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(54) **Footwear**

(57) There is provided a sole unit 12 having a midsole section 14 and an outsole section 15. The midsole incorporates a number of cavities 17 which open at their top ends 18 and which are wider at their bottom ends 19. The outsole section 15 incorporates a number of dia-

phragm elements 21 which close off the bottoms of the cavities 17. In some arrangements there is a footbed 13 which has in its underside a number of recesses 25 disposed above each of the cavities 17, the recesses 25 being linked by channels and incorporating orifices 27 leading to the inside of an article of footwear.

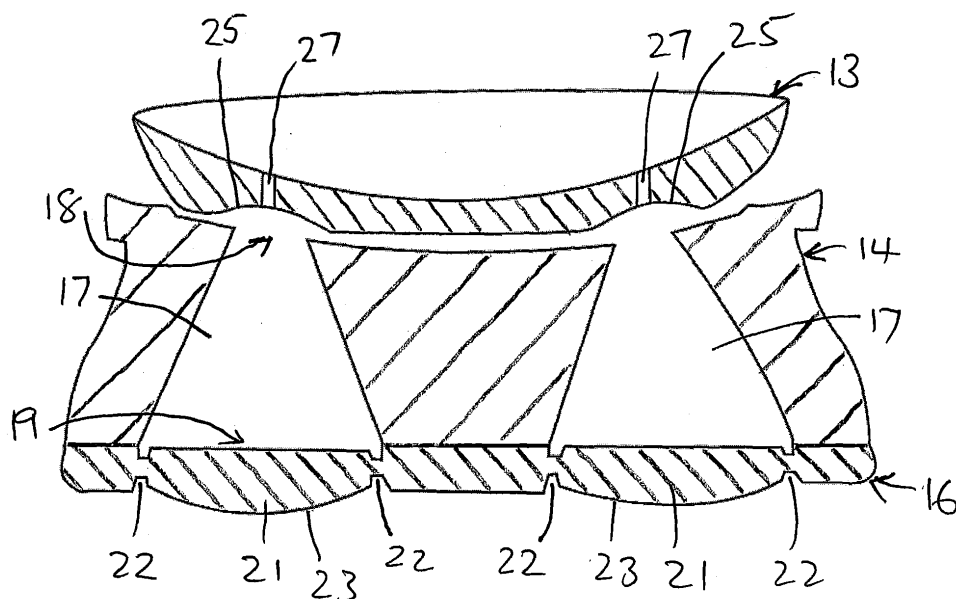


FIGURE 3

Description

[0001] This invention relates to footwear and more particularly to sole units for boots and shoes.

[0002] It is known from EP 0122985 to provide a sole unit moulded from a resilient material, in which sole unit are provided a plurality of cavities and a system of channels formed in the upper surface for interconnecting the cavities. A bulge is formed on the bottom surface at the location of each cavity, the cavities being formed substantially wholly in the general thickness of the sole unit.

[0003] According to the present invention, there is provided a sole unit for an article of footwear comprising a midsole section and an outsole section, the midsole section having formed therein a plurality of cavities each of which is open at its top end and is of smaller cross-sectional area at said top end than its bottom end, the outsole section incorporating a plurality of diaphragm elements, each of which closes off the bottom of one of the cavities and is capable of resiliently deflecting relative to its associated cavity to effect a pumping action therein.

[0004] Usually, the sole unit also comprises a footbed disposed above the midsole section, the footbed having a through orifice at the location of the top opening of each cavity. Preferably, the footbed has a number of channels in its underside, said channels interconnecting the cavities of the sole unit. Often, further through orifices lead from the channels to the top side of the footbed and also the area of the underside of the footbed surrounding each orifice is concave.

[0005] In preferred arrangements the cross-sectional area of each cavity continually reduces towards its top end and preferably the cavities are substantially frusto-conical. Conveniently, each diaphragm is defined by a reduced thickness periphery and in addition the lower surface of each diaphragm is domed downwardly so as to protrude below the surrounding portions of the outsole section.

[0006] With some preferred embodiments, the midsole section is formed from a different material to the outsole section. Preferably, the midsole section is formed separately from and is secured to the outsole section. Sometimes the outsole section is formed from a plurality of separate portions which are attached to the midsole section. Preferably, the outsole section is not continuous over the entire footprint of the sole unit.

[0007] It is also possible that valve means are provided to control air flow through and/or between the cavities. In some sole units, the diaphragms are transparent or semi-transparent.

[0008] Embodiments of the present invention will now be described by way of example. The description makes reference to the accompanying drawings in which:

Figure 1 is a side perspective view of an article of footwear incorporating a sole unit according to the present invention,

Figure 2 is an exploded view from below of the sole

unit shown in Figure 1,

Figure 3 is a lateral cross-sectional view through the assembled sole unit of Figure 2,

Figure 4 is a lengthwise cross-sectional view through the heel part of an alternative sole unit according to the present invention,

Figure 5 is a lateral cross-sectional view through the heel part shown in figure 4, and

Figure 6 is a perspective view of a valve insert shown in figures 4 and 5.

[0009] Referring to the drawings, there is shown an article of footwear 10 having an upper 11 secured to a sole unit 12. In this arrangement, the sole unit comprises a footbed 13, a midsole section 14 and an outsole section 15. The footbed 13 is moulded from a resilient plastics material such as polyurethane but other materials could also be used. In this arrangement, the midsole section is moulded from a resilient plastics material such as EVA but again other materials would be suitable. The outsole section 15 comprises a number of natural rubber or synthetic rubber outsole portions 16 but a continuous outsole could also be used, as could other materials. This particular rubber compound has a Shore hardness of between 55 and 65 but other hardnesses could be employed depending on the required characteristics of the footwear. The use of separate outsole portions 16 can also lend itself to the provision of different materials in different parts of the outsole section 15 to produce varied wear/comfort characteristics.

[0010] The midsole section 14 has a plurality of frusto-conical cavities 17 each of which has a small opening at its top end 18 and a wider opening at its bottom end 19. In addition, there are a number of optional grooves 20 in the underside of the midsole section 14, the grooves improving the flexibility of the sole unit in chosen areas and giving an element of decoration. The outsole portions 16 are securely bonded to the underside of the midsole section and the outsole portions 16 are shaped so as not to cover the grooves 20.

[0011] The parts of the outsole portions 16 which cover the bottom ends 19 of the cavities 17 are in the form of diaphragms 21 each of which connects to the surrounding part of outsole portion 16 by means of a peripherally extending portion 22 of reduced thickness. Each reduced thickness portion 22 enables its enclosed diaphragm 21 to resiliently deflect more easily relative to its adjacent cavity 17. The lowermost surface 23 of each diaphragm bulges downwardly so as to protrude below the surrounding parts of the outsole portion 16.

[0012] The underside of the footbed 13 has a concave recess 25 positioned above each cavity top end 18 and the recesses 25 are interconnected by means of channels 26 formed in the underside of the footbed. A through orifice 27 is provided at each recess 25 to effect communication with the top side of the footbed. Further orifices 28 are provided in the channels 26. The action of walking causes the diaphragms 21 to deform resiliently upwards

into the cavities 17 and back again thereby pumping air from cavity to cavity via the channels 26 and recesses 25. This action also causes air to flow through the orifices 27 and 28 to provide a ventilating effect within the upper 11 of the article of footwear.

[0013] In more advanced embodiments, valve means may be provided to control the flow of air into and/or out of the cavities, or through the orifices 27, 28, or along the channels 26. The valve means could be one-way mechanisms or could rely on compressive closure of the openings due to weight transfer during the walking cycle.

[0014] One example of a sole unit having a valve arrangement is shown in figures 4 to 6. The heel area of the sole unit incorporates an air inlet member 40 which is located generally in the midsole section 14 and which extends laterally in this embodiment. The inlet member 40 is generally tubular and is open to the atmosphere at one or both of its lateral ends 43. The inside of the inlet member 40 communicates with two of the cavities 17 in the heel area via one-way valves 41. In this embodiment the one-way valves 41 are in the form of "duck-bill" valves but other types of valves are envisaged. Air can therefore be drawn into the cavities 17 by suction when the diaphragms 21 deform resiliently downwards. The cavities 17 also have one-way valves 42 which control communication with the recesses 25/channels 26. Again, in this example the one-way valves 42 are "duck-bill" valves which are ideally carried by the inlet member 40.

[0015] Fresh air drawn into the cavities 17 as the diaphragms 21 deform downwards is then passed outwardly through the valves 42 when the diaphragms 21 deform upwardly into the cavities 17. This fresh air is distributed around the sole unit and out through orifices 27 and 28 (not shown in figures 5 and 6). This passage of air can assist ventilation of the shoe and/or can provide a cooling action and/or can assist in the dispersal of moisture and/or odour.

[0016] The precise form and location of the valve system is a matter of design choice and could be provided for more cavities than the two shown. The inlet member and valves need not be separate components but could be moulded as part of the midsole.

[0017] In other embodiments, the diaphragms 21 could be formed of a transparent or semi-transparent material such that the inside of the cavities/underside of the footbed can be seen. Contrasting colours in the cavity could produce a desirable decorative effect.

[0018] It will be appreciated that the number of cavities could vary as could their precise shape. Also, the reduced thickness portions 22 which define the shapes of the diaphragms could be omitted or partially omitted if the material of the outsole was already sufficiently flexible. The footbed could be omitted in some types of footwear, for example where an insole is lasted to the upper in which case the midsole would be secured to the lasting margin of the upper. Other modifications will be apparent without departing from the scope of the attached claims.

Claims

1. A sole unit for an article of footwear comprising a midsole section and an outsole section, the midsole section having formed therein a plurality of cavities each of which is open at its top end and is of smaller cross-sectional area at said top end than its bottom end, the outsole section incorporating a plurality of diaphragm elements, each of which closes off the bottom of one of the cavities and is capable of resiliently deflecting relative to its associated cavity to effect a pumping action therein.
2. A sole unit as claimed in claim 1, wherein the sole unit also comprises a footbed disposed above the midsole section, the footbed having a through orifice at the location of the top opening of each cavity.
3. A sole unit as claimed in claim 2, wherein the footbed has a number of channels in its underside, said channels interconnecting the cavities of the sole unit.
4. A sole unit as claimed in claim 3, wherein further through orifices lead from the channels to the top side of the footbed.
5. A sole unit as claimed in any one of claims 2 to 4, wherein the area of the underside of the footbed surrounding each orifice is concave.
6. A sole unit as claimed in any one of claims 1 to 5, wherein the cross-sectional area of each cavity continually reduces towards its top end and preferably the cavities are substantially frusto-conical.
7. A sole unit as claimed in any one of claims 1 to 6, wherein each diaphragm is defined by a reduced thickness periphery.
8. A sole unit as claimed in any one of claims 1 to 7, wherein the lower surface of each diaphragm is domed downwardly so as to protrude below the surrounding portions of the outsole section.
9. A sole unit as claimed in any one of claims 1 to 8, wherein the midsole section is formed from a different material to the outsole section.
10. A sole unit as claimed in any one of claims 1 to 9, wherein the midsole section is formed separately from and is secured to the outsole section.
11. A sole unit as claimed in claim 10, wherein the outsole section is formed from a plurality of separate portions which are attached to the midsole section.
12. A sole unit as claimed in any one of claims 1 to 11, wherein the outsole section is not continuous over

the entire footprint of the sole unit.

- 13.** A sole unit as claimed in any one of claims 1 to 12, wherein valve means are provided to control air flow through and/or between the cavities. 5
- 14.** A sole unit as claimed in any one of claims 1 to 13 wherein one or more of the cavities communicate with the atmosphere via one or more one-way valves. 10
- 15.** A sole unit as claimed in any one of claims 1 to 14, wherein the diaphragms are transparent or semi-transparent. 15

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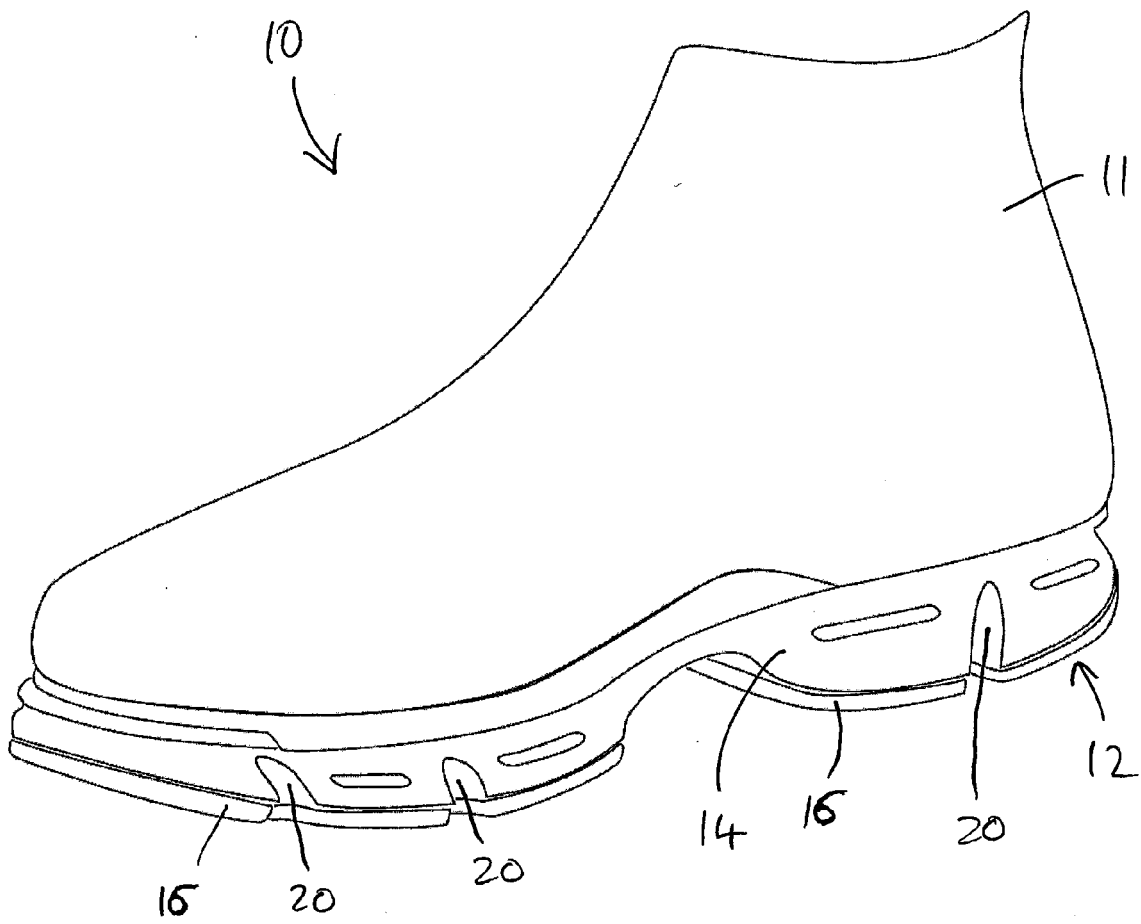


FIGURE 1

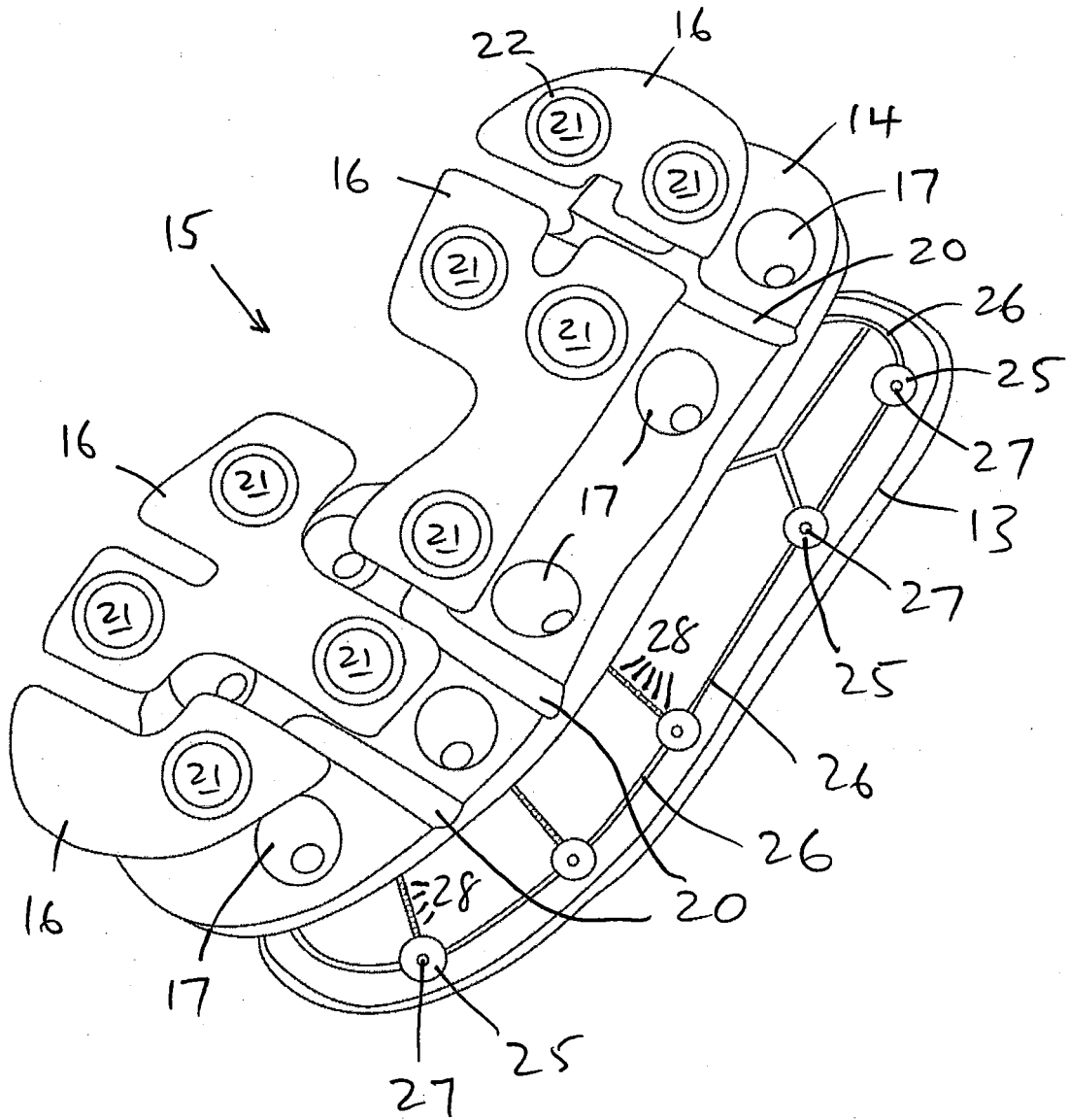


FIGURE 2

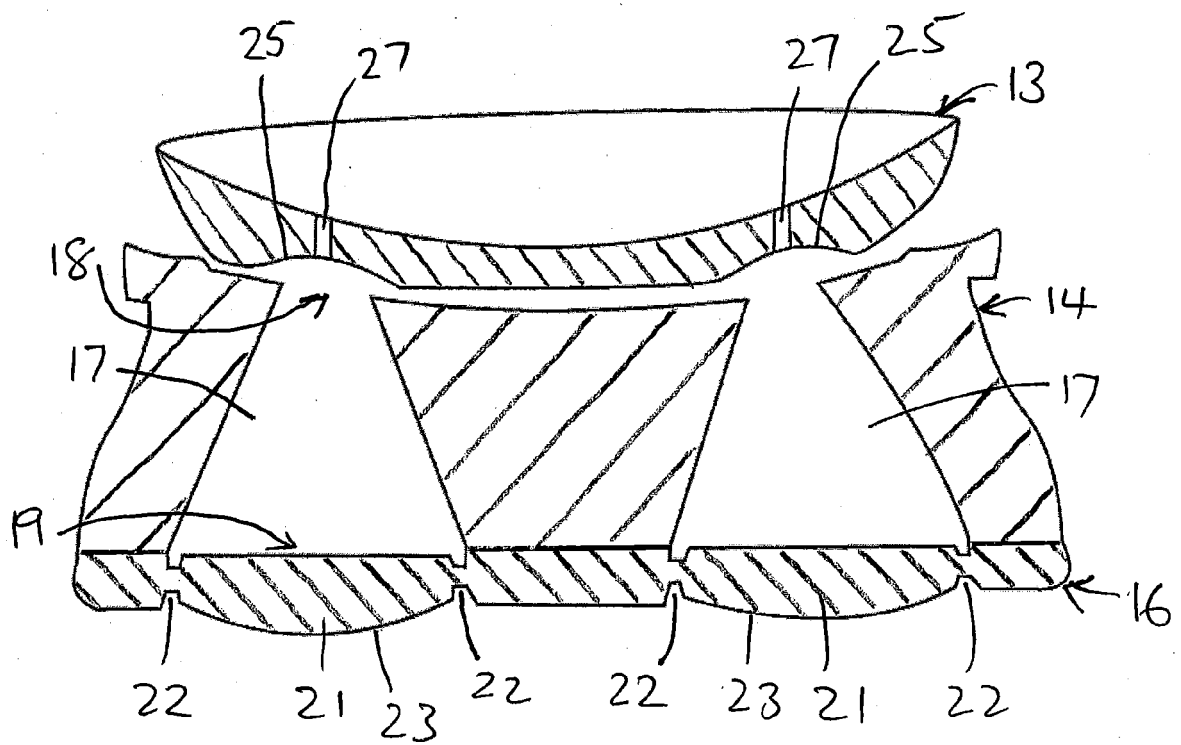


FIGURE 3

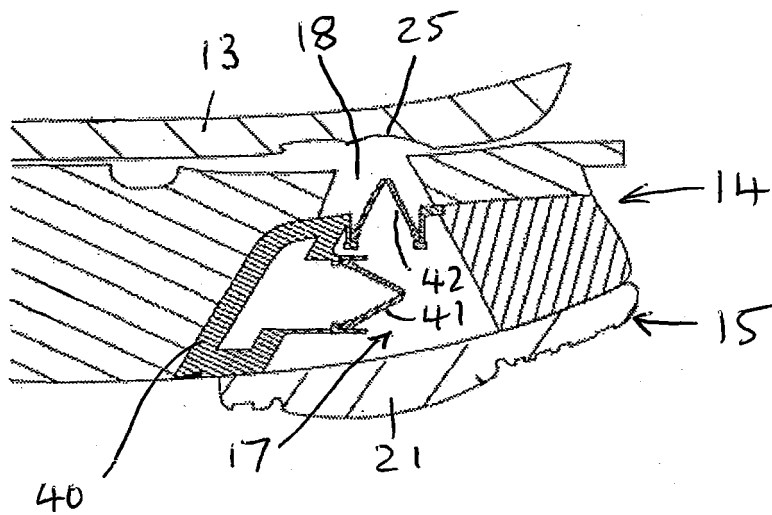


FIGURE 4

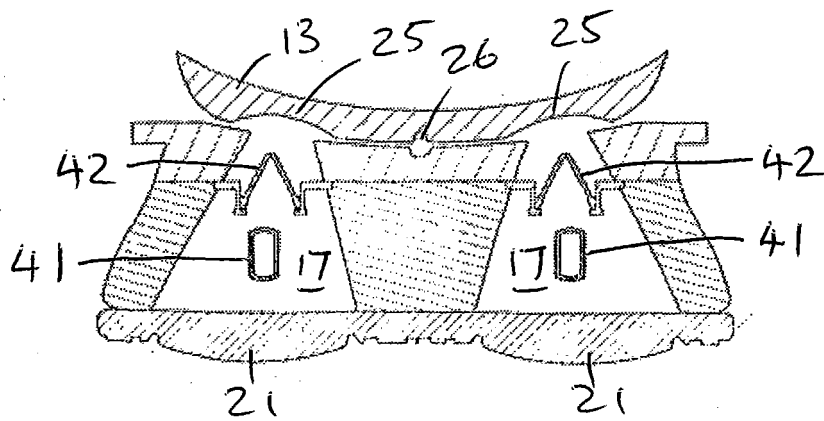


FIGURE 5

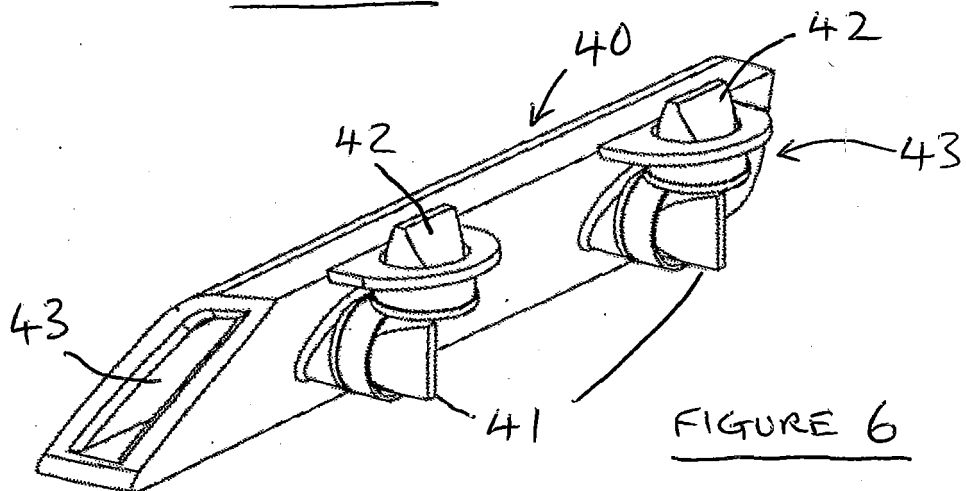


FIGURE 6



EUROPEAN SEARCH REPORT

Application Number
EP 09 15 1269

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 6 751 890 B1 (TSAI MAO-CHENG [TW]) 22 June 2004 (2004-06-22) * the whole document *	1,9,10	INV. A43B7/08
A	WO 2005/051115 A (B A G S P A [IT]); BRACALENTE ENRICO [IT]) 9 June 2005 (2005-06-09) * abstract; figures *	1	
A	US 5 815 949 A (SESSA RAYMOND V [US]) 6 October 1998 (1998-10-06) * the whole document *	1,15	
A	EP 1 457 125 A (LEDERER STEFAN [DE]) 15 September 2004 (2004-09-15) * abstract; figures *	1,7	
A	US 4 319 412 A (MULLER ROBERTO ET AL) 16 March 1982 (1982-03-16) * column 3, line 25 - line 37; figures 2,3 *	1	
D,A	EP 0 122 985 A (CLARKS LTD [GB]) 31 October 1984 (1984-10-31) * abstract; figures *	1	TECHNICAL FIELDS SEARCHED (IPC) A43B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 29 April 2009	Examiner Schölvinc, Thérèse
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 15 1269

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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29-04-2009

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REFERENCES CITED IN THE DESCRIPTION

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