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AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
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DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
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(54) Title: A SOLE FOR FOOTWEAR

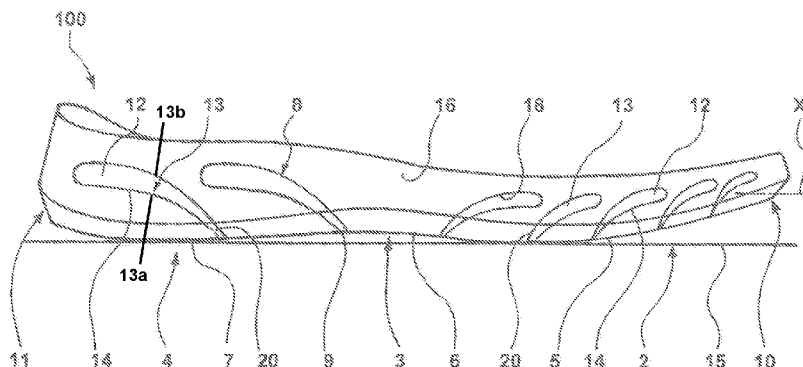


FIG. 1

(57) Abstract: A sole for footwear extends longitudinally in a toe-heel direction X comprises a tread surface and at least one slot which extends transversely relative to the toe-heel direction X and comprising at least a portion which has an extent in that toe-heel direction X which narrows progressively in the direction towards the tread surface. The slot comprises a curved longitudinal portion with concavity which is directed towards the tread surface when the sole is in a rest condition.

WO 2017/145131 A1

A sole for footwear

DESCRIPTION

The present invention relates to a sole for footwear and a footwear comprising such a sole.

5 In the technical field of footwear it is particularly known to produce soles which are provided with notches which extend transversely relative to the longitudinal extent of the sole in order to improve the flexibility thereof in predetermined directions.

Examples of such soles are described in US 20060061012 A1 and in JP 2005218543 A.

10 US20060061012 A1 relates to an article for footwear, the sole of which is provided between the respective sides with a plurality of incisions. The incisions extend substantially perpendicularly to the tread surface of the sole defining respective openings in that surface.

JP2005218543 A relates to soles for footwear which are provided, in the respective
15 rear-foot and forefoot zones, with channels which extend in the direction of the width of the sole. The channels of the rear-foot and forefoot zones are inclined towards the rear end and front end of the sole, respectively, so as to define a preferred deformation direction of the sole which allows the support time of the sole on the ground to be reduced when using the footwear during the practice of a
20 sporting activity, such as running and jogging or during a walk.

Another example of a sole for footwear provided with cavities is described in US 5797199 A. That sole is provided with a tread surface and cavities which have a size in the longitudinal extent of the sole which increases in the direction towards the tread surface. The Applicant has observed that the solution described in US
25 5797199 A brings about an excessive weakening of the sole in the vicinity of the tread surface at the above-mentioned cavities, which may compromise the capacity of the sole to provide adequate support for the foot. The Applicant has further observed that a weakening of the sole in that zone is not desirable, the tread

surface being the portion of the sole by means of which the forces transmitted by the foot are discharged to the ground.

More generally, the Applicant has observed that the solutions set out above are subjected to a number of disadvantages such as a non-homogeneous absorption of the load acting on those soles during a walking or running cycle as well as a non-optimum thrust of the foot so as to promote the advance thereof.

The problem addressed by the present invention is to provide a sole for footwear and a footwear comprising that sole which is structurally and functionally configured to overcome at least one of the disadvantages set out with reference to the cited prior art.

In the context of this problem, an object of the invention is to provide a sole for footwear which is suitable for conforming to the natural movement of the foot during a walking or running cycle.

Another object of the invention is to provide a sole for footwear which uses the energy accumulated during the stance of the foot on the ground in order to urge the advance thereof during walking or running.

Another object of the invention is to reduce the dispersion of the energy which is accumulated by the sole during a walking or running cycle.

This problem is solved and at least one of these objects is achieved by means of a sole for footwear and a footwear comprising that sole in accordance with the independent claims which are appended to the present description, respectively.

Preferred features of the invention are defined in the dependent claims.

The features and additional advantages of the invention will be better appreciated from the following detailed description of a preferred though non-exclusive embodiment thereof which is illustrated by way of non-limiting example with reference to the appended drawings, in which:

- Figures 1 and 2A are schematic side views of a sole according to the invention,

- Figures 2B and 2C are schematic views of a detail of Figure 2A and
- Figure 3 is another side view of a sole according to the invention.

With initial reference to Figure 1, there is generally designated 100 a sole for footwear which is carried out according to the present invention.

5 The sole 100 extends longitudinally in a toe-heel direction X between a front end 10 thereof and a rear end 11 thereof.

The sole 100 comprises a tread surface 5, 6, 7 which is intended to be directed towards the ground during the use of the above-mentioned sole.

Preferably, the sole 100 comprises a forefoot zone 2, a mid-foot zone 3 and a rear-
10 foot zone 4 which are mutually contiguous in the toe-heel direction X and which are provided with respective portions of the tread surface 5, 6, 7.

In the context of the present invention, the expression "tread surface 5, 6, 7" is intended to identify the external surface of the sole 100 which is intended to be directed towards the ground during the use of the sole 100, that is to say, during
15 the use of a footwear including the sole 100 by a user.

In particular, the tread surface 5, 6, 7, or at least the portions 5, 7 thereof in relation to the forefoot zone 2 and rear-foot zone 4, is intended to come into contact with the ground during the use of the sole 100.

Preferably, the forefoot zone 2 and rear-foot zone 4, more preferably also the mid-
20 foot zone 3, are produced from resilient material so as to allow the sole 100 to become deformed when a load is applied thereto.

Preferably, the forefoot zone 2 and rear-foot zone 4, more preferably also the mid-foot zone 3, are produced from polymeric materials which are selected in accordance with different needs.

25 According to an aspect of the invention, the sole 100 can be compressed in directions which are transverse to the tread surface 5, 6, 7 and can further become deformed in the toe-heel direction X.

In an embodiment of the invention, the forefoot zone 2 and rear-foot zone 4 are

structurally independent. Alternatively, the above-mentioned zones are structurally integrated in a monobloc structure.

Preferably, the sole 100 comprises a first and a second side 16, 17 which are opposite each other with respect to the toe-heel direction X and which laterally
5 delimit the tread surface 5, 6, 7.

The sole 100 according to the invention is provided with at least one slot 8 which extends transversely relative to the toe-heel direction X.

According to an aspect of the invention, at least a portion of the slot 8 has an extent in the toe-heel direction X which narrows progressively in the direction
10 towards the tread surface 5, 6, 7.

That feature ensures adequate support of the sole for the foot without compromising the capacity for resistance provided by the sole near the tread surface 5, 6, 7.

In other words, the slot 8 may have a smaller extent in a zone near the tread
15 surface 5, 6, 7 with respect to the extent which it has in the region of a distal zone with respect to the tread surface 5, 6, 7, typically directed towards the surface at which the foot of the user is supported.

According to an aspect of the invention, the slot 8 comprises a curved longitudinal portion 13 with concavity 14 which is directed towards the tread surface 5, 6, 7
20 when the sole 100 is in a rest condition.

In the context of the present invention, the sole 100 is in a rest condition when no external force is applied thereto. In particular, the sole 100 is distended when it is in the above-mentioned rest condition.

The provision of the above-mentioned curved longitudinal portion 13 allows
25 definition of a longitudinal extent of the slot 8 which is coherent with the rotational movement of the foot, in particular with the flexion and extension movements of the foot, which movement is obtained by the rotation of the tibial/tarsal articulation about a rotation axis which extends through the malleoli of the ankle, during

walking.

That feature advantageously allows the sole 100 to conform to the natural movement of the foot during a walking cycle, making walking easier and more comfortable.

5 According to an aspect of the invention, the curved longitudinal portion 13 is delimited in the lower side by a curved surface 13a with concavity directed towards the tread surface 5, 6, 7 when the sole 100 is in the rest condition.

This solution turns out to be particularly valuable from the aesthetic point of view and is particularly advantageous for ease of walking, particularly allowing a gradual
10 deformation of the structure.

According to an aspect of the invention, the curved longitudinal portion 13 is delimited in the lower side by the curved surface 13a and in the upper side, that is to say, at the side opposite the curved surface 13a, by an upper surface 13b.

Preferably, the upper surface 13b is a curved surface with concavity directed
15 towards the tread surface 5, 6, 7 when the sole 100 is in a rest condition. More preferably, the curved surface 13a and the upper surface 13b substantially have the same radius of curvature.

Preferably, the slot 8 defines an opening 9 in the tread surface 5, 6, 7. According to
20 an aspect of the invention, the opening 9 is substantially closed when the sole 100 is in a rest condition.

Preferably, the opening 9 narrows until it is completely closed in the vicinity of the tread surface.

Those solutions turn out to be particularly valuable from the aesthetic point of view.

Preferably, the slot 8 defines a respective hole 18, 19 in the first side 16 and/or the
25 second side 17. Preferably, the opening 9 extends transversely to the toe-heel direction X from the first side 16 to the second side 17.

According to an embodiment of the invention, the slot 8 extends longitudinally from the opening 9 towards an end of the sole 100 which is longitudinally nearer the

opening 9 between the front end 10 and the rear end 11, that is to say, towards the end of the sole 100 nearest the opening 9 in the toe-heel direction X.

This feature allows definition of a longitudinal extent of the slot 8 which is coherent with the rotational direction of the foot during the phase which follows the phase of stance on the ground of a rear portion thereof during walking or, alternatively, allows definition of a longitudinal extent of the slot 8 which is coherent with the rotational direction of the foot during the thrust phase with a front portion thereof during walking.

This feature turns out to be particularly suitable for promoting the natural movement of flexion and extension of the foot during walking.

Preferably, the longitudinal section of the slot 8, more preferably the entire above-mentioned longitudinal section, has an arcuate profile, wherein the longitudinal section of the above-mentioned slot 8 is obtained by intersecting the sole 100 with a cut plane which is parallel with an axis which extends in the toe-heel direction X and which is transverse, in particular perpendicular, to the tread surface 5, 6, 7.

Preferably, the slot 8 is provided with a final portion 12 which is located in the forefoot zone 2 or rear-foot zone 4, the final portion 12 being longitudinally opposite the opening 9 which is defined by the slot 8.

Advantageously, a slot 8 with a final portion 12 located in the rear-foot zone 4 advantageously provides a large surface for absorption of the energy produced by the load acting on the sole 100 in the stance phase of the foot during walking. In particular, a slot 8 with a final portion 12 located in the rear-foot portion 4 has a longitudinal extent which is coherent with the rotation direction of the foot during the phase which follows the phase of stance on the ground of a rear portion thereof during walking.

Advantageously, a slot 8 with a final portion 12 located in the forefoot zone 2 allows a release of the energy absorbed in the stance phase of the foot towards the front portion of the foot during walking. In particular, the slot 8 with a final portion 12

located in the forefoot zone 2 has a longitudinal extent which is coherent with the rotational direction of the foot in the thrust phase with a front portion thereof during walking.

According to an embodiment of the invention, the final portion 12 extends
5 longitudinally in a direction which is substantially parallel with a bearing plane 15 of the sole 100, the bearing plane 15 being defined by the tread surface 5, 6, 7.

The longitudinal extent of the final portion 12 is therefore substantially normal to a component which is perpendicular to the bearing plane 15 of a load acting on the sole 100 in the stance phase and bearing phase of the foot during walking. This
10 results in a greater surface for absorbing the energy produced by the load on the sole 100.

According to an embodiment of the invention, the slot 8 comprises an initial portion 20 which extends longitudinally from the opening 9 so as to have a longitudinal extent axis Y which is inclined by an angle α with respect to the bearing plane 15 of
15 the sole 100.

Preferably, the angle α is between 30° and 60° , and even more preferably between 40° and 50° , when the final portion 12 of the slot 8 is located in the rear-foot zone 4. Even more preferably, the angle α is approximately 45° .

In this manner, in the rotation phase of the foot which follows the stance phase of a
20 rear portion thereof during walking, the energy absorbed by the final portion 12 is released in the advance direction of the foot by means of the curved longitudinal portion 13, thereby increasing the quantity of thrust given by the sole 100 to the foot in the above-mentioned advance direction (Figures 2A and 2B).

Preferably, the angle α is between 30° and 60° , and even more preferably between
25 40° and 50° , when the final portion 12 of the slot 8 is located in the forefoot zone 2. Even more preferably, the angle α is approximately 45° .

In this manner, the curved longitudinal portion 13 of the slot 8 provides for control of the advance of the foot during bearing on the ground, absorbing at least a

portion of the energy which is thereby transferred from the rear-foot zone 4 to the forefoot zone 2 of the sole 100 (Figures 2A and 2C).

Subsequently, that is to say, during the thrust phase of the foot, the final portion 12 provides for releasing the energy which is absorbed by the slot 8 in a substantially normal direction away from the bearing plane 15 of the sole 100, consequently promoting the detachment of the foot from the ground. Therefore, this promotes the comfort perceived by the user of a footwear provided with a sole 100 according to the invention.

The slot 8 may be located in the mid-foot zone 3 so as to maximize the effect of transfer of energy accumulated in the stance phase of the foot.

According to an embodiment of the invention, the slot 8 narrows in the region of the opening 9. In this manner, the energy transferred by the slot 8 to the foot during the bearing and thrust phase is maximized.

With reference to the figures, there may be provision for the forefoot zone 2 and/or the rear-foot zone 4 to comprise one or more respective slots 8. Figure 3 finally shows possible arrangements of the slots 8 (illustrated with a broken line) in the sole 100, wherein the slots 8 may have different angulations with respect to the bearing plane 15.

The invention thereby solves the problem set, at the same time achieving a plurality of advantages. In particular, the slot(s) of the sole allow(s) the sole to become adapted to the natural movement of the foot during a walking cycle and the energy accumulated in the sole during the stance of the foot on the ground to be used in order to urge the advance thereof during walking.

Claims

1. A sole for footwear (100) which extends longitudinally in a toe-heel direction (X) between a front end (10) thereof and a rear end (11) thereof, comprising:
- 5 • a tread surface (5, 6, 7) which is intended to be directed towards the ground during the use of the sole (100) and
- at least one slot (8) which extends transversely relative to the toe-heel direction (X) and comprising at least a portion which has an extent in the toe-heel direction (X) which narrows progressively in the direction towards
- 10 the tread surface (5, 6, 7);
- the slot (8) comprising a curved longitudinal portion (13) with concavity (14) which is directed towards the tread surface (5, 6, 7) when the sole (100) is in a rest condition.
- 15 2. The sole for footwear according to claim 1, wherein the curved longitudinal portion (13) is delimited in the lower side by a curved surface (13a) with concavity which is directed towards the tread surface (5, 6, 7) when the sole (100) is in a rest condition.
- 20 3. The sole for footwear according to any one of the preceding claims, wherein the slot (8) defines an opening (9) in the tread surface (5, 6, 7), the slot (8) extending longitudinally from the opening (9) towards the end of the sole longitudinally nearest the opening (9) between the front end (10) and the rear end (11).
- 25 4. The sole for footwear according to any one of the preceding claims, wherein the slot (8) has a longitudinal section with an arcuate profile.
5. The sole for footwear according to any one of the preceding claims, wherein the

sole (100) comprises a forefoot zone (2), a mid-foot zone (3) and a rear-foot zone (4) which are mutually contiguous in the toe-heel direction (X) and which are provided with respective portions of the tread surface (5, 6, 7), the slot (8) comprising a final portion (12) which is longitudinally opposite the opening (9) and
5 which is located in the forefoot zone (2) or rear-foot zone (4).

6. The sole for footwear according to claim 5, wherein the final portion (12) extends longitudinally in a direction substantially parallel with a bearing plane (15) of the sole (100), the bearing plane (15) being defined by the tread surface (5, 6, 7).

10

7. The sole for footwear according to claim 5 or 6, wherein at least the forefoot zone (2) and rear-foot zone (4) are produced from resilient material.

8. The sole for footwear according to any one of claims 5 to 7, wherein the slot (8)
15 comprises an initial portion (20) which extends longitudinally from the opening (9) so as to have a longitudinal extent axis (Y) which is inclined by an angle (α) with respect to the bearing plane (15).

9. The sole for footwear according to claim 8, wherein the angle (α) is between 30°
20 and 60° when the final portion (12) of the slot (8) is located in the forefoot zone (2).

10. The sole for footwear according to claim 8 or 9, wherein the angle (α) is between 30° and 60° when the final portion (12) of the slot (8) is located in the
25 rear-foot zone (4).

11. The sole for footwear according to any one of the preceding claims, wherein the slot (8) narrows in the region of the opening (9).

12. The sole for footwear according to any one of the preceding claims, wherein the opening (9) is substantially closed when the sole (100) is in the rest condition.

5 13. The sole for footwear according to any one of the preceding claims, wherein the forefoot zone (2) and/or rear-foot zone (4) comprise(s) one or more respective slot(s) (8).

10 14. The sole for footwear according to any one of the preceding claims, wherein the forefoot zone (2) and rear-foot zone (4) are structurally independent.

15 15. The sole for footwear according to any one of the preceding claims, wherein the sole comprises a first and a second side (16, 17) which are opposite each other with respect to the toe-heel direction (X) and which laterally delimit the tread surface (5, 6, 7), the slot (8) defining a respective hole (18, 19) in the first side (16) and/or in the second side (17).

16. Footwear comprising a sole according to any one of claims 1 to 15.

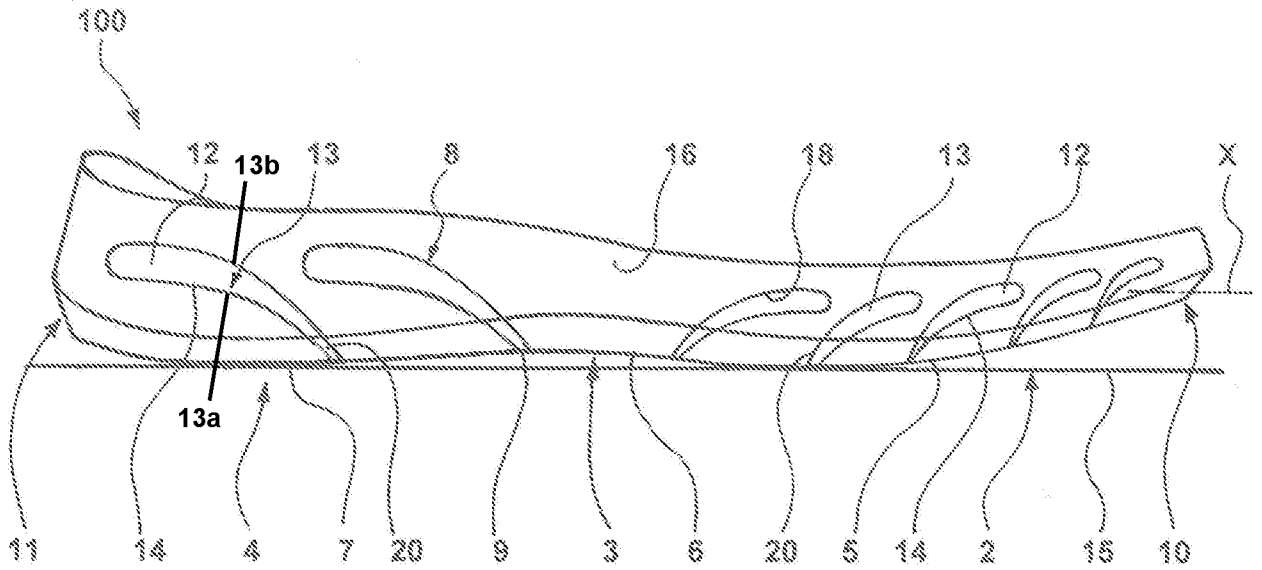


FIG. 1

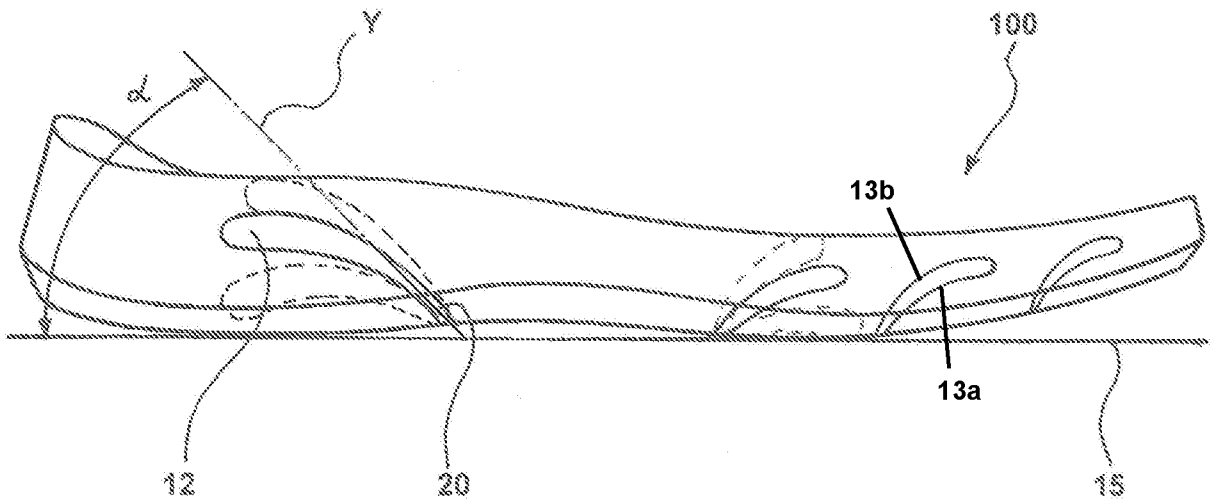


FIG. 3

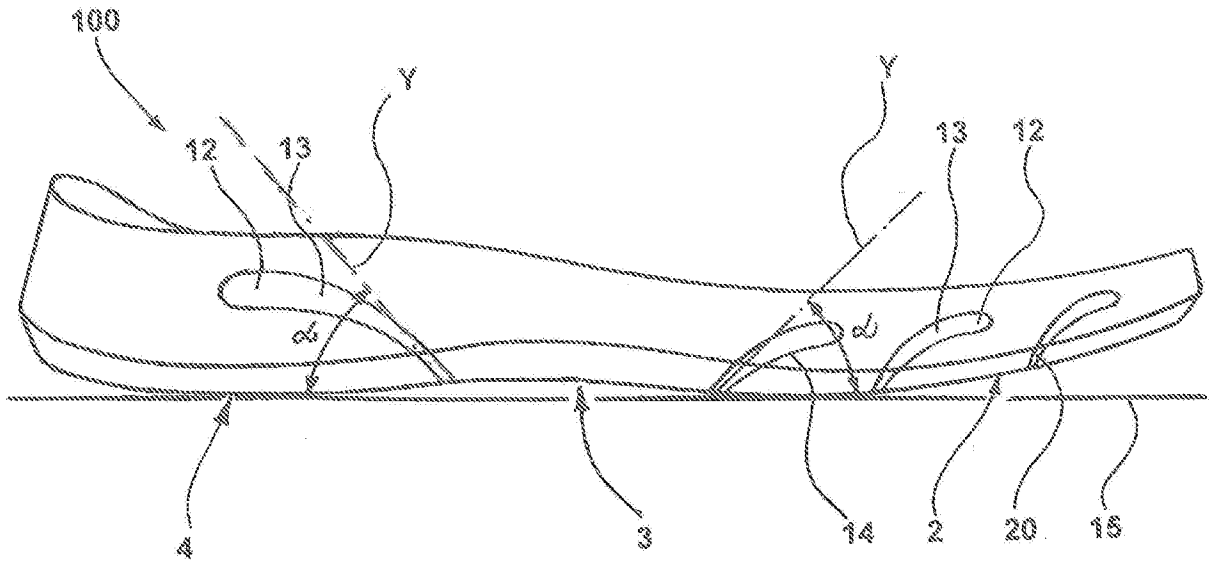


FIG. 2A

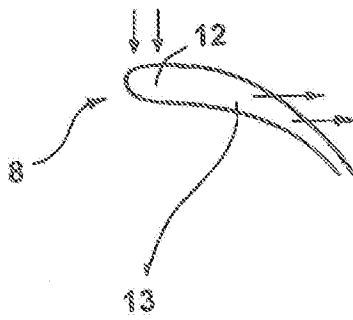


FIG. 2B

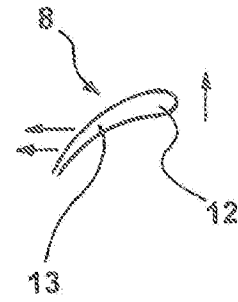


FIG. 2C

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. A43B13/20 A43B13/18 A43B13/14
ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
A43B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 713 140 A (BAGGENSTOSS ALOIS C [US]) 3 February 1998 (1998-02-03) figures -----	1-16
Y	US 5 797 199 A (MILLER TODD [US] ET AL) 25 August 1998 (1998-08-25) figures -----	1-16
A	US 2009/241371 A1 (KIMURA TAKAYA [JP] ET AL) 1 October 2009 (2009-10-01) figures -----	1-16
A	US 2013/152428 A1 (BISHOP JENNIFER [US] ET AL) 20 June 2013 (2013-06-20) figures -----	1-16

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5713140	A	03-02-1998	NONE

US 5797199	A	25-08-1998	US 5625963 A 06-05-1997
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US 2009241371	A1	01-10-2009	JP 5037407 B2 26-09-2012
			JP 2009240590 A 22-10-2009
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			WO 2009122860 A1 08-10-2009

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