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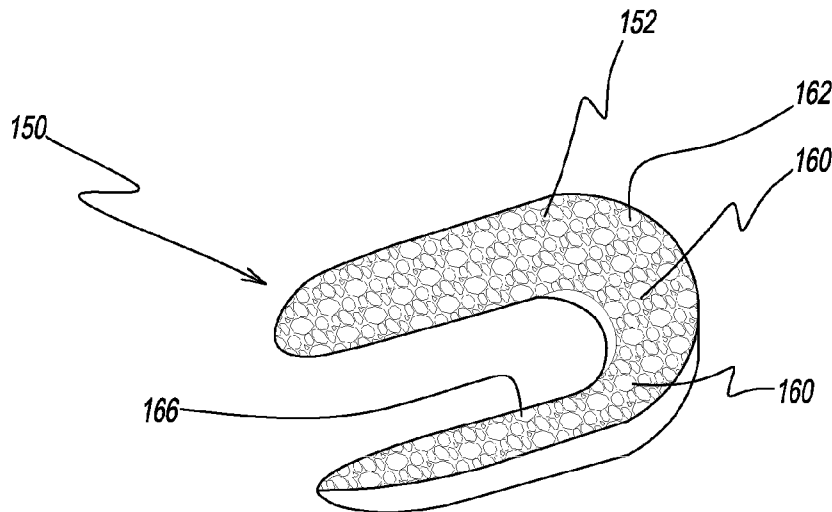
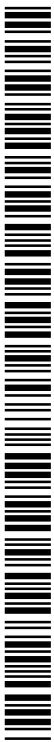


FIG. 5

(57) Abstract: The present disclosure provides for a dynamic support that is disposed beneath the heel of a wearer that is moldable by the underside of the foot to provide at least partial support to at least one of the medial arch, lateral arch, transverse and metatarsal arch and heel of the foot of a wearer. The present disclosure provides for a customized insole that contains a dynamic member that is able to adjust to the contour of a heel and to at least a portion of an arch of a wearer of such insole. The present disclosure provides for a customized insole that contains a contoured support.



A DYNAMIC SUPPORT FOR AN ARTICLE OF FOOT WEAR

BACKGROUND

5 **1. Field of the Disclosure**

This disclosure relates to a support for a shoe that is able to provide customized and continued support to the heel and one or more of the arches of the foot of the wearer. More particularly, the present disclosure relates to a support that is disposed inside of a shoe that is able to provide support to a portion of the foot using both a static support shell with a dynamic support component.

15 **2. Description of the Related Art**

In the prior art there are various known methods for capturing and supporting the contours of the foot of a wearer, however, an inexpensive, uncomplicated, clean, and accurate methodology for dynamically providing support to the arches and heel of the foot and, in particular, to the medial arch and lateral of the foot of a wearer, does not exist.

Therefore, there exists a need in many applications and contexts, such as but not limited to, the fields of customized foot supports, footwear and the like, for a dynamic support or an article containing a dynamic support that provides customized support for the plantar surface of the foot.

SUMMARY

The present disclosure provides for a dynamic support that is disposed beneath the heel of a wearer that is moldable by the underside of the foot to provide at least partial support to at least one of the medial arch, lateral arch,

transverse and metatarsal arch and heel of the foot of a wearer.

The present disclosure provides for a customized insole that contains a dynamic member that is able to adjust to the contour of a heel and to at least a
5 portion of an arch of a wearer of such insole.

The present disclosure provides for a customized insole that contains a contoured support and a dynamic support that together provide for customized arch support of the heel and at least one arch of the foot of the wearer.
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The present disclosure provides for a midsole that includes a dynamic support that is moldable by the underside of the foot to provide at least partial support to one of the arches of the foot of a wearer.

15 The present disclosure provides a support shell that is molded to support the arches of the foot of a wearer; in particular, the lateral arch, the metatarsal arch, the medial arch and the lateral arch of the a foot of a wearer.

Another embodiment includes a resilient spacer disposed between the base
20 support shell or built-in portion of the shoe and the dynamic support in the heel portion.

Still yet another embodiment includes a support for an article of foot wear comprising: a dynamic support that is capable of molding a portion of a
25 plantar surface of a foot, wherein the dynamic support comprises a fluid material combined with a lubricity enhancer. The fluid material is a highly viscous fluid material comprising silicone. The lubricity enhancer is at least one material selected from the group consisting of: polytetrafluoroethylene (PTFE) and grease.

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A further embodiment includes a support for an article of foot wear comprising: a dynamic support that is capable of molding a portion of a plantar surface of a foot, wherein the dynamic support comprises a U-shaped member and either a gas or a fluid disposed therein.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1a illustrates a dynamic support according to the present disclosure;

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FIG. 1b illustrates an insole for placement in an article of footwear having a dynamic support, according to the present disclosure;

FIG. 1c illustrates an insole with a dynamic support in the heel region;

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FIG. 2 illustrates a top view of a base support shell with dynamic support according to the present disclosure;

FIG. 3 illustrates a cross-section view of base support shell and dynamic support of FIG. 2 taken along line 3-3;

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FIG. 4 illustrates a cross-section of a package for holding particles of dynamic support;

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FIG. 4A illustrates a cross-section of a package for holding particles of dynamic support similar to Fig. 4, above, but also including a resilient spacer disposed under the dynamic particle support in the heel region according to another embodiment of present disclosure;

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FIG. 5 illustrates a dynamic support according to the present disclosure;

FIG. 6 illustrates a second top view of a base support shell with dynamic support according to the present disclosure;

5 FIG. 7 illustrates a perspective view of the base support shell taken from the medial side;

FIG. 8 illustrates a perspective view of the base support shell taken from the lateral side;

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FIG. 9 illustrates a further perspective view of the base support shell taken from the medial side;

15 FIG 10a illustrates a bottom view of a base support shell according to the present disclosure;

FIG. 10b illustrates a side view of a base support shell having a support element;

20 FIG. 10c illustrates a rear view of base support shell having a support element;

FIG. 10d illustrates a medial side of base support shell having support elements and stiffening support structure;

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FIG. 11 illustrates components of a first embodiment of the insole of in an unassembled configuration, according to the present disclosure;

30 FIG. 12 illustrates a base support shell, according to a second embodiment of the insole of the present disclosure;

FIG. 13 illustrates a base support shell, according to a third embodiment of the insole of the present disclosure;

FIG. 14 illustrates an insole in an unassembled configuration with dynamic support and liner, according to a second embodiment of the insole according to the present disclosure;

FIG. 15 illustrates an insole in an unassembled configuration with dynamic support and liner, according to a third embodiment of the insole according to the present disclosure;

FIG. 16 illustrates an insole with a secondary dynamic particle support;

FIG. 16A illustrates an insole with a secondary dynamic support which also includes a resilient spacer disposed under the dynamic particle support in the heel region according to another embodiment of present disclosure;

FIG. 17 illustrates an exploded view of the insole of Fig. 16;

FIG. 17A illustrates an exploded view of the insole of Fig. 16A with the resilient spacer;

FIG. 18 illustrates a further embodiment of the insole according to the present disclosure having an additional permeable medium layer over dynamic component and/or particles;

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FIG. 19 illustrates a midsole for a shoe;

FIGS. 20a and 20b illustrate a midsole for an athletic shoe; and

30 Figs. 21a through 21c illustrate the dynamic support of the present disclosure incorporated into a brace.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings and in particular to Fig. 1a, a dynamic support is shown and referenced by reference numeral 150. Dynamic support 5 150 is a moldable member that deforms and retains the shape of a heel of a wearer and a portion of at least one of the lateral, medial, metatarsal or transverse arch of a foot during wear in a shoe of a wearer. Dynamic support 150 has a U-shaped configuration and is disposed under the heel of the wearer of a shoe. Dynamic support 150 has two arms 8 that are either connected to 10 each other or connected with a base 6. Dynamic support 150 is made from materials that permit such dynamic support. Such materials conform to and simultaneously support the heel of the wearer. Dynamic support 150 is configured to support a portion of at least one of the lateral, medial, metatarsal and/or transverse arch of the wearer.

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While dynamic support 150 is shown as having a U-shaped configuration dynamic support may also have the shape of a torus or an ovoid. Dynamic support 150 may have asymmetrical shapes to add support to medial and/or lateral arches.

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Dynamic support 150 may be inserted into an article of footwear beneath a heel to provide dynamic support to the medial arch and lateral arch, and in particular, the posterior portion of the medial and lateral arch. Accordingly, dynamic support 150 may be inserted inside of a shoe.

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Alternatively, as shown in Fig. 1b, dynamic component 150 can be used with a base support shell 50, as described in greater detail below, to form an insole 10 with specifically customized heel and arch support. Insole 10 includes a base support shell 50, a liner 100 and a dynamic support that is 30 disposed between base support shell 50 and liner 100. Fig. 1c illustrates insole 10 and dynamic support 150 without liner 100 for ease of viewing.

Referring to Fig. 2 and Fig. 3, dynamic support 150 provides support to the posterior medial arch immediately adjacent to the heel portion 45 of base support shell 50. Dynamic support 150 supports a portion of the arch beneath and adjacent to the calcaneus bone. Dynamic support 150 may also support a
5 posterior portion of the lateral arch on the outer side of a foot of a wearer.

Fig. 3 shows a cross-section of dynamic support 150 disposed inside of base support shell 50. Fig. 3 shows that dynamic support 150 is pre-contoured with a slight radius 152. Liner (not shown) would be secured to top of
10 dynamic support 150. Dynamic support 150 is disposed in heel portion 45 of base support shell 50. Dynamic support 150 is compressed by wearer under pressure of weight during ambulation to provide support and comfort to the heel and support and comfort to lateral and medial arch areas of foot. Accordingly, dynamic support 150 must be moldable yet must maintain its
15 shape once it has been molded by the user during wear.

Dynamic support 150 can be made using various materials. As shown in Fig. 5, dynamic support 150 may include individually movable components, such as particles 160. Particles 160 may include seeds, such as bird seeds,
20 beads, or granules that are solid or hollow and made from wood, polyurethane, polypropylene, polyvinylchloride, polyethylene of fibrous, resilient or solid components. Particles 160 may include a range of hardnesses to accommodate the support needs of a wearer. When seeds are used, seeds may be large or small size seeds. Large sized and medium sized seeds have a diameter of from
25 2mm to 3mm and small sized seeds have a diameter of from 1mm to 2mm. Dynamic support 150 may be made from individually movable components that are fibers or strands instead of particles. Fibers may be made from resilient materials such as rubber, polystyrene and elastomeric synthetic materials. Dynamic support 150 may also have a porous outer surface.

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Particles 160 may also include air spheres. Air spheres are made from resilient materials such as rubber, polystyrene and elastomeric synthetic materials with encapsulated air. Accordingly, such materials are highly resilient with excellent memory return. Such materials may have a flexural modulus of 10,000, a specific gravity of 1.209 and a durometer of 45-50 Shore A. Air spheres preferably have a diameter in a range of from 1.5mm to 3mm and are compressible and filled with air.

Particles 160 may be placed in a U-shaped container prior to use for easy handling as shown in Fig. 4. Particles 160 may be placed in package 163 that is not preformed and hence does not have radius like support of Fig. 3. When package 163 is not preformed, a flexible packaging must be used to permit stretching when package is formed by user. Preformed packages are particularly effective in a retail setting in which users may wish to select the composition and/or hardness of dynamic support 150. Fig. 4A shows resilient spacer 153 disposed under dynamic particle support 150 in the heel region (not shown). Resilient spacer 153 is approximately 2 mm thick and is preferably formed of an elastomeric material, such as Poron® (e.g. a registered trademark of Rogers Corporation pertaining to microcellular urethanes). This spacer 153 allows for enhanced cushioning or shock absorbing in the heel region.

Package 163 may be formed by processes such as injection molding, vacuum forming or stamping. Alternatively, package 163 may be formed from fabrics such as polyester. Package 163 may be secured to base shell support 50 by an adhesive. Package 163 may be covered by a coating of silicone or other resilient material or medium for additional cushioning. A spacer 167 may be included between opposite sides of package 163 to maintain position of particles 160 in package base support shell 50. Spacer 167 may have of width of approximately 3.18 to 6.35 mm and be affixed to lower surface of base shell support. A larger spacer of from 12.9 mm to 25.40 mm may be used to secure a liner, which covers particles 160 in package

163, in place. In each of the configurations noted above, that are formed by the consumer, the packaged particles may be coated on the surface with a layer such as silicone, a permeable medium (e.g., screen mesh), polyester fabric, tec. A film of adhesive may be applied to the layer and an additional layer of fabric
5 may be used to cover film of adhesive.

Dynamic support 150 can also be formed by a consumer. Dynamic support 150 contains seeds or small particles that may be placed in package 163 with a material such as epoxy or polyurethane resin. A catalyst such as
10 water can be introduced to the contents of dynamic support 150 to activate the polyurethane for example. Different combinations of catalyst may be mixed with the polyurethane. A consumer may place dynamic support 150, polyurethane and water, in a package 163 to be placed in a shoe for molding during ambulation. Alternatively, package 163 may contain a pouch
15 containing the water catalyst that can be opened by a consumer during ambulation. Mixing of the water catalyst with the polyurethane would activate the polyurethane. The dynamic support 150 would be formed during ambulation by the consumer.

20 Referring to Fig. 5, particles 160 may be mixed with a medium 162 to enhance their ability to maintain a shape during use to maximize support to wearer of an insole. Medium 162, such as for example, polymer silicone may be used to form dynamic support 150. Dynamic support 150 can be made to include different ratios of particles 160 and medium 162 to achieve the desired
25 characteristics of dynamic support 150. By increasing the proportion of particles 160 relative to silicon for example, the memory of the silicone is reduced making support component 150 softer and more malleable. In other words, a medium 162, such as silicone, makes dynamic support 150 harder after such medium 162 has cured and hardened. Particles 160 may also be
30 wetted with water prior to adding to medium 162 to reduce the memory of the resulting dynamic support 150. In addition to silicone, medium 162 may also

include materials such as urethane, EDPM, or foamed materials like ethafoam or neoprene.

In addition combining particles 160 with medium 162, a lubricant 166 may be added to medium 162 to maintain fluid state of medium 162. A lubricant 166 such as PTFE (polytetrafluoroethylene), prevents the silicone from curing too readily and fully hardening and also reduces the recovery in compression or memory of the silicone. In addition to PTFE, other lubricants, such as PTFE grease, grease enhanced with PTFE, liquid polyurethane, ceramic grease and synthetic lubricants such as **Krytox®**, a registered trademark of DuPont and is a family of high-performance synthetic lubricants (oils and greases) with a variety of applications. It is a colorless polymer containing ether functionality. Krytox oils are fluorocarbon polymers of polyhexafluoropropylene oxide, with a chemical formula:



where the degree of polymerization, n, generally lies within the range of 10 to 60. These compounds are collectively known by many names including perfluoropolyether (PFPE), perfluoroalkylether (PFAE) and perfluoropolyalkylether (PFPAE). A unique identifier is their CAS registry number, 60164-51-4.

In addition to PFPE, Krytox grease also contains telomers of PTFE and in fact was designed as a liquid or grease form of PTFE. It is thermally stable, nonflammable (even in liquid oxygen), and insoluble in water, acids, bases, and most organic solvents. It is nonvolatile and useful over a broad temperature range of -75 to 350 °C or higher. Its high resistance to ionizing radiation makes it useful for the aerospace and nuclear industries. It can also withstand extreme pressure and high mechanical stress.

The combination of medium 162, such as silicone with lubricant 166 such as PTFE together with particles 160 can achieve a customized dynamic support 150 depending upon the needs of the individual and still offer support to the heel and arch while still offering resilience and desired molding.

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Fibers, seeds, or beads, may also be combined with a medium and/or a lubricity enhancer to provide the functionality described above with regard to particles 160.

10 A malleable and softer dynamic support 150 is achieved with a lower percentage of medium 162 (silicone) and lubricant 166 (PTFE); whereas a harder dynamic support 150 is achieved with a higher percentage of medium 162 (silicone) combined with particles 160. A support member 150 with too much resilience from the silicone would not provide the customized support to the heel and arch of the wearer by retaining any deformation during wear. In contrast, dynamic support 150 with too much PTFE may not have a degree of resilience.

20 When dynamic support 150 includes particles 160 with lubricant 166, without medium 162, a mesh overlay encourages even distribution of the underlying beads or fibers in dynamic support 150 as shown in Fig. 18 at 253.

25 When medium and large seeds are mixed a range of from 4% to 20% silicone relative to the volume of seeds used. A preferred range of silicone is 2% to 10% relative to the volume of seeds. Silicone and PTFE can be mixed with medium and large seeds in the following ratios by volume 36% silicone plus 8% PTFE, 11% silicone and 5% PTFE, 5% silicone and 1% PTFE and 16% silicone and 8% PTFE. The working range of silicone is from 32% to 1% PTFE by volume. When PTFE is used alone with medium and large sized seeds, the working range PTFE is from 2% to 12% by volume with a preferred range from 7% to 10%. Organic materials can also be mixed with medium

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and large sized seeds. For example, peanut butter and flour may be used. From 15% to 20% peanut butter plus from 3-5% flour by volume may be used.

When small seeds are used as the particles, a range of from 100% small
5 seeds (particles) by volume relative to 5% silicone is used. A preferred range
of 2% to 8% silicone by volume relative to 100% seeds, silicone and PTFE
can be mixed with small seeds in the following ratios by volume: 22%
silicone, plus 8% PTFE, 16% silicone and 5% PTFE. The working range of
10 silicone is from 4% to 22% volume and 3% to 8% PTFE by volume. When
PTFE is used with small sized seeds, the working range PTFE is from 2% to
7% by volume with a preferred percentage of 6%. Organic materials can also
be mixed with small seeds. For example, peanut butter and flour may be used.
From 15% to 20% peanut butter plus from 3-5% flour by volume may be used.

15 Alternatively, the support component 150 can be entirely made from
medium 162 and lubricant 166 or silicone 162 alone. When a combination of
silicone and PTFE are used, a range of 9% to 16% PTFE and from 84% to
91% of silicone is used. A range of from 11% to 12% of silicone is preferred,
for support component 150 to retain memory and contour. When dynamic
20 support 150 includes medium 162 and lubricant 162, such materials can be
prepackaged (such as in a package 163) to provide a custom fit.

A dynamic support 150 that is medium 162 alone can also be
customized to a user. To specifically fit dynamic support 150 that is entirely
25 medium 162, medium 162 must be dispensed into base support shell 50 and
covered with a liner 100, shown in Fig. 1b. The user applies the weight on
their foot and body to the insole to contour the dynamic support to the plantar
surface of the foot. After several hours, dynamic support will harden and
retain the contour of the foot.

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Dynamic support 150 can have a variety of anatomical contours and sizes to adjust to the needs of the user. Dynamic support 150 may be provided in different sizes, narrow, medium and wide, to accommodate heel widths of differing sizes. For example, dynamic support 150 can be specifically structured for a child, to aid in excessive pronation or supination. Dynamic support 150 can have a variety of densities depending upon the weight of the user. For example, a 22.68 kg child would have a dynamic support 150 having a relatively viscous or low density composition, while a 90.72 kg adult would have a dynamic support 150 of a denser composition.

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Referring to Fig. 6, dynamic support 150 is not only confined to heel portion 45. Dynamic support 150 migrates during wear to support a portion of the lateral and medial arches that are anterior to the heel. Dynamic support 150 migrates to support portions of the medial arch and the lateral arch that are anterior to the heel and are not supported by contoured portion 55 or lateral portion 54, respectively of base support shell 50. Significantly, dynamic support 150 conforms to underside of medial arch and lateral arch of the wearer as such support 150 flows over contoured portion 55 and lateral portion 54 of base support shell 50.

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Together, dynamic support 150 and base support shell 50 provide support to the heel of the wearer and to at least one of a lateral arch, a medial arch and a transverse arch. Dynamic support 150 and base support shell 50 each provide partial support to the arch(es) of the wearer.

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Referring to Fig. 7 a detailed drawing of base support shell 50, according to the first embodiment of insole 10 that is taken from medial side, is shown. Referring to Figs.6 and 8, a detailed drawing of base support shell 50, according to the first embodiment of insole 10, is shown that is taken from the lateral side. Base shell support 50 has an upper surface 15 and a lower surface 20. Base support shell 50 is molded and structured to support the four

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arches of the foot, namely, the medial arch, the lateral arch, the metatarsal arch and the transverse arch.

Base support shell 50 has a lateral side 25 that corresponds to a lateral
5 side and lateral arch of a foot, a medial side 30 that corresponds to a medial side and the medial arch of foot, and a side wall 28. Side wall 28 has a height of approximately an inch to accommodate dynamic support 150 (not shown). Base support shell 50 has an anterior portion 35, a heel portion 45 and a middle portion 40 between anterior portion 35 and the heel portion 45. Heel
10 portion 45 has a center heel portion 44.

Base support shell 50 has a contoured portion 55 that provides a partial medial arch support to the medial arch of the wearer. In particular, contoured portion 55 supports an anterior portion of the medial arch proximate the
15 metatarsals of the wearer. Contoured portion 55 is on the medial side 30 of base support shell 50, a part of the anterior portion 35 and the middle portion 40 of base support shell 50. Contoured portion 55 provides resilient support to an arch of a wearer when force is applied, flexed and released, during ambulation, for example. Contoured portion 55 is anterior to the of heel
20 portion 45 of base support shell 50.

Similarly, base support shell 50 has a contoured portion 54 that that provides a partial lateral arch support to the lateral arch of the wearer. In particular, contoured portion 54 supports an anterior portion of the lateral arch
25 proximate the metatarsals of the wearer. Contoured portion 54 is on the lateral side 25 of base support shell 50 and is a part of the anterior portion 35 and the middle portion 40 of base support shell 50. Contoured portion 54 provides resilient support to an arch of a wearer when force is applied, flexed and released, during ambulation, for example. Contoured portion 54 is anterior to
30 the of heel portion 45 of base support shell 50.

Dynamic support 150 partially supports both the posterior medial arch and posterior lateral arch which together with contoured support 55 and 54, provide the support to the medial and lateral arch of the wearer. By being a moldable member, dynamic support 150 is able to provide the dynamic support to the posterior medial arch and posterior lateral arch of the wearer. Dynamic support 150 migrates beneath lateral and metatarsal arches of foot during ambulation. Dynamic support 150 migrates in a direction towards contoured portion 54 and 55 of lateral and medial sides of the foot. In this way, base support shell 50 and dynamic support 150 together may provide for support of the entire medial and lateral arch of the wearer.

Base support shell 50 is preferably vacuum molded, injection molded or stamp molded to a semi-flexible, semi-rigid or rigid shell depending upon the needs of the user. The degree of rigidity is controlled by the thickness to which base support shell 50 is molded or molded with stiffening enhancing elements. Base support shell 50 is molded using material such as polyvinylchloride (PVC), polyurethane, polypropylene or other plastic. The thickness of contoured portion 50 is preferably from 1mm to 3mm.

Base support shell 50 adjusts to the plantar contour of a foot of a wearer from downward force after several hours of wear by user. Contouring of base shell support 50 may be hastened by application of heat.

Base support shell 50 has contoured portion 52 that supports the transverse arch and contoured portion 53 that supports the metatarsal arch of the wearer. Contoured portion 52 and contoured portion 53 are located between contoured portion 55 on medial side and contoured portion 54 on lateral side. The base support shell 50 is structured to support all four arches. Significantly, all four arches are molded into base support shell 50 to support the medial, lateral, metatarsal and transverse arches of the foot.

Referring to Fig. 9, an additional layer 70 may be affixed to upper surface of base shell support shell 50. Layer 70 is a thin layer of molded material, preferably reinforced with, for example, fiber glass, to provide additional support or strength to base support shell 50. In use, layer 70 would
5 be selectively applied to upper surface of base support shell 50 for added reinforcement. Alternatively, additional flexibility could be maintained at contoured portions 54, 55 by forming such portions to be thinner in comparison to other portions of base support shell 50 to permit a greater degree of resilience in flexion and custom contouring during ambulation or for
10 greater comfort. If more support is needed, base support shell 50 may be molded to have a different thickness or to include stiffening geometry. Base support shell 50 may be injection molded with ribs 53, for example, in the contoured portions 54, 55 to provide additional structural support. In particular, ribs 53 may be molded on the lower surface 20 and selectively
15 placed under contoured portion 54, 55, as shown in Fig. 10a and 10d.

Fig.10a shows lower surface 20 of base support shell 50. Lower surface 20 may have additional support elements 75 and 80. For example, a bottom pad 80 is applied to lower bottom surface 20 adjacent to contoured
20 portion 55 to provide additional support. An additional pad 75 is applied to the lower surface 20 immediately below the transverse arch, metatarsal arch or heel portion 45, for added support. The resilient material of pads 80 and 75 provide support beneath lower surface 20. Pads 80 and 75 provide an upward force on surface 20 due to the resilient material from which pads are
25 constructed. The purpose of the pad 75 and pad 80 are to reinforce the metatarsal arch, the medial arch and/or the lateral arch to provide support in addition to support provided by base support shell 50.

Fig. 10b shows a support pad 82 beneath heel portion 45. Fig. 10c
30 shows that pad 82 may have an asymmetrical configuration depending upon the needs of the wearer. Fig. 10d shows supports 75, 80 and 82 affixed to

underside of base support shell 50. There may be four pads, such that each of the four pads is positioned beneath one of the arches to provide additional support beneath the arch. The pads are removable and may be selectively placed.

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Referring to Fig. 11, a further component of insole 10 is liner 250. Liner 250 has an upper surface 255 and a lower surface 260, a heel portion 265 and an anterior portion 263. Liner 250 overlays base support shell 50 and is longer than the 2/3 length base support shell 50. Upper surface 255 of liner
10 may optionally be covered with a fabric layer that is trimmed to fit the length of base support shell. Heel portion 265 is shaped to mate with heel portion 45 of base support shell 50 to contain or sandwich dynamic support 150 between liner 250 and base support shell 50. Liner 250 includes a contoured portion that overlays contoured portion 55 and 54 of base support shell 50 and
15 dynamic support 150, to easily conform to contoured portion 55 and 54 and provide a snug fit in the shoe of the wearer. Liner 250 conforms to support base shell 50 to provide cushioning to the wearer and to secure particles 160 of support component within insole 10.

20 Liner 250 provides cushioning for the heel of the wearer. Liner 250 is secured to base support shell 50, at side walls 28, at center portion 44 and at anterior portion 35 of base support shell 50. By being secured at center portion 44 of heel, liner 250 ensures that particles 160 of dynamic support 150 stay in place around perimeter of base support shell 50, when dynamic support
25 150 includes high proportion of particles by volume. Liner 250 is secured to base support shell 50 by an adhesive, stitches or by snap fittings.

Liner 250 may be injection molded and have regions, such as a heel region, a medial arch region, a metatarsal arch region, a lateral arch region and
30 a transverse arch region, of varying densities. For example, the heel region may have a soft density, the arch region may have a higher density than the

heel region because it must support a level of weight of the user. The metatarsal region beneath toes may be soft to accommodate diabetic users, for example. Alternatively, when liner 250 is vacuum formed it has a uniform density throughout its length. For additional softness and cushioning effect, materials such as Poron (e.g., a registered trademark of Rogers Corporation) may be laminated to bottom surface of liner 250.

An additional layer 252 of a cushioning material such as foam or Poron could be placed between liner 250 and base shell support 50 in the heel region to provide an additional layer of cushioning to the heel of the wearer. Alternatively, dynamic support 150 can be placed directly on base support shell 50 and covered with a thin layer of leather, to provide a cushioning effect as well. When dynamic support 150 is made from silicone, such silicone in its non-cured state that is in direct contact with the thin layer of leather acts as an adhesive securing the leather to dynamic support 150.

In FIG. 12 and FIG. 14, second embodiment of insole is shown and referenced by reference numeral 350. Insole 350 has a base support shell 300, a top liner 305 and a dynamic support 310. Dynamic support 310 is disposed between base support shell 300 and liner 305. Base support shell 300 is structured to only support the heel of the wearer, and, therefore, includes a heel portion 325. Accordingly, base support shell 300 does not have a contoured portion that supports the anterior end of the medial arch of the wearer proximate the metatarsals and the flanges of the foot. Dynamic support 310 disposed in heel portion 325 supports a posterior portion of medial arch and lateral arch disposed proximate heel of wearer. Liner 305 has an anatomical heel molded to conform to the heel portion 325 of base support shell 350. Referring to FIG. 10c, a medial wedge 82 may be placed under dynamic support 310 or outer medial side. Alternatively, liner 305 can extend the full length of the foot to which insole 350 is inserted and have a molded contour portion built in. Liner 305 can have an anatomical contour with extra

supportive thickness in the arch and metatarsal contour or a 2/3 foot length liner.

Referring to Fig. 13 and Fig. 15, a third embodiment is shown and as a
5 full length insole and is referenced by reference numeral 450. Insole 450 includes a base support shell 400, a liner 410 and a dynamic support 420. Dynamic support 420 is disposed between base support shell 400 and liner 410. Base support shell 400 is structured to support the entire foot of the wearer, and includes a heel portion 425, a middle portion 430 and an anterior
10 distal portion 435. Accordingly, base support shell 400 has a contoured portion 440 that supports the medial arch and lateral arch of the foot of the wearer. Dynamic support 420 disposed in heel portion 425 supports a posterior portion of medial arch and lateral arch disposed proximate heel of
15 heel portion 425 of base support shell 400. An underside of insole 450 may include support wedges, similar to pads 75 and 80 of Fig. 10a of base support shell 50.

In the third embodiment, a secondary dynamic support may be
20 provided in the anterior portion of the midsole or insole heel portion 45 of base support shell 50, as shown in Fig 16. Secondary dynamic support 151 also comprises particles 160 similar to dynamic support 150, except that secondary dynamic support 151 has a shape of a truncated oval to mimic the topography beneath the toes in the midsole or insole, according to the present embodiment
25 may also be located to support the anterior portion of the foot. Fig. 16A depicts yet another embodiment wherein resilient spacer 153 is disposed under dynamic particle support 150 in heel portion 45.

In a further embodiment shown in Fig. 17, the insole 600, in addition to
30 base support shell 50, liner 250 and dynamic support 150, a further layer 253 overlies particles 160 of dynamic support 150. Layer 253 overlies particles

160 to contain such particles in heel portion 45 of base support shell 50. Layer 253 may be a permeable medium (e.g., screen mesh), polyester fabric or any such porous layer that may be secured to particles 160 by a coating 254. When coating 254 is made from a material such as silicone, such silicone
5 penetrates porous layer 253 to bond to particles 160. By covering particles 160 with layer 253, particles 160 are able to migrate beneath the heel and posterior portion of the lateral and medial arches and are prevented from escaping into other portions of shoe.

10 The steps of assembling the insole are described below in particular to reference to Fig. 2, 10a, 17 and Fig. 18. Independent of the embodiment of insole that is being assembled, the steps are identical. Base support shell 50 is formed using vacuum forming, injection molding or stamping to achieve the desired shape including contoured portions 54, 55, 52, 53 as desired.

15 Base support shell 50 can be adjusted if contoured portion provides too much support in the medial or metatarsal arch. The arch may be lowered by directing heat, such as from a heat source towards the arch for approximately 30 seconds to soften the material. The pressure exerted on base shell support
20 50 by the weight of the wearer during ambulation will adjust the arch to the proper height.

On underside 20 of base support shell 50, as shown in Fig. 10a, pads 75 and 80 are selectively placed and secured to provide added support to the
25 central and medial portions of the base support shell 50 to provide support and resilience. Pads 75 and 80 can be secured, by an adhesive for example, to lower surface 20. Pads 75 and 80 can be secured to base support shell 50 at any time after base support shell 50 is formed and cured and may be removed by user or wearer.

30

Fig. 17A shows the resilient spacer 153, which is disposed between dynamic particle support 150 and the top surface of based support shell 50. In particular, both resilient spacer 153 and dynamic particle support 150 are disposed in heel portion 45.

5

Referring to Fig. 18, dynamic support 150 is placed into heel portion 45 of base support shell 50. A spacer 88 is secured to the center 44 of the heel portion 45 to prevent migration of dynamic support 150 into this region of support base shell 50. Alternatively, spacer 88 could have a longer shape to create a channel to maintain dynamic support 150 in perimeter of heel portion 25. Spacer 88 is placed between arms of U-shaped dynamic support 150. Spacer 88 is preferably glued to center of heel portion 45 and has a thickness from 1mm to 2mm. Spacer 88 not only ensures that dynamic support 150 will maintain its position proximate wall 28 of heel portion 45, but also provides a degree of support under the calcaneus of the wearer. Spacer 88 also ensures that an adequate volume of dynamic support 150 is disposed proximate side wall 28 to migrate into space between underside of posterior medial and lateral arches and base support shell 50.

A permeable medium 89 can be used to cover dynamic support 150 to ensure that the dynamic support 150 and particularly particles 160 of support component 150 do not migrate from a position between base support shell 50 and liner 250, such as shown in Fig. 18. Permeable medium 89 is secured to side wall 28 and to spacer 88 by an adhesive, stitches or snaps. Permeable medium 89 also provides a degree of shock resistance to heel of wearer because it acts as a hammock to distribute pressure of heel against sides of dynamic support 150. A layer of silicone for example may be placed over permeable medium as a coating. Permeable medium 89 is not required to cover dynamic support 150 when it contains silicone; however, permeable medium 89 provides the force distribution feature described. When dynamic support 150 includes particles 160 alone, permeable medium 89 is placed over

such particles 160 to prevent migration or escape of particles 160 from between base support shell 50 and liner 250. Permeable medium 89 may covered topped with a layer of silicone or Poron. Such layer of silicone is connected or adheres to side wall 28. Silicone layer is allowed to dry over
5 dynamic support 150, for several hours such as 24 hours. The durometer of thin layer of silicone is preferably of a low hardness. Such durometer preferably is in the range of from 10 – 20 hardness is used. This layer of silicone not only acts to confine particles 160 to heal portion, but also acts as a cushioning layer to render support component 150 that includes exclusively
10 particles 160, more resilient and soft. Permeable medium 89 or other materials such as polyester fabrics or stretch nylons, are used whenever there exists the possibility of particles 160 being released.

Alternatively, silicone coating alone may be applied to surface of
15 particles 160 directly when they are placed in heal section 45. After dynamic support 150 is placed, liner 250 is preferably placed over dynamic support 150 and secured to spacer 88 and side walls 28 of base support shell 50. Spacer 88 provides for adhesive contact to secure liner 250 to base support shell 50 at center 44 of heel portion 45.

20

Dynamic support 150 may be permitted to cure so that dynamic support 150 is hard enough to be handled during manufacturing. After curing, dynamic support 150 may be covered with silicone or with a permeable medium 89 to prevent any particles from escaping and not compromising the
25 ability of such blend of particles to migrate. The use of permeable medium 89 is particularly preferable for an athletic shoe. When dynamic support 150 contains PTFE and a lubricant, dynamic support is deformable yet maintains support beneath heel and lateral and medial arch of wearer. Alternatively, dynamic support 150 can comprise only silicone.

30

Liner 250 is then placed over base support shell 50 and dynamic support 150 is secured in place. Liner 250 may optionally be placed over and secured over permeable medium 89 and silicone layer if such components are used. Liner 250 is preferably placed over dynamic component 150 after
5 hardening. Liner 250 ensures that support component 150 will not migrate from its position between liner 250 and base support shell 50. Yet, liner 250 permits dynamic support to migrate between base support shell 250 and liner 250 to provide support in region of medial arch and lateral arch.

10 Fig. 19 shows a midsole 500 having dynamic support 510 and base support shell 50 built into a shoe 501. Midsole 500 is actually built in to the structure of shoe 501 during the manufacturing process. Base support shell 50 is a premade base shell with built-in anatomical contours, specifically medial, lateral, metatarsal and transverse arches, are provided. Dynamic support 510
15 as discussed previously is also placed into midsole 500 during manufacturing process with a top liner 515.

In an alternative embodiment, midsole 500 can have a length of approximately two-thirds the length of shoe 501 and have a built in contour
20 portion 520. Midsole 500 also comprises a dynamic support 510 in region supporting the heel or arch of the wearer. Dynamic support 510 is supported by sidewalls of the shoe. In this embodiment, dynamic support 510 is covered with a material 530 such as leather, towards the end of the shoe. Built in contour portion 520 provides partial medial arch and lateral arch support, as in
25 the earlier embodiments of the present disclosure. Dynamic support 510 may be removed from shoe 501 or replaced depending upon the needs of the wearer.

Fig. 19 also shows midsole 500 having a secondary dynamic support
30 513 located at ball and toe region of the foot. In this embodiment, a flexible permeable medium 515 covers and retains secondary dynamic support 513 in

position. Additionally, the particles could also migrate within the forward metatarsal region to provide a supportive custom fit.

Fig. 20a shows a medial side of a foot of athletic shoe 600 that has a
5 midsole 605, and a base sole 610 that is injection molded (portions removed for clarity). Base sole 610 has an outer top surface 615, an anatomical contour 620, a heel region 625 and a top liner 618. Midsole 605 also has a sole covering 630 and a shoe sole 635. A dynamic support 650 having a substantially u-shaped configuration with particles is placed into heel region
10 625 during manufacturing. Dynamic support 650 is fixedly secured to heel region 625 and by an adhesive.

Fig. 20b shows a cross-section of midsole 605. Midsole 605 also shows
a spacer 655 that is placed between top liner 618 and base sole 610. Spacer
15 655 maintains position of dynamic support 650 at sides of heel region 625.

Figs. 21a through 21c illustrate a dynamic support 150, and base support
shell 950 that is incorporated into a boot or brace 900. Base support shell 950
is either a 2/3 or full length component. Brace 900 has a hinge 903 with a
20 flange 904 that connects upper boot 905 to lower boot 910. Dynamic support 150 and base shell support 950 together provide the combined lateral and medial support the lateral and medial arches of the wearer, as described in earlier embodiments. Dynamic support 150 migrates during wear to support a
portion of the lateral arch, medial, metatarsal or transverse arch.

25

Although the present disclosure describes in detail certain
embodiments, it is understood that variations and modifications exist known to
those skilled in the art that are within the disclosure. Accordingly, the present
disclosure is intended to encompass all such alternatives, modifications and
30 variations that are within the scope of the disclosure as set forth in the disclosure.

WHAT IS CLAIMED IS:

1. A support for an article of foot wear comprising
5 a dynamic support that is capable of molding to a portion of a plantar surface of a foot, wherein said dynamic support comprises a plurality of independently movable particles.
- 10 2. The support according to claim 1, wherein said plurality of independent movable particles are suspended in at least one material selected from the group consisting of: fluid materials, lubricity enhancers, and catalysable polymers.
- 15 3. The support according to claim 1, wherein said plurality of independently movable particles are selected from the group consisting of: seeds, air spheres, polyurethane particles, polypropylene particles, polyvinylchloride particles, polyethylene particles, resilient rubber particles, solid particles, granules, fibers and strands.
- 20 4. The support according to claim 2, wherein said fluid material is a highly viscous fluid material comprising silicone.
- 25 5. The support according to claim 2, wherein said lubricity enhancer is at least one material selected from the group consisting of: polytetrafluoroethylene (PTFE) and grease.
- 30 6. The support according to claim 1, wherein said dynamic support exhibits a shape selected from the group consisting of: a substantially U-shaped member, a substantially torus-shaped member and a substantially ovoid shaped member.

7. The support according claim 1, further comprising:
- 5 a base support shell having a heel portion, wherein said dynamic support is disposed on and supported by said base support shell.
8. The support according to claim 7, wherein said base support shell is a molded member comprising a flat portion, a curved wall that surrounds said flat portion to form said heel portion, and two or
- 10 more contoured portions disposed on opposite sides of said flat portion.
9. The support according to claim 8, wherein said contoured portions comprise a medial arch support portion disposed on one side of said flat portion and a lateral arch support portion disposed on an
- 15 opposite side of said flat portion.
10. The support according to claim 7, wherein said base support shell is a flexible component that supports said dynamic support.
- 20
11. The support of claim 7, wherein said base support shell is a moldable member that comprises a thermoplastic polymer.
12. The support of claim 11, wherein said thermoplastic polymer is
- 25 selected from the group consisting of: polyvinylchloride (PVC), polyurethane, polypropylene, polyethylene or plastic.
13. The support according to claim 1, further comprising:
- 30 a built-in portion of a shoe; and

liner that covers said built-in portion of a shoe;

5 wherein said dynamic support is disposed between said built-in portion of the shoe and said liner that conforms to a portion of said built-in portion of a shoe and to the plantar surface of the foot of a wearer to support at least one arch of the foot of the wearer during wear.

10 14. The support of claim 13, wherein said liner comprises a compliant medium.

15 15. The support according to claim 1, further comprising a permeable medium disposed about said independently movable particles.

16. The support according to claim 7, further comprising a resilient spacer disposed between said base support shell and said dynamic support in said heel portion.

20 17. The support according to claim 13, further comprising a resilient spacer disposed between said built-in portion of the shoe and said dynamic support.

25 18. A support for an article of foot wear comprising:
a dynamic support that is capable of molding a portion of a plantar surface of a foot, wherein said dynamic support comprises a substantially U-shaped member and either a gas or a fluid disposed therein.

30

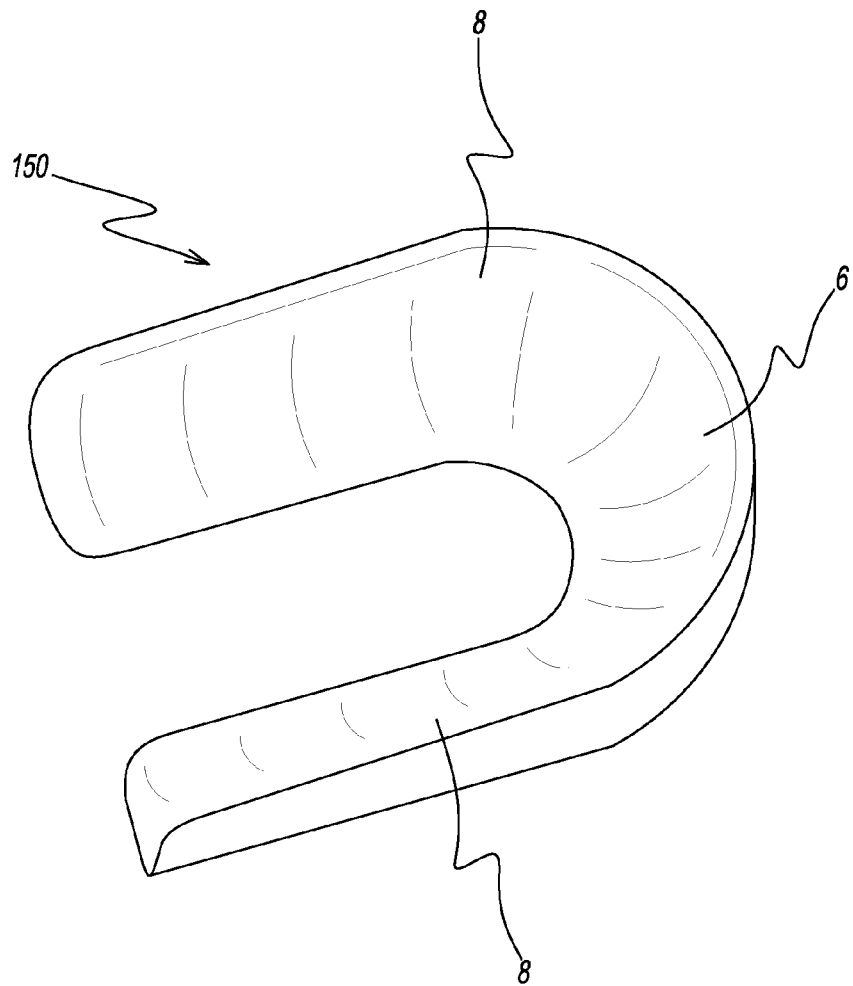


FIG. 1a

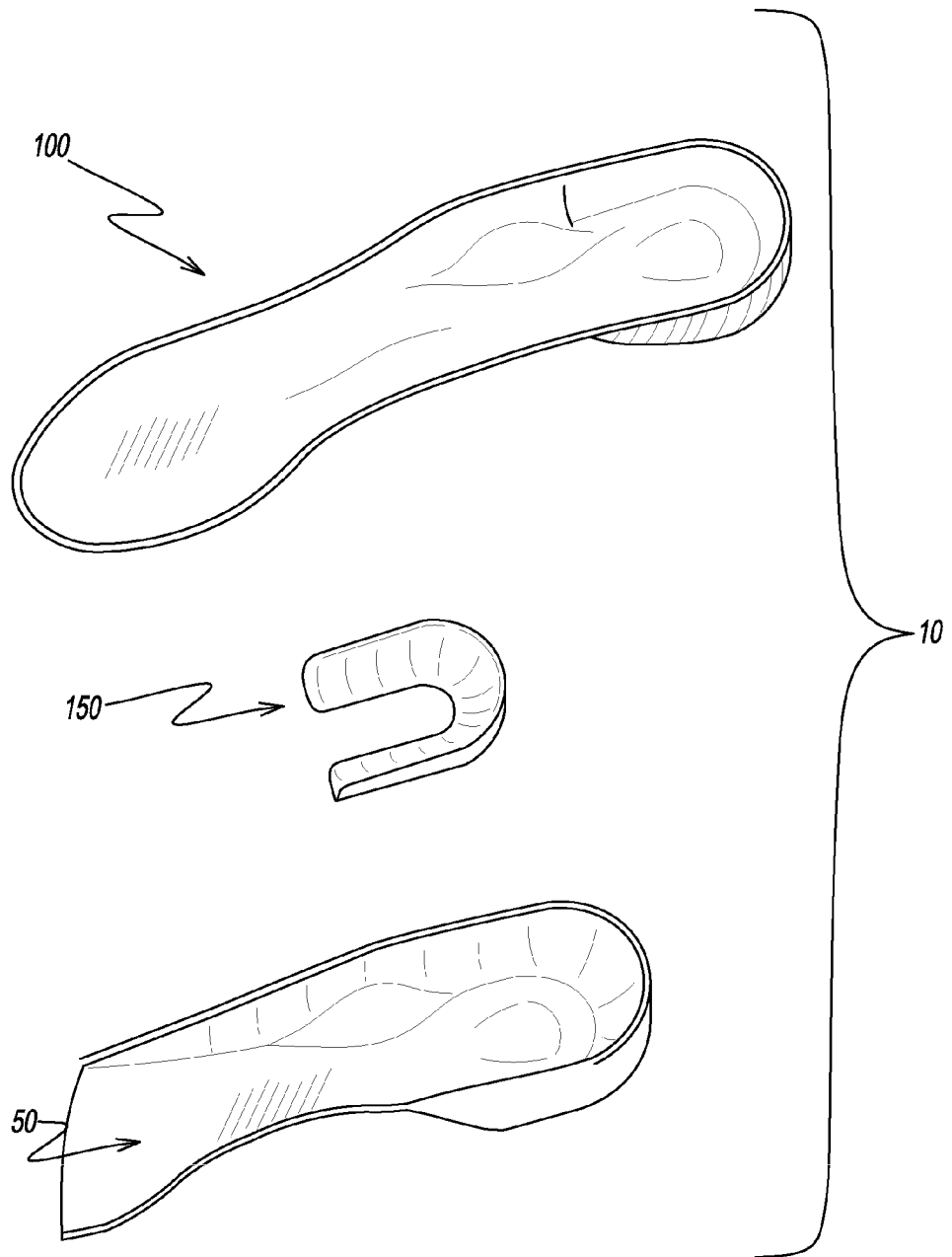


FIG. 1b

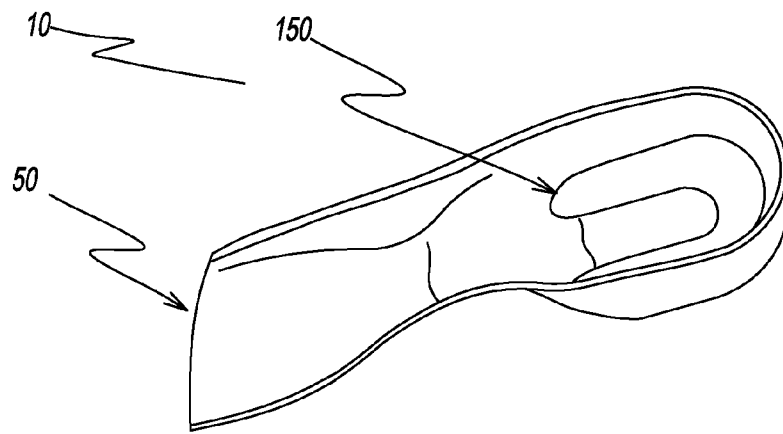


FIG. 1c

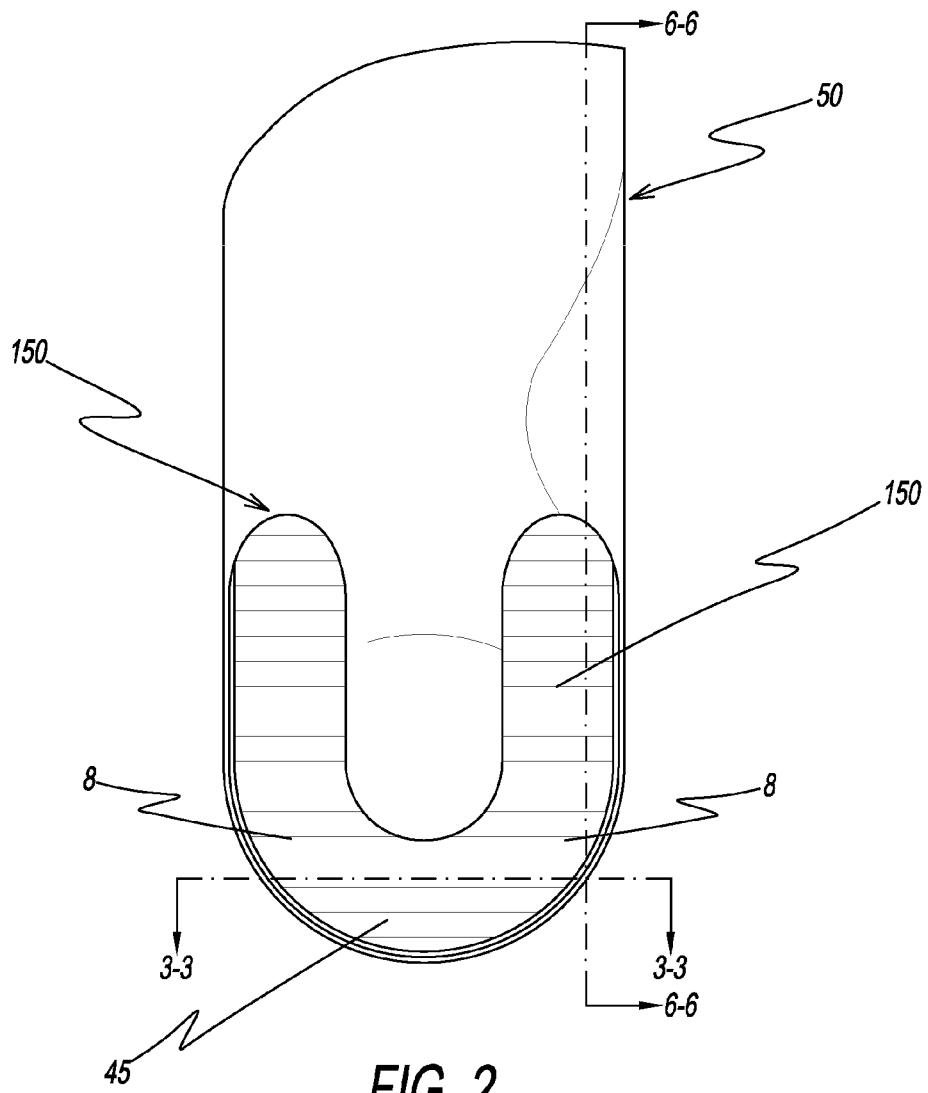


FIG. 2

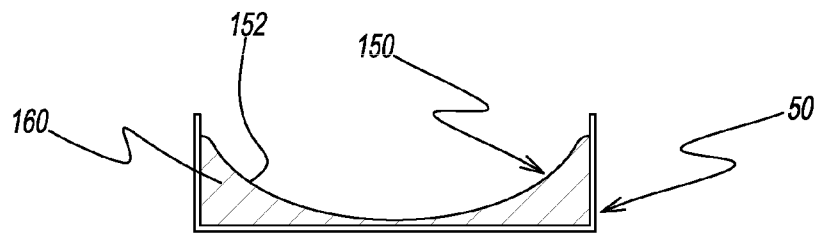


FIG. 3

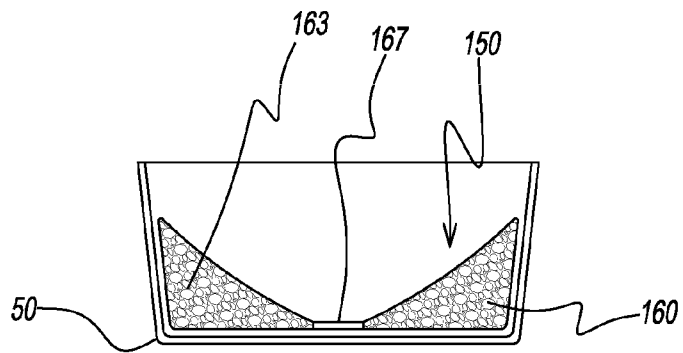


FIG. 4

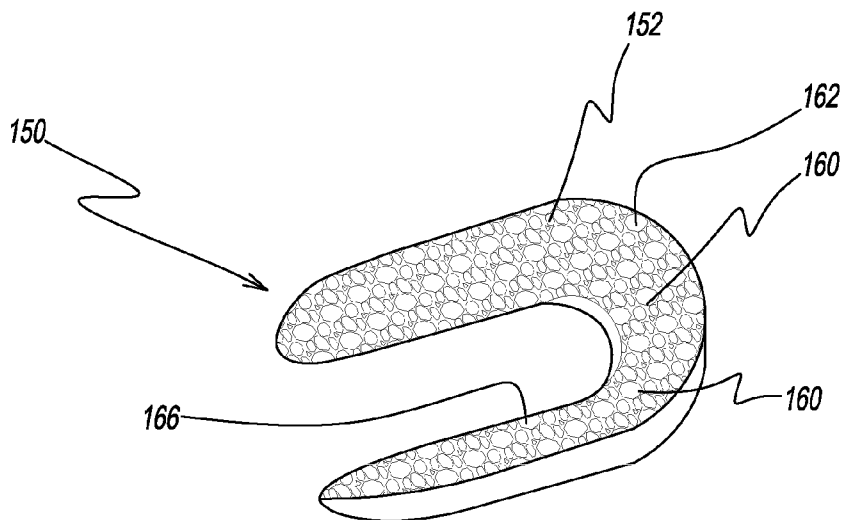


FIG. 5

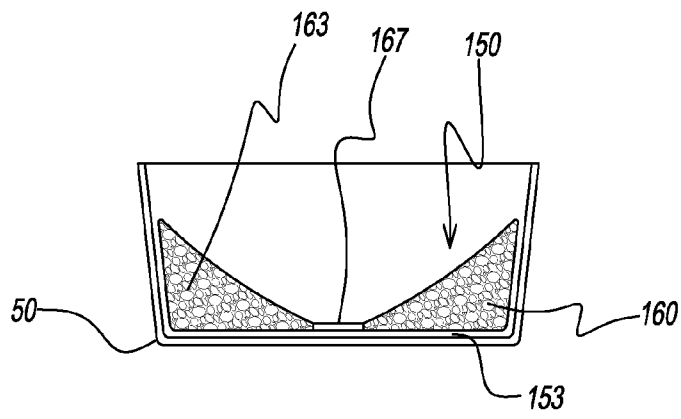
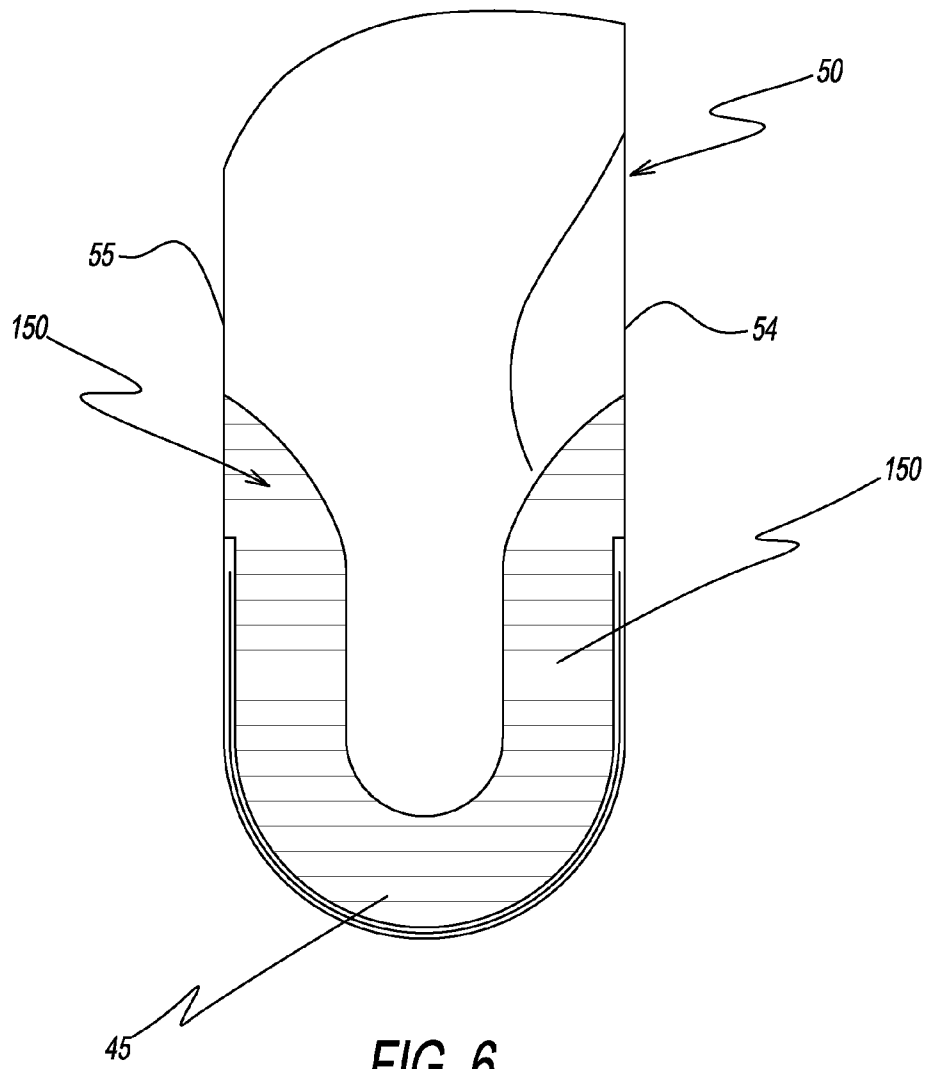


FIG. 4A



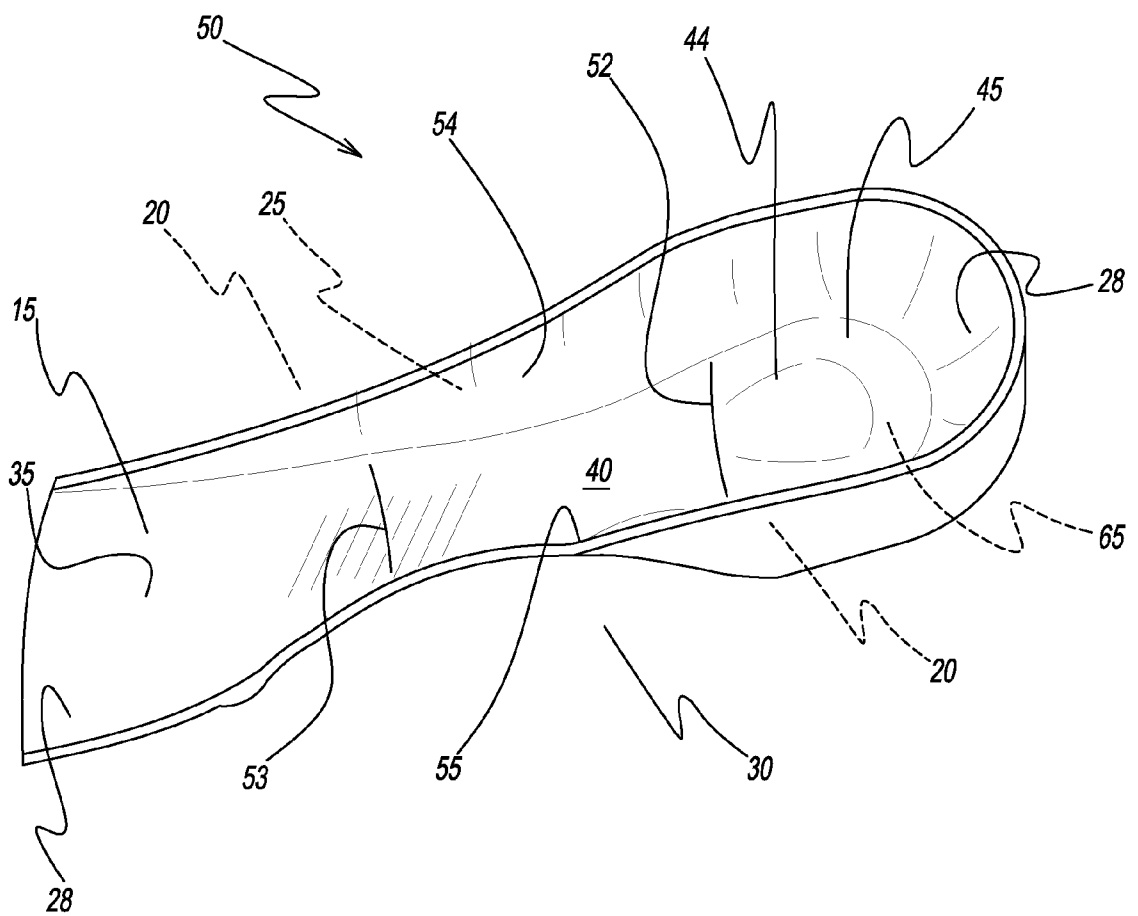


FIG. 7

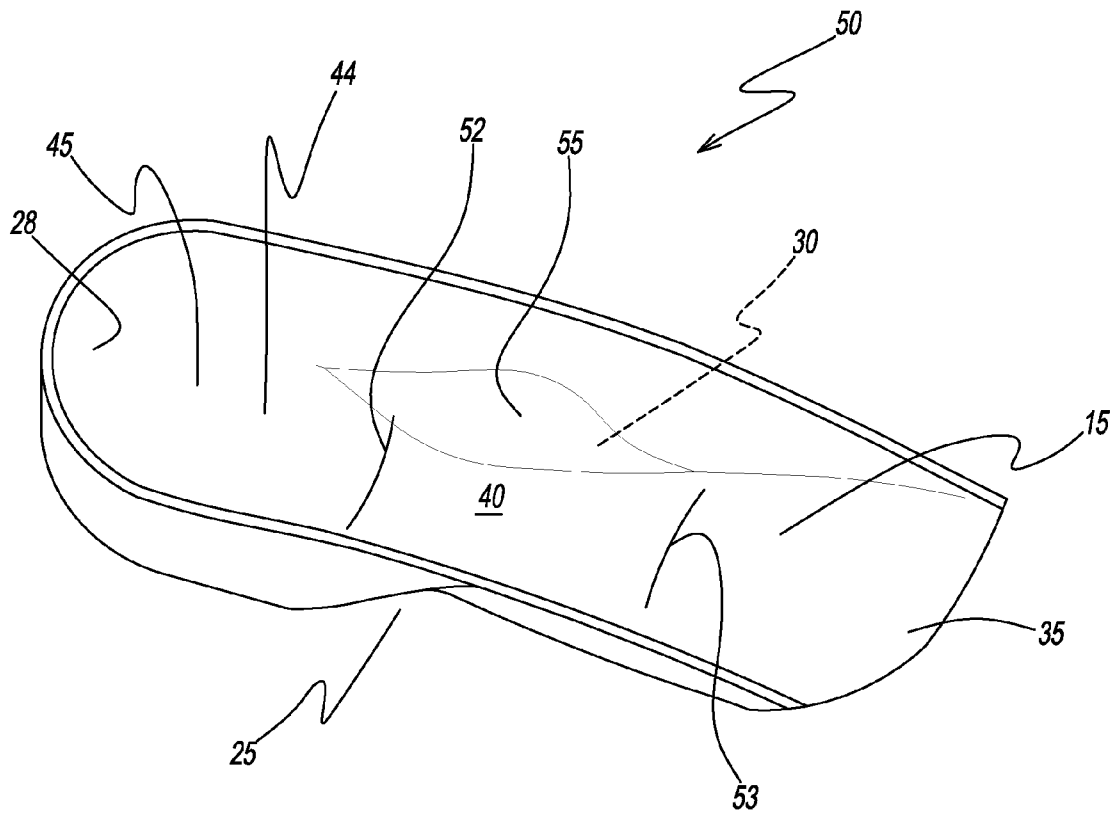


FIG. 8

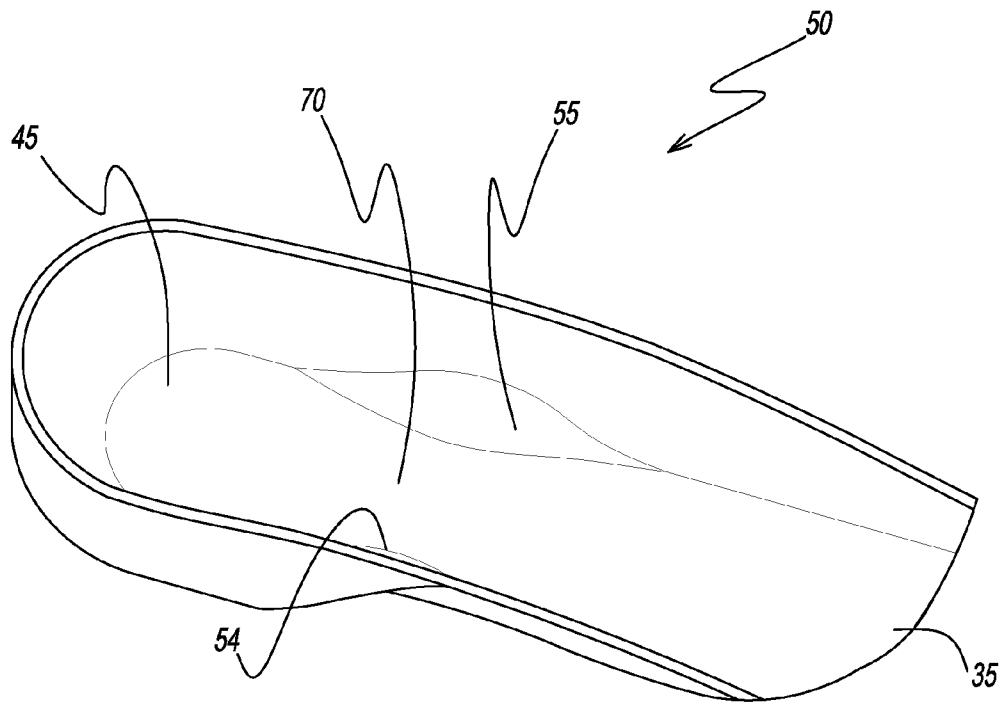


FIG. 9

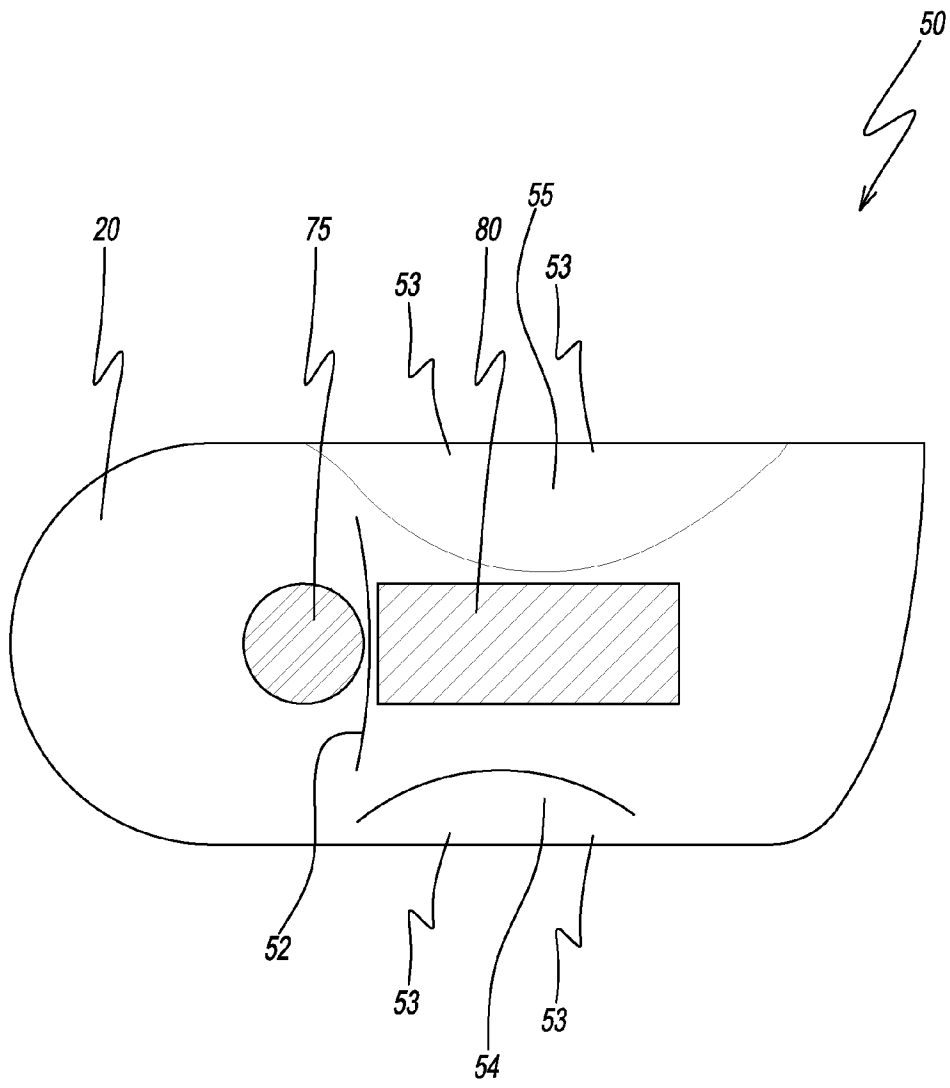


FIG. 10a

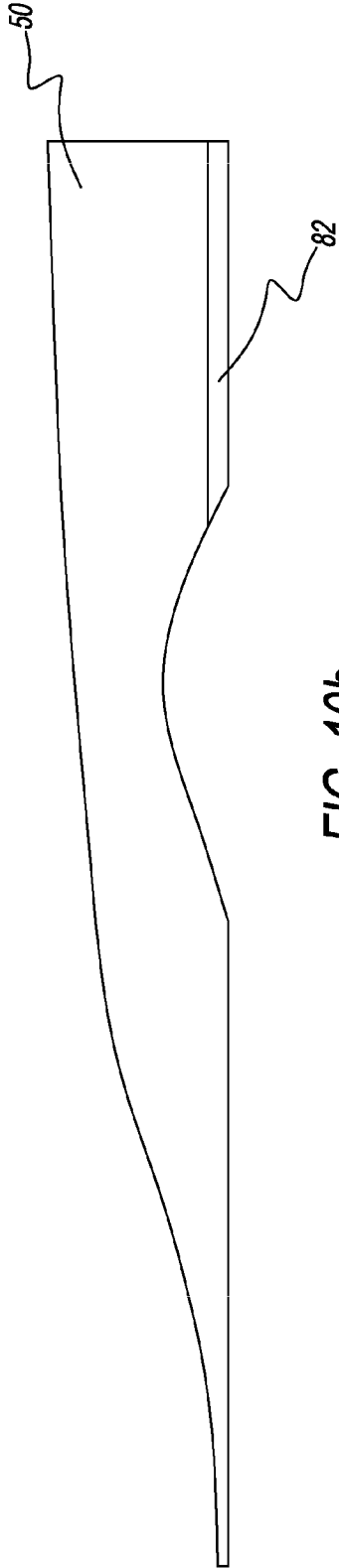


FIG. 10b

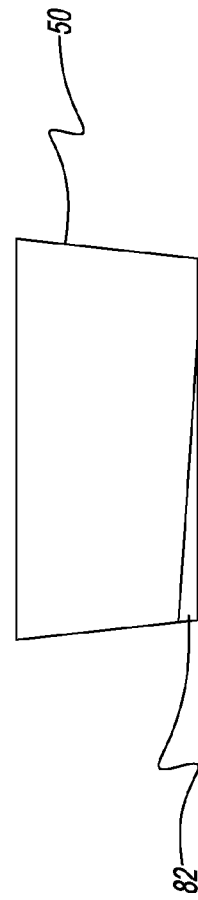


FIG. 10c

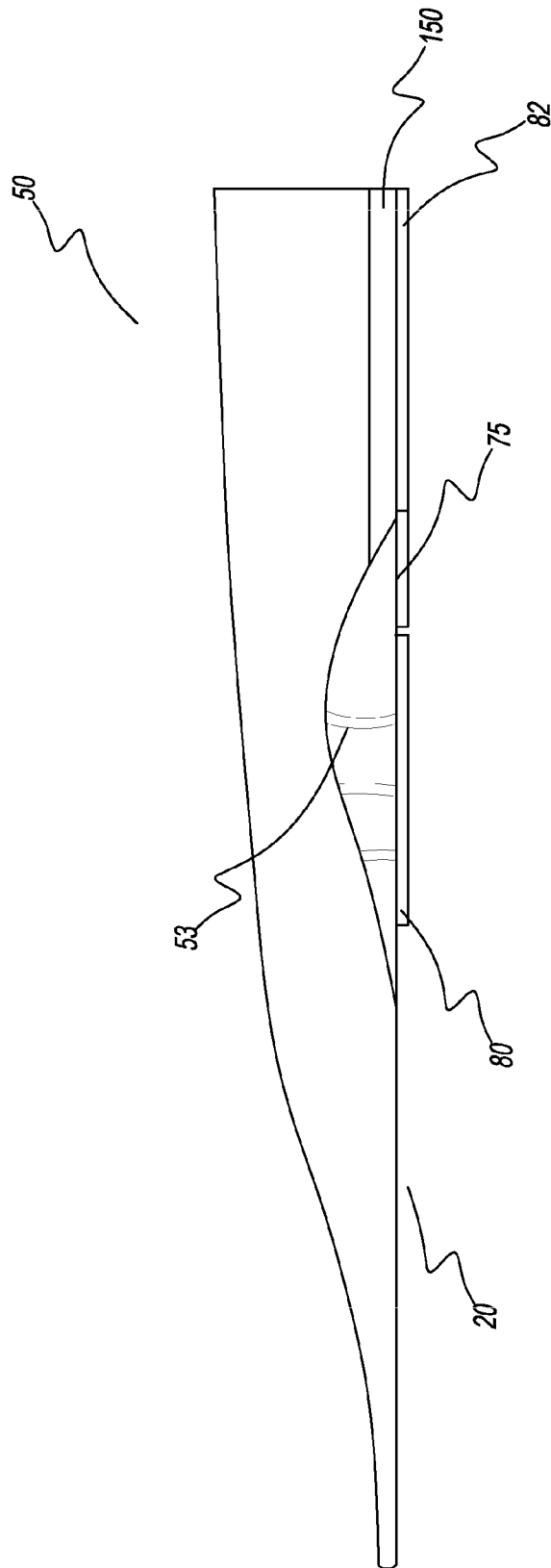


FIG. 10d

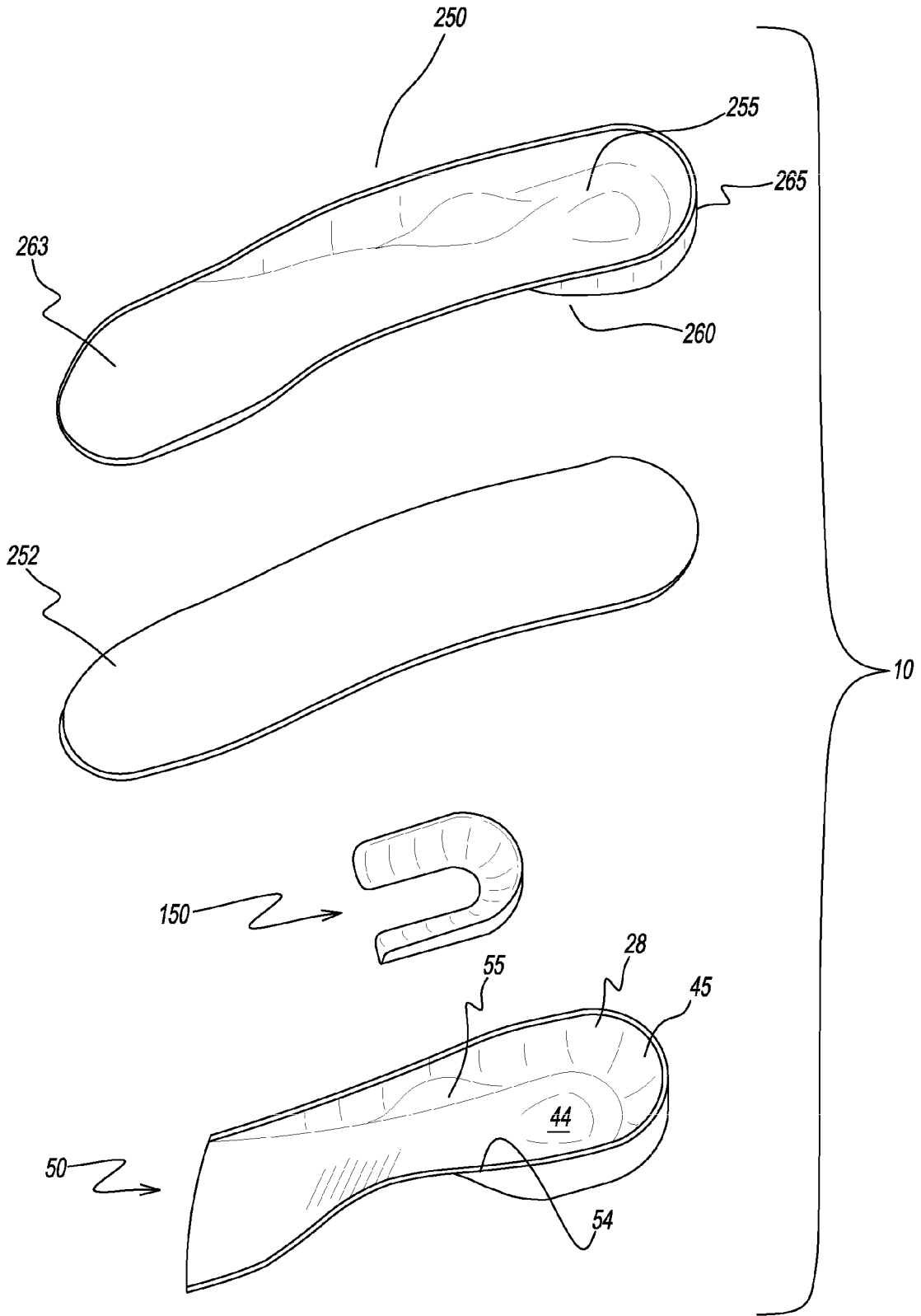


FIG. 11

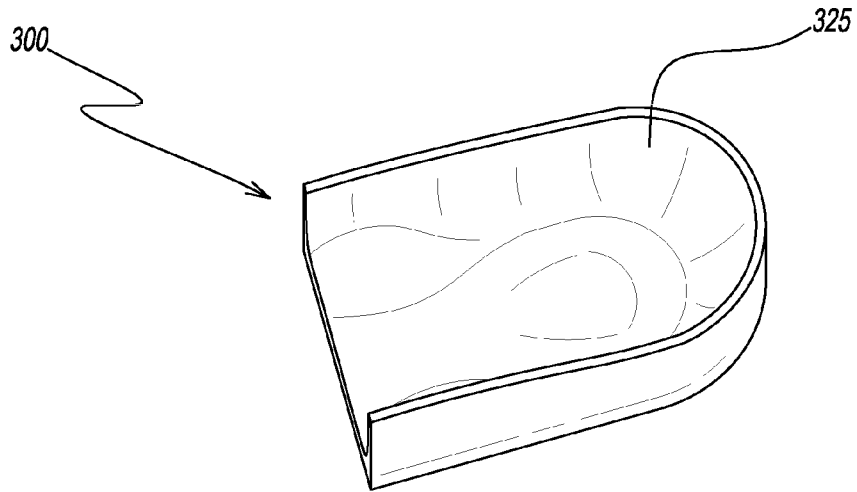


FIG. 12

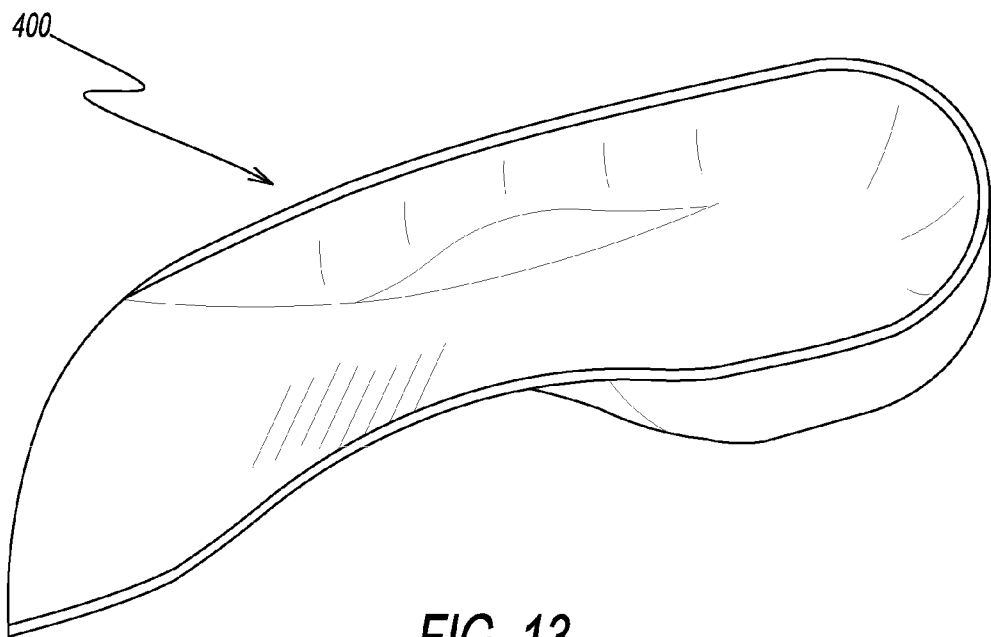


FIG. 13

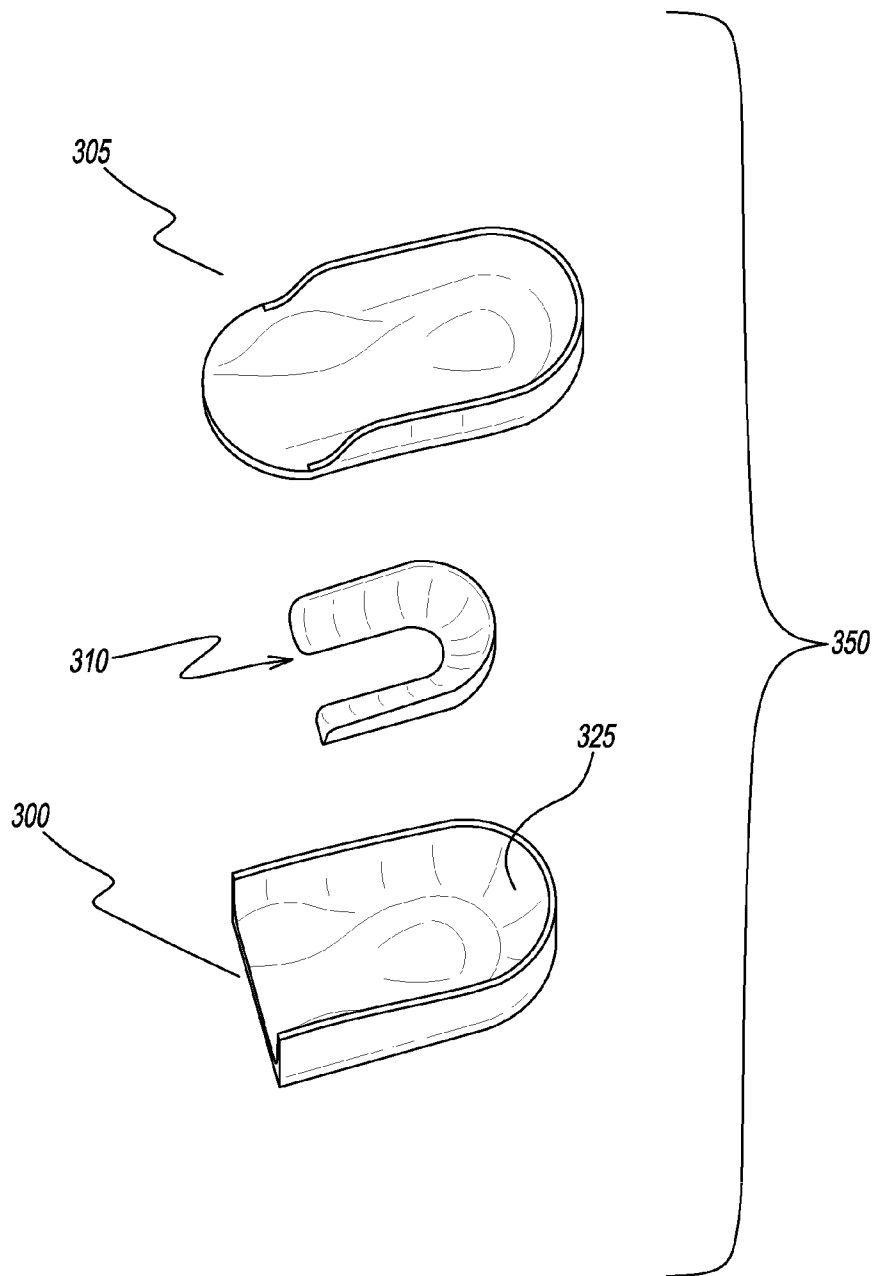


FIG. 14

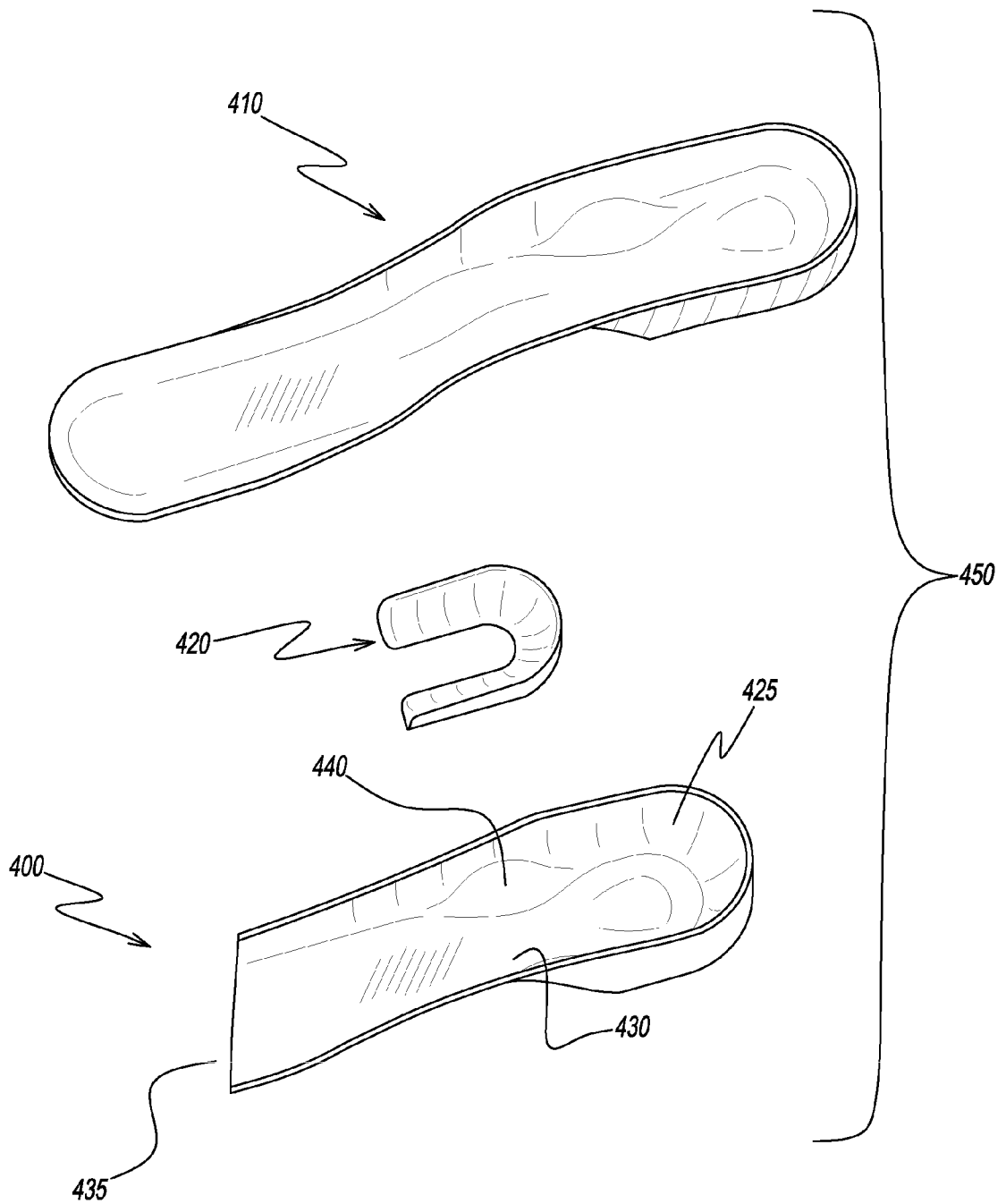
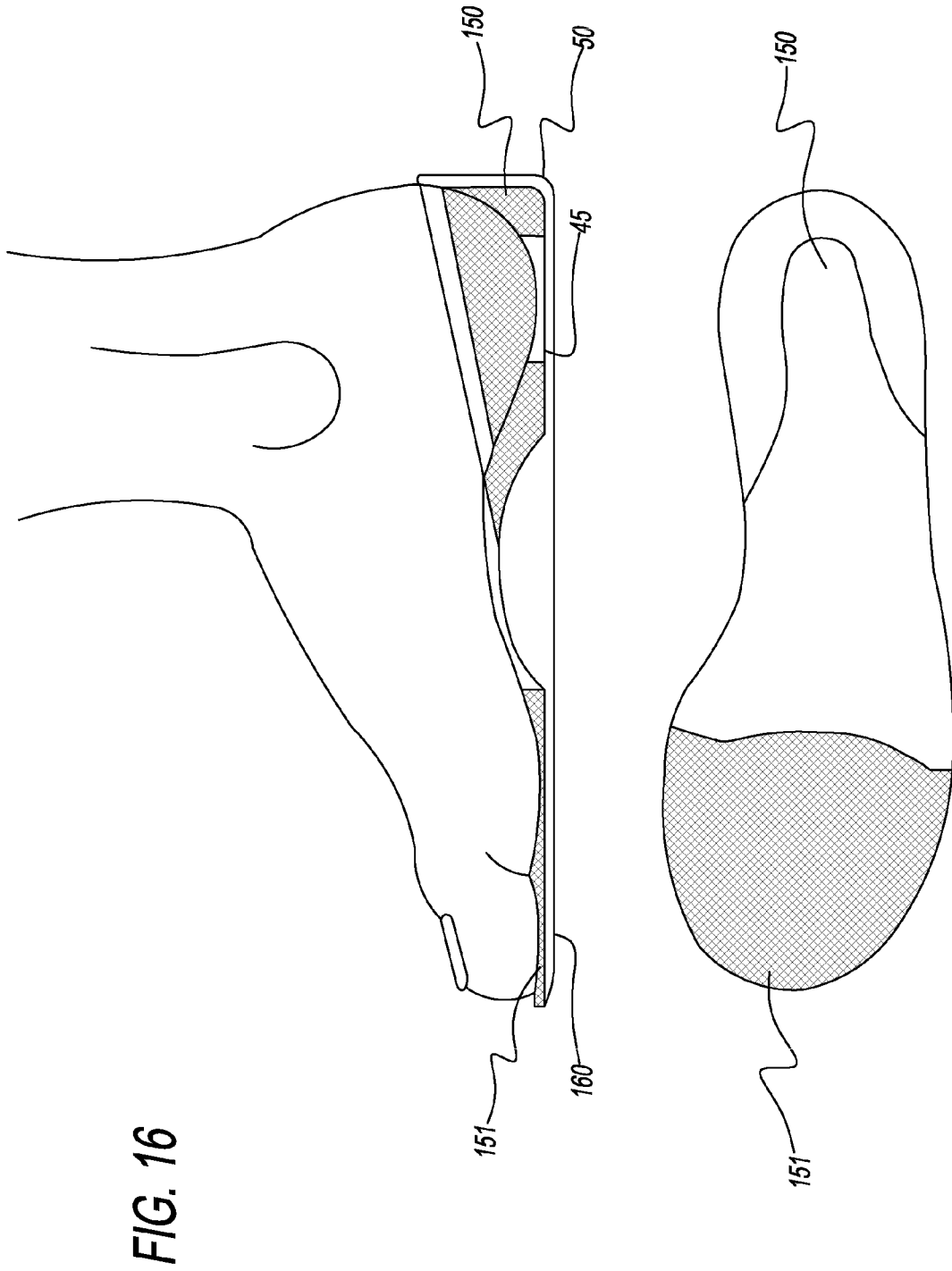


FIG. 15



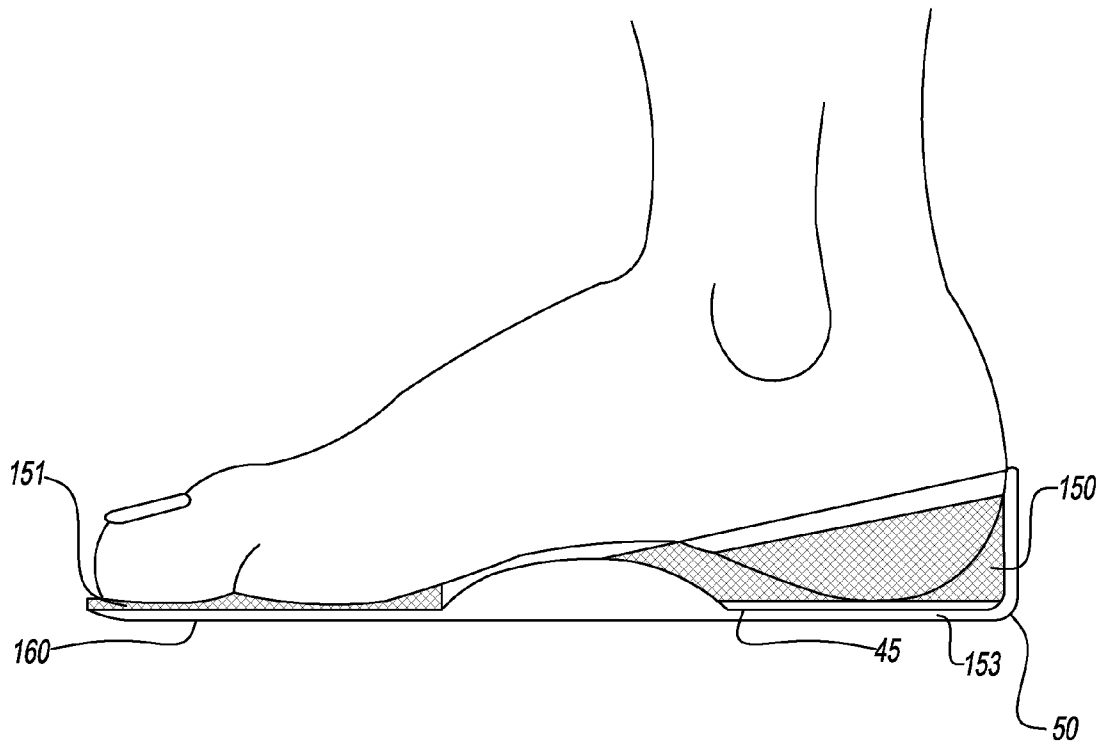


FIG. 16A

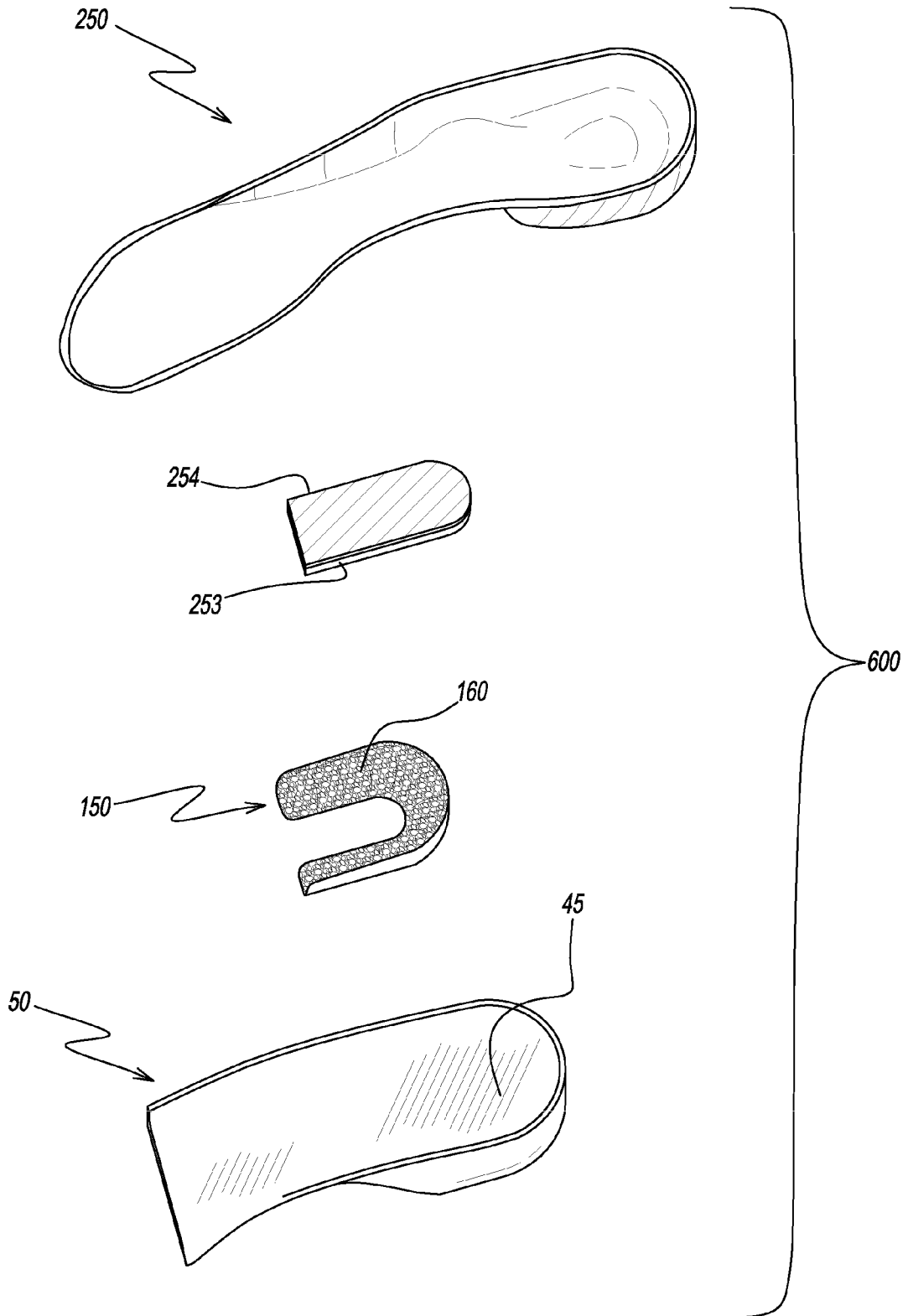


FIG. 17

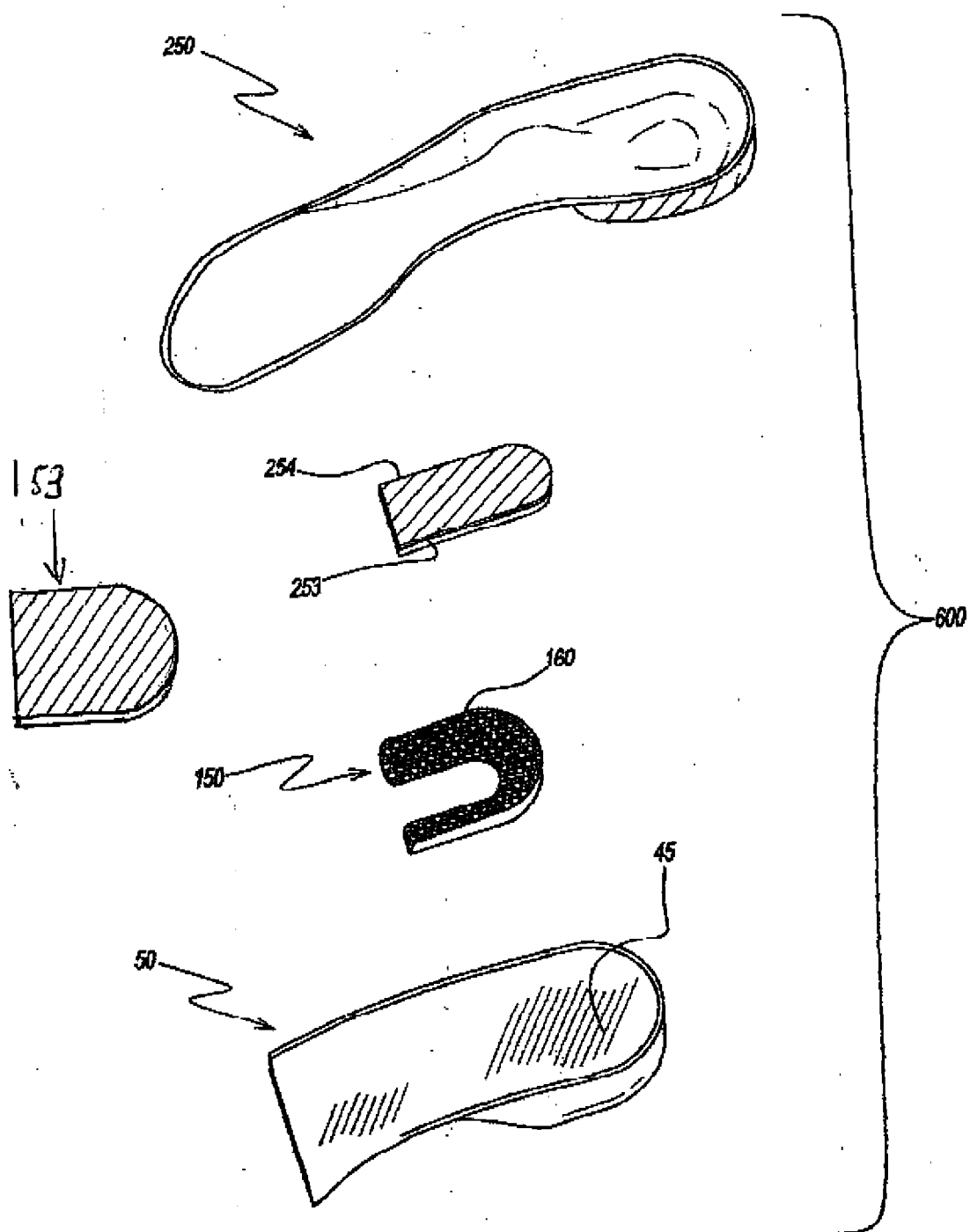


FIG. 17A

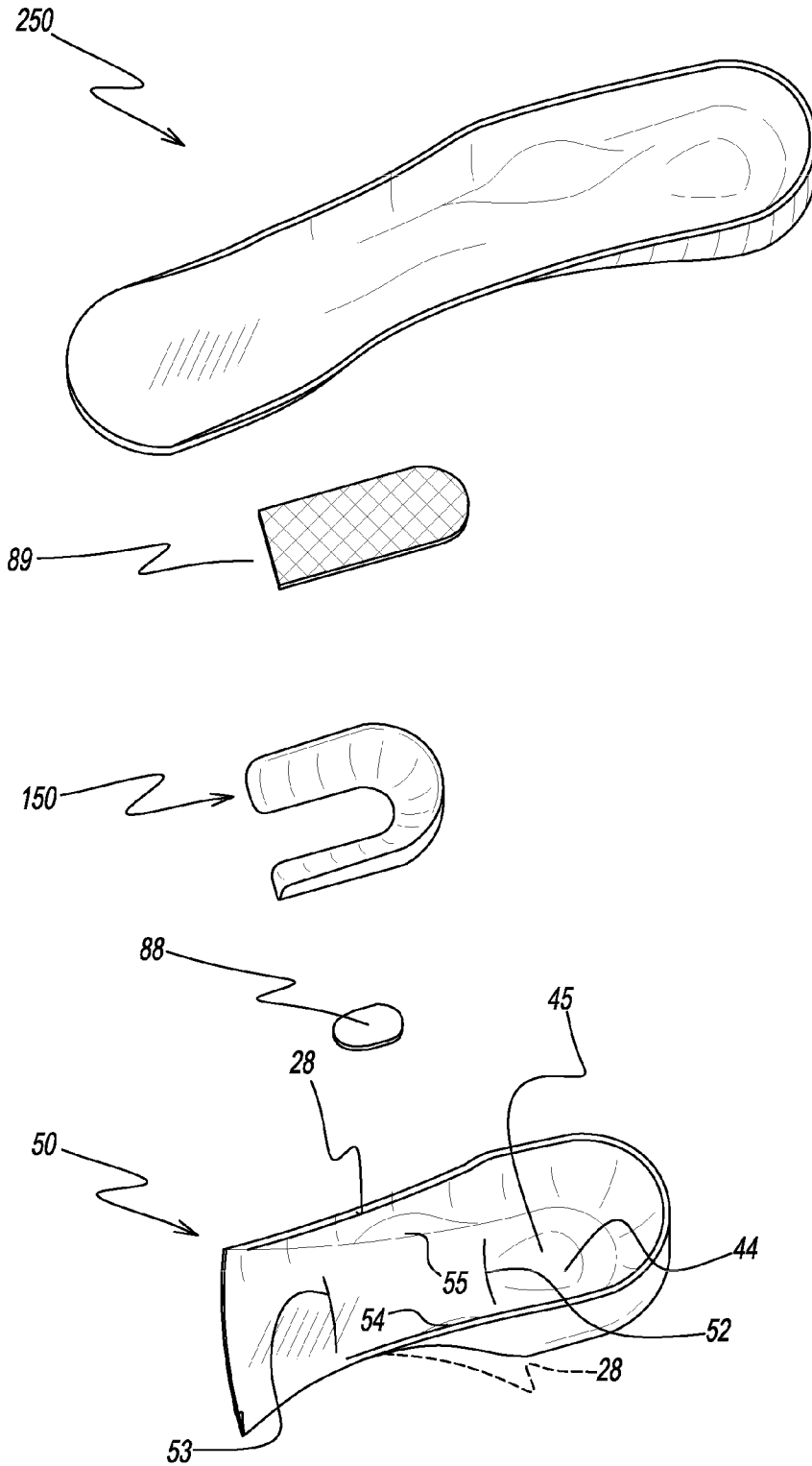


FIG. 18

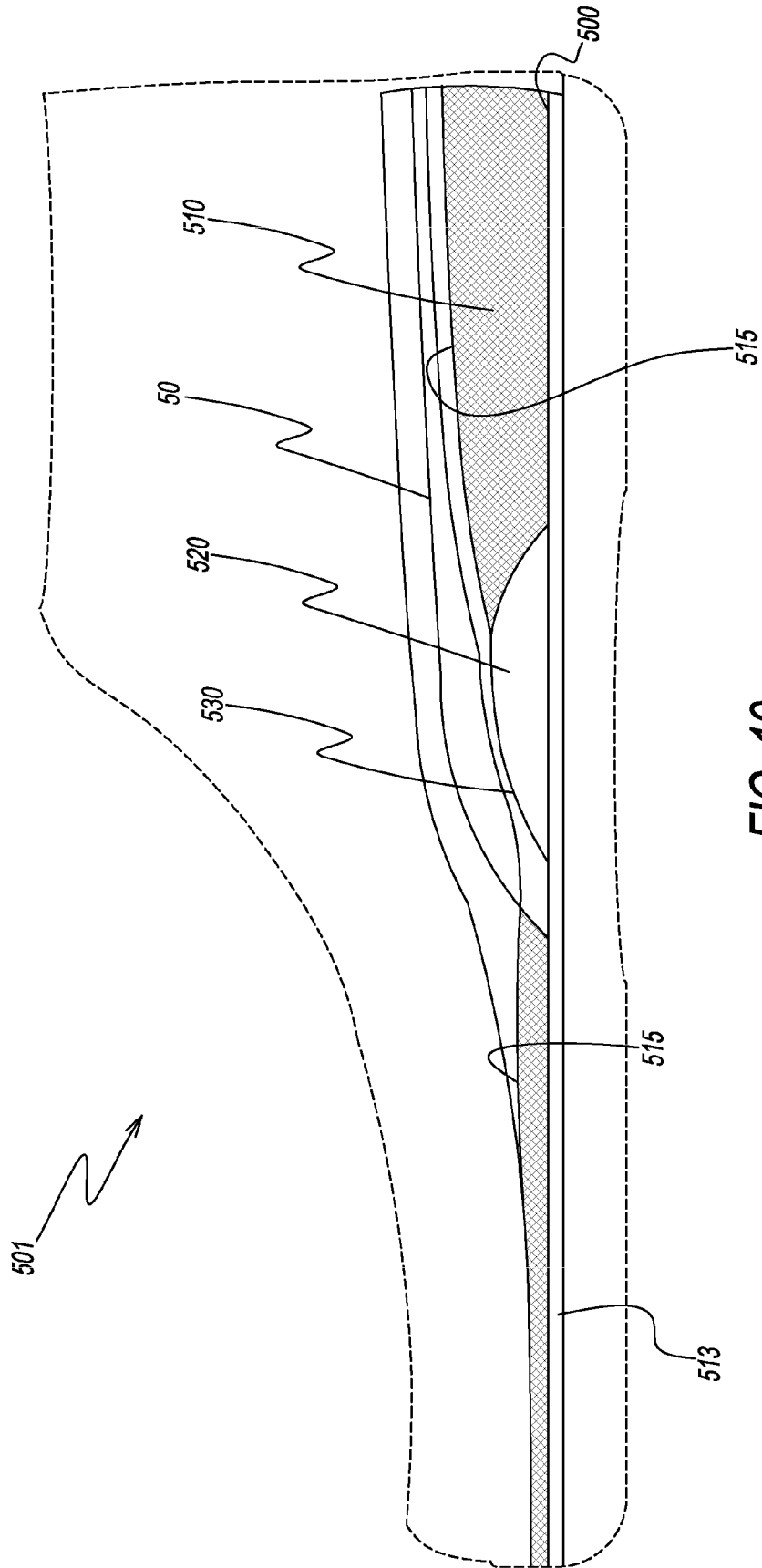


FIG. 19

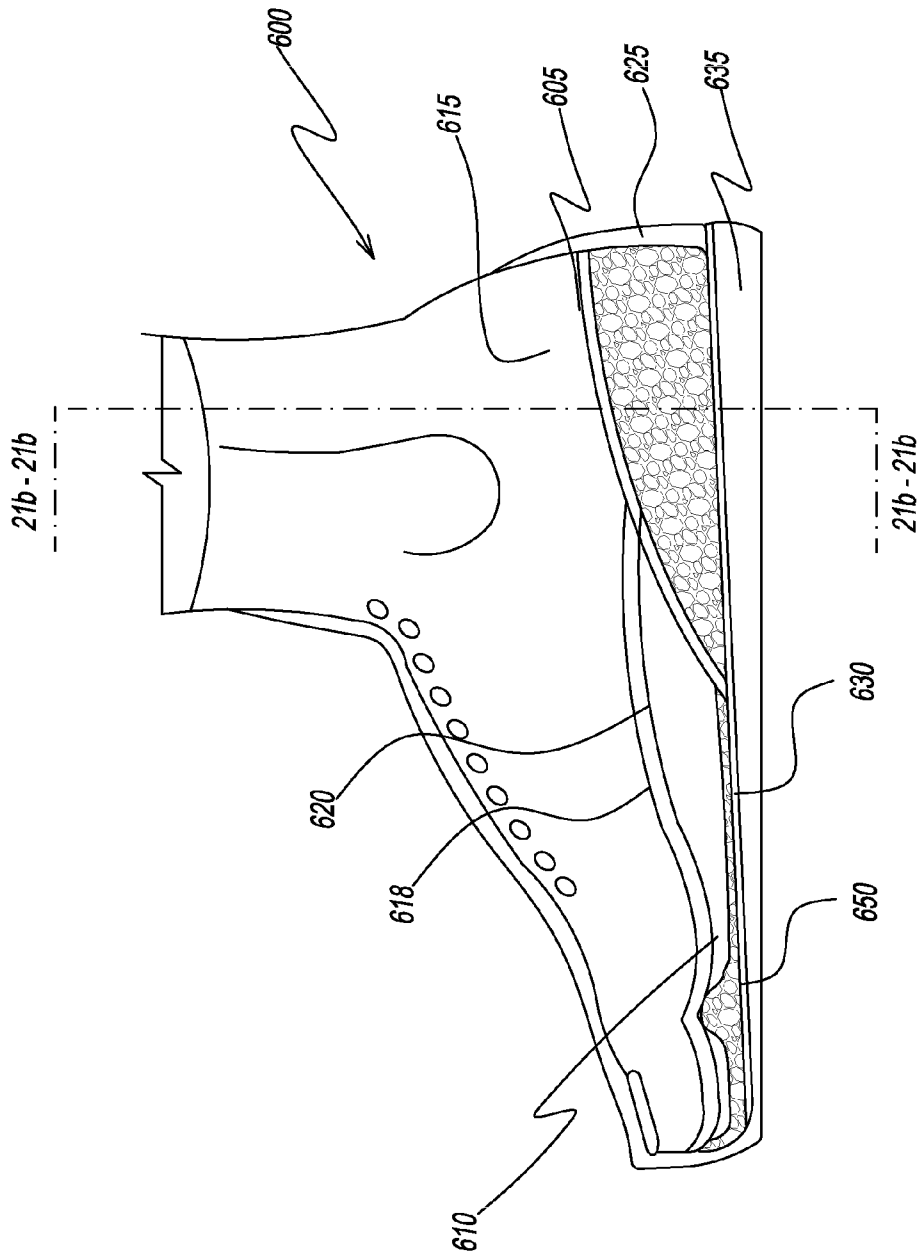
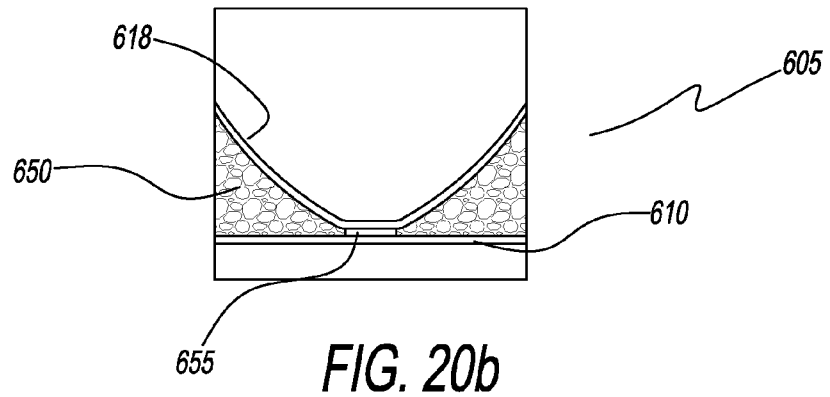


FIG. 20a



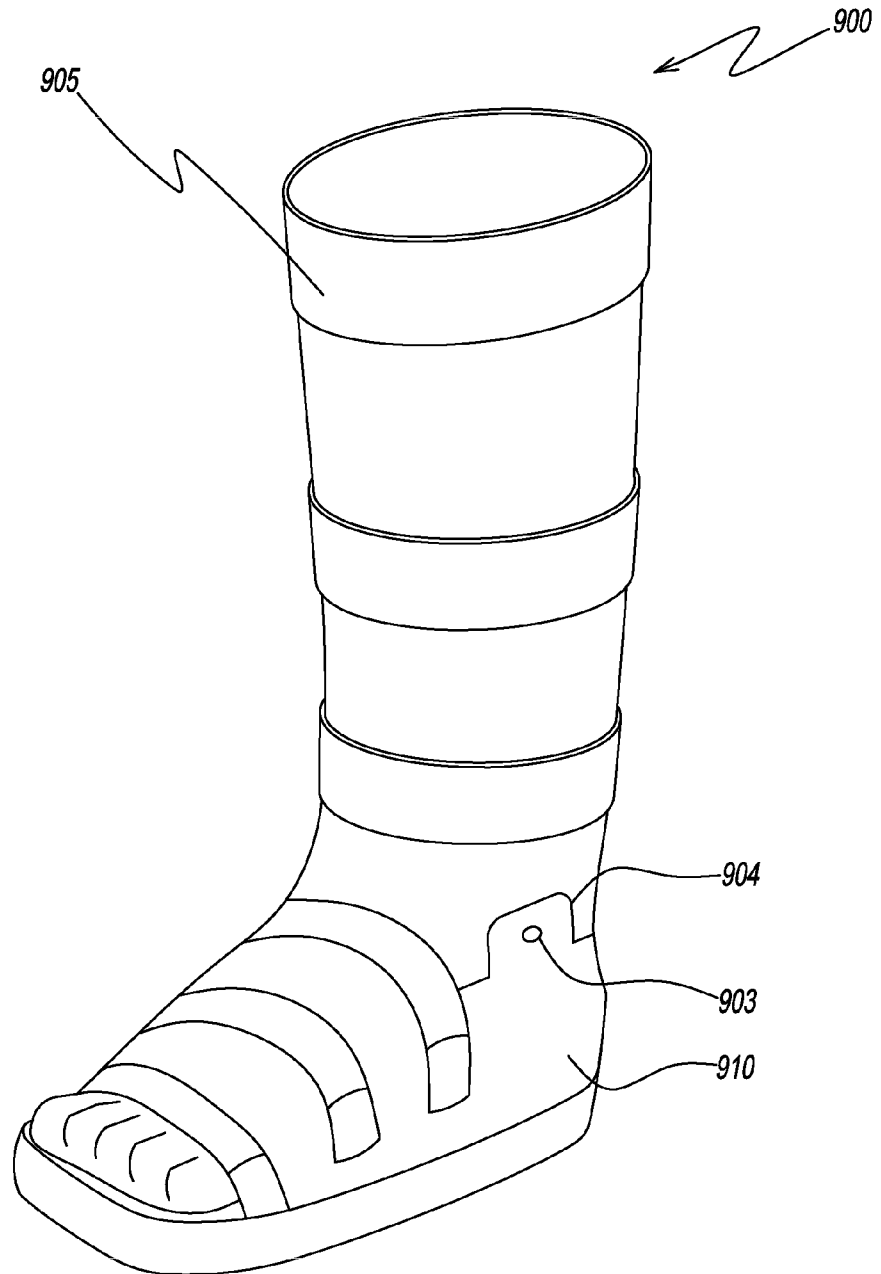
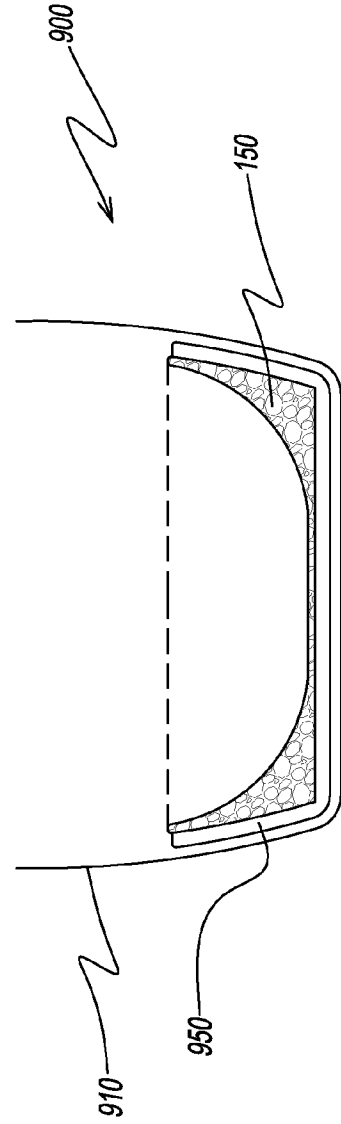
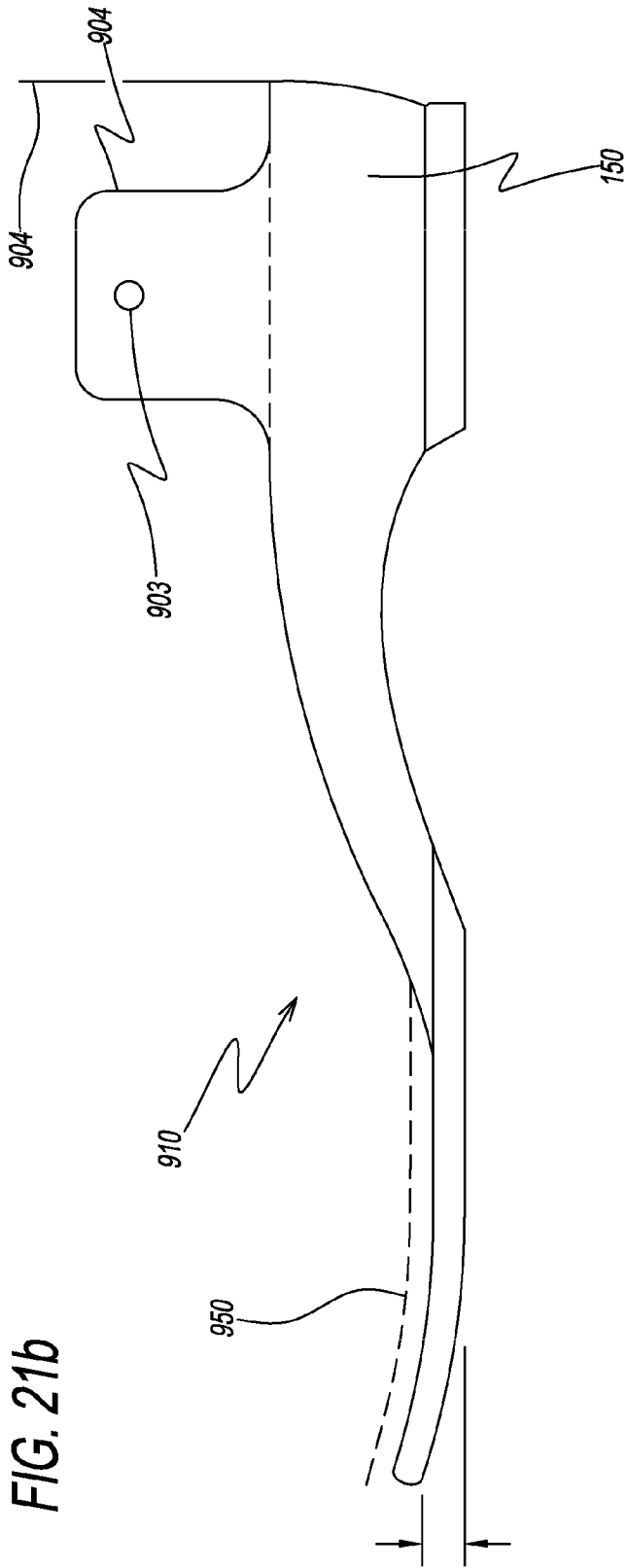


FIG. 21a



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2013/033146

| A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - A43B 13/18 (2013.01) USPC - 36/28 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) IPC(8) - A43B 7/14, 7/32, 13/18, 21/26 (2013.01) USPC - 36/28, 43, 88, 93, 153 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched CPC - A43B 7/144, 7/1445, 13/18, 13/189 (2013.01) Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PatBase, Google Patent | | |
| C. DOCUMENTS CONSIDERED TO BE RELEVANT | | |
| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
| X | US 5,363,570 A (ALLEN et al) 15 November 1994 (15.11.1994) entire document | 1-3, 6-8, 10, 15, 18 |
| -- | | |
| Y | | 4, 5, 9, 11-14, 16, 17 |
| Y | US 6,158,149 A (RUDY) 12 December 2000 (12.12.2000) entire document | 4, 5, 11-14, 16, 17 |
| Y | US 2005/0144807 A1 (SWENSEN) 07 July 2005 (07.07.2005) entire document | 9 |
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| <input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> | | |
| * Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family | | |
| Date of the actual completion of the international search 20 May 2013 | | Date of mailing of the international search report 14 JUN 2013 |
| Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201 | | Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774 |