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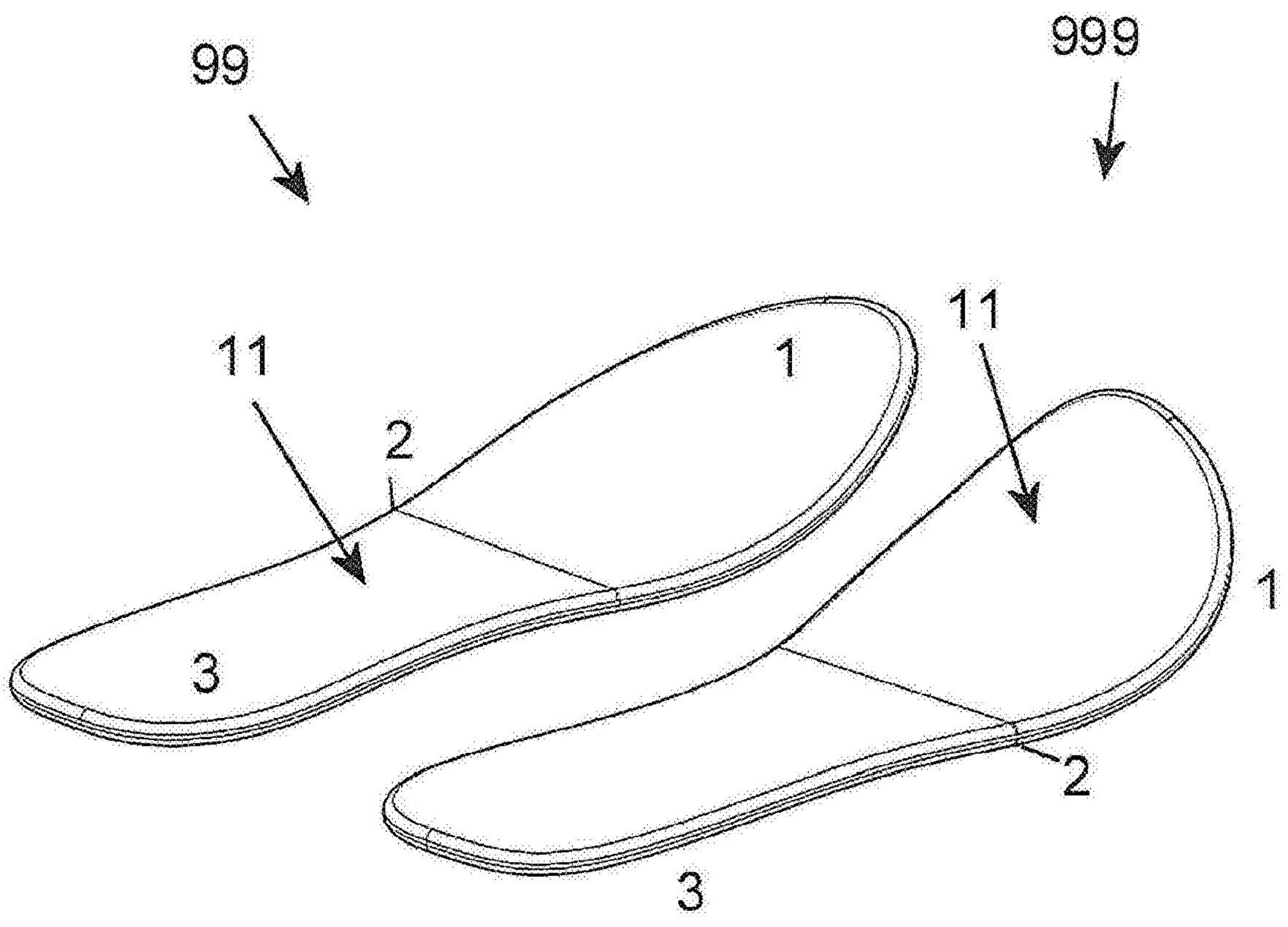

FIG. 1

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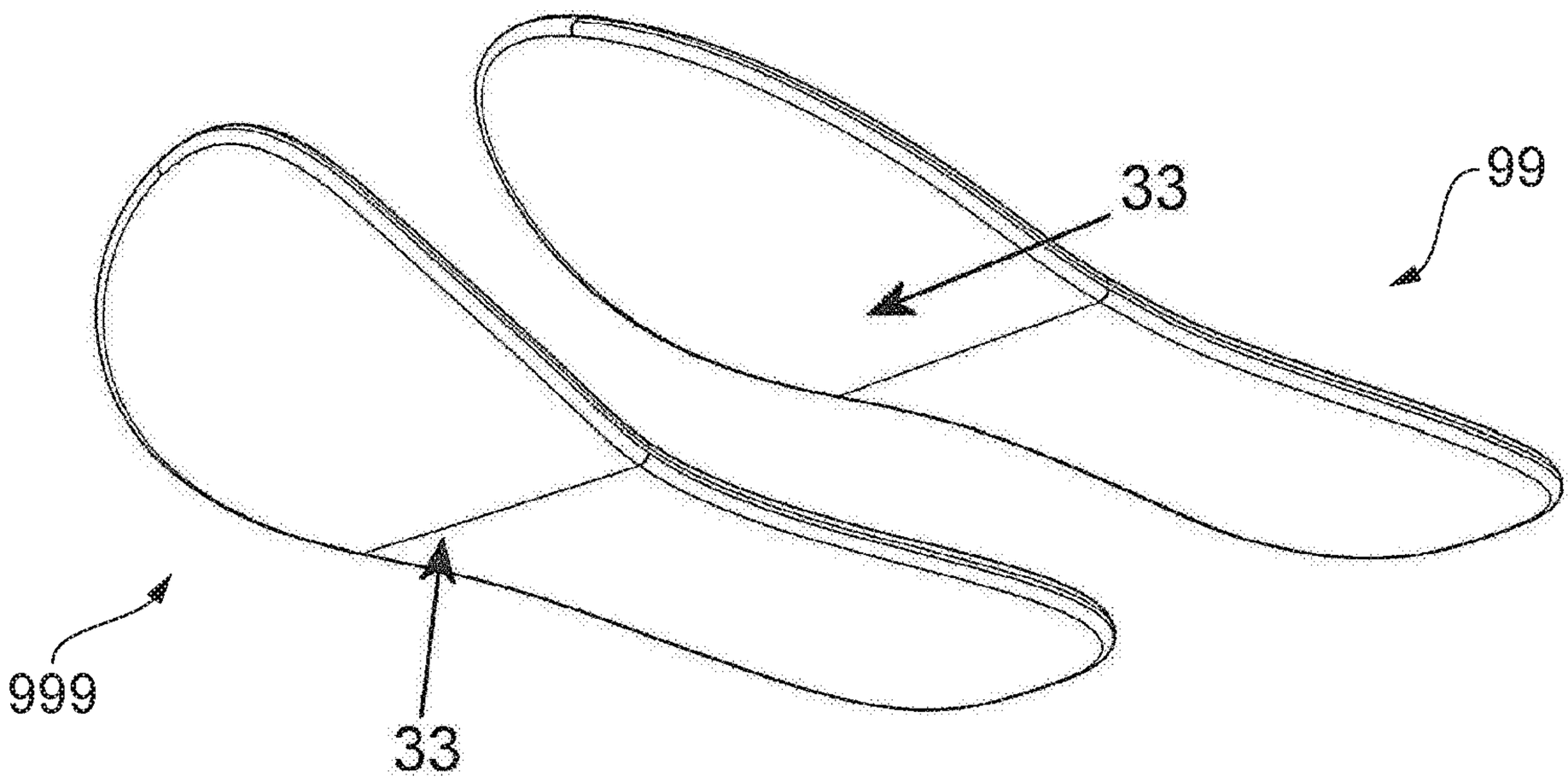

FIG. 2

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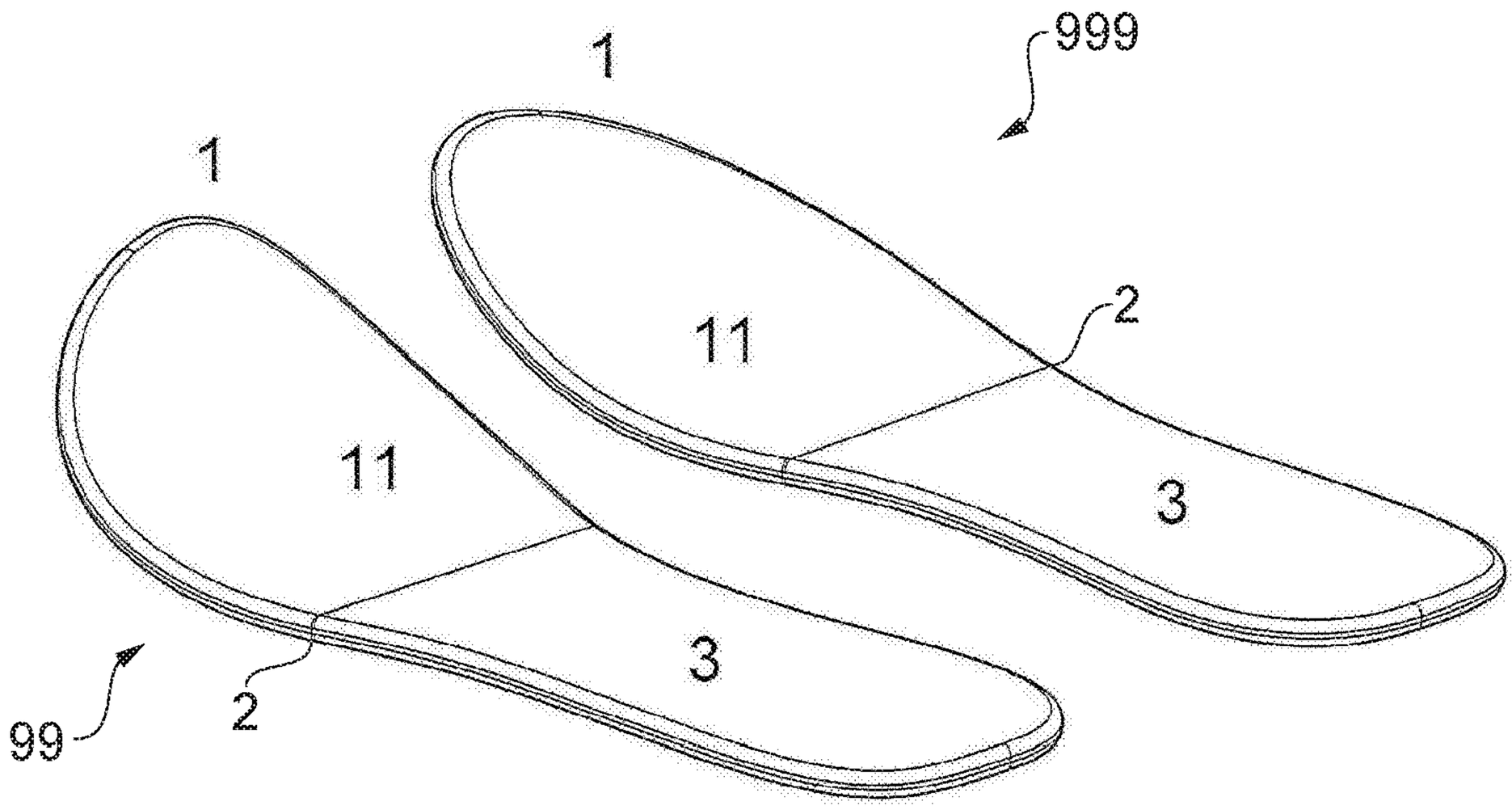

FIG. 3

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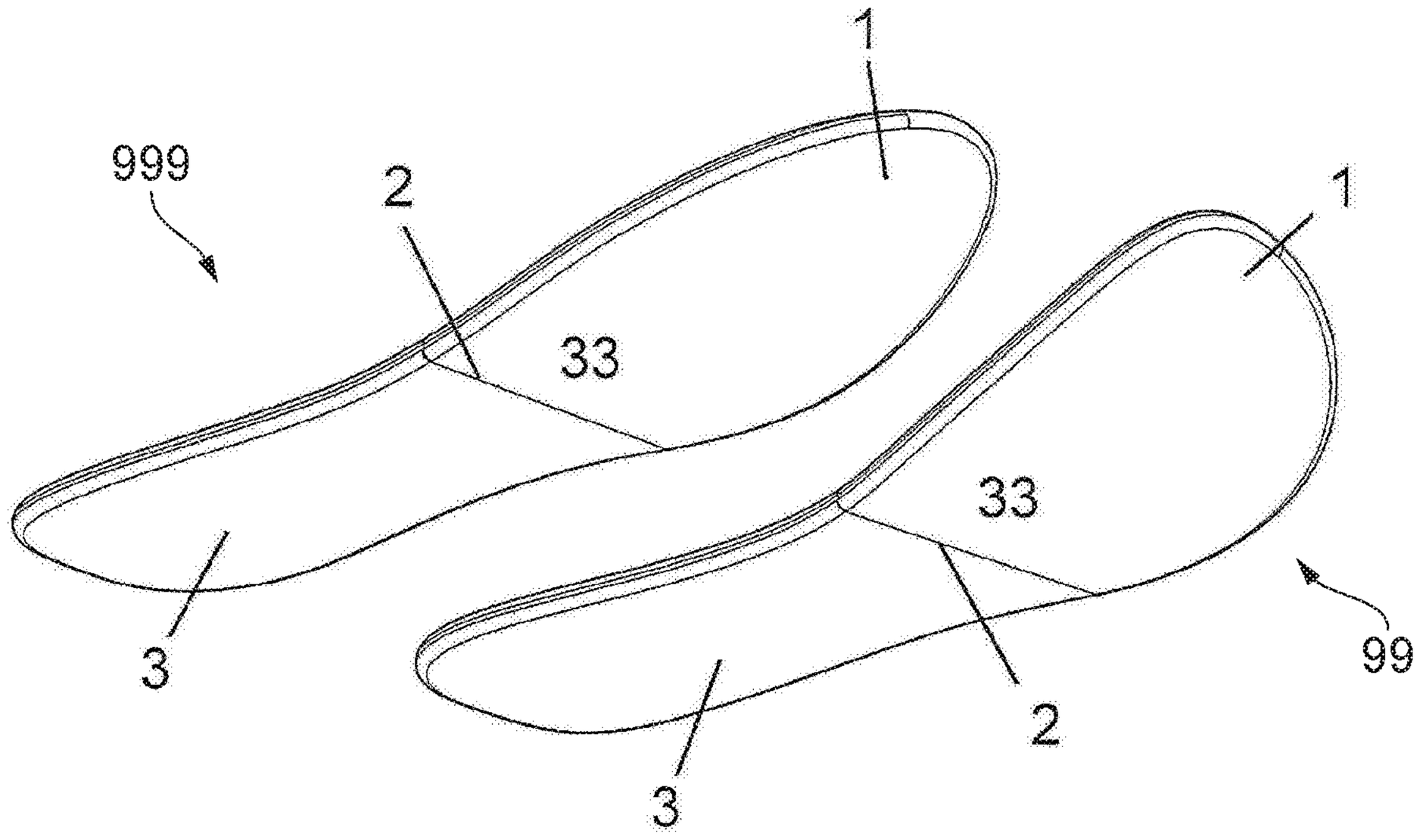

FIG. 4

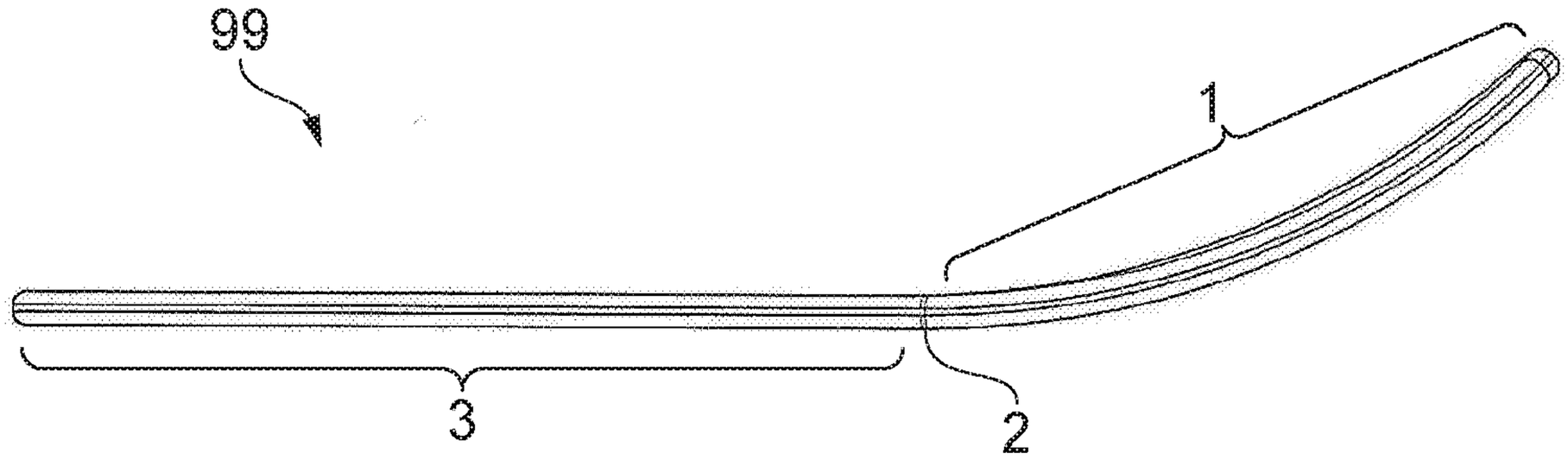

FIG. 5a

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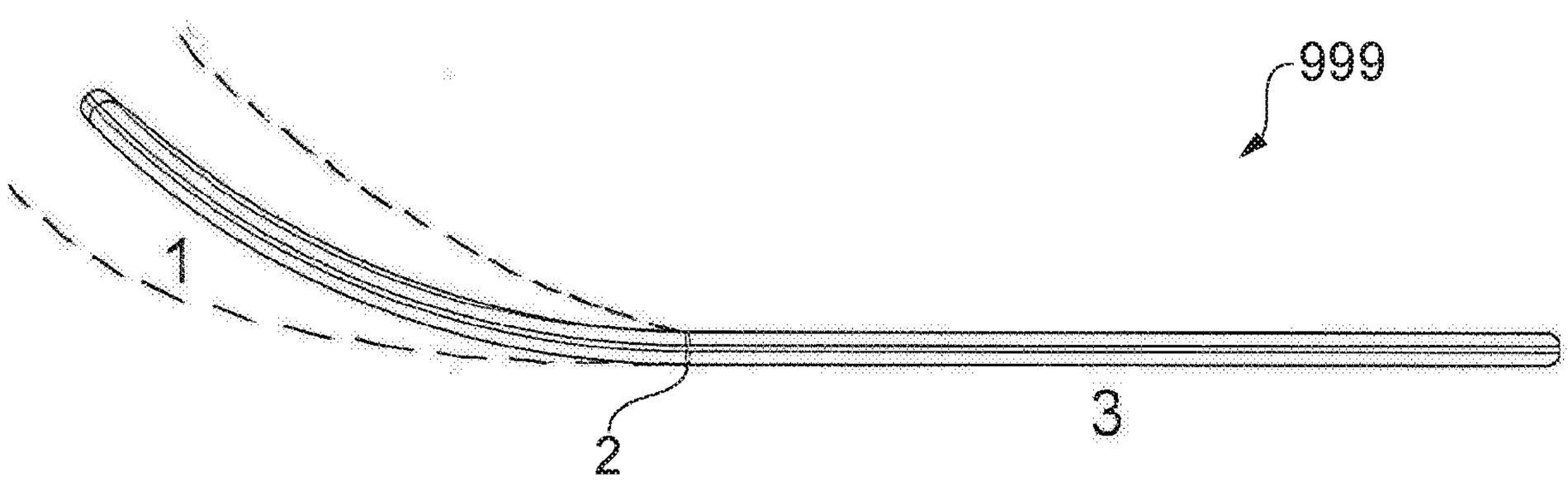

FIG. 5b

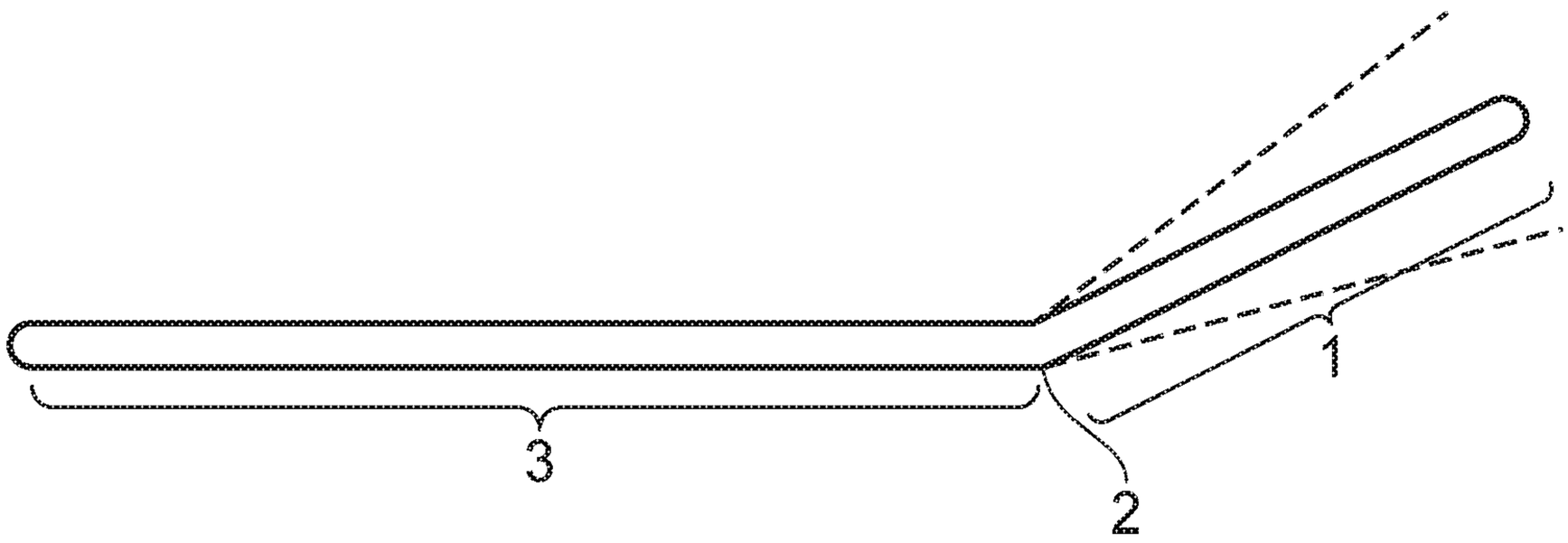

FIG. 5c

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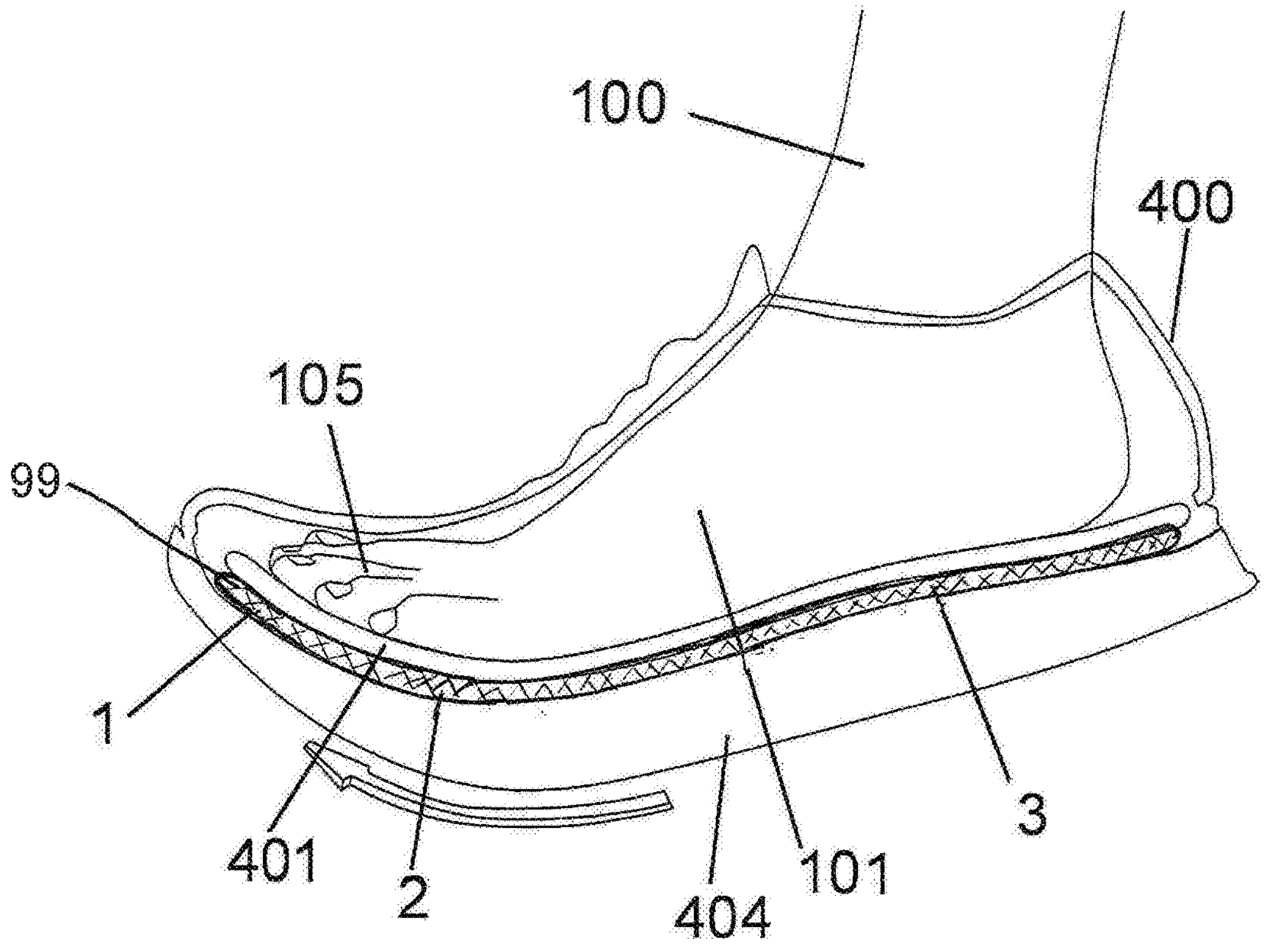

FIG. 6

A DEVICE FOR AN ITEM OF FOOTWEAR

Field of the Invention

The present invention relates to a device for use with an item of footwear, in particular a device for rearrangement of a standard footwear sole; more particularly but not exclusively an orthotics device for foot drop or drop foot.

Background

Many people are affected by drop foot, a condition which can cause a person to drag their foot on the ground when walking, particularly stubbing toes on the swing phase of walking. In most cases dorsiflexion of the toes is not possible, or is restricted as a result of the condition.

Foot drop is often caused by compression of the nerve that controls the muscles that lift the foot but can have many causes. Foot drop can occur due to various ailments or diseases, such as following a stroke, or in people suffering from Multiple Sclerosis or Parkinson's' disease. Foot drop can also sometimes be caused by nerve damage linked to diabetes and inherited conditions that cause peripheral nerve damage and muscle weakness, such as Charcot-Marie-Tooth disease.

As an additional consequence of foot drop is that nerves around the knee or lower spine can become trapped and nerves in the leg can be injured or damaged during hip or knee replacement surgery.

With foot drop it is also difficult to lift the front part of the foot off the ground meaning a tendency to scuff toes along the ground, increasing risk of falls where the sufferer ends up having to the foot higher than usual when walking.

Prior Art

DE 202 016 100 379 (MEYER) discloses a foot lifting orthosis of caring for individuals with general foot lifting weaken, with a foot support part, with at least one support

portion and with an intermediate the foot support part. The at least one support portion extending connecting portion extends laterally from the foot support part to support portion extends, characterized in, that the foot support part is formed by a plurality of layers of the laminate, wherein a fibre at an angle to the longitudinal centre axis of the foot, in the course of the scrim, is aligned with a supporting member.

WO 201 525 191 (SOLIDORO) discloses orthosis for foot drop intended to control and stabilize the position of the foot of a user with reduced or zero control of the lifting function of the same foot, of the type comprising a plantar insole shaped with length such to be extended.

WO 200 994 712 (SANDERSON) teaches an orthotic for a shoe that is a substantially foot shaped sheet of fibreglass and/or carbon fibre reinforced epoxy polymer with high flexural strength in order to resist flexing as the wearer runs or walks.

US2017/172782A1 (MCDONNELL) discloses an orthotic device that has an electronically actuated muscle operatively connected to a frame.

US5088479A1 (DETORO discloses an ankle and foot orthosis for protection and partial immobilisation of the ankle/foot or L shape construction.

US2004/118017A1 (SPENCO MEDICAL) discloses an insole with a moulded base and top sheet for facilitating airflow.

US2010/257753 (ATHLETIC PROPULSION LABS) discloses an athletic shoe upper with a spring.

The present invention provides a means of elevating the toes of a wearer that does not require activation of movement of parts to achieve this.

Summary of the Invention

According to a first aspect of the present invention there is provided a device for positioning under a wearer's foot that is located on a sole of an item of footwear in

use, the device comprising: a plantar surface for engagement of a wearer's sole below the arch and heel, a joint portion extending from the plantar surface that is arranged in use to be under a wearer's metatarsophalangeal joint and an end that extends from the joint portion and is arranged to extend under, and engage with, the wearer's phalanges, wherein the end is inclined upwards to provide an arcuate surface commencing from the joint portion that lifts a wearer's phalanges; and wherein at least the joint portion and end are substantially rigid such that the device, when arranged in or on an item of footwear, lifts the wearer's phalanges continuously during a stride.

The device is shaped to correspond to the footprint of a wearer such that the device fits within or upon traditional footwear.

In this way the device provides a means of lifting and supporting the phalanges (toes) of a wearer throughout a stride. Advantageously this provides an aid to a wearer who may be suffering from foot drop that is a muscular weakness or paralysis that makes it difficult or nor possible to lift the front part of the foot and in particular the toes.

The device is a unitary body that is shaped to correspond to the footprint of a wearer. In this way the device can easily be arranged under the wearer's foot, within or upon the upper face of a sole of an item of footwear in the same manner as an innersole of a shoe. Therefore, the full area of the wearer's sole is supported upon the device in use.

Preferably the device may be arranged beneath an innersole of an item of footwear, therefore the device is arranged between the sole of the shoe and the innersole.

The device is unitary because it is formed as a single piece and does not have separate interlinked or jointed parts that move relative to one another. In contrast to some prior art devices the present invention is formed as a single part which in use is permanently arranged under the sole of a wearer's foot. The device may be formed as a single cast or mould.

In preferred embodiments the device may be available as a discrete part for addition to a variety of items of footwear. In this way the device is inserted into an item of

footwear so as to be laid on the sole of the footwear upon which a wearer's foot is located.

In other embodiments the device may be incorporated in an item of footwear. For example the item of footwear may be manufactured to include the device already arranged as part of the sole of the footwear.

The end is raised upwards from the plantar surface to provide a lifted surface upon which a wearer's toes are located in use. The curvature commences at the joint portion and thus corresponds to the metatarsophalangeal joint and thus the point at which joint flexion is naturally permitted.

It is appreciated that the plantar surface, joint portion and end are each regions of the device.

The plantar surface is substantially flat and shaped to correspond to the footprint of the heel and instep region of a wearer's sole.

In some embodiments the plantar surface may be entirely flat.

In other embodiments the plantar surface may be shaped to correspond to the contour of a wearer's sole, for example including a raised edge to cup a wearer's heel and a raised instep.

The device is configured to incline from the joint portion which corresponds to the metatarsophalangeal joint. In this way the toes are lifted in a natural manner that corresponds to the joint between the metatarsals and phalanges.

The end is curved with respect to the plantar surface.

Preferably the joint portion and end are curved upwards from the plantar surface so as to provide an arcuate surface upon which the wearer's toes rest in use.

A wearer may select the degree to which the end is curved and, thus enabling a wearer to select a device that best matches their foot shape and the elevation

required to comfortably position the toes and provide the desired level of elevation to assist with a wearer's stride.

It is appreciated that the curvature of the end is provided within a range that permits sufficient elevation of the toes, without causing discomfort and whilst also be suitable for accommodation within a traditional shoe, without modification.

Preferably the end is curved within a range of a 10cm radius of curve to a 25cm radius curve. More preferably the end is curved within a range of 12cm radius of curve to 18cm radius of curve.

The degree of elevation of the toes created by the curvature of the end may be tailored to a wearer and/or to the type of footwear being worn, or activity to be performed.

The devices may be provided in a range of configurations enabling a wearer to select the degree of elevation of the end.

In some embodiments the end may comprise a toe cap, which cap may be arranged to return over the wearer's toes, and act to deviate the toe cap of the item of footwear.

In some embodiments the device may be formed from carbon-fibre, synthetic plastics material, lightweight composite or polymer.

At least the end has a high level of rigidity so as to maintain the toes in an elevated position during a stride.

The whole device may be formed from material of the same rigidity or may have regions of, varying rigidity.

Varying rigidity may be achieved through use of different materials at different regions of the device and/or different thicknesses or weights of the materials used to form the device.

For example the plantar surface may have a greater degree of flexion than the end so that the movement through the arch of the foot is permitting during a stride. Or alternatively, in some other embodiments, the device is formed entirely from substantially rigid material, which material has minimal to no flexure in use thus maintain the foot in a constant position during the stride.

In some embodiments the surfaces of the device may comprise a different material or level of flexure, for example comprising a different thickness or weight of material. In this way the device may enable flexure from behind the toe mounds.

The end may define an inner edge, a distal edge, and an outer edge, wherein the inner edge of the end comprises the edge adjacent the big toe, and the outer edge the edge adjacent the little toe.

In some embodiments the joint portion may enable transverse twisting, for example wherein the outer edge may be at a different inclination to the inner edge.

In some embodiments the joint portion may enable multi-axial inclination of the end. For example in this way the device may enable flexure of the end and toes at different inclinations. This may enable flexing of the smaller toes, for example whilst the big toe is held directed upwards.

In some embodiments the device may be multi-laminate. For example in some embodiments a top layer may comprise a resiliently deformable or yielding material, such as a closed cell structure foam, so as to provide greater comfort. In other embodiments different layers may comprise differing materials, or different strength patterns such as arranged for transverse strength or inflexibility and for longitudinal strength or inflexibility.

In yet a further embodiment the device may include a strengthened core, such as a metal sheet, surrounded by synthetic plastics material coating.

In some embodiments the device may comprise a layer of support adjacent the toes. For example in some embodiments the device may comprise padded or support or structural scaffolding below the elevated end.

In some embodiments the device may comprise a foot attachment mechanism, or a footwear securement means, which means or mechanism may be arranged to limit slippage of the foot on the device or the device in the footwear, respectively. This may comprise elastomeric portions, such as elastic strapping, or corresponding hook and loop portions, such as Velcro (RTM) tabs.

In some embodiments the device may comprise an outer surface, to top and/or bottom which may comprise a raised and lowered profile, or textured surface, so as to provide enhanced grip to the wearer's foot and/or against the item of footwear, such as the sole of the footwear and/or the innersole of the footwear so as to limit slippage of the foot and/or the device against the item of footwear.

For example a lower surface of the device may be textured to limit movement against the item of footwear, whereas the upper surface may be smooth so as to allow a wearer's foot to move freely over the device.

In a further embodiment the device may comprise a lower surface, in particular the end that may be equipped with adhesive or hook and loop tabs, which allow the device to be firmly adhered in use to corresponding tabs or the upper surface of the footwear's sole. In this way the footwear sole may be pulled upwards at the toe end by the device, so as to maintain toe space around a wearer's toes and thereby to limit discomfort of the toes pushing against the underside of the upper of the footwear. This may be particularly relevant for aftermarket device embodiments.

A preferred embodiment of the invention will now be described by way of example only and with reference to the Figures in which:

Brief Description of Figures

Figure 1 shows an isometric view of a matching pair of embodiments of the device according to the present invention;

Figure 2 shows a reverse isometric view of the embodiments shown in Figure 1;

Figure 3 shows a third isometric view of the embodiments shown in Figure 1;

Figure 4 shows a fourth isometric view of the embodiments shown in Figure 1;

Figures 5 show side views of first (Figures 5A and 5B) and second (Figure 5C) embodiments of the invention; and

Figure 6 shows an embodiment of the device in use.

Detailed Description of Figures

With reference to Figure 1 to 4 and Figures 5A and 5B there is shown a pair of matching embodiments of the device (left 99, and right foot 999 respectively) for each foot generally comprising a device for an item of footwear. Each device has three main regions; a plantar surface 3 for engagement of a wearer's sole below the arch and heel, a joint portion 2 in use located at the wearer's metatarsophalangeal joint and an inclined end 1, which end is arranged to engage the wearer's phalanges.

The joint portion 2 deviates the plantar surface 3 into the end 1.

The device 99,999 is arranged to be worn as part of an item of footwear. The device may be positioned in or upon the sole of an item of footwear so that in use the device is arranged to elevate the wearer's toes. It is appreciated that the device may affect or flex the item of footwear so as to lift the end of the item of footwear and thus maintain toe space.

The device is a single part, with matching embodiments corresponding to the foot print of each foot.

A line is shown in Figures 1 to 4 and Figures 5A and 5B, this line indicates the joint portion. It is appreciated that the line does not need to be visible on the device.

The device shown curves upwards from the ball of the foot to the toe, and when inserted into the shoe, it creates an upward curvature lifting the toe end of the shoe which therefore keeps the toes of the wearer upwardly mobile and reduces the risk of the toe stubbing on the ground helping to prevent trips/fall.

This is for use by anyone who suffers with foot drop, stroke or any other debilitating condition that effects the ability of the leg muscles to lift the fore foot adequately for mobility. The embodiment takes the form of one main component that is lightweight and thin but still strong enough to bear the load of the wearer without too much flexibility.

Figures 5A and 5B show side views of the device with a curved surface extending from the joint portion and through the end providing a curved surface for the toes.

Figure 5B includes a dashed line that indicates alternative ranges of curvature that may be provided on other devices. For example moulds with different curvatures at the ends may be provided.

Figure 5C shows a second embodiment of the device in which the end is angled from the joint portion to provide a flat angled surface upon which a wearer's toes rest in use. Figure 5C also includes dashed lines to indicate a range at which the end may be elevated in other devices. This embodiment is not covered by the claims but serves to provide an indication as to how range of inclination may be varied.

With reference to Figure 6 an embodiment of the device is shown in use in an item of footwear 400, on a wearer's foot 101 and leg 100.

The device 99 is arranged upon the footwear sole 404 in the item of footwear 400 such that it lifts the wearer's toes 105, as well as the item of footwear's front part. The device 99 (crosshatched area) is arranged under an innersole 401 so the device is sandwiched between the footwear sole 404 and the innersole 401. This arrangement provides greater comfort and helps to locate the device in use.

The device 99 is arranged within the item of footwear in use, and may be permanently incorporated therein, for example at manufacture or retail. Alternatively the device may be placed within the footwear or shoe after purchase, such as by the wearer.

The device as pictured thereby provides a substantially rigid shoe insert that is curved to aid sufferers of drop foot.

The device aims to flex the toes and toe end of the shoe upwards to reduce the chance of the foot/toes dragging whilst walking in the swing phase. The embodiment is advantageous as traditional braces can be bulky and clumsy whereas this is thin, lightweight and discreet.

The device as pictured may be manufactured from carbon fibre or synthetic plastics material such as a stiff thermoplastic. In this way the device is strong, durable and lightweight.

The embodiment could come in a range of sizes/colours to suit the wearer.

A textured surface to the top surface 11, and/or to the bottom surface 33 may provide more grip for the wearer and reduce the chance of the device slipping when being worn.

The invention has been described by way of examples only and it will be appreciated that variation may be made to the above-mentioned embodiments without departing from the scope of invention as defined by the claims, in particular but not solely combination of features of described embodiments.

Claims

1. A device for positioning under a wearer's foot that is is located on a sole of an item of footwear in use comprising: a plantar surface for engagement of a wearer's sole below the arch and heel, a joint portion extending from the plantar surface that is arranged in use to be under a wearer's metatarsophalangeal joint and an end that extends from the joint portion and is arranged to extend under, and engage with, the wearer's phalanges, wherein the end is inclined upwards to provide an arcuate surface commencing from the joint portion that lifts a wearer's phalanges; and wherein at least the joint portion and end are substantially rigid such that the device, when arranged in or on an item of footwear, lifts the wearer's phalanges continuously during a stride.

2. A device according to claim 1 wherein the arcuate surface is curved between a 10cm radius of curve to a 25cm radius of curve.

3. A device according to claim 1 wherein the arcuate surface is curved between a 12cm radius of curve to a 18cm radius of curve.

4. A device according to any preceding claim wherein the entire device is substantially rigid.

5. A device according to any preceding claim wherein the device is formed from carbon fibre.

6. A device according to any preceding claim wherein the device is formed from synthetic plastics material.

7. A device according to any preceding claim with a footwear securement means.

8. A device according to claim 7 wherein the footwear securement means comprises adhesive.

9. A device according to claim 7 wherein the footwear securement means comprises hook and loop portions.

10. A device according to any preceding claim with a foot attachment mechanism.

11. A device according to claim 10 wherein the foot attachment mechanism is formed from an elastomer.

12. A device according to any preceding claim having at least a textured upper or lower surface.

13. A device according to any preceding claim including a toe cover.

14. An item of footwear including the device according to any of claims 1 to 13.

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