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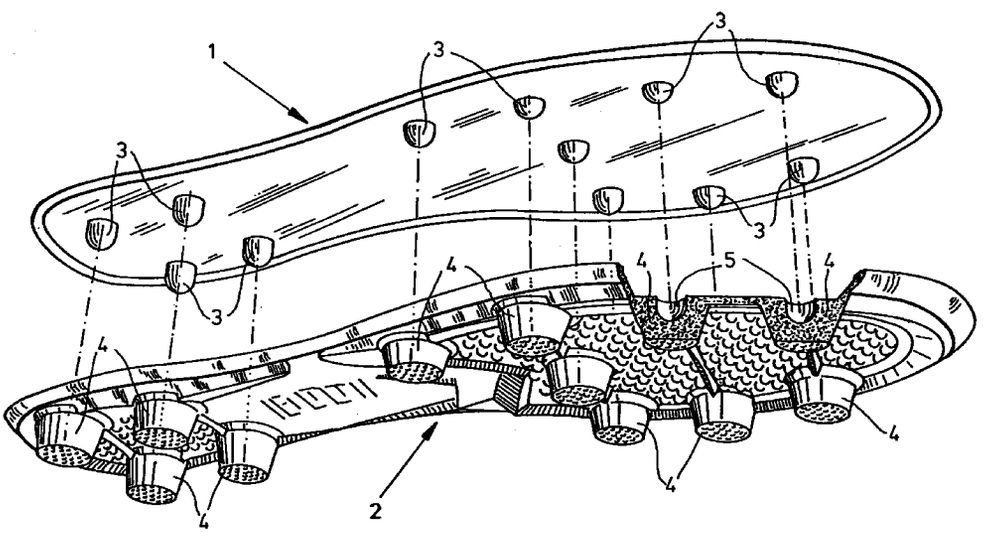
(54) A sole for a soccer shoe, a method for manufacturing said sole for a soccer shoe and a soccer shoe thus obtained

(57) The invention relates to a sole for a soccer shoe, comprising an intermediate sole (1) and a lower sole (2), said lower sole (2) on the underside comprising closed projections (4) distributed over the sole area, whereby the lower sole (2) and the intermediate sole (1) are made of polyurethane and the intermediate sole (1) is on the underside provided with studs (3), which are distributed over its sole area and which are capable of engaging in the recesses (5) of the closed projections (4) of the lower sole (2).



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Description

The present invention relates to a sole for a soccer shoe, comprising an intermediate sole and a lower sole, said lower sole on the underside comprising closed projections distributed over its sole area. The present invention furthermore relates to a method for manufacturing said sole, to a soccer shoe provided with said sole and to a method for manufacturing said soccer shoe.

Such a sole for a soccer shoe, consisting of an intermediate sole and a lower sole, whereby the lower sole comprises closed projections on the underside, which are distributed over the sole area, is known from European Patent Application No. 0 340 053. According to the said patent application the sole for a soccer shoe consists of a bottom layer of a dense, sealed compact material, such as rubber, and a light upper layer of an expanded material, such as polyurethane foam. The bottom layer comprises closed projections bounding open-work portions, which are in particular located in the supporting areas of the forefoot and the heel, whereby the upper layer fills the open-work portions so as to form skates. Skates of this type are provided with projecting flexible protrusions.

A drawback of shoes of this type is the poor shock absorption they exhibit. When playing soccer, with frequent accelerations, stops, evasive manoeuvres, strong and repeated loads in various positions and jumps, an adequate shock absorption is essential in order to prevent muscle injury and fatigue. Another drawback of such shoes is the a-symmetric pressure distribution in the shoes. An a-symmetric pressure distribution means that the pressure in the heel of the shoe differs from the pressure in the forefoot of the shoe. This gives the wearer the feeling that the stud of the lower sole forces its way up to the foot itself. In such a case the wearer of such shoes will mention tired feet and possibly a feeling of numbness in his feet. Consequently the degree of comfort of such shoes is low. Furthermore the lower sole must be wear-resistant and provide a good stability to the foot in order to prevent injuries.

The object of the present invention is to provide a sole for a soccer shoe which exhibits a better shock absorption and pressure distribution in the sole than the soccer shoes as they are known from the prior art.

Another object of the present invention is to provide a sole for a soccer shoe which prevents the closed projections from forcing their way up to the foot.

The above objectives are accomplished by using a sole for a soccer shoe according to the invention, and the sole of a soccer shoe as referred to in the preamble is according to the invention characterized in that said lower sole and said intermediate sole are made of polyurethane and that the intermediate sole is on the underside provided with studs, which are distributed over the sole area and which are capable of engaging in the recesses of the closed projections of the lower sole. As a result of said engagement of the studs of the intermediate sole in the recesses of the closed projections of the lower sole the closed projections are prevented from forcing their way up to the foot. A construction of intermediate sole and lower sole of this type also leads to a symmetric pressure distribution in the shoe, as a result of which the sole will provide a better shock absorption and there will be no perception of tired feet.

Preferably the polyurethane of the lower sole has a greater hardness or density than the polyurethane of the intermediate sole. The use of polyurethane having different degrees of hardness or density results in an adequate shock absorption. An adequate shock absorption means a smaller risk of sports injuries and is perceived as a comfortable feeling by the wearer of the shoe. The use of polyurethane having different degrees of hardness or density also results in a symmetric pressure distribution in the shoe. In addition the use of polyurethane having a high degree of hardness or density in the lower sole provides a satisfactory resistance against wear. An example of a commercial polyurethane used for the lower sole is Daltoped AP 18000 (ICI Polyurethanes, Belgium) with a density of 1000-1200 and a shore hardness of 80-85. An example of a commercial polyurethane used for the intermediate sole is Daltoped AP 44500 (ICI Polyurethanes, Belgium) with a density of 380-420 and a shore hardness of 45-50.

In a preferred embodiment the sole for a soccer shoe is made by injecting the intermediate sole directly onto the lower sole. The advantage of this is that a strong bond is created between the intermediate sole and the lower sole.

In another preferred method for manufacturing a soccer shoe comprising a lower sole and an intermediate sole according to the invention the sole for a soccer shoe is preferably produced by injecting the intermediate sole directly onto the upper material (without glued joints) and injecting the lower sole directly onto the intermediate sole (likewise without glued joints). The advantage of this is that it will not be necessary to stitch through the top material of the soccer shoe, in connection with the excellent bond of the intermediate sole to the top material on the one hand and of the lower sole to the intermediate sole on the other hand.

For preparing polyurethane a polyisocyanate composition consisting of a prepolymer and free polyisocyanate is reacted with a mixture of polyols, water and possible additives. Organic polyisocyanates which may be used in the preparation of the polyisocyanates include aliphatic, cycloaliphatic and araliphatic polyisocyanates. The polyether polyols, used for preparing the prepolymer have an average nominal functionality of 2 - 6, preferably of 2 - 4. These compounds have a number average molecular weight of 2,000 - 6,000, preferably 2,000 - 5,000 and most preferably 3,000 - 5,000. The polyetherpolyols, which may be used for preparing the isocyanate-terminated prepolymer include products obtained by the polymerisation of ethylene oxide with another cyclic oxide. The isocyanate-terminated prepolymer is prepared by reacting an excessive amount of the polyisocyanate and said polyether polyol, in order to obtain a prepolymer having the indicated NCO (isocyanate) value. The polyol, used for reacting with the isocyanate-terminated prepol-

ymer, may have a number average molecular weight of 500 - 10,000, preferably 750 - 6,000 and an average nominal functionality of 2 - 6. Suitable polyols include polyesters, polyesteramides, polythioethers, polycarbonates, polyacetals, polyolefins, polysiloxanes and polyethers. The amount of water used as a foaming agent may be varied in known manner in order to achieve the desired density. Suitable amounts of water are generally at least 0.3 parts by weight, preferably 0.3 - 1.2 parts by weight, per 100 parts by weight of the reaction system. The reaction system may furthermore comprise conventional additives, like catalysts, surfactants, colorants, stabilisers, fillers, and chain extenders and cross-linkers. The preparation of polyurethane comprising different degrees of hardness or density is a technique which is known per se and which is disclosed in European Patent Applications 0 358 328, 0 393 903, 0 497 492, 0 508 648 and 0 547 760, which are incorporated herein by reference.

The present invention will be explained hereafter with reference to a Figure and testing examples.

The appended drawing shows a perspective bottom view of sole of a soccer shoe according to the invention.

The intermediate sole 1 comprises studs 3 distributed over the area of intermediate sole 1. Lower sole 2 is provided with closed projections 4 on the underside, said projections being distributed over the area of lower sole 2. The closed projections 4 are formed with recesses 5. The studs 3 of the intermediate sole 1 are capable of engaging in the recesses 5 of the closed projections 4 of lower sole 2. The following experiments have been carried out by TNO. (Dutch organisation for applied scientific research)

Testing example 1

Determining of the shock-absorbing properties of shoe soles with a high stress rate.

This test is carried out in order to determine the shock-absorbing properties of shoe soles.

The set-up consists of a stamp driven by a lineary motor. The stamp bumps against the shoe arranged around a foot model. The foot model and the shoe can be placed in various positions with respect to the stamp, whereby the stamp bumps against the heel of the shoe. With each bump the displacement and the force are registered by recorders. With a first measurement the stamp moves at a very low velocity against the shoe, until a force of at least 800 N is reached. The degree of compression that occurs thereby is stored in the computer. The movement is carried out at a substantially constant velocity. Four different velocities are used, namely 0.01, 0.03, 0.09 and 0.32 m/sec. The result of this test is a displacement/force characteristic, in which a compression stage and a decompression stage can be distinguished. The slope of the compression stage is a measurement of the stiffness of the compressed material. The area between the compression curve and the decompression curve is a measurement of the energy loss that occurs during the bump.

The test was carried out with six types of shoes. Type S1 is a soccer shoe with a sole construction according to the invention. Soccer shoes with type S2-S6 are commercial available soccer shoes.

Table 1 below shows the initial stiffness for various velocities. Table 2 shows the final stiffness for various velocities. Table 3 shows the energy loss for the various velocities.

TABLE 1

Initial stiffness (N/mm): average deviation and standard deviation for each velocity								
shoe type	velocity: 0.01 m/sec		velocity: 0.03 m/sec		velocity 0.09 m/sec		velocity: 0.32 m/sec	
S1	203	10	211	7	219	9	231	8
S2	369	22	386	24	419	34	477	48
S3	230	27	239	26	250	26	258	29
S4	455	15	465	0	497	21	543	36
S5	254	8	271	11	296	10	318	7
S6	286	11	295	12	313	7	311	9

TABLE 2

Final stiffness (N/mm): average deviation and standard deviation for each velocity								
shoe type	velocity: 0.01 m/sec		velocity: 0.03 m/sec		velocity 0.09 m/sec		velocity: 0.32 m/sec	
S1	317	3	325	7	353	6	359	12
S2	588	12	575	14	642	15	702	16
S3	338	8	355	7	386	9	397	4
S4	600	13	597	20	650	26	706	25
S5	392	19	385	18	427	23	447	23
S6	440	3	451	11	485	7	517	13

TABLE 3

Energy loss (N/mm): average deviation and standard deviation for each velocity								
shoe type	velocity: 0.01 m/sec		velocity: 0.03 m/sec		velocity 0.09 m/sec		velocity: 0.32 m/sec	
S1	551	5	628	10	676	7	840	9
S2	404	6	422	12	410	12	437	9
S3	615	18	621	17	606	18	647	20
S4	353	2	355	5	341	8	360	8
S5	678	26	706	16	698	15	807	22
S6	386	9	405	7	399	8	457	20

From the above Table 1 it is apparent that the initial stiffness for shoe type S1 according to the invention is lower than the initial stiffness for shoe types S2-S6 at all velocities. The same applies to the final stiffness, as is apparent from Table 2. From table 3 it appears that the energy loss for shoe type S1 at the various velocities is higher than for shoe types S2-S6. From these shock absorption tests it appears that shoe type S1 according to the invention exhibits a better shock absorption than shoe types S2-S6.

Testing example 2

Determination of the pressure distribution in the shoe.

The shoe types used were the same as in testing Example 1. The shoes are arranged around a standard mechanical foot, whereby a pressure measurement system is provided between foot and shoe. Then the whole is placed in a stepping simulator, whereby the shoe/foot is placed on a hard base with a maximum vertical load of 2000 N, whereby the heel is loaded. The degree to which the studs force their way up to the underside of the foot is evaluated by means of the pressure measuring system. Table 4 shows the area per pressure range in the heel part.

TABLE 4

Area per pressure range in the heel part.						
shoe type	45<p>40	50<p>45	55<p>50	60<p>55	65<p>60	p>65
S1	6	6	4	0	1	1
S2	23	10	10	2	0	4
S3	14	8	8	3	2	4
S4	15	8	8	2	4	10
S5	14	10	9	0	0	4
S6	3	1	5	2	1	7

From the above Table 4 it appears that shoe type S2-S5 and, to a smaller extent, shoe type S6 exhibit a higher and more concentrated pressure in the heel part than shoe type S1 according to the present invention. Moreover, shoe type S1 according to the present invention exhibits the most symmetric pressure distribution in the shoe.

Claims

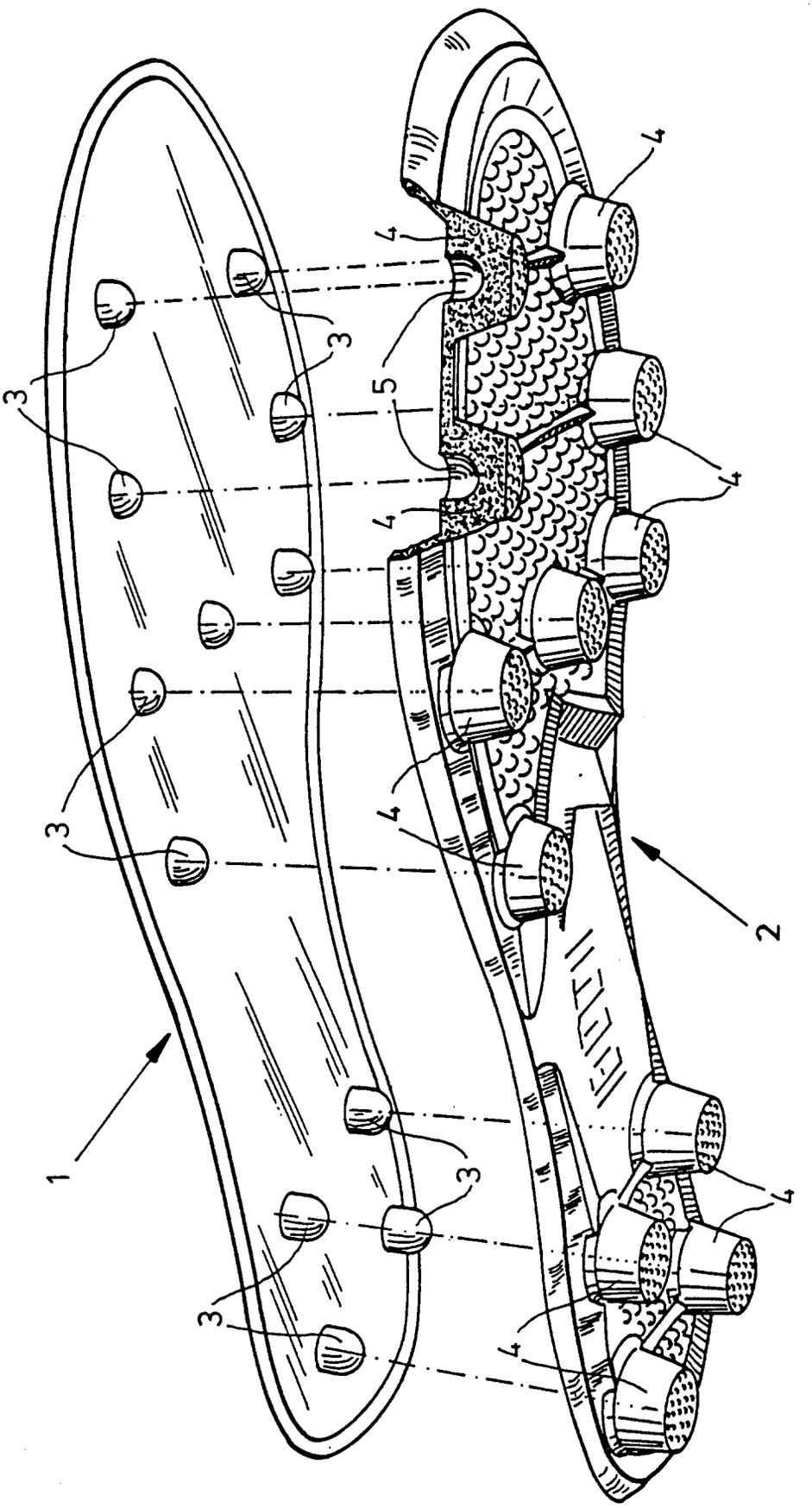
1. A sole for a soccer shoe, comprising an intermediate sole and a lower sole, said lower sole on the underside comprising closed projections distributed over the sole area, characterized in that said lower sole and said intermediate sole are made of polyurethane and that said intermediate sole is on the underside provided with studs, which are distributed over its sole area and which are capable of engaging in the recesses of the closed projections of the lower sole.

2. A sole according to claim 1, characterized in that the polyurethane of said lower sole exhibits a higher density or a greater hardness than does the polyurethane of said intermediate sole.

3. A method for manufacturing a sole according to claim 1 or 2, characterized in that said intermediate sole is injected directly onto the lower sole.

4. A soccer shoe provided with a sole, characterized in that said sole corresponds with a combination of an intermediate sole and a lower sole as described in claims 1 and 2.

5. A method for manufacturing a soccer shoe according to claim 4, characterized in that said intermediate sole is injected directly onto the upper material of said soccer shoe and that said lower sole is injected directly onto said intermediate sole.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EUROPEAN SEARCH REPORT

Application Number
EP 96 20 0110

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A,D	EP-A-0 340 053 (PATRICK) 2 November 1989 * the whole document *	1,2	A43B13/12 A43B13/26
A	DE-A-27 33 605 (ADIDAS) 2 February 1978 * the whole document *	1,2	
A	US-A-4 667 423 (J. AUTRY) 26 May 1987 * the whole document *	1,2	
A	US-A-4 897 936 (R. FUERST) 6 February 1990 * the whole document *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

A43B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18 April 1996	Declerck, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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