a space for housing the shock-absorbing cushion 11't and 11'p which is approximately double compared to the case described previously. In addition to having all the merits and being subject to all the variants already described for the embodiment of Figs. 1-3, the embodiment of the sole structure of Fig. 4 has the additional advantage of using an element already present in the normal construction of the shoe, that is to say the wedge, to block the cushions in position.

[0029] By knowing beforehand the intended sector of the shoe (for example distinguishing a shoe for children from a shoe for adults), it is therefore possible to design and manufacture a sole structure to measure with always optimum shock-absorbing capacities.

[0030] Returning to Figs. 1-3, to prevent the shock-absorbing sole structure designed in this way from causing conditions of lateral instability of the sole on the ground, the lower part of the tread 1 is provided with a system of stabiliser elements.

[0031] The stabilisation elements are represented by a pair of arched protuberances 17 positioned outside of the opposite end side portions of the sole cavity 5 and by a pair of arched protuberances 19 positioned outside of the opposite end side portions of the heel cavity 3.

[0032] The protuberances 17 and 19 have a slightly lower height than that of the enlargements 7 and 9 of the tread in such a way as to allow equilibrium of the sole without penalising its shock-absorbing capacity.

[0033] According to a possible variant, the stabilisation system could comprise additional side protuberances or side protuberances of a different shape from those illustrated hitherto but always surrounding as a minimum the opposite side ends of the heel cavity 3 and sole cavity 5.

[0034] The stabilisers can also be formed by elements materially and structurally similar or identical to the cushions of the present invention, in this latter case possibly also having a height equal to that of the enlargements 7 and 9 of the lower surface of the tread.

[0035] Naturally it can also be foreseen, as a variant of the present embodiment, to fragment the sole cavity and the heel cavity on the tread 1" into a series of smaller sub-cavities 3" and 5", each to be filled with a corresponding shock-absorbing cushion 11'"t and 11'"p, as illustrated in Fig. 5. In this case the covering element 13" is smooth and the cushions are evenly scattered throughout the sole, therefore without the need for stabilisation elements, only necessary when the cushions

are arranged centrally in the sole and heel.

[0036] Figs. 6 and respectively 7 show a variant of the shock-absorbing sole structure of the present invention, wherein the shock absorption elements 11'"t and 11'"p and respectively 11""t and 11""p can be removably inserted in the body of the sole.

[0037] In this case the housings of the shock-absorbing elements are formed by cavities transversely extended in relation to the sole and open at the opposite ends in such a way as to allow manual pressure insertion of the shock-absorbing elements. This enables the adoption of an elastic filling material suitable for every weight to be shock-absorbed, or manual replacement of the shock-absorbing elements which may have become worn in time.

[0038] In Fig. 6, which illustrates a classic sole structure and therefore of minimal thickness,covering element 13"' is smooth and heel 3"' and sole 5"' cavities for housing the elastic material are placed on the tread 1"'. On the contrary sole structure in Fig. 7 comprises a wedge 13"" of thickness such as to allow shaping on the lower surface thereof of a heel cavity 333 and a sole cavity 555 corresponding to the sole cavity 3"" and heel cavity 5"" of the tread 1"", in such a way as to double, compared to the previous case, the space available for the shock-absorbing elastic material.

[0039] The process of construction of a shoe using the shock-absorbing sole structure of the present invention involves a first phase wherein the tread is moulded with the tread cavities and any stabiliser elements, a second phase wherein the elastic cushions are inserted and blocked in the sole and heel cavities by gluing the covering layer or wedge or simply by fitting the cushions in the respective cavities, and finally the last phase wherein the upper is mounted on the peripheral strip of the upper surface of the sole.

[0040] Naturally, in the case of shock absorption elements which can be inserted removably in the sole, the insertion can be carried out manually when assembly of the shoe has already concluded.

[0041] The present description of a possible preferred embodiment of the present invention has to be understood as a non-limiting example of the more general concept claimed.

[0042] In particular the shape and number and arrangement of the heel and sole cavities and of the elastic cushions inserted therein can also be different from those shown hitherto, without thereby departing from the basic concept underlying the invention which is that of providing a shock-absorbing structure made by inserting and blocking in position in appropriate cavities of the tread a series of cushions in a solid material, having an elastic behaviour similar to air, in such a way as to support the foot, damping those stresses transmitted thereby to the sole which may be damaging to the health of the spine.

Claims

1. A shock-absorbing sole structure of the type comprising: a sole with tread (1, 1', 1", 1"', 1"") in turn having at least one heel cavity (3, 3', 3", 3"', 3"") and at least one sole cavity (5, 5', 5", 5"', 5"") on the upper surface of the tread (1, 1', 1", 1"', 1""), a heel protuberance and a sole protuberance on the lower surface of the tread (1,1', 1", 1 "', 1"") corresponding to the heel cavity (3, 3', 3", 3"', 3"") and respectively to the sole cavity (5, 5', 5", 5"', 5""); and an element (13, 13', 13", 13"', 13"") for covering the heel cavity (3, 3', 3", 3"', 3"") and the sole cavity (5, 5', 5", 5"', 5"") to be fixed above the upper surface of the tread (1, 1', 1", 1"', 1""), characterised in that elastic shock-absorbing means (11t and 11p, 11't and 11'p, 11"t and 11"p, 11'"t and 11'"p, 11""t and 11""p) are provided in the housings defined by the internal walls of the heel cavity (3, 3', 3", 3"', 3"") and of the sole cavity (5, 5', 5", 5"', 5"") and by the lower wall of said covering element (13, 13', 13", 13"', 13""), said elastic shock-absorbing means (11t and 11p, 11't and 11'p, 11"t and 11"p, 11'"t and 11'"p, 11""t and 11""p) being formed by a solid material with elastic behaviour similar to air.

2. A shock-absorbing sole structure according to the previous claim, characterised in that said housings are closed with said elastic means (11t and 11p, 11't and 11'p, 11 "t and 11"p) inserted non-removably in said housings.

3. A shock-absorbing sole structure according to claim 1, characterised in that said housings are laterally open with said elastic means (11'"t and 11'"p, 11""t and 11""p) which can be removably inserted in said housings.

4. A shock-absorbing sole structure according to any one of the previous claims, characterised in that said covering element is in the form of a wedge (13', 13"") of the sole structure, and in that said wedge (13', 13"") has portions of its lower surface which define a heel cavity (33, 333) and a sole cavity (55, 555) corresponding to a respective heel cavity (3', 3"") and sole cavity (5', 5"" of the tread (1', 1"").

5. A shock-absorbing structure according to any one of the previous claims, characterised in that it comprises one single heel cavity (11t) and one single sole cavity (11p), and in that stabilisation elements (17 and 19) are provided on the side of the lower surface of the tread (1), arranged at least around the external lateral portions of the heel and sole protuberance (7 and 9).

6. A shock-absorbing structure according to any one of claims 1 to 4, characterised in that it comprises

a plurality of cavities (3" and 5") distributed in the heel and sole region of the tread (1").

7. A shock-absorbing sole structure according to any one of the previous claims, characterised in that said covering element (13, 13', 13", 13"', 13"") is made integral with the upper surface of the tread (1, 1', 1", 1"', 1"") by any known technique chosen from among gluing and welding.

8. A shock-absorbing sole structure according to any one of the previous claims, characterised in that said elastic shock-adsorbing means (11t and 11p, 11't and 11'p, 11"t and 11"p, 11 "'t and 11"'p, 11""t and 11""p) are of foam rubber.

9. A shock-absorbing sole structure according to any one of claims 1 to 8, characterised in that said elastic shock-adsorbing means (11t and 11p, 11't and 11'p, 11"t and 11"p, 11"'t and 11"'p, 11""t and 11""p) are of latex foam.

10. A shock-absorbing sole structure according to any one of claims 1 to 7, characterised in that said elastic shock-adsorbing means (11t and 11p, 11't and 11'p, 11"t and 11"p, 11"'t and 11"'p, 11""t and 11""p) are of any type of material with elastic physical behaviour having the properties of foam rubber or latex foam.

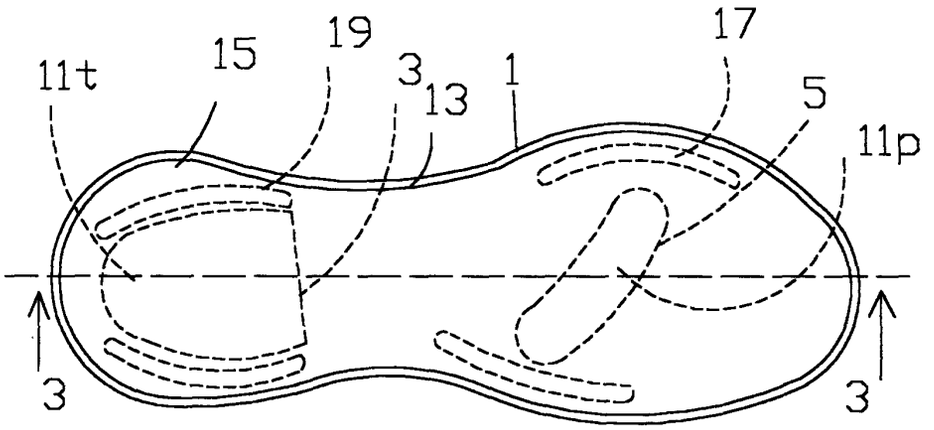

Fig. 1

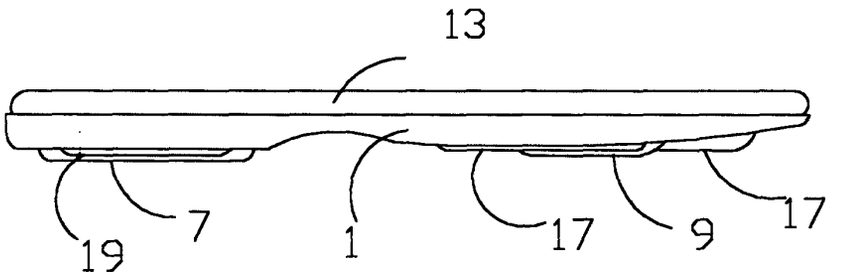

Fig. 2

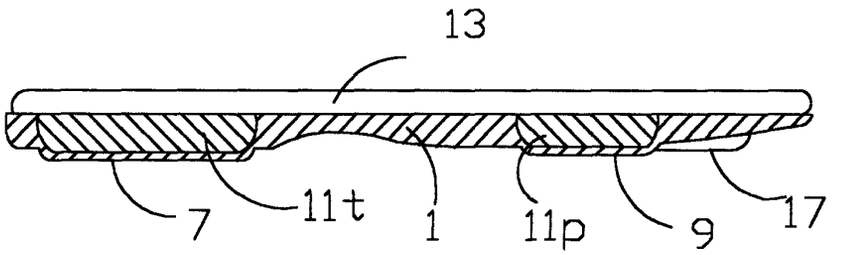

Fig. 3

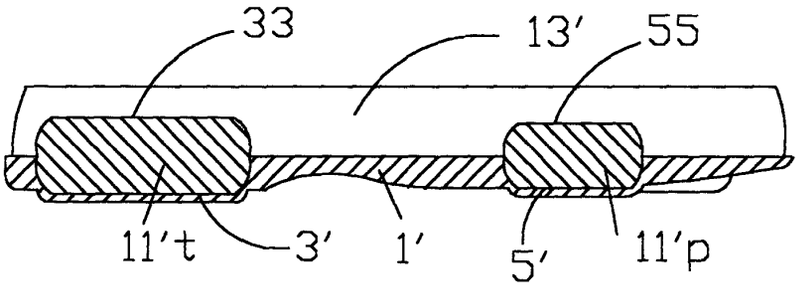

Fig. 4

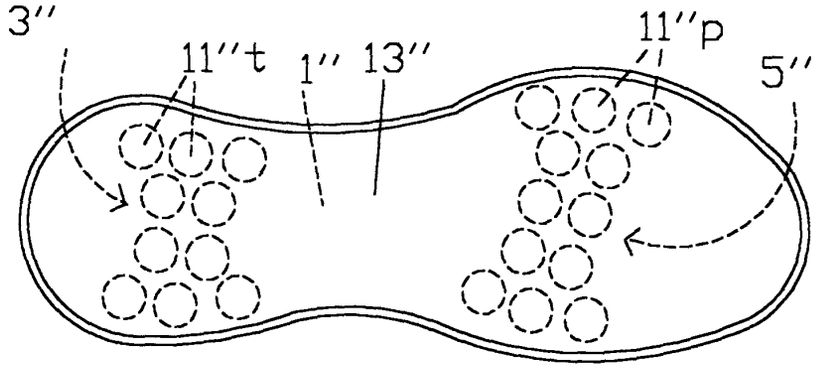

Fig. 5

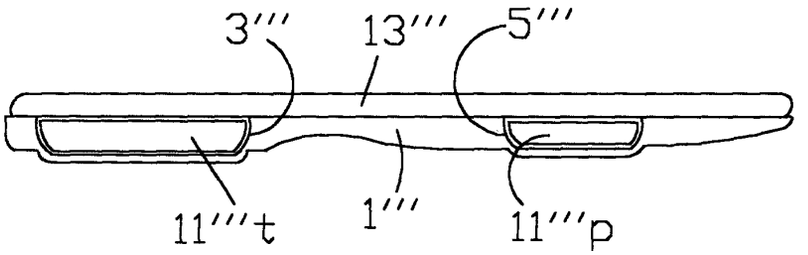

Fig. 6

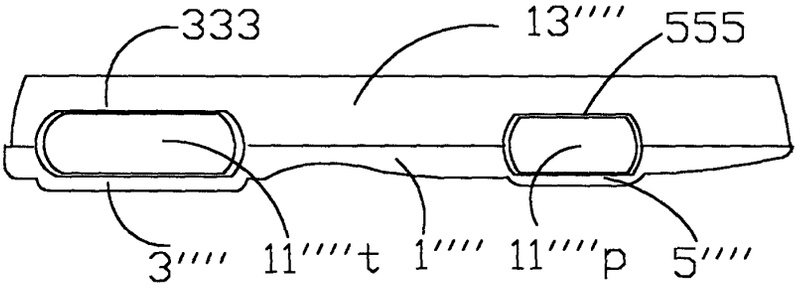

Fig. 7