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PLANTAIRE ET DE READAPTATION
(54) Title: DYNAMIC ARCH STABILIZATION AND REHABILITATIVE SHOE INSOLE DEVICE

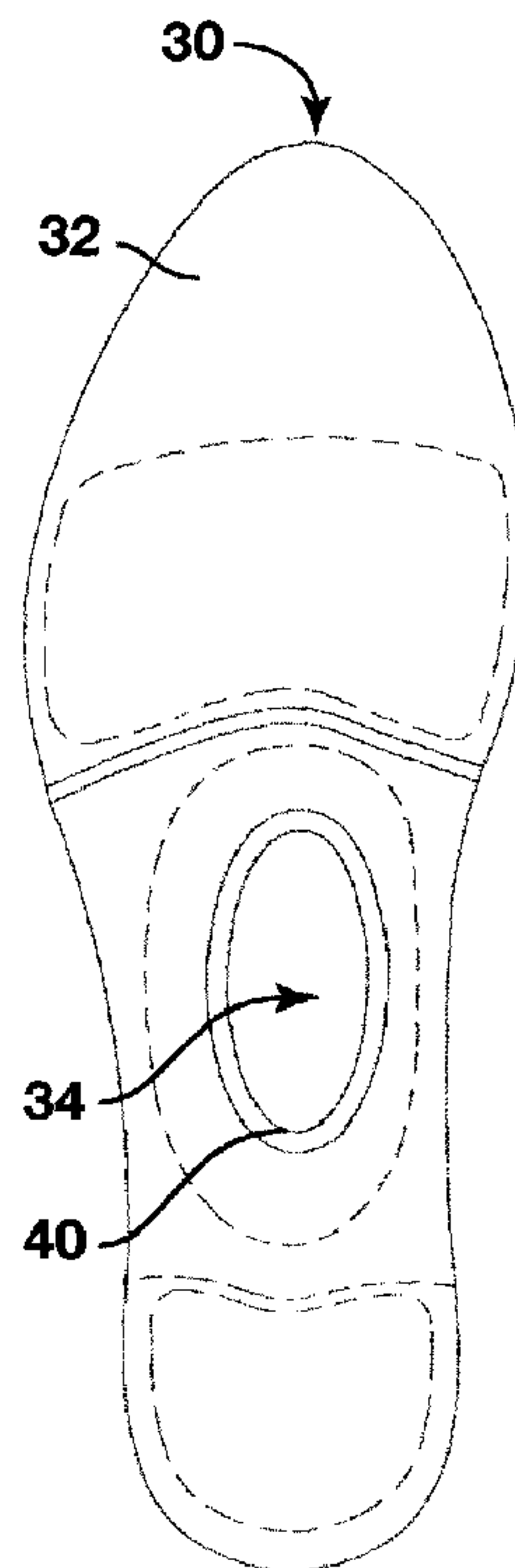


Fig. 1

TOP

(57) **Abrégé/Abstract:**

An insole device configured to fit the profile of a human foot to promote dynamic proprioceptive stimulation of the mechanoreceptors and nociceptors in the skin of the sole of the foot at the anatomical apex of the foot's arch system. The



(57) **Abrégé(suite)/Abstract(continued):**

midfoot section of the insole device has a receptacle located central to the foot's anatomical arch apex that receives interchangeable resilient ellipsoidal and spherically shaped biofeedback catalysts of many shapes and forms. The resilient ellipsoidal and spherically shaped biofeedback catalysts present to the plantar aspect of the foot at a location found to be the anatomical apex of the foot's arch system.

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[Continued on next page]

(54) Title: DYNAMIC ARCH STABILIZATION AND REHABILITATIVE SHOE INSOLE DEVICE

(57) Abstract: An insole device configured to fit the profile of a human foot to promote dynamic proprioceptive stimulation of the mechanoreceptors and nociceptors in the skin of the sole of the foot at the anatomical apex of the foot's arch system. The midfoot section of the insole device has a receptacle located central to the foot's anatomical arch apex that receives interchangeable resilient ellipsoidal and spherically shaped biofeedback catalysts of many shapes and forms. The resilient ellipsoidal and spherically shaped biofeedback catalysts present to the plantar aspect of the foot at a location found to be the anatomical apex of the foot's arch system.

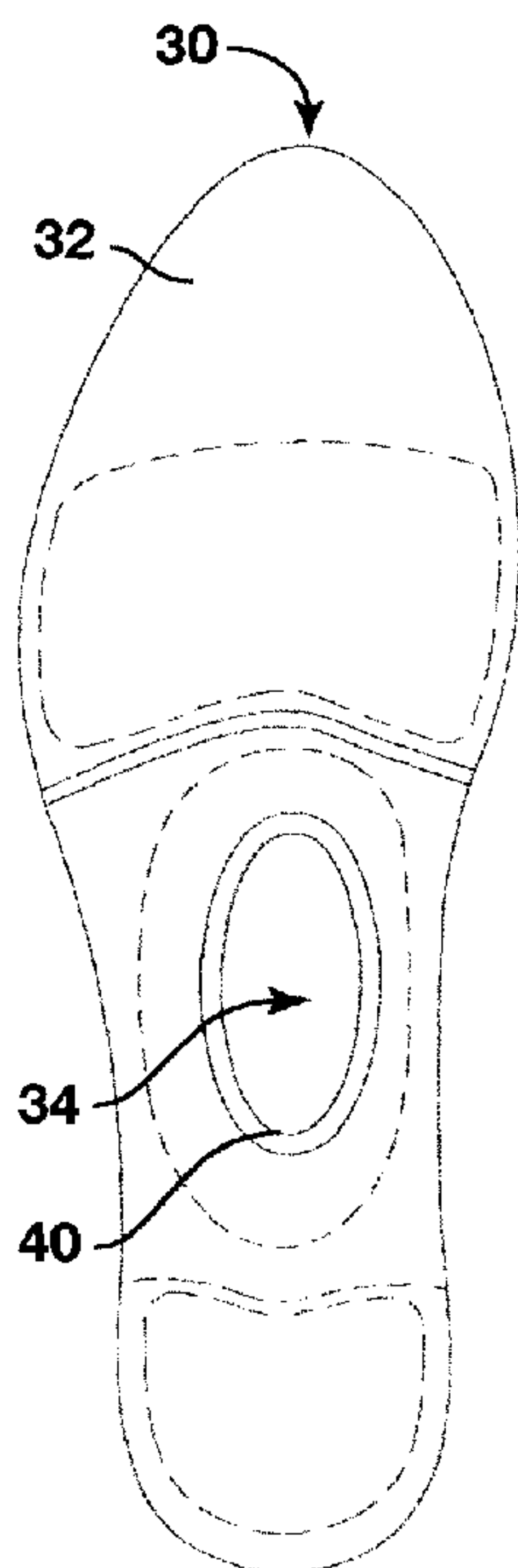
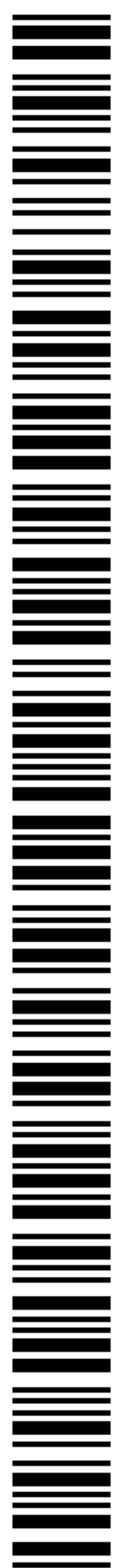


Fig. 1

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Dynamic Arch Stabilization and Rehabilitative Shoe Insole Device

This application claims the benefit of priority from U.S. provisional application no. U.S. 61/457,235 filed February 9, 2011, the entire content of which is incorporated herein by reference.

FIELD OF THE INVENTION

[0001] The present invention relates to an insole for a shoe. In particular, the present invention relates to an insole device that can rehabilitate a foot by stimulating a proprioceptive reflex response in the wearer's foot.

BACKGROUND OF THE INVENTION

[0002] Professionals dealing with gait related pathologies generally accept that a large majority of persons will, at some time in their lives, suffer some form of gait related pain or dysfunction. It is also well accepted that, in the majority of cases, the mechanism underlying the pathology, injury, or dysfunction is biomechanically related to the foot's musculoskeletal capabilities during the interface between the foot and the ground, during the initial contact, support, and propulsion phases of the gait cycle.

[0003] It has been proposed that providing a device to create a proprioceptive, or internal, feedback stimulus to a user's foot can directly target the underlying pathology, injury, or dysfunction. Such devices are disclosed in U.S. Pat. No. 5,404,659 to Burke et al., in U.S. Pat. No. 6,301,807 to Gardiner, and in U.S. Pat. No. 6,732,457 to Gardiner.

[0004] As disclosed in U.S. Pat. No. 5,404,659, an arch rehabilitative catalyst stimulates the Golgi tendon organ, which in turn, stimulates the musculoskeletal structure of the foot to rehabilitate the foot structure. The catalyst is an asymmetrically domed

hump, which creates a mild to strong discomfort to initially stimulate the Golgi tendon organ.

[0005] However, it has been found that the device disclosed in U.S. Pat. No. 5,404,659 does not function as described, and that the majority of users find the device too uncomfortable to use. In particular, when subjected to conventional vertical compressive forces of a person walking in the range of 2.5 times body weight, the device is designed to deflect between 40% and 60% of its maximum height, and when subject to only one times a person's weight, there should be no deflection. In addition, as disclosed in U.S. Pat. No. 5,504,659, the device has an ideal apex height of 5.25% to 7.6% of the total foot length. A device built according to these dimensions and deflection capabilities results in an overly high arch height, and can cause severe discomfort, and possible injury, to a wearer. It is further disclosed that the absolute, non-weight bearing height of the device should be the same regardless of body weight and arch height. This is clearly wrong, since different wearers will have different comfort thresholds and arch heights.

[0006] In general, the device disclosed in U.S. Pat. No. 5,404,659 does not function as described. Users would find the device too hard to use successfully, and rather than stimulating a proprioceptive response, the device would cause pain and discomfort at each step. The pain engendered in the foot of a wearer would, in fact, cause the user to limit the pressure applied to the foot to avoid the discomfort, rather than exercising the foot by creating an imperceptible stimulation as is its stated goal.

[0007] As disclosed in U.S. Pat. No. 6,301,807 and in U.S. Pat. No. 6,732,457, an arch rehabilitative catalyst stimulates the Golgi tendon organ, which in turn, stimulates the musculoskeletal structure of the foot to rehabilitate the foot structure. The catalyst is an asymmetrically domed structure having a said maximum height at its apex from 1% to 5% of the length of the foot. The catalyst does not provide a bracing function but instead, proprioceptive feedback. The plantar aspect of the catalyst has a receptacle for receiving

an interchangeable insert. Many forms thereof, are disclosed. The catalyst is resiliently deformable to apply an upwardly directed pressure to stimulate the Golgi tendon organ, and deflects from between 40% and 100% of its maximum height in response to the vertical forces of a person standing at rest.

[0008] As disclosed in U.S. Pat. No. 6,301,807, the plantar aspect of the device is also characterized by a substantially domed shaped catalyst with a receptacle with vertical walls for removeably accommodating a resilient member with corresponding vertical walls.

[0009] As disclosed in U.S. Pat. No. 6,732,457, the plantar aspect of the device is also characterized by a substantially domed shaped catalyst with a cavity or receptacle for removeably accommodating an insert which acts between the catalyst and an underlying surface to control the resilient deformability of the catalyst; and that the cavity and insert have an engagement means for resisting separation of the insert from the insole and lateral shifting therebetween.

[0010] However, it has been found that the devices disclosed in U.S. Pat. No. 5,404,659, in U.S. Pat. No. 6,301,807, and U.S. Pat. No. 6,732,457 have a number of limitations that inhibit the devices' optimal positioning and the degree of stimulus provided to the plantar surface of the foot while the foot is interfacing with the ground, during the initial contact, support, and propulsion phases of the multidirectional bipedal activity gait cycles.

[0011] In general the devices disclosed in U.S. Pat. No. 5,404,659, in U.S. Pat. No. 6,301,807, and U.S. Pat. No. 6,732,457 incorporate dome shaped catalysts the positioning of which is fixed. This fixed positioning of the dome shaped catalysts restricts the stimulus to the center of the foot's arch apex to only those times when users of the devices are standing perfectly erect on perfectly horizontal terrain. In instances when the

users are engaging in multidirectional bipedal activities during which their lower limbs are not perpendicular to the terrain whether the terrain is horizontal or not, users of the devices would experience stimulus to less than optimal locations around the periphery of the center of the arch apex as the foot moves about the dome shape. This less than optimal location of the stimulus to the sole of the foot results in a less than optimal proprioceptive reflex response and a less stable musculoskeletal arch system and ankle.

[0012] In addition, the devices disclosed do not allow for any degree of adjustability in the relative positioning of the dome shaped catalyst to accommodate users who have feet of identical length but have variances in foot type. For example one person could have a longer arch and shorter toes and another have a shorter arch and longer toes, yet both could have the same foot length. In another example one person could have a wide foot and another a narrow foot, yet both could have the same foot length as the aforementioned persons. Therefore, the devices disclosed would fail to provide stimulus at the optimal location for one of the individuals.

Summary of the Invention

[0013] An insole device configured to fit the profile of the human foot to promote dynamic proprioceptive stimulation of the mechanoreceptors and nociceptors in the skin of the sole of the foot at the anatomical apex of the foot's arch system. The anatomical apex of the foot arch system being defined as the highest part of the mid-foot's boney structure when viewed from the mid-foot's medial to lateral aspect between the calcaneous (heel) and metatarsal heads (forefoot).

[0014] The midfoot section of the insole device has a receptacle located central to the foot's anatomical arch apex that receives interchangeable resilient ellipsoidal and spherically shaped biofeedback catalysts of many shapes and forms. The resilient ellipsoidal and spherically shaped biofeedback catalysts present to the plantar aspect of the foot at a location found to be the anatomical apex of the foot's arch system.

[0015] The resilient ellipsoidal and spherically shaped biofeedback catalysts display physical properties as to dynamically stimulate the body's natural neuromuscular reflex mechanisms that effectively optimally align and stabilize the foot's musculoskeletal arch system and ankle. The plantar aspect of the ellipsoidal and spherically shaped biofeedback catalysts encourages the catalysts to dynamically roll and pivot about their plantar apexes as they mirror the foot's movement through multidimensional activities. This dynamic movement ensures that the ellipsoidal and spherically shaped biofeedback catalysts' dorsal aspect apexes always optimally align with anatomical apex of the foot's arch system regardless of the angle at which the foot contacts the ground.

[0016] The net result is a more structurally sound foot capable of optimally managing the forces generated during all bipedal activities with the most efficient use of muscular energy and the lowest degree of injury inducing stress. With regular use, the stimulated neuromuscular activity results in the foot's musculoskeletal structure becoming progressively stronger and less susceptible to injury. The insole device provides rehabilitative, preventive, and performance enhancing benefits.

[0017] The resilient ellipsoidal or spherical biofeedback catalysts display physical properties such that they do not provide functional bracing or support to the plantar aspect of the foot.

[0018] The insole device has the ability to receive and interchange the resilient ellipsoidal or spherical biofeedback catalysts and the many forms thereof, as well as having provision to ensure proper placement of the catalysts relative to the user's anatomical arch apex.

[0019] Preferred embodiments of the invention are illustrated below with reference to the accompanying illustrations in which:

Description of the Drawings

Figure 1 is a top plan view of a shoe insole device according to the present invention;

Figure 2 is a bottom plan view corresponding to Fig 1;

Figure 3 is a section on line A-A' of Fig 2;

Figure 4 is a side elevation corresponding to Fig 2;

Figure 5 is a section on line B-B' of Fig 2;

Figure 6 is a section on line C-C' of Fig 2;

Figure 7 is a section on line D-D' of Fig 2;

Figure 8 is a side elevation of a catalyst portion of the insole device;

Figure 9 is a top plan view corresponding to Fig 8.

Figure 10 is a side elevation of an embodiment of a catalyst according to the present invention;

Figure 11 is a top plan view corresponding to Fig 10;

Figure 12 is a front elevation corresponding to Fig 10.

Figure 13 is a side elevation of an embodiment of a catalyst according to the present invention having a profile somewhat different from that of Fig 10;

Figure 14 is a top plan view corresponding to Fig 13;

Figure 15 is a front elevation corresponding to Fig 13;

Figure 16 is a front elevation of yet another shaped catalyst;

Figure 17 is a side elevation corresponding to Fig 16;

Figure 18 is a front elevation of a bottom shape corresponding to Fig 15;

Figure 19 is a side elevation corresponding to Fig 18;

Figure 20 is a front elevation of a bottom portion of the catalyst of Fig 16

Figure 21 is a side elevation corresponding to Fig 20;

Figure 22 illustrates a first alternate embodiment of a catalyst and associated tether according to the present invention in which an assembled catalyst/tether is illustrated at the top with an exploded view therebelow shown from the sagittal plane, frontal plane, and horizontal plane (left, centre and right respectively);

Figure 23 illustrates a second alternate embodiment of a catalyst and associated tether according to the present invention in which an assembled catalyst/tether is illustrated at the top with an exploded view therebelow shown from the saggital plane, frontal plane, and horizontal plane (left, centre and right respectively);

Figure 24 illustrates a third alternate embodiment of a catalyst and associated tether according to the present invention in which an assembled catalyst/tether is illustrated at the top with an exploded view therebelow shown from the saggital plane, frontal plane, and horizontal plane (left, centre and right respectively);

Figure 25 illustrates a fourth alternate embodiment of a catalyst and associated tether according to the present invention in which an assembled catalyst/tether is illustrated at the top with an exploded view therebelow shown from the saggital plane, frontal plane, and horizontal plane (left, centre and right respectively);

Figure 26 illustrates a fifth alternate embodiment of a catalyst and associated tether according to the present invention in which an assembled catalyst/tether is illustrated at the top with an exploded view therebelow shown from the saggital plane, frontal plane, and horizontal plane (left, centre and right respectively);

Figure 27 illustrates a sixth alternate embodiment of a catalyst and tether according to the present invention in which an assembled catalyst/tether is illustrated at the top with an exploded view therebelow shown from the saggital plane, frontal plane, and horizontal plane (left, centre and right respectively);

Figure 28 illustrates how a catalyst according to the present invention moves dynamically with a foot;

Figure 29 illustrates a variety of multi-density catalyst shapes;

Figure 30 is a perspective view from above of the seventh alternate embodiment according to the present invention;

Figure 31 is a perspective view from the bottom corresponding to Figure 30;

Figure 32 is a side elevation corresponding to Figure 30;

Figure 33 is a bottom plan view corresponding to Figure 31 but showing a catalyst present;

Figure 34 is a section on line 34-34 of Figure 33 but rotated left to right;

Figure 35 is an enlargement of the encircled area identified by A in Figure 34;

Figure 36 corresponds to Figure 35 but shows the catalyst removed;

Figure 37a is a sagittal view of a catalyst according to the present invention illustrating how it may rock fore and aft;

Figure 37b is a frontal view corresponding to Figure 37 but illustrating side to side rocking at motion;

Figure 38 is a top plan view corresponding to Figures 37a and 37b;

Figure 39 is a top plan view of an alternate embodiment of a catalyst according to the present invention;

Figure 40 is a section on line 40-40 of Figure 39;

Figure 41 is a section on line 41-41 of Figure 39;

Figure 42 is a top plan view of another alternate embodiment of a catalyst according to the present invention;

Figure 43 is a section on line 43-43 of Figure 42;

Figure 44 is a section on line 44-44 of Figure 42;

Figure 45 is yet another alternate embodiment of a catalyst according to the present invention;

Figure 46 is a section on line 46-46 of Figure 45;

Figure 47 is a section on line 47-47 of Figure 45;

Figure 48 is a top plan view of a still further alternate embodiment of a catalyst according to the present invention;

Figure 49 is a section on line 49-49 of Figure 48; and

Figure 50 is a section on line 50-50 of Figure 48.

DESCRIPTION OF THE INVENTION

[0020] A dynamic arch stabilization and rehabilitative insole device is generally illustrated by reference 30 in the Figures. The insole device 30 consists of a flexible insole body having an outer portion 32 defining an upwardly opening hole or passage 34 located central to the foot's anatomical arch apex. The hole 34 receives interchangeable substantially ellipsoidal and spherically shaped catalysts 40 for interfacing with the plantar aspect of a human foot.

[0021] The catalysts 40 have an apex 42 on the dorsal surface for aligning with a target area within the foot, the target area being defined by the anatomical arch apex.

[0022] The plantar aspect (bottom) 44 of the catalysts, in concert with the flexible insole body encourage the catalysts to dynamically roll and pivot about their plantar apexes as they mirror the foot's movement through multidimensional activities.

[0023] The catalysts 40 are resiliently deformable to apply an upwardly directed pressure to stimulate the nociceptors and mechanoreceptors in the skin of the sole of the foot in response to downward pressure on the catalyst by the foot. The ellipsoidal and spherically shaped catalysts provide resilient deformability to allow the catalyst to deflect from between 10% and 100% of their maximum height in response to vertical forces of a person standing at rest being applied to the catalyst.

[0024] The catalysts' 40 resilient deformability may be selected so as to provide constant or variable resistance in response to vertical forces of a person standing at rest being applied to the catalyst. For example the catalyst may provide a constant or progressively increased or decreased compressive resistance relative to the degree of deformation.

[0025] The catalysts 40 may be of varied sizes and shapes relative to foot length and width and arch height.

[0026] The dorsal aspect (top) 43 of the catalysts 40 may have varied radii or apexes at different locations relative to their horizontal midline to accommodate for a variety of foot types of the same foot length and ensure the optimal location of the stimulus provided.

[0027] The dorsal aspect 43 of the catalysts 40 may have varied radii or apexes at different locations relative to their frontal plane midline (50 in Figure 10) to accommodate for a variety of foot types of the same foot length and ensure the optimal location of the stimulus provided.

[0028] The plantar aspect 44 of the catalysts 40 may have varied radii or apexes at different locations relative to their horizontal midline (50 in Figure 10) to optimize the dynamic rolling and pivoting motion specific to requirements of different bipedal activities or pathologies.

[0029] The plantar aspect 44 of the catalysts 40 may have varied radii or apexes at different locations relative to their frontal plane midline to optimize the dynamic rolling and pivoting motion specific to requirements of different bipedal activities or pathologies.

[0030] The catalysts' 40 resilient deformability may be achieved by a variety of mechanical spring-like mechanisms or the use of resiliently deformable materials or a combination thereof.

[0031] The catalysts 40 may be comprised of a variety of materials, densities, and resiliencies such as foams, rubbers, plastics, or other flexible materials. The catalysts may be comprised of one piece made from one material or comprised of a number of pieces made from different materials. Catalysts 40 comprised of a number of pieces may be preassembled as one unit or may be comprised of a number of interchangeable interlocking pieces that can be assembled by the user. The catalysts may be hollow and pressurized to varying degrees with gas, for example air or nitrogen.

[0032] Figure 29 illustrates a variety of one piece designs for the catalyst 40 wherein a first density/resiliency material 150 is overmoulded onto a second density/resiliency material 152 having a higher or lower density/resiliency.

[0033] The flexible insole body 30 may be comprised from a variety of materials such as foams, rubbers, and plastics as well as synthetic and natural fabrics. The insole body 30 may be comprised of one piece made from one material or may be comprised of a number of pieces made from different materials. Insole bodies made of a number of pieces may be preassembled as one unit or may be comprised of a number of interchangeable interlocking pieces that can be assembled by the user. The catalysts may also incorporate a mechanical spring (spiral or leaf) comprised of metal or a metal alloy.

[0034] The flexible insole body and catalysts 40 may have a variety of co-operating engagement means for securing interchangeable ellipsoidal and spherically shaped catalysts to the insole body. The co-operating engagement means may include

detent means for resisting separation of the ellipsoidal and spherically shaped catalysts from the insole body and may allow or restrict shifting therebetween.

[0035] The detent means may include a groove or channel or indent 70 around the long axis circumference of the shaped catalysts. See for example Figures 1-20, 26 and 30-38. The inner circumference of said channel or indent would correspond to the circumference of the hole 34 in the insole body 32 to receive the edge 35 of the hole 34. An insole body with a hole 34 of a larger circumference relative to the circumference of the channel in the catalysts would provide a co-operating engagement means for securing the catalysts to the insole body 32 and allow the catalysts 40 to move or adjust slightly within the insole body 32 while still resisting separation. An insole body with a hole of an equal circumference relative to the circumference of the channel or indent 70 in catalysts 40 would provide a co-operating engagement means for securing the catalysts 40 to the insole body and allow for less movement or adjustment within the insole body.

[0036] Another cooperating engagement means for securing interchangeable catalysts 40 to the insole body 32 may include flexible or elastic tethers 80 that extend from the catalysts having an enlarged end at their distal ends. The enlarged ends would fit into corresponding cavities or smaller holes in the insole body thereby securing the tether's larger ends into the insole body and securely suspending the catalysts in the center of the hole in the insole body.

[0037] Another co-operating engagement means for securing interchangeable catalysts 40 to the insole body may include a flexible or elastic anchor or tether 80 that is affixed to the insole body 32 so as to bisect the long axis center of the hole 34 in the insole body 32. As shown in Figure 25, the catalyst 40 would incorporate a slit 82 along the long axis from one side through to a larger channel 84 at the center of the catalyst's long axis. The larger channel 84 at the center of the catalyst's long axis would correspond in size and shape to the size and shape of the tether 80. The shape of the tether 80 and

corresponding channel 84 in the catalyst 40 would be such as to permit or restrict the long axis movement of the catalyst 40 along the tether 80 while insuring that the catalyst 40 remains secured to the tether 80. Alternatively, as illustrated in Figure 23, the slit 82 may open into a cylindrical passage 83 which received the tether 80. Longitudinal movement of the catalyst 40 to the tether 80 in this case is limited by stops 85 fore and aft the catalyst 40.

[0038] As illustrated in Figure 24, another co-operating engagement means for securing interchangeable ellipsoidal and spherically shaped catalysts 40 to the insole body 32 may include a flexible or elastic tether 80 that is affixed to the insole body 32 as to bisect the long axis center of the hole 34 in the insole body. The catalysts 40 would be comprised of opposing top and bottom pieces with one of the pieces 90 and 92 respectively having a protrusion 94 extending from the center of its base; the protrusion 94 being larger at its distal end. The opposing piece 92, 90 would provide for a cavity with dimensions that would correspond to the protrusion, so that when fitted together the opposing pieces would interlock. The tether 80 would provide for a positioning hole 86 at its center, the shape of the hole 86 corresponding to the cross sectional shape of the protrusion. The catalyst 40 would be secured to the insole body 32 by inserting the protrusion 94 through the hole 86 in the tether 80 then inserting the protrusion 94 in the cavity 96 of the opposing piece in such a manner as to interlock the opposing pieces 90, 92 to each other and the tether. The protrusion 94 may be a separate component or “plug” as illustrated in Figure 27.

[0039] Another co-operating engagement means for securing interchangeable ellipsoidal and spherically shaped catalysts 40 incorporating a channel or indent 70 around their long axis circumference to the insole body 32, may include a flexible or elastic tether 80 that is affixed to the insole body 32 as to bisect the long axis center of the hole 34 in the insole body 32. The tether 80 would incorporate an elastic ring 88 at its center; the shape of the ring 88 matching the corresponding shape of the catalyst's long axis circumference; the hole in the ring 88 being smaller in circumference than the

channel or indent 70 around the long axis circumference of the ellipsoidal and spherically shaped catalysts 40. When the ring 88 in the tether 80 is stretched to fit into the channel or indent 70 in the catalyst 40, the resulting tension of the ring 88 on the catalyst 40 ensures that the catalyst 40 remains secured to the tether 80.

[0040] Figures 30 through 36 show another embodiment of the present invention as illustrated in Figures 30 through 36 which differs from the above described embodiments namely in the internal configuration of the catalyst 40. As best seen in Figures 33, 34 and 35, the catalyst 40 has a plurality of cavities extending inwardly from a bottom face thereof. The illustration shows a honeycomb-like configuration, however the cavities could have round, rectangular, oval, square, hexagonal, octagonal, polygonal, etc. cross-sectional shapes, or even a combination thereof. The cavities could all be of similar size and wall thickness or consist of varying sizes and wall thicknesses. Furthermore the side walls defining the cavities could be substantially parallel or alternatively, have varying degrees of draft or even be bulged. The catalyst could be made from a variety of materials such as foams, rubbers, silicones, plastics, etc. as a one piece or multi-piece part in one or a combination of materials. For example, the top could be a clear plastic and the “honeycomb” could be a thermal plastic rubber, that is either overmoulded or attached with an adhesive.

[0041] By varying the materials and the above geometrical features, one is able to vary the compression, rebound, and dynamic movement characteristics to accommodate progressive level of resiliencies in a variety of different applications/needs (foot types, body weight, pathologies, activities).

[0042] Although the “honeycomb” arrangement is shown having a groove 70 extending thereabout for mounting within the hole 30 within the insole body, it could be adapted to a flexible or elastic tether arrangement of the sort described previously.

[0043] Figures 39 through 50 show a variety of alternate embodiments of a catalyst according to the present invention. According to the Figures 39 through 41 embodiment, the catalyst 40 has resilient plastic like top and bottom caps 110 and 112,

respectively. Housed between the top and bottom caps 110, 112, respectively, is an oval-shaped ring 114 which may be of plastic or steel that offers resiliently. The ring 114 may or may not be filled with a foam 116 in its core. The ring 114 with or without the foam 116 acts as a mechanical spring.

[0044] In the Figures 42 through 44 embodiment, the catalyst 40 comprises resilient plastic or moulded foam top and bottom caps 120 and 122 overmoulded on a thermal plastic elastomer, thermal plastic rubber or foam core 124.

[0045] In the Figures 45 through 47 embodiment, the catalyst 40 has resilient plastic-like or moulded foam top and bottom caps 130, 132 respectively. Interspersed therebetween is a die-cut foam ring 136 which may extend around a foam core 138 having a different foam density than the foam ring 136.

[0046] In the Figures 48 through 50 embodiment, the catalyst 40 has resilient plastic-like or moulded foam top and bottom caps 140, 142 respectively interspersed between which is a die-cut foam ring 146 surrounding a gas or air-filled core 148.

[0047] The foregoing description of the preferred embodiments and examples of the apparatus and process of the invention have been presented to illustrate the principles of the invention and not to limit the invention to the particular embodiments illustrated. It is intended that the scope of the invention be defined by all of the embodiments encompassed within the claims and/or their equivalents.

AMENDED CLAIMS
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Claims

1. An insole device comprising:

a sole shaped outer portion defining an upwardly open receptacle in a midfoot section thereof;

a proprioceptive reflex catalyst mountable in said receptacle;

said catalyst being positionable to engage an anatomical apex of the sole face of the arch of a wearer's foot;

said catalyst having an ellipsoidal or spherical shape, being dimensioned to move dynamically in harmony with the said foot's natural movement;

said catalyst having a resiliency sufficient to stimulate the mechanoreceptors and nociceptors in the skin of said sole at said apex but not to artificially support the said apex;

said catalyst having a resiliency sufficient to stimulate the body's natural neuromuscular proprioceptive protective arch reflex response; and

cooperating engagement means extending between said outer portion and said catalyst for connecting said catalyst to said outer portion to locate said catalyst in said receptacle while allowing said movement of said catalyst relative to said outer portion.

2. The insole device of claim 1 wherein:

said receptacle is a passage through said outer portion.

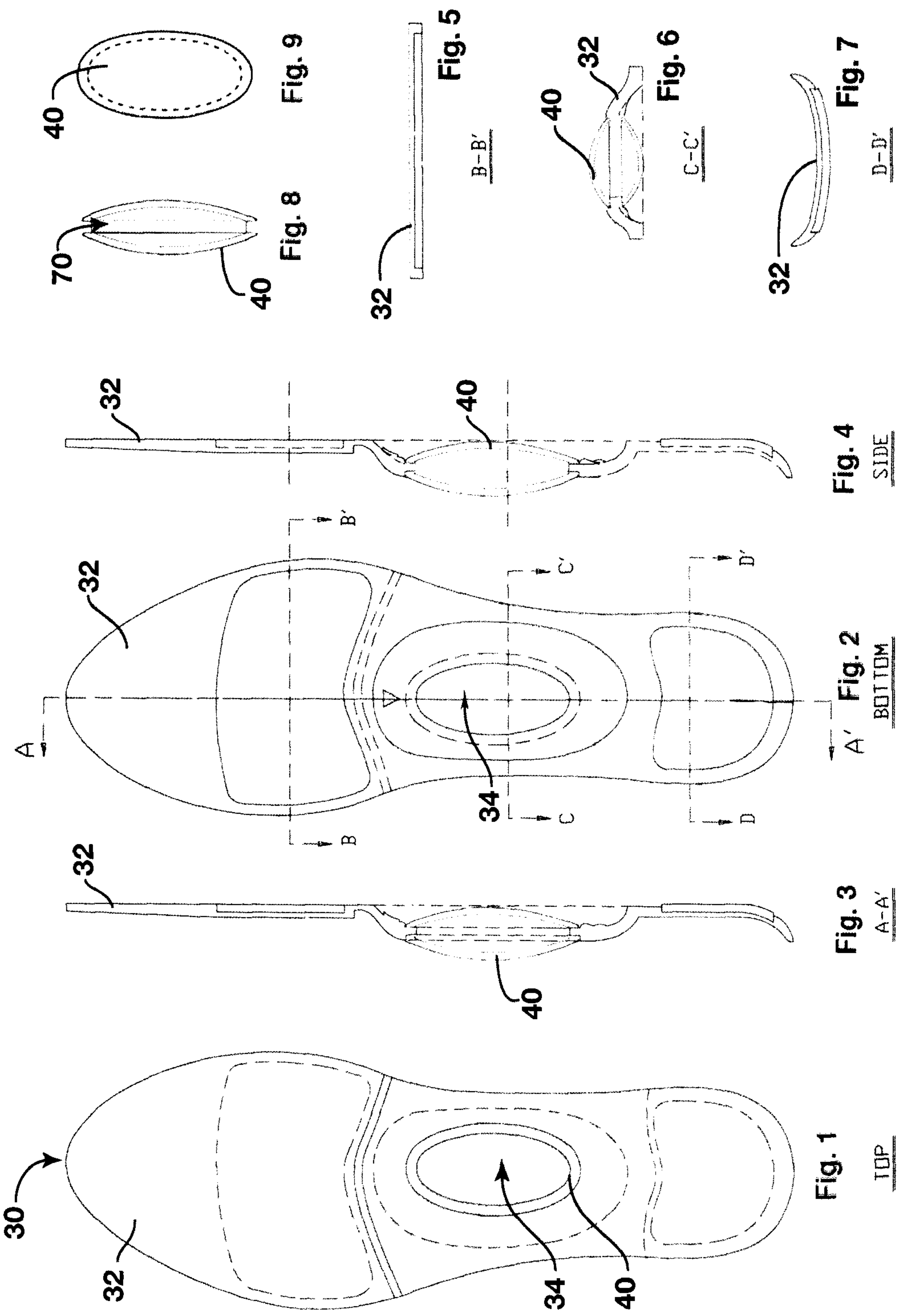
3. The insole device of claim 2 wherein:

said cooperating engagement means is a groove extending about said passage for receiving an edge of said passage

4. The insole device of claim 1 or 2 wherein:

said cooperating engagement means is at least one resilient member secured to said catalyst and said outer portion.

5. The insole device as claimed in any one of claims 1-4 wherein said catalyst is provided with a plurality of cavities extending upwardly from a lower surface thereof, said cavities being defined by walls which also separate said cavities; the dimensions of said walls and said cavities being selected to provide desired resilient properties.
6. Any invention illustrated and/or described herein.



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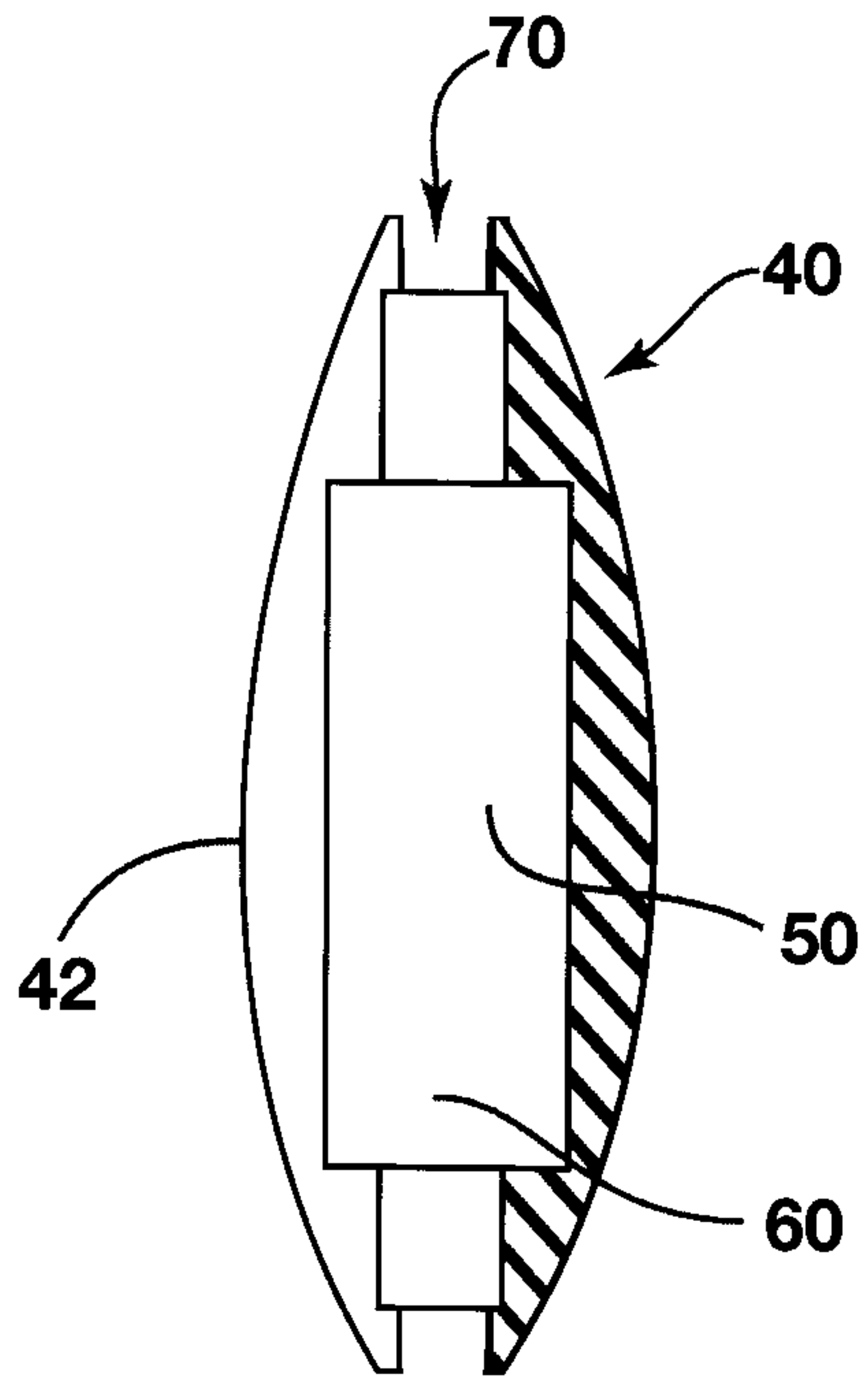


Fig. 10

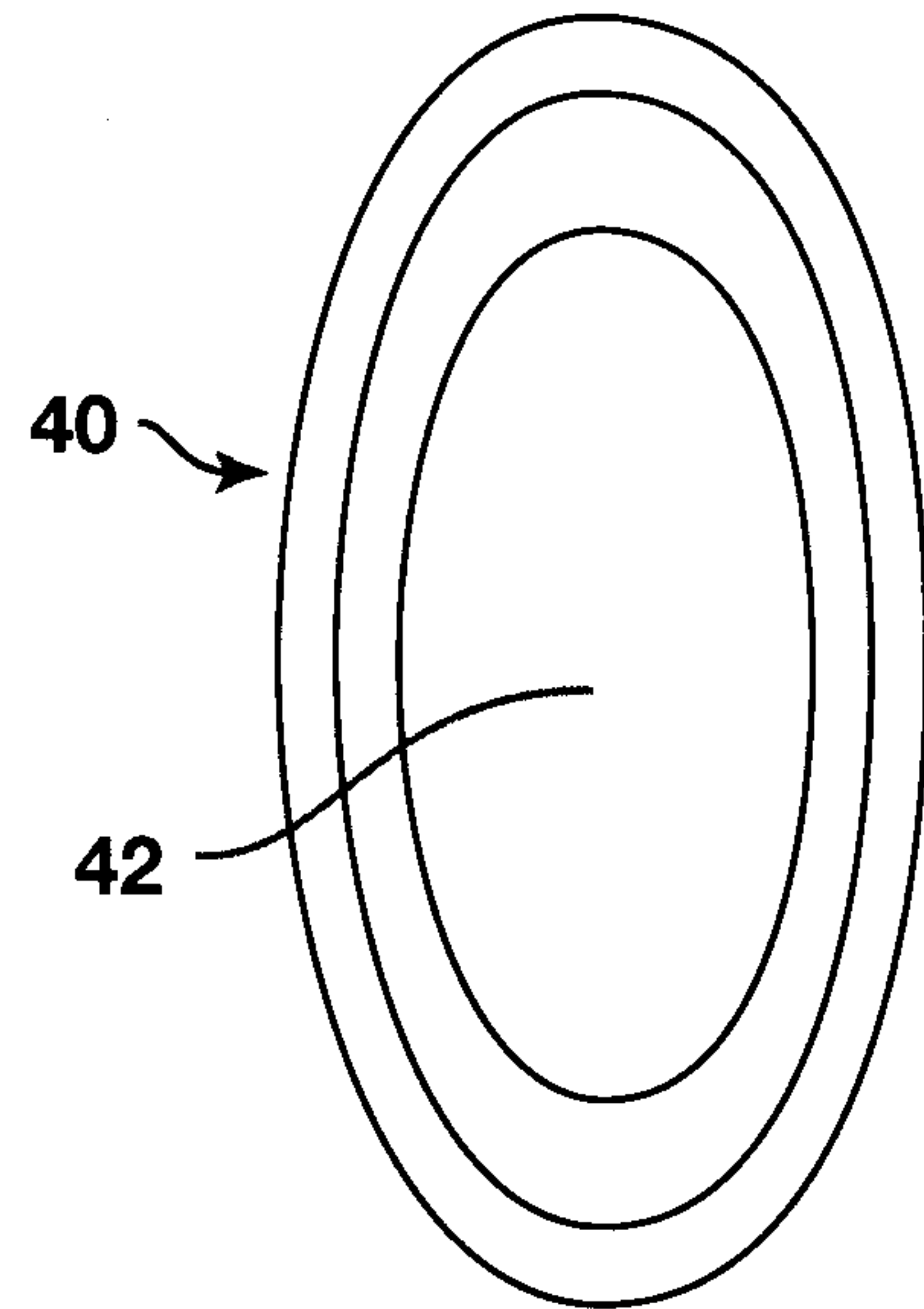


Fig. 11

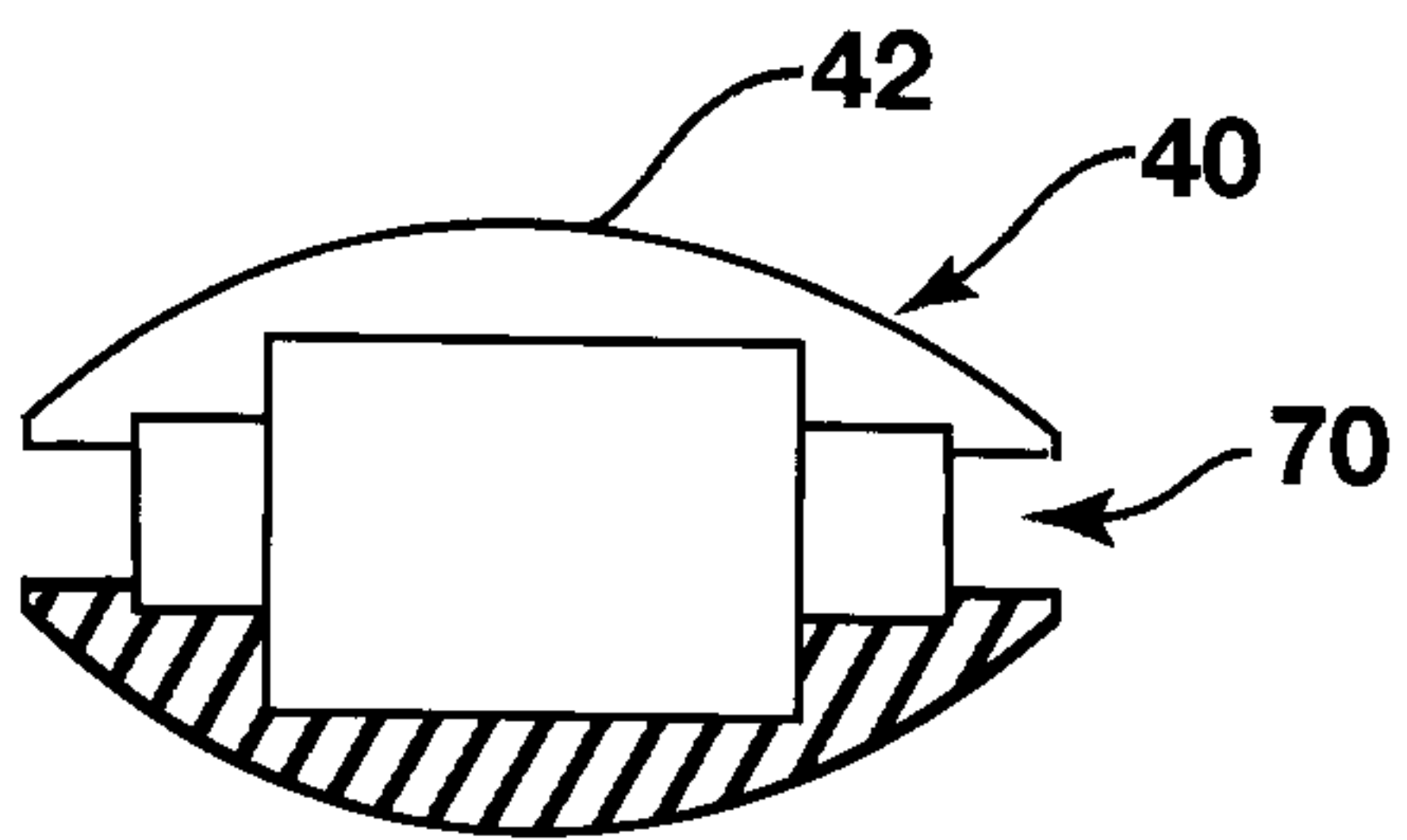
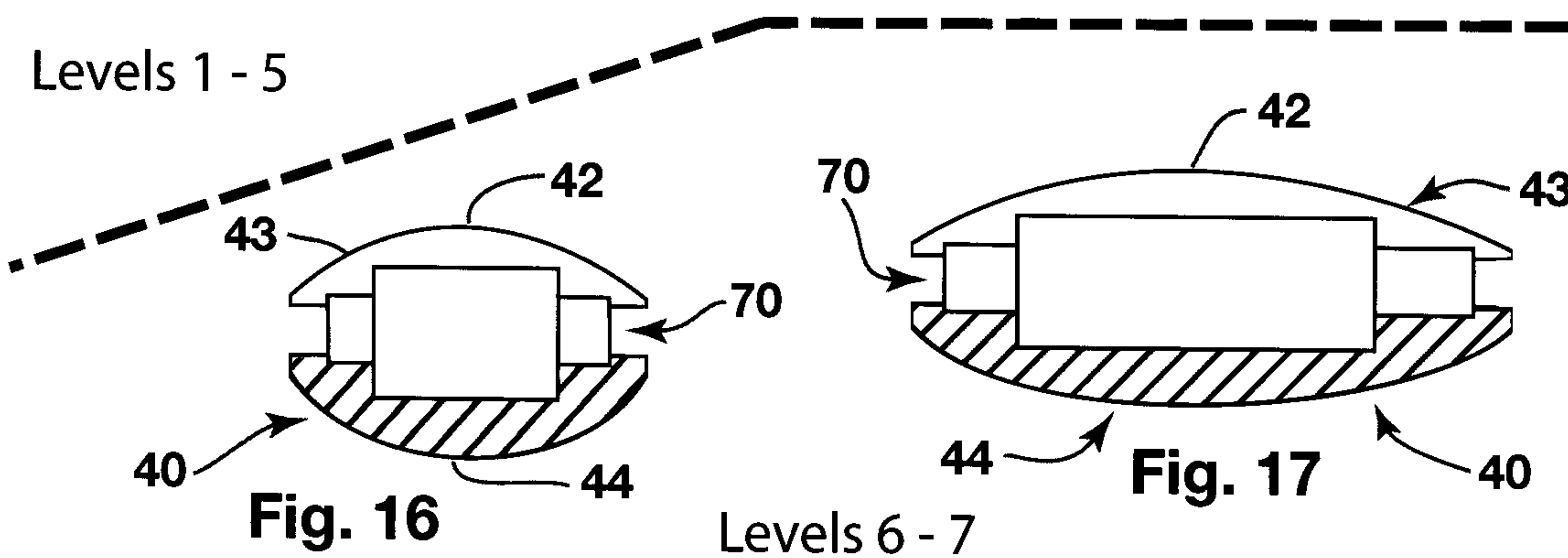
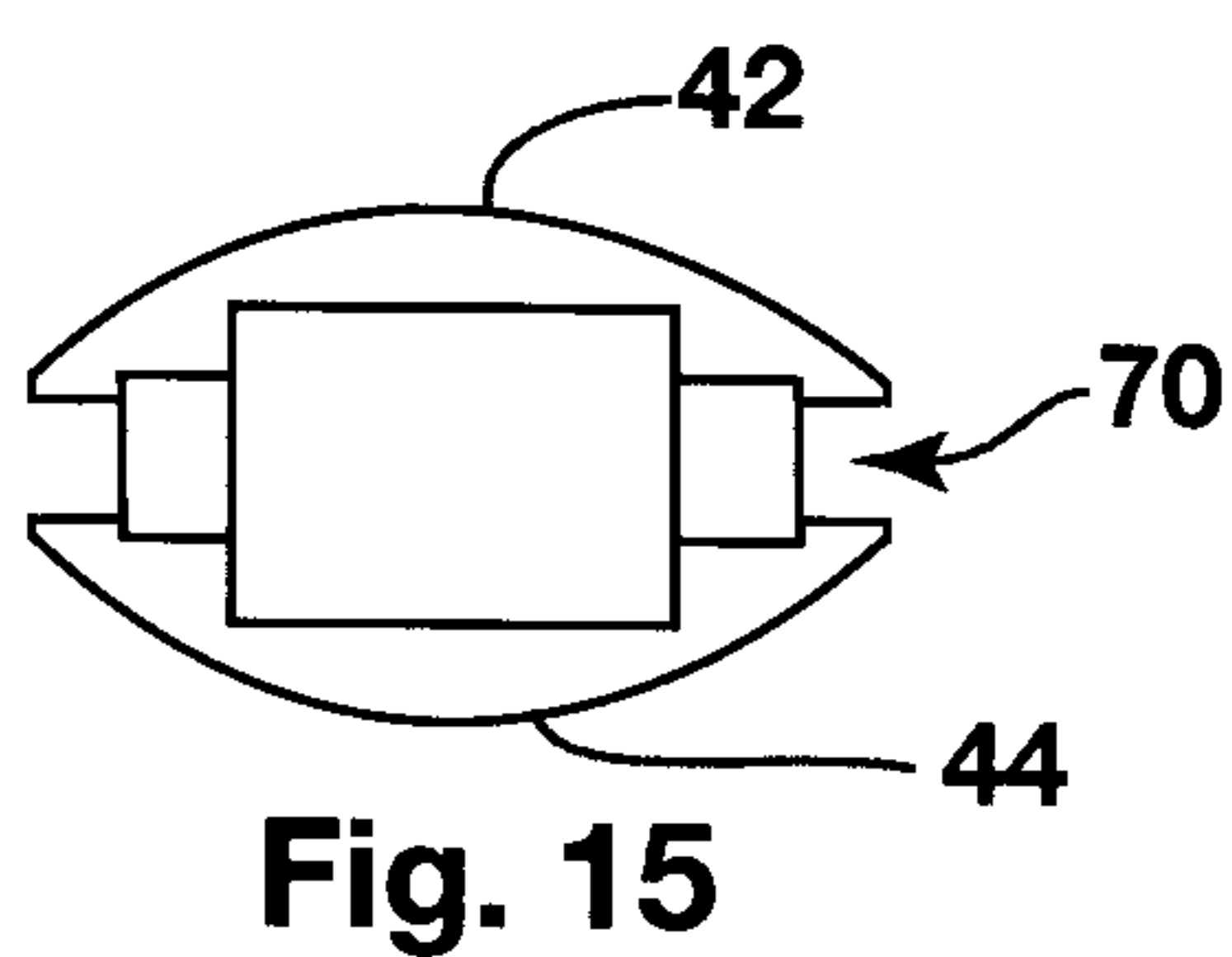
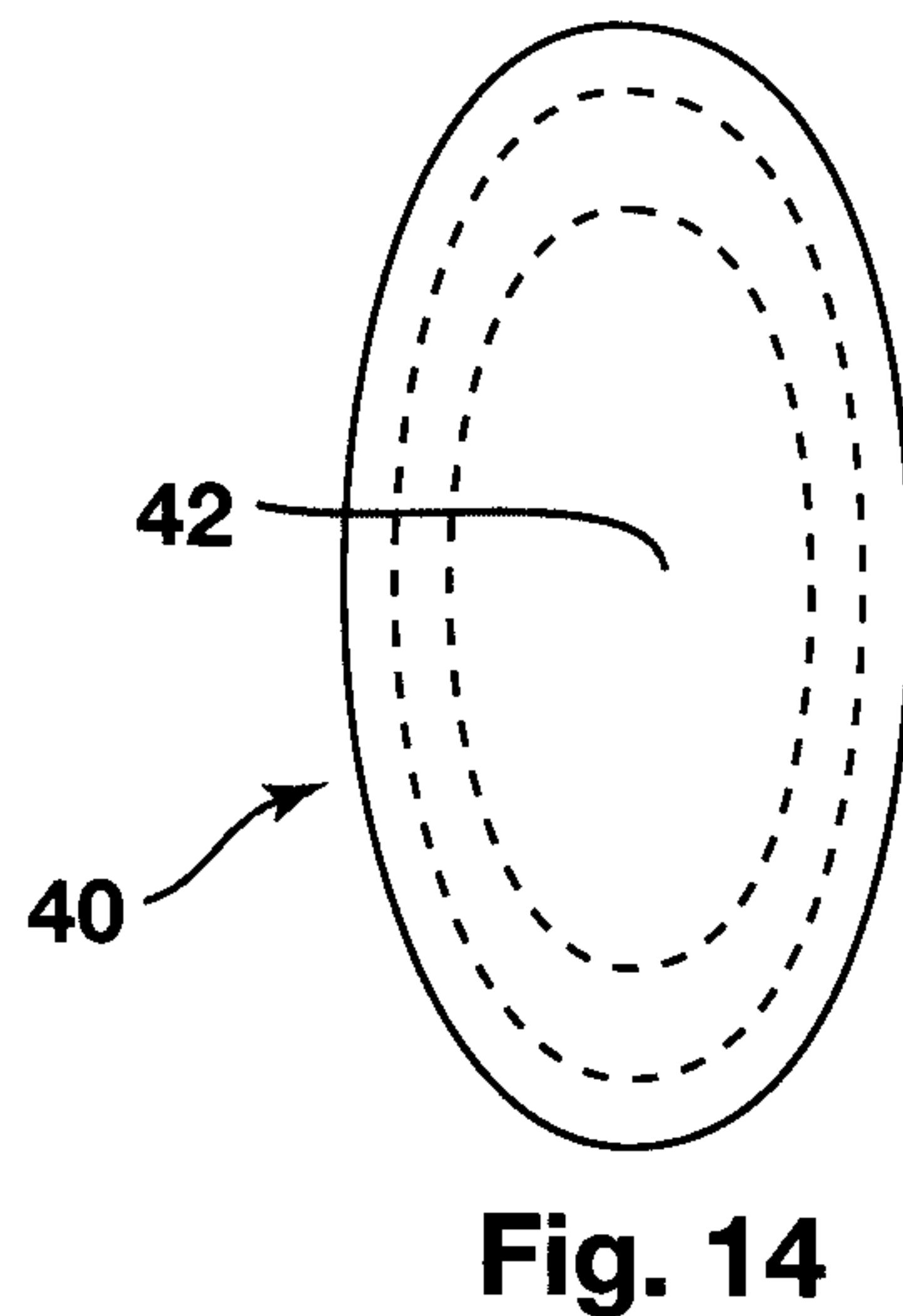
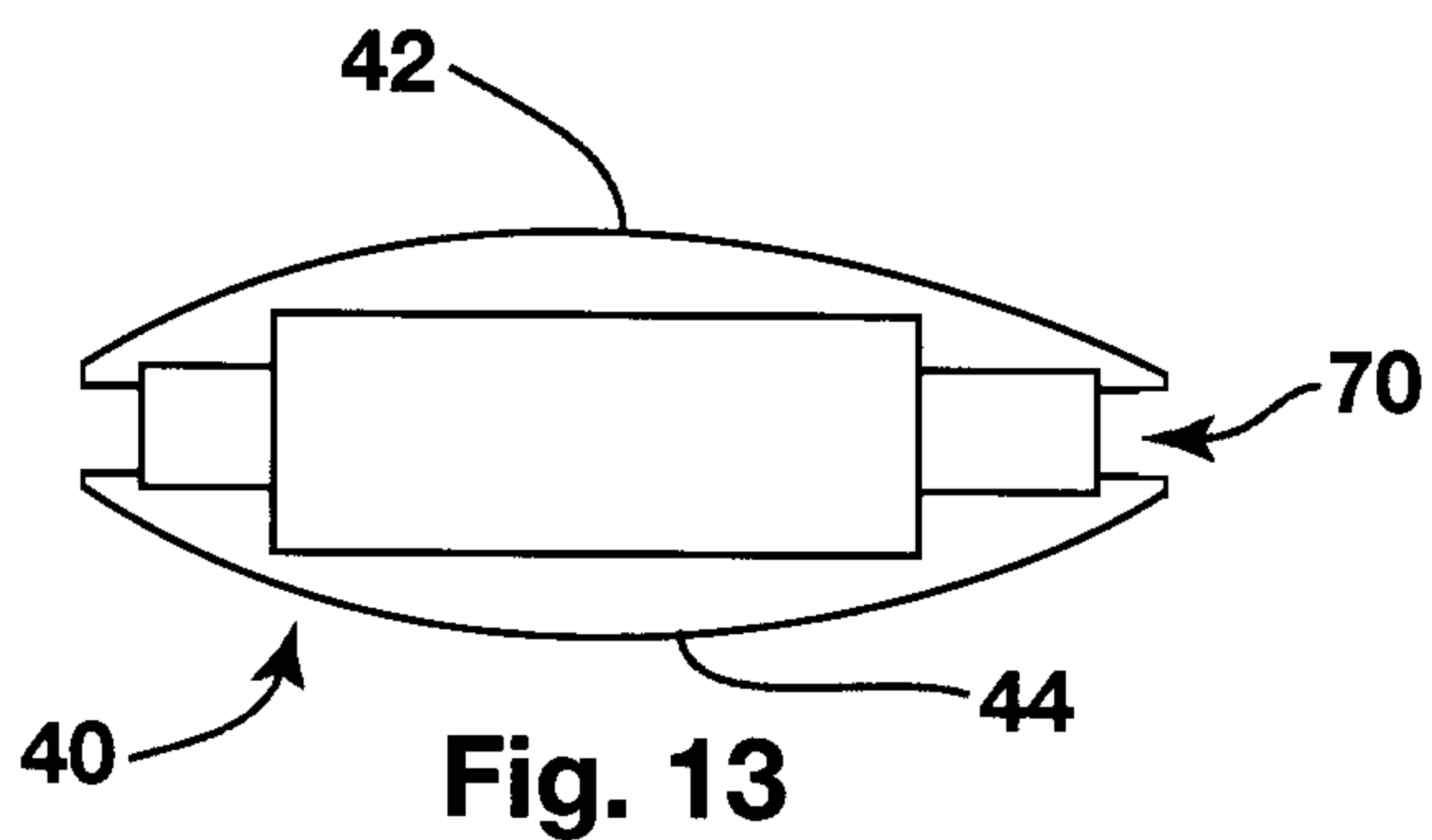
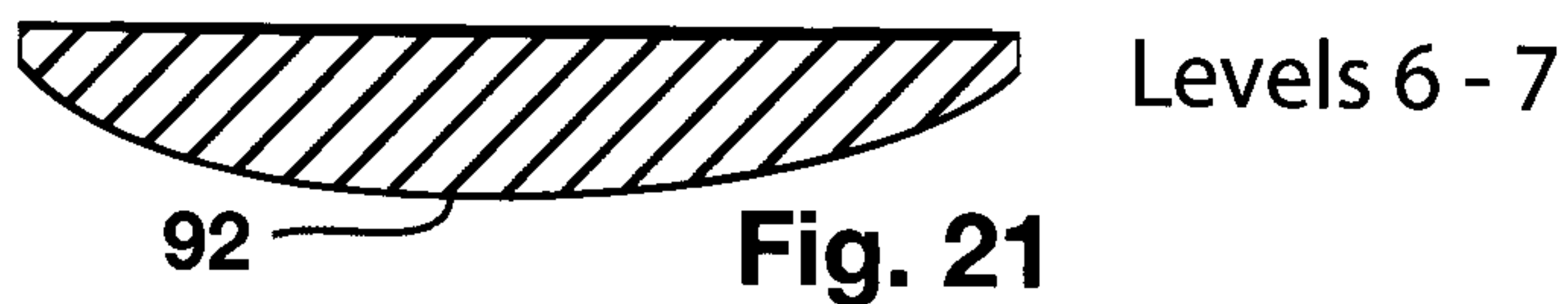
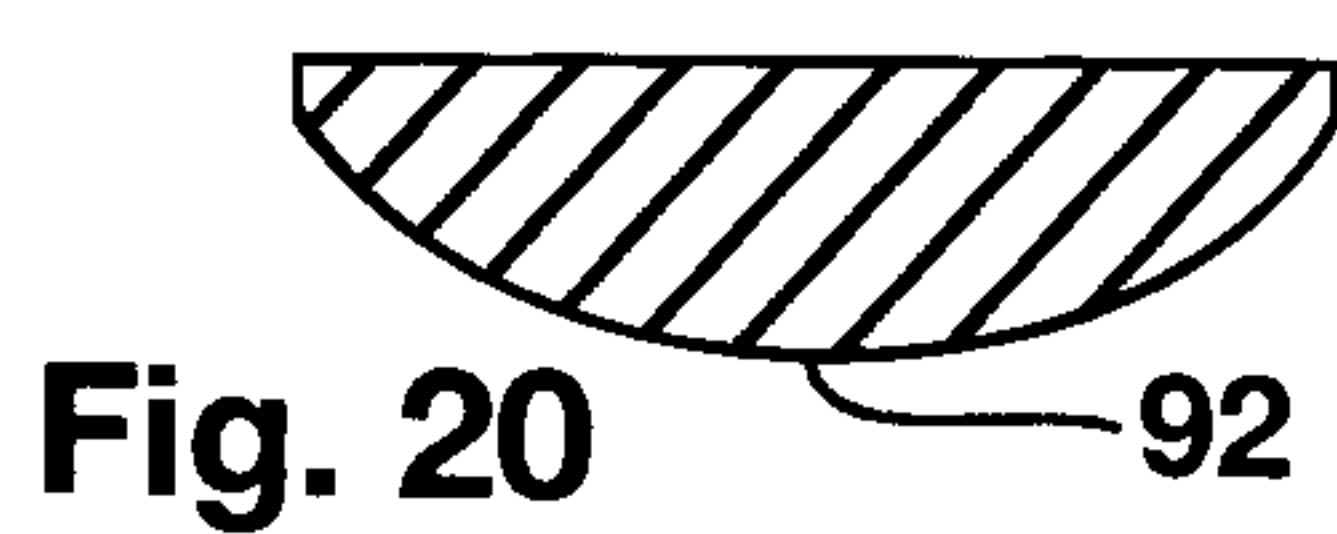
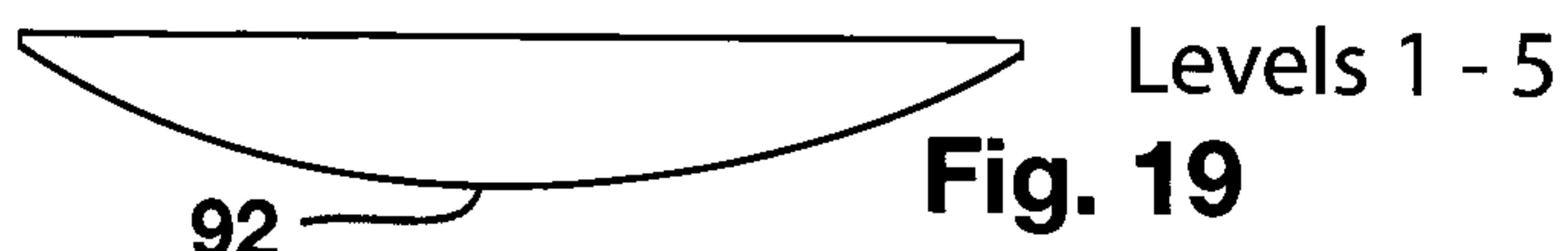
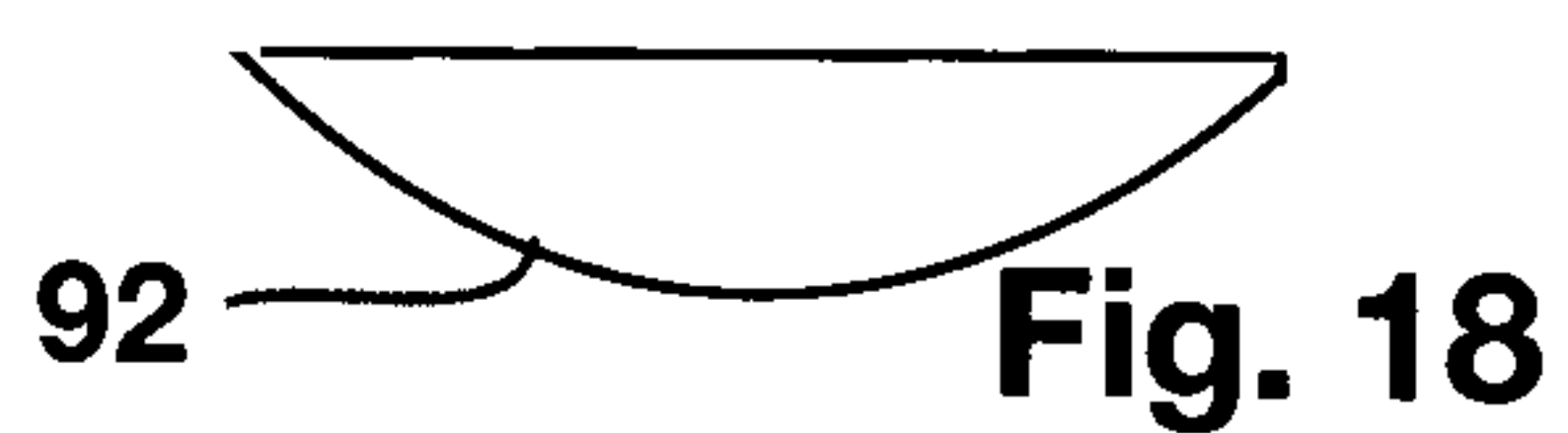


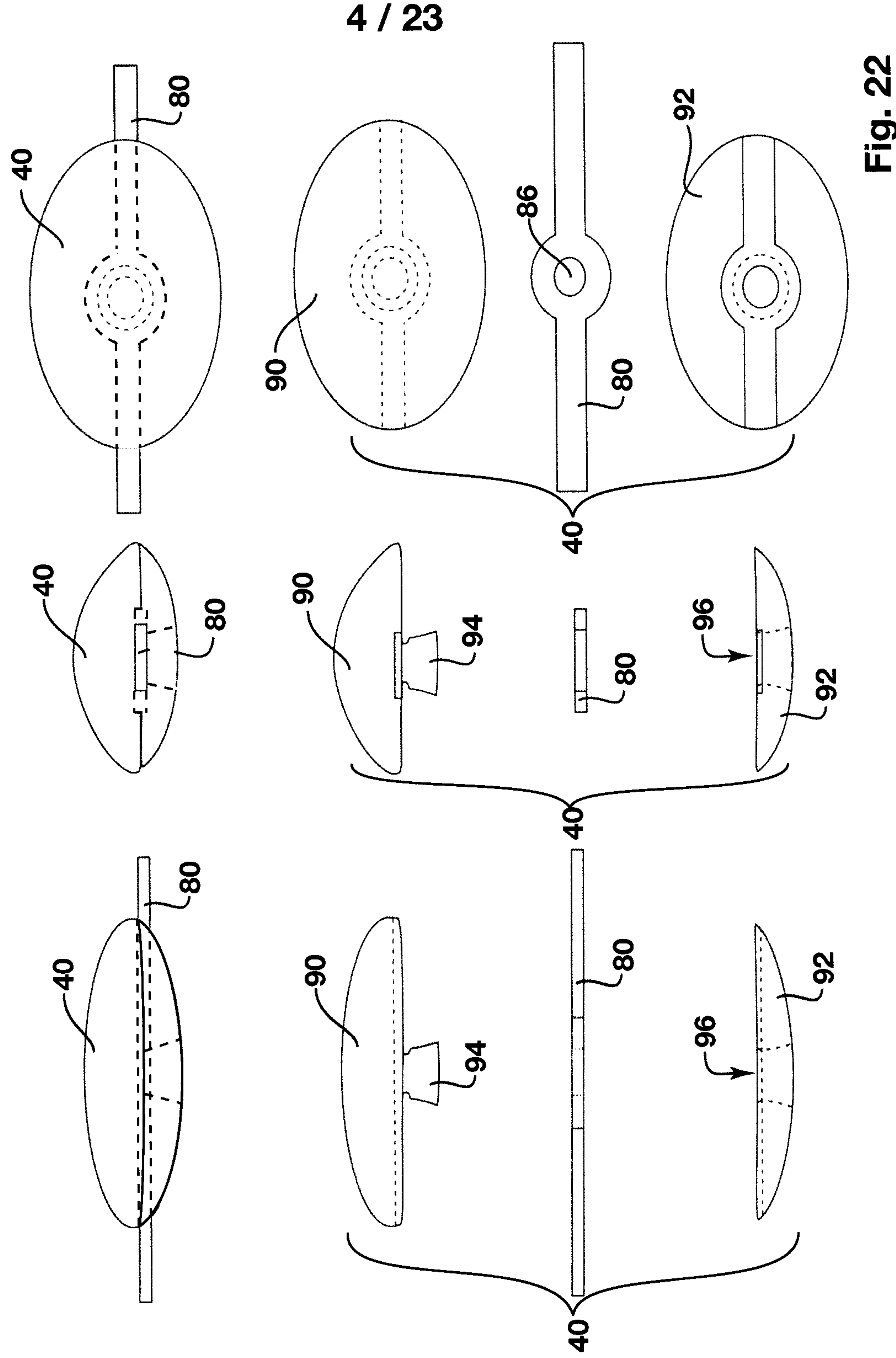
Fig. 12

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Bottom Shapes





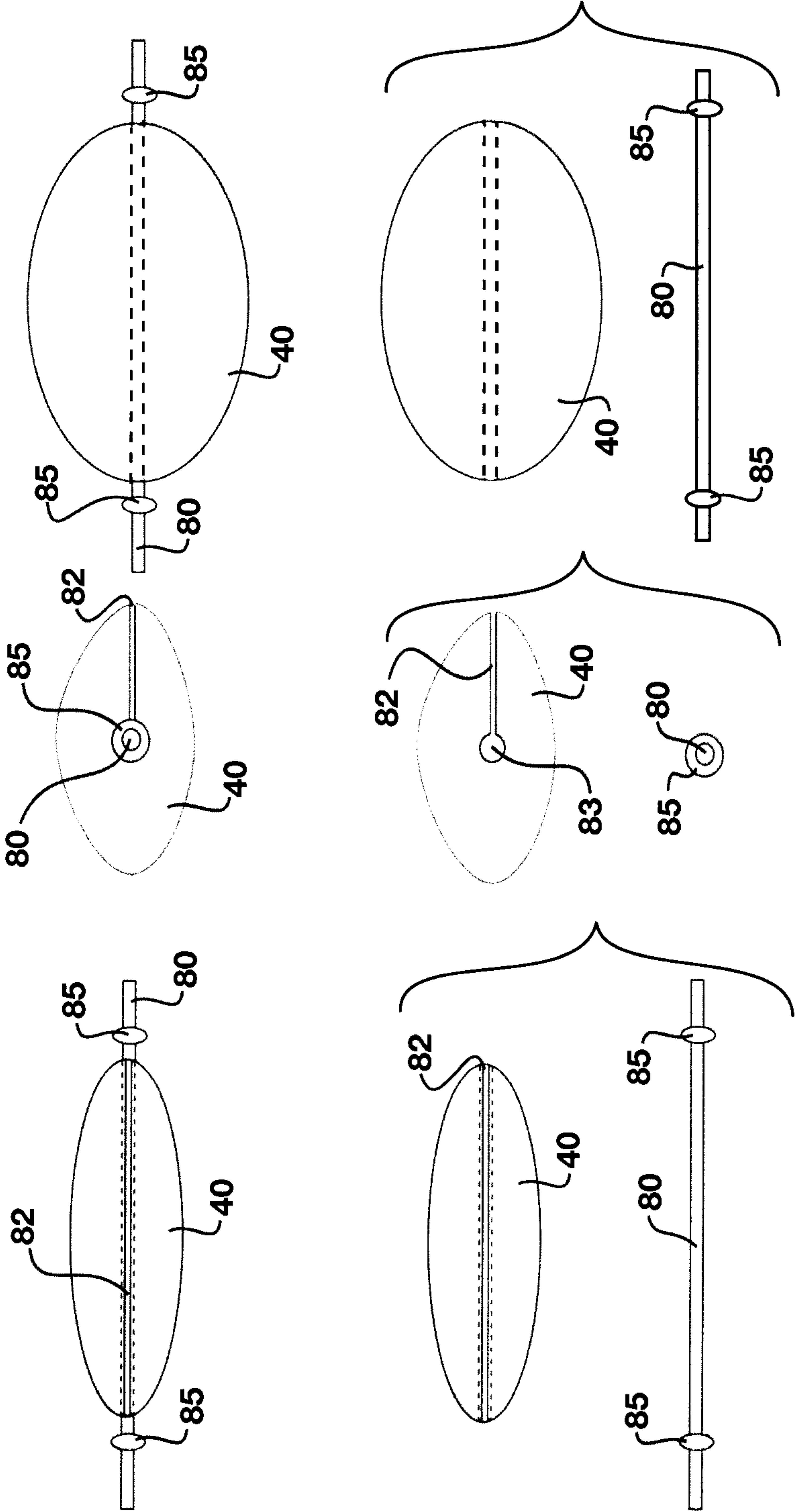


Fig. 23

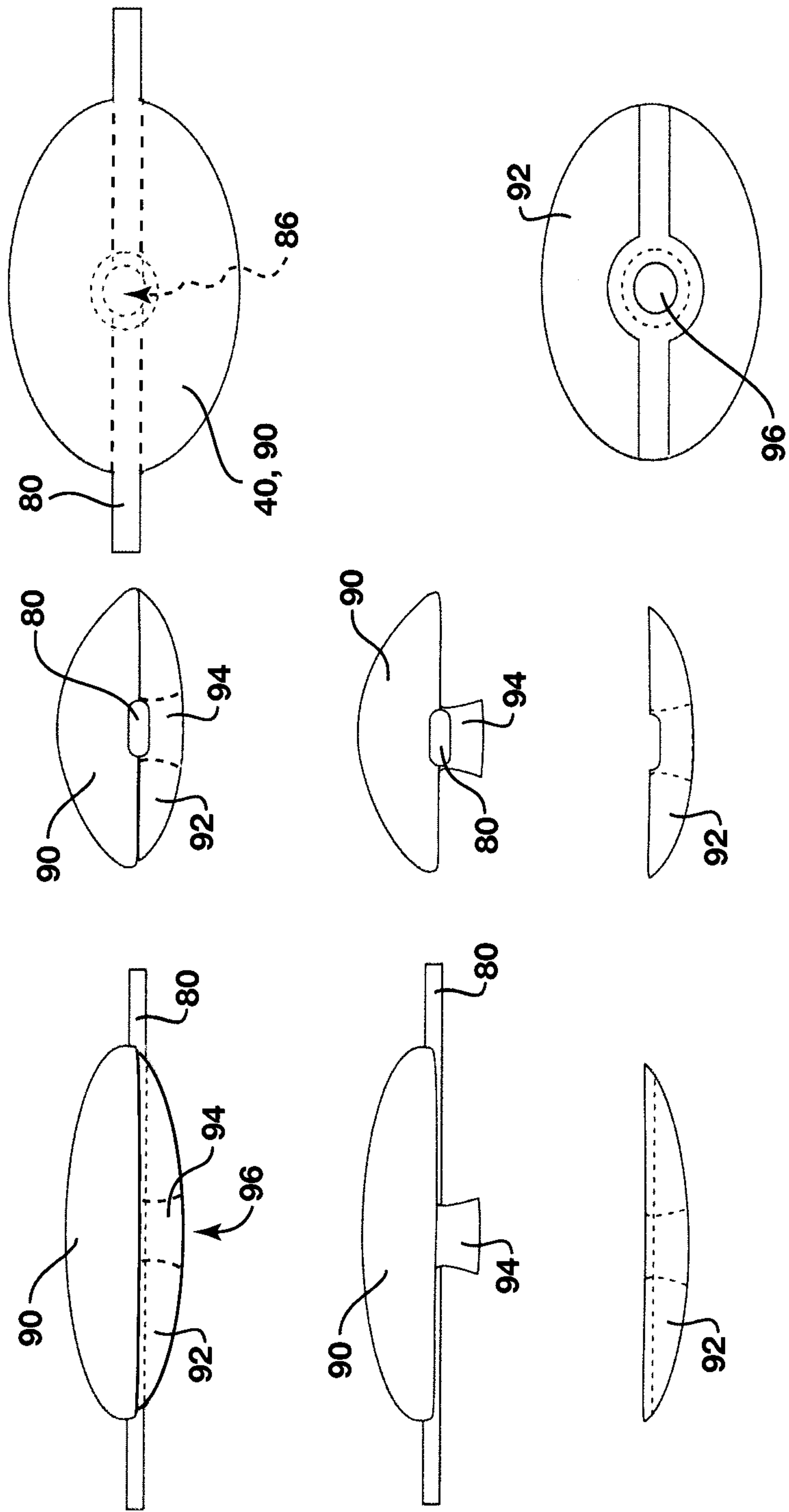


Fig. 24

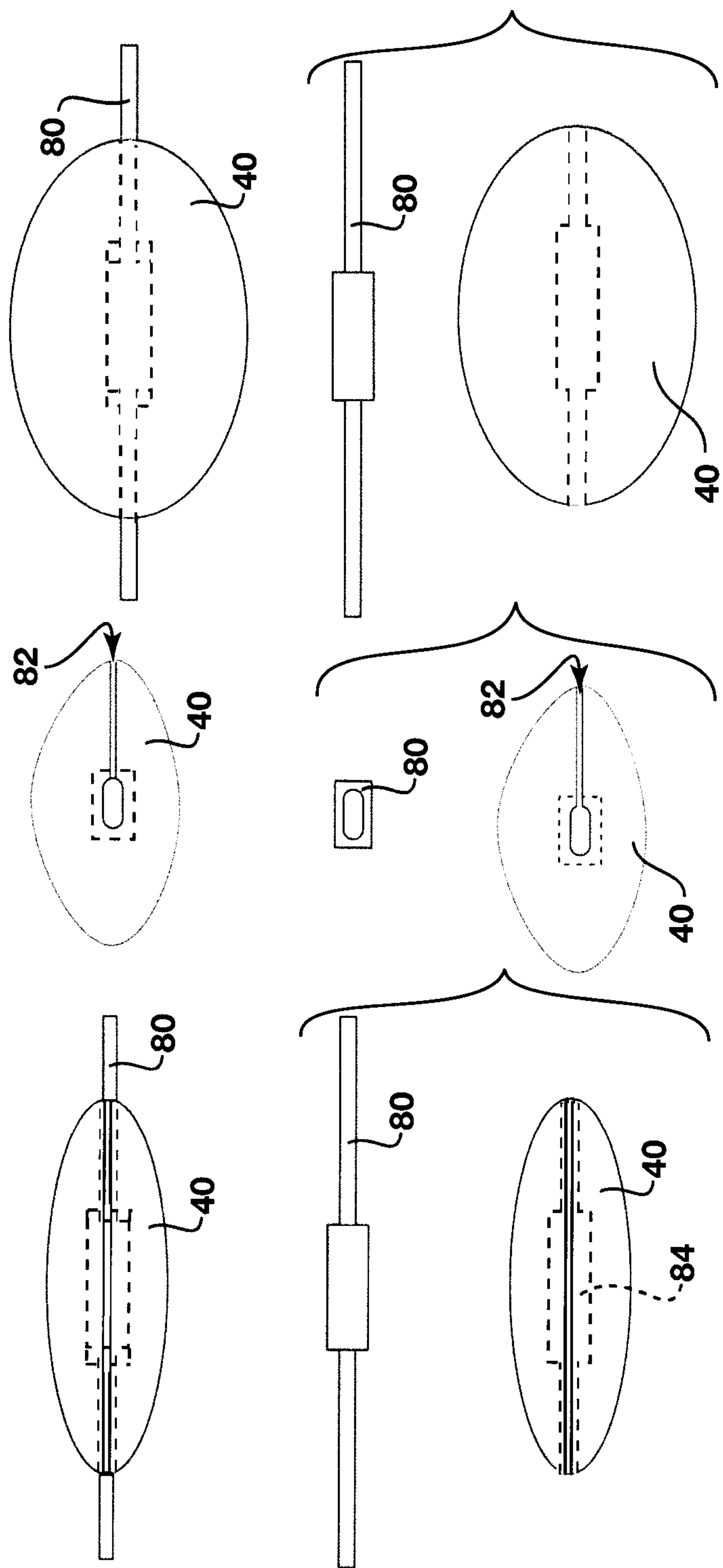


Fig. 25

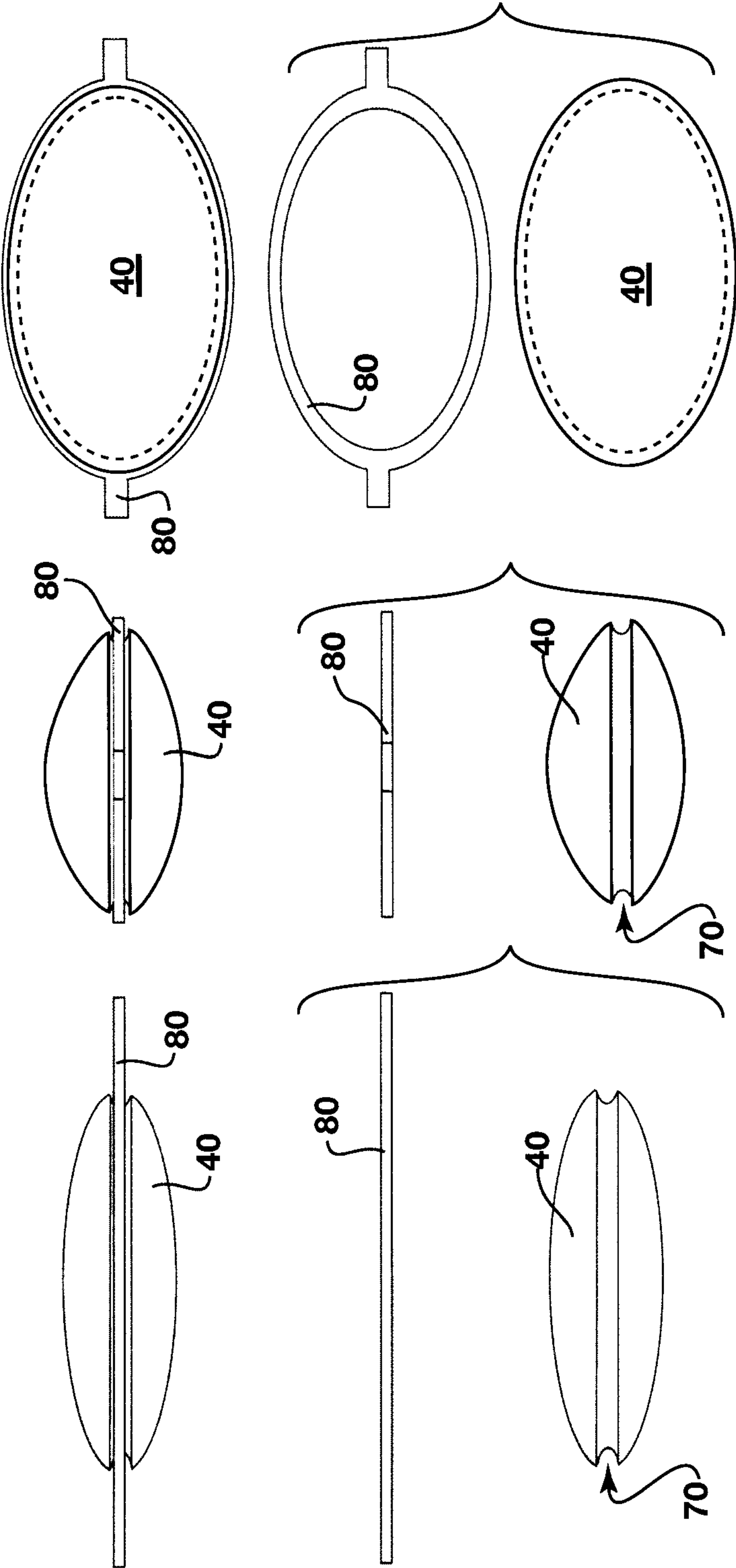


Fig. 26

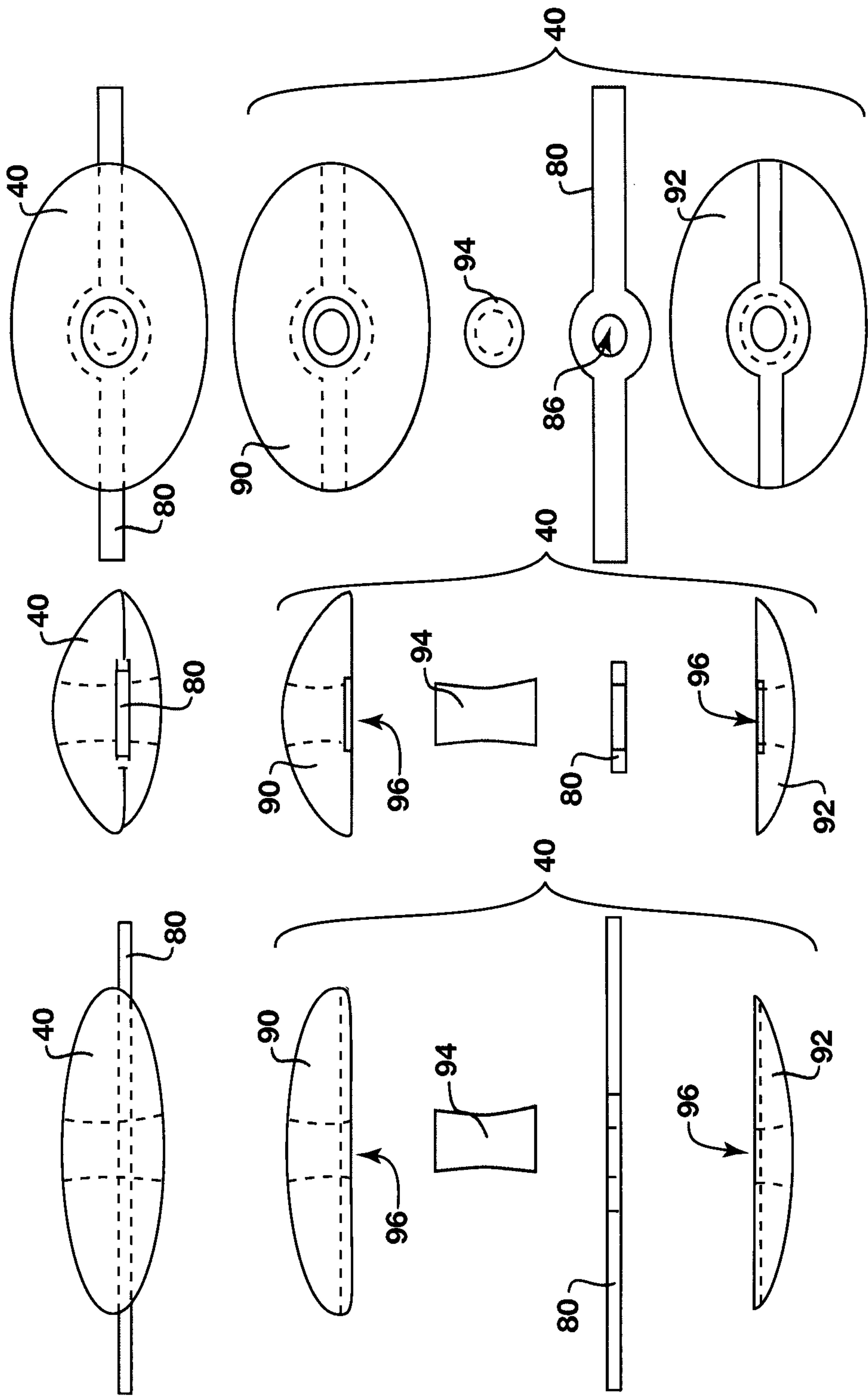


Fig. 27

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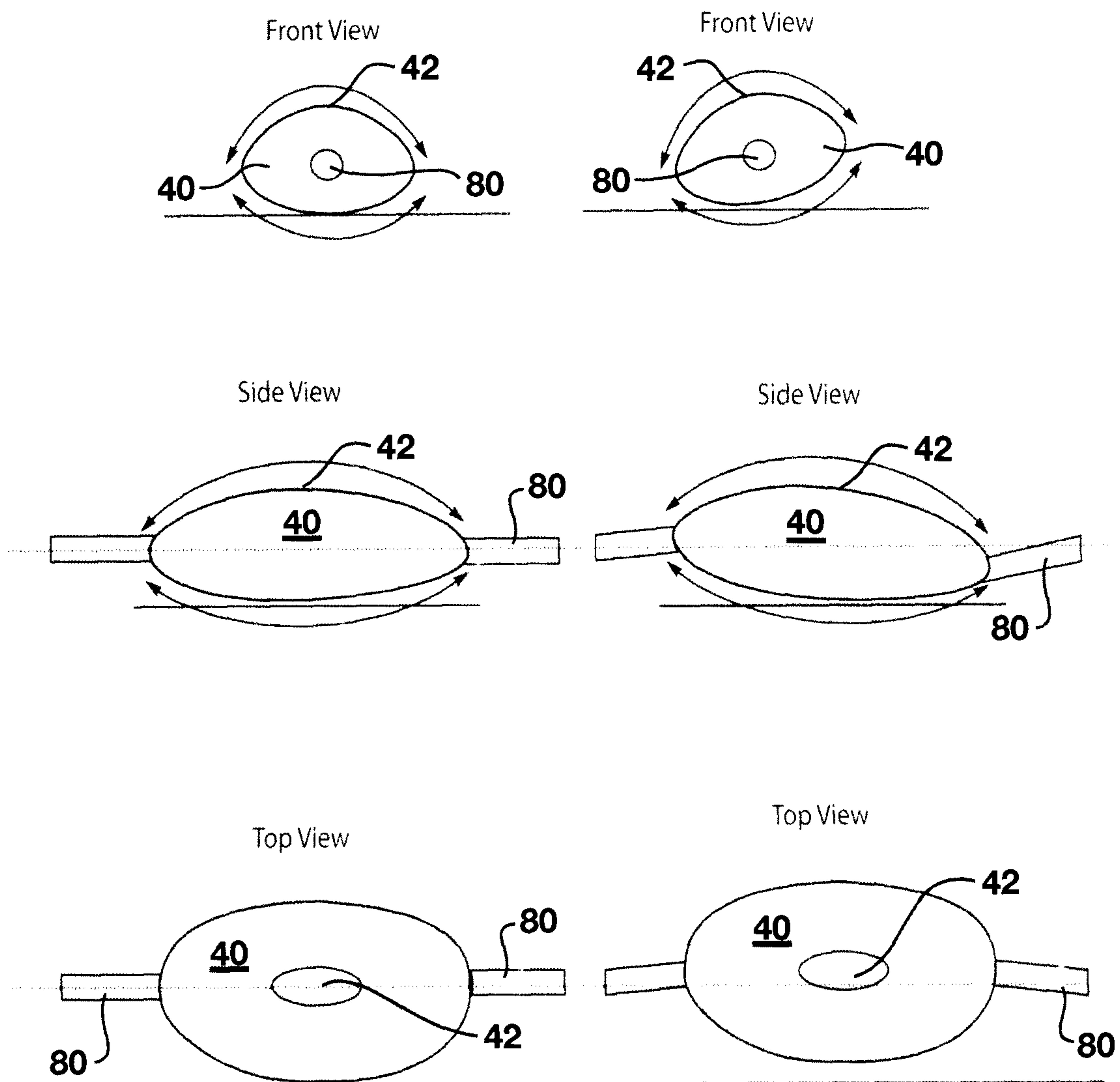


Fig. 28

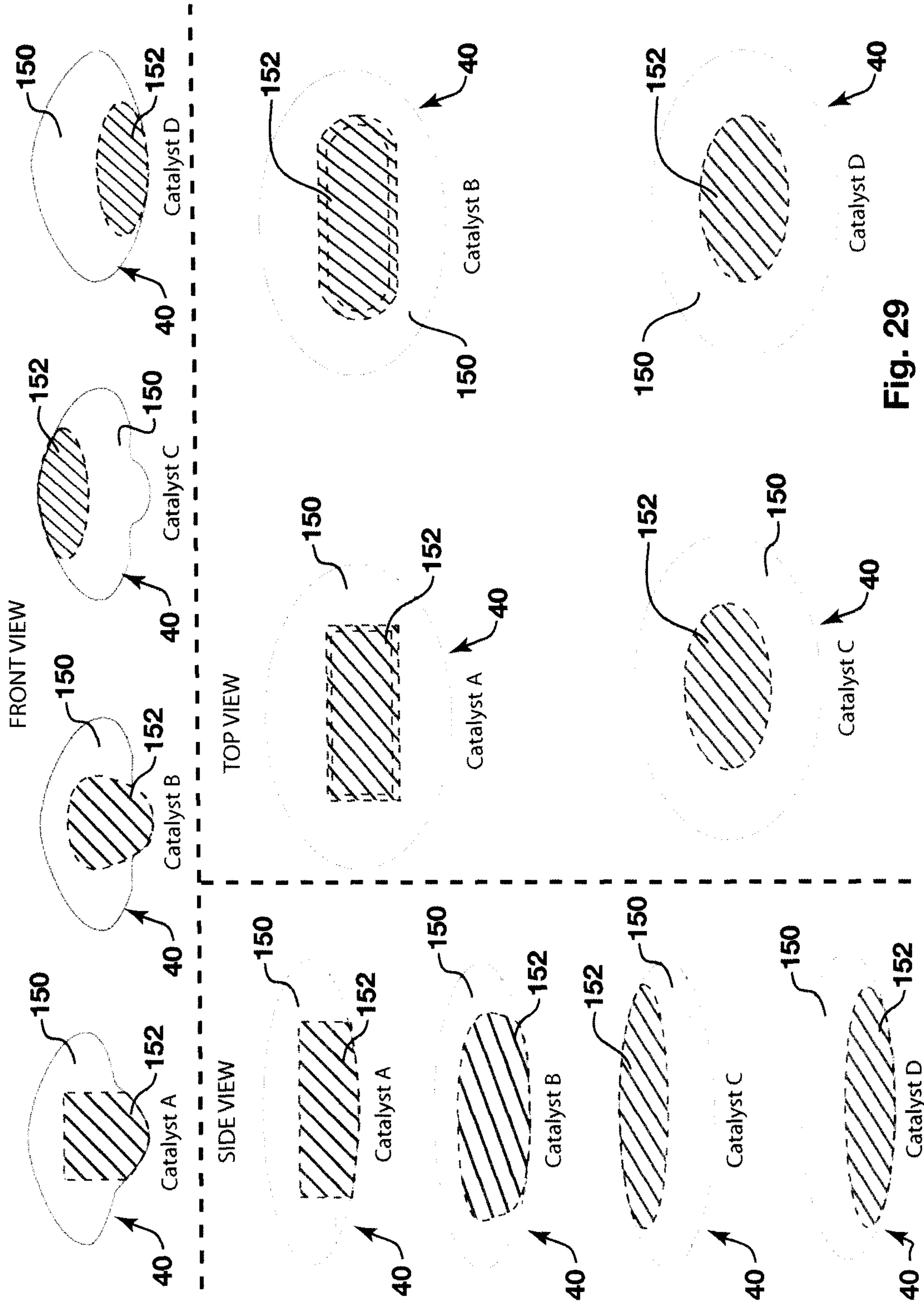
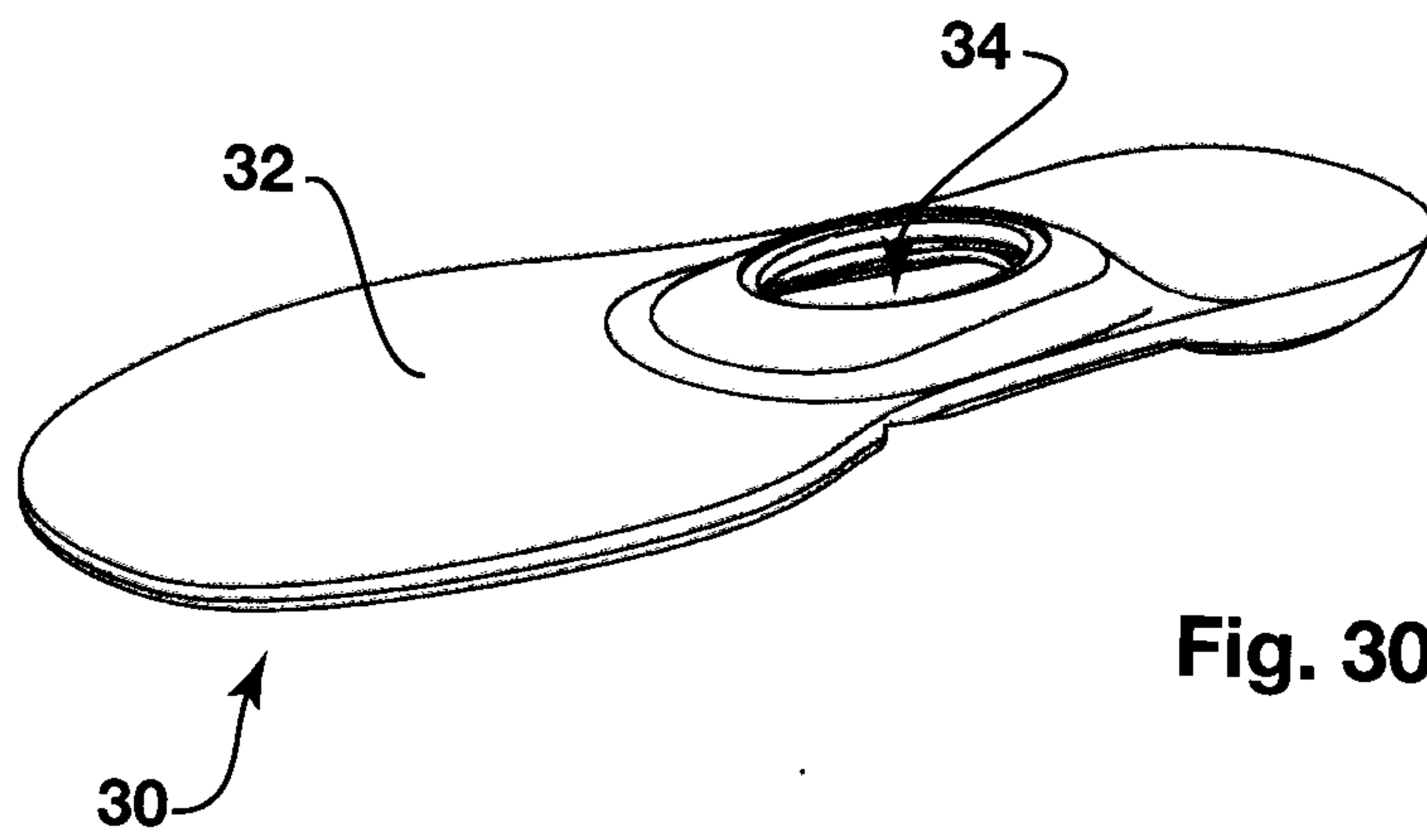
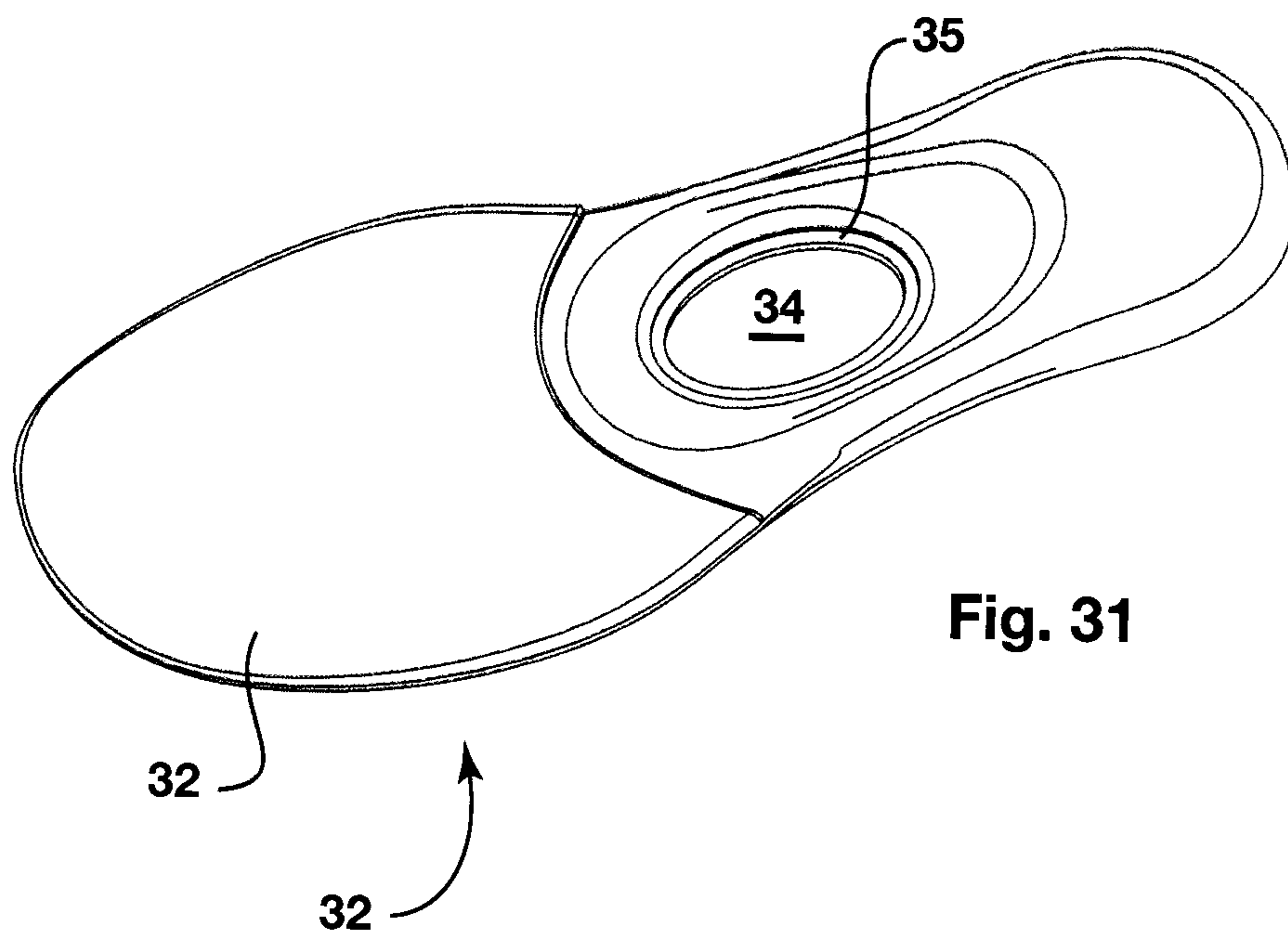


Fig. 29

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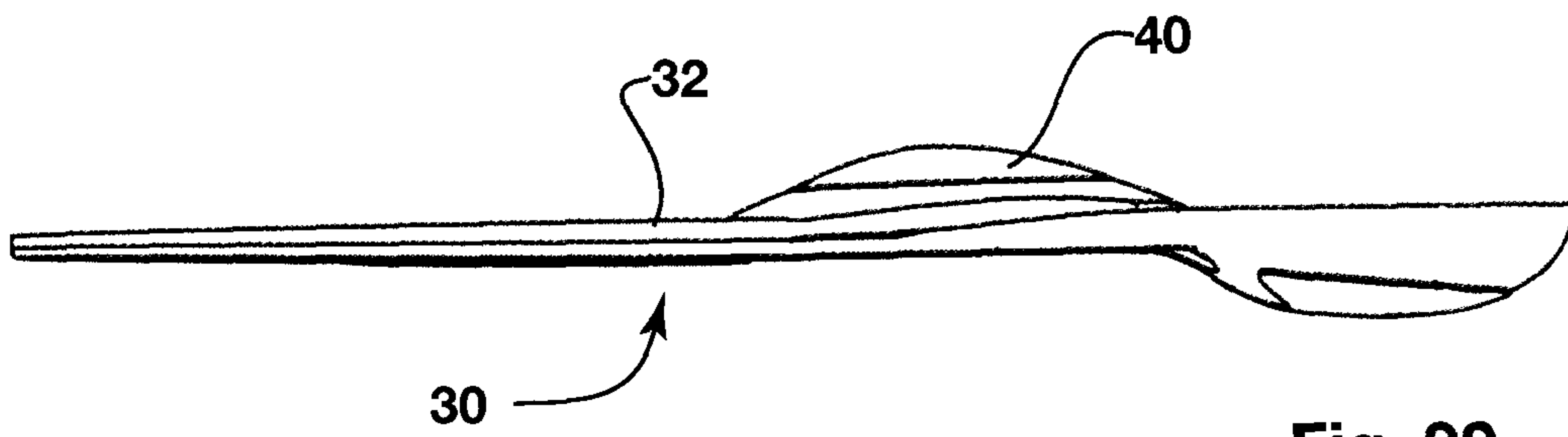
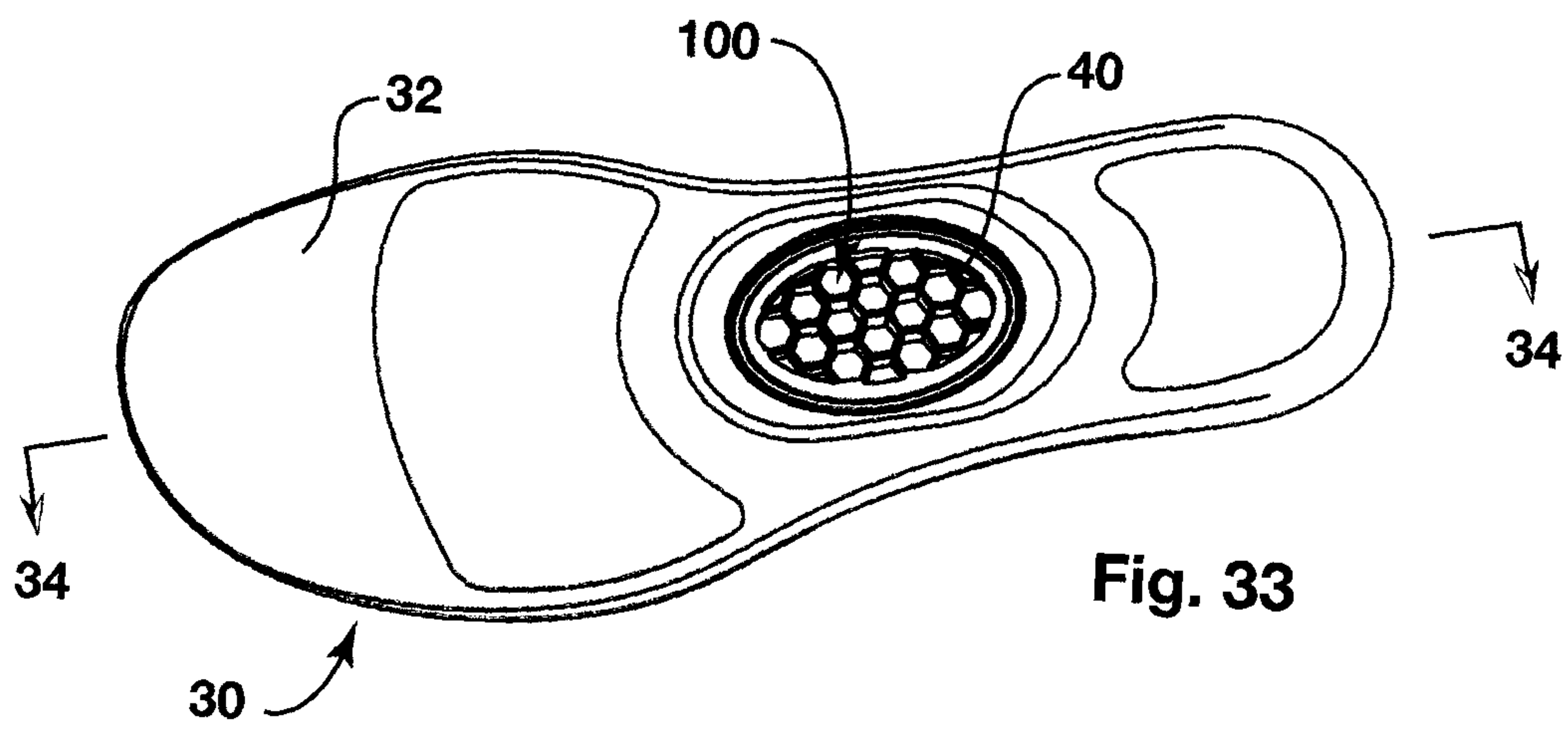


Fig. 32

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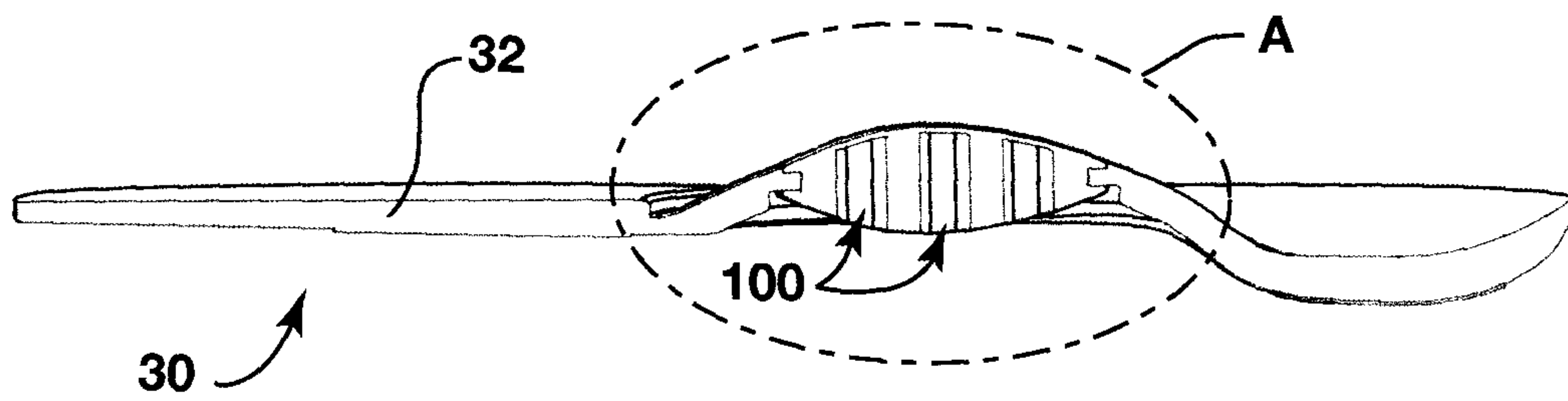
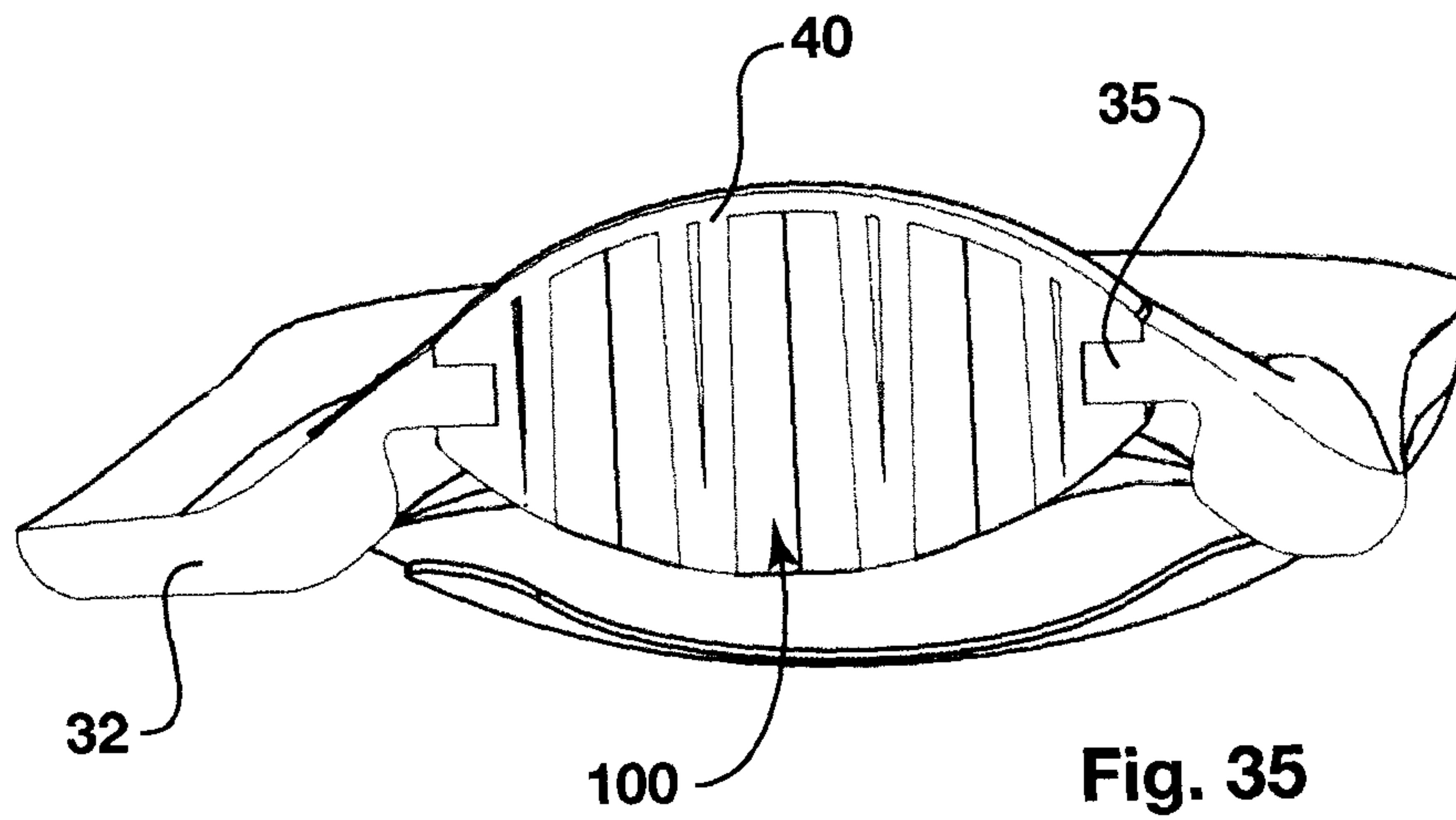


Fig. 34

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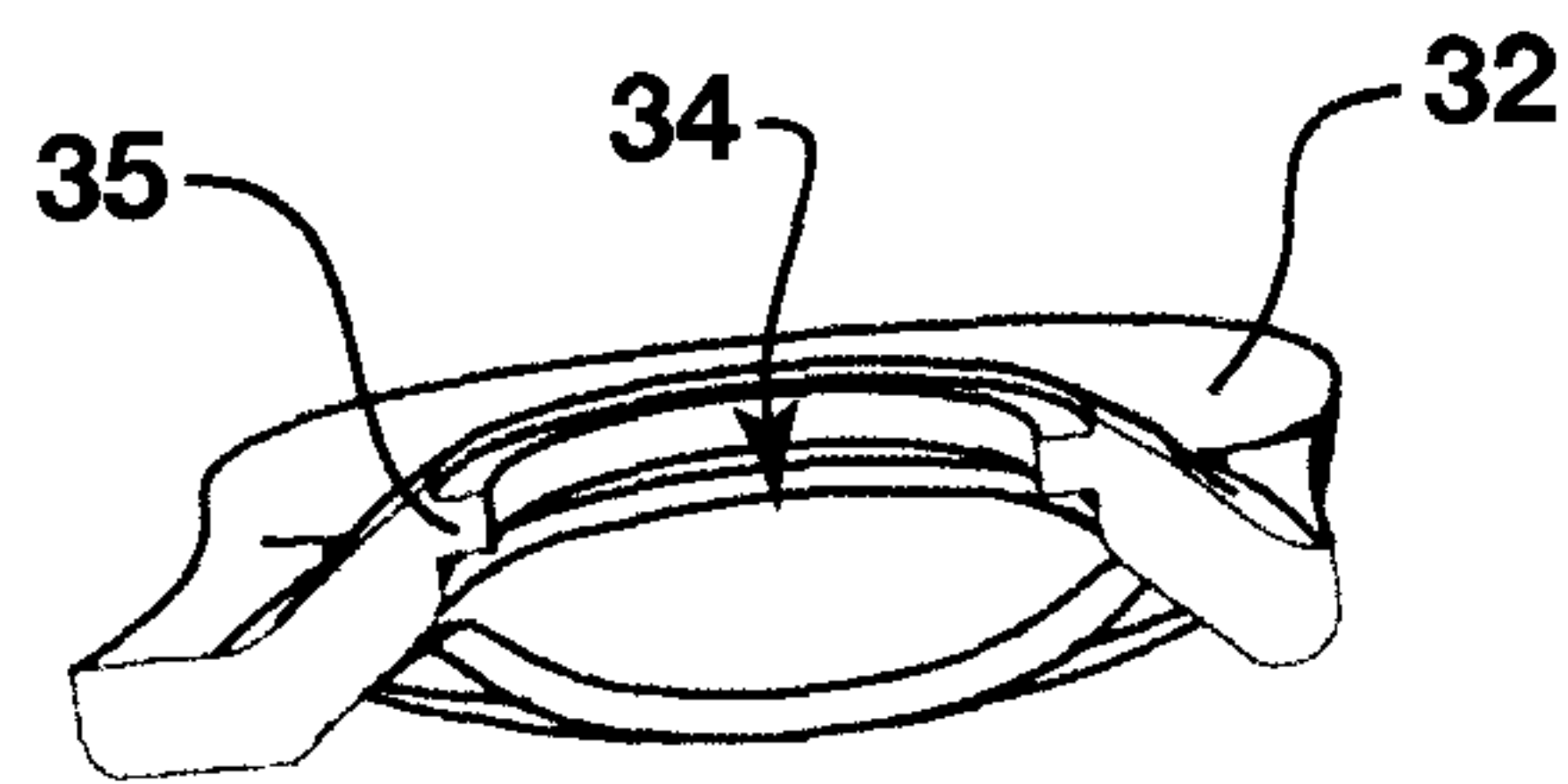
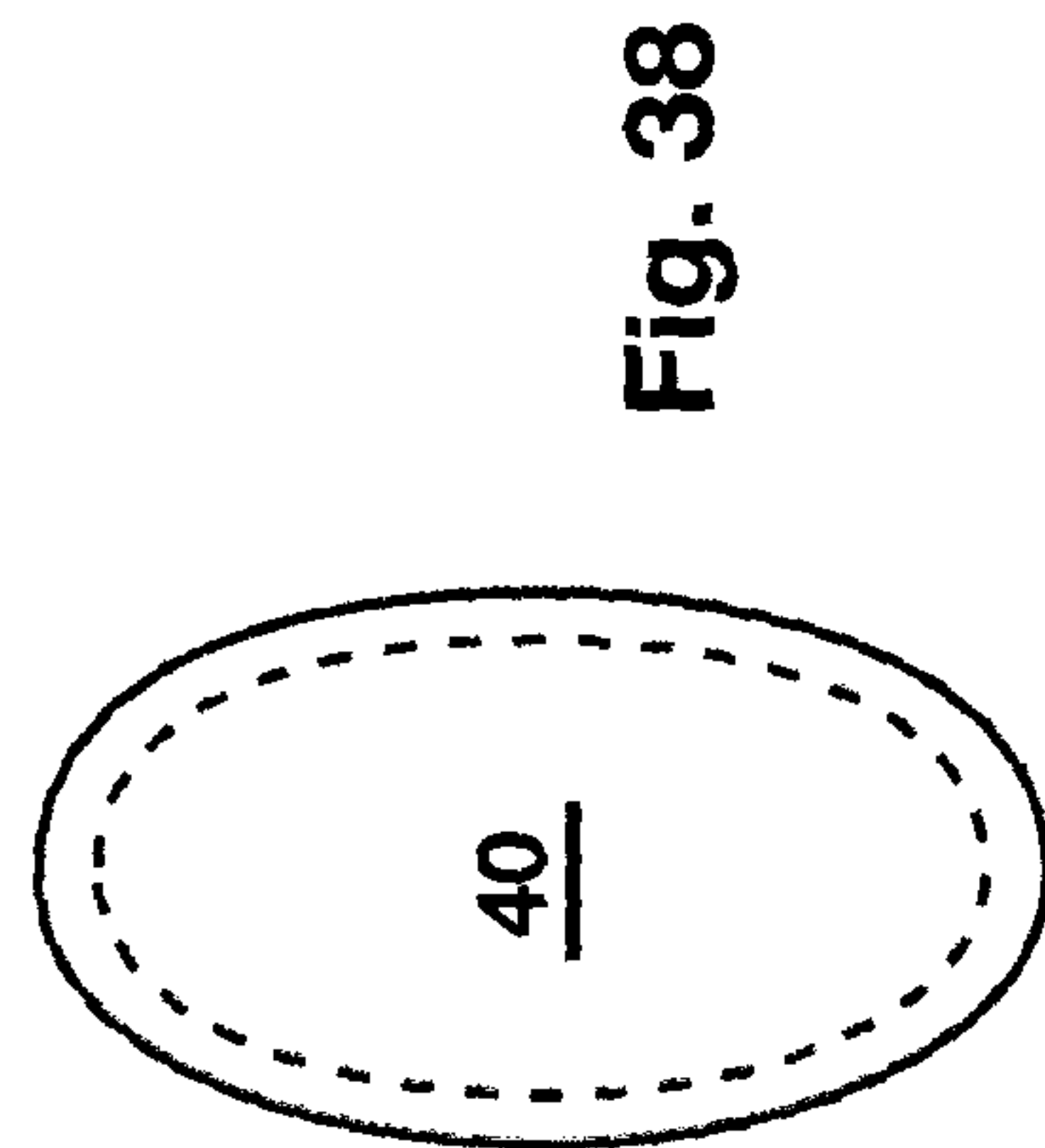
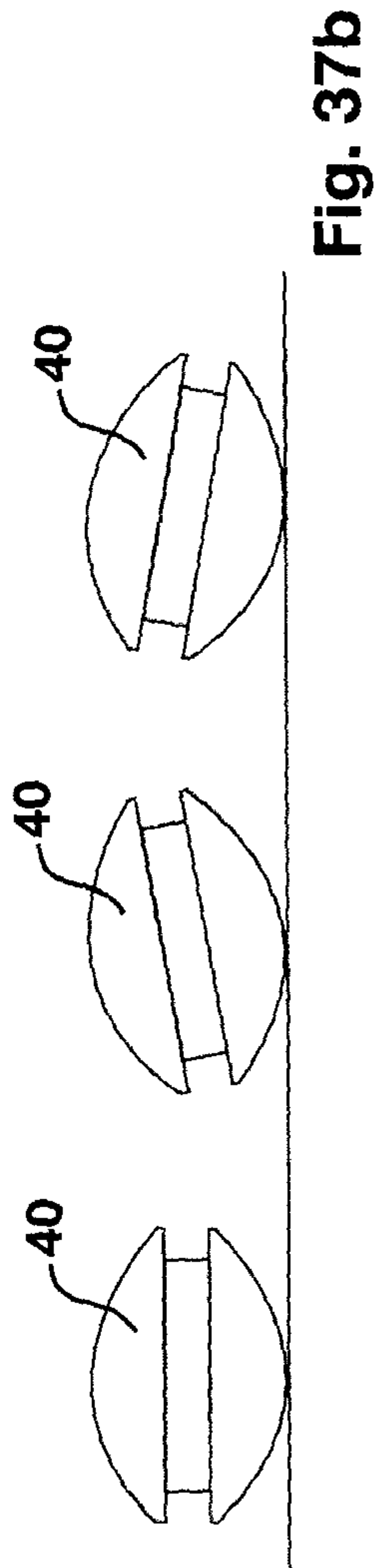
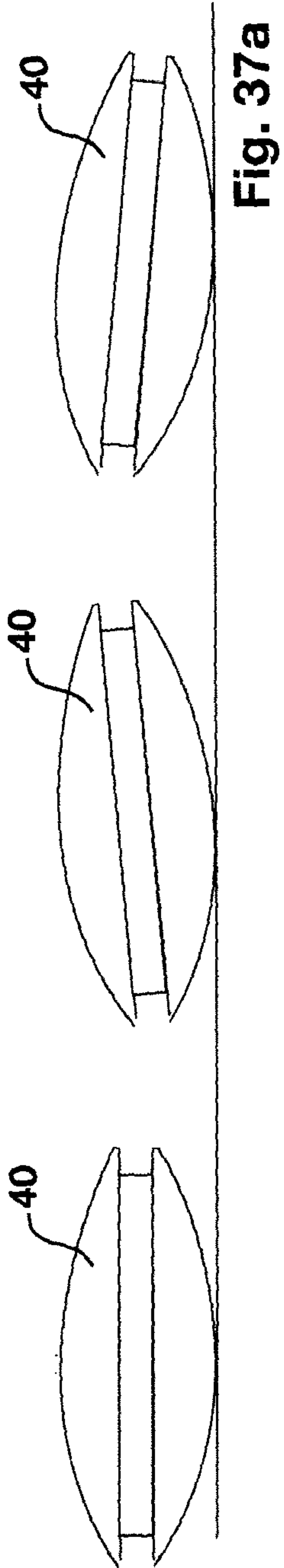
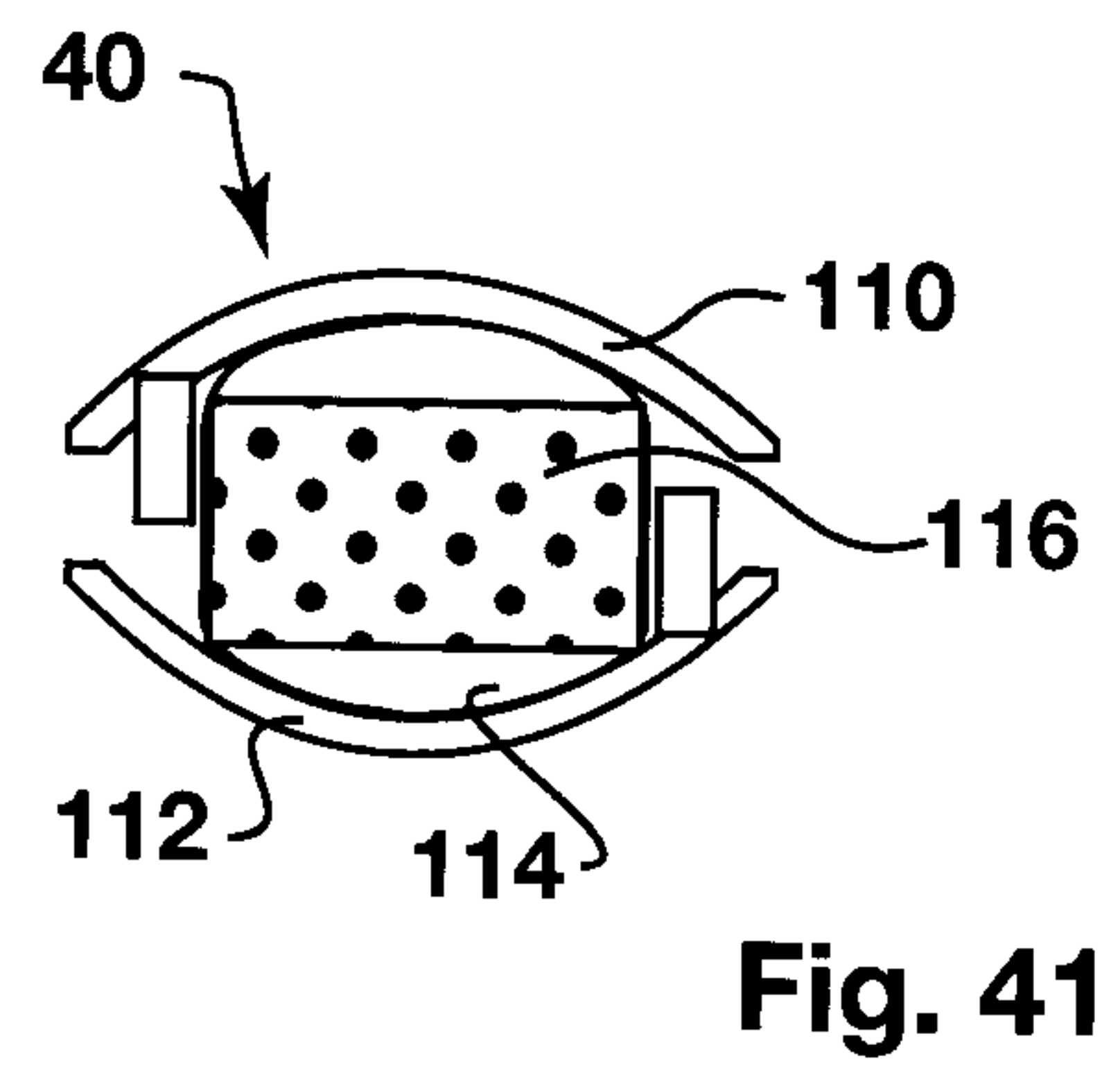
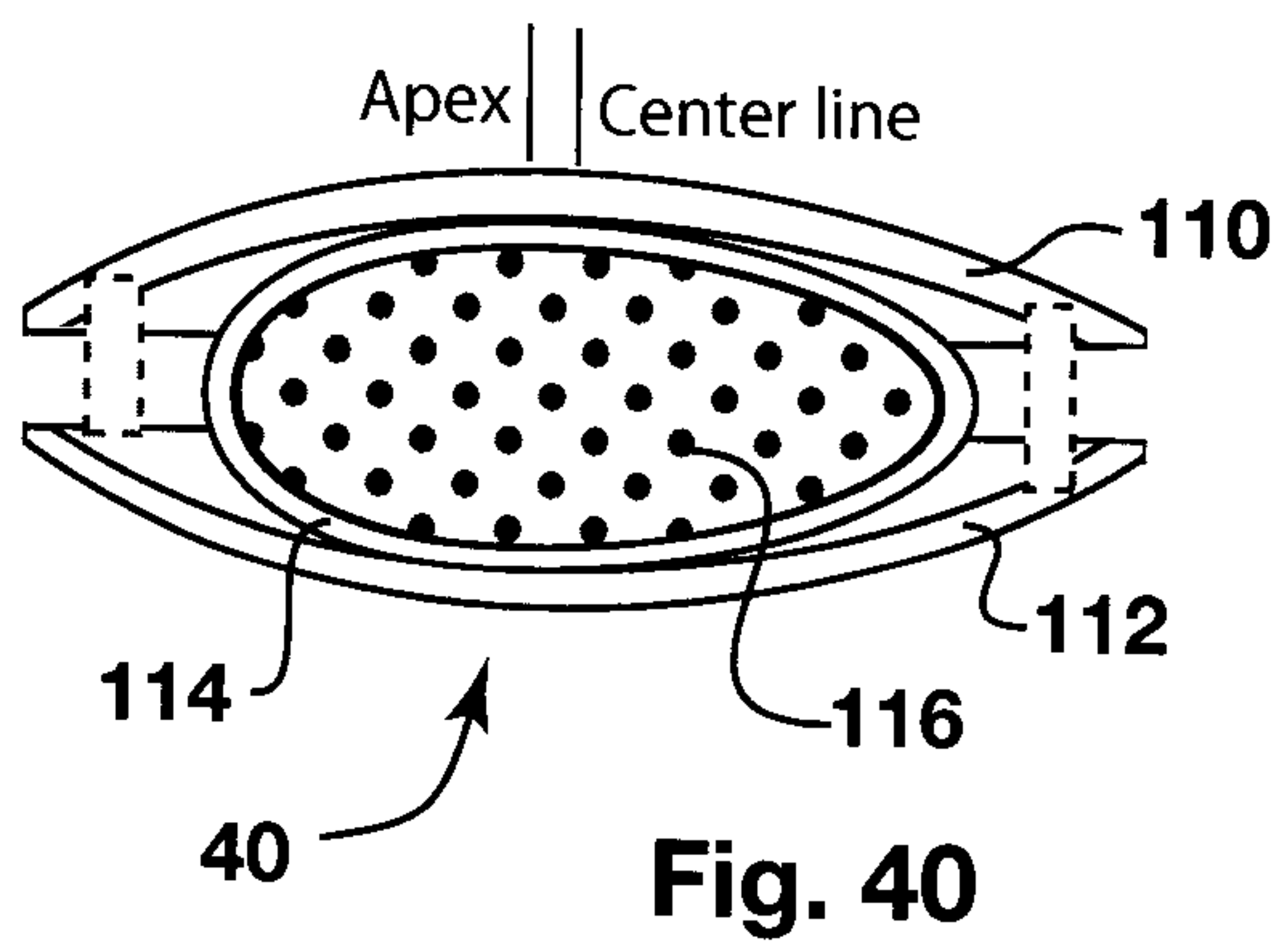
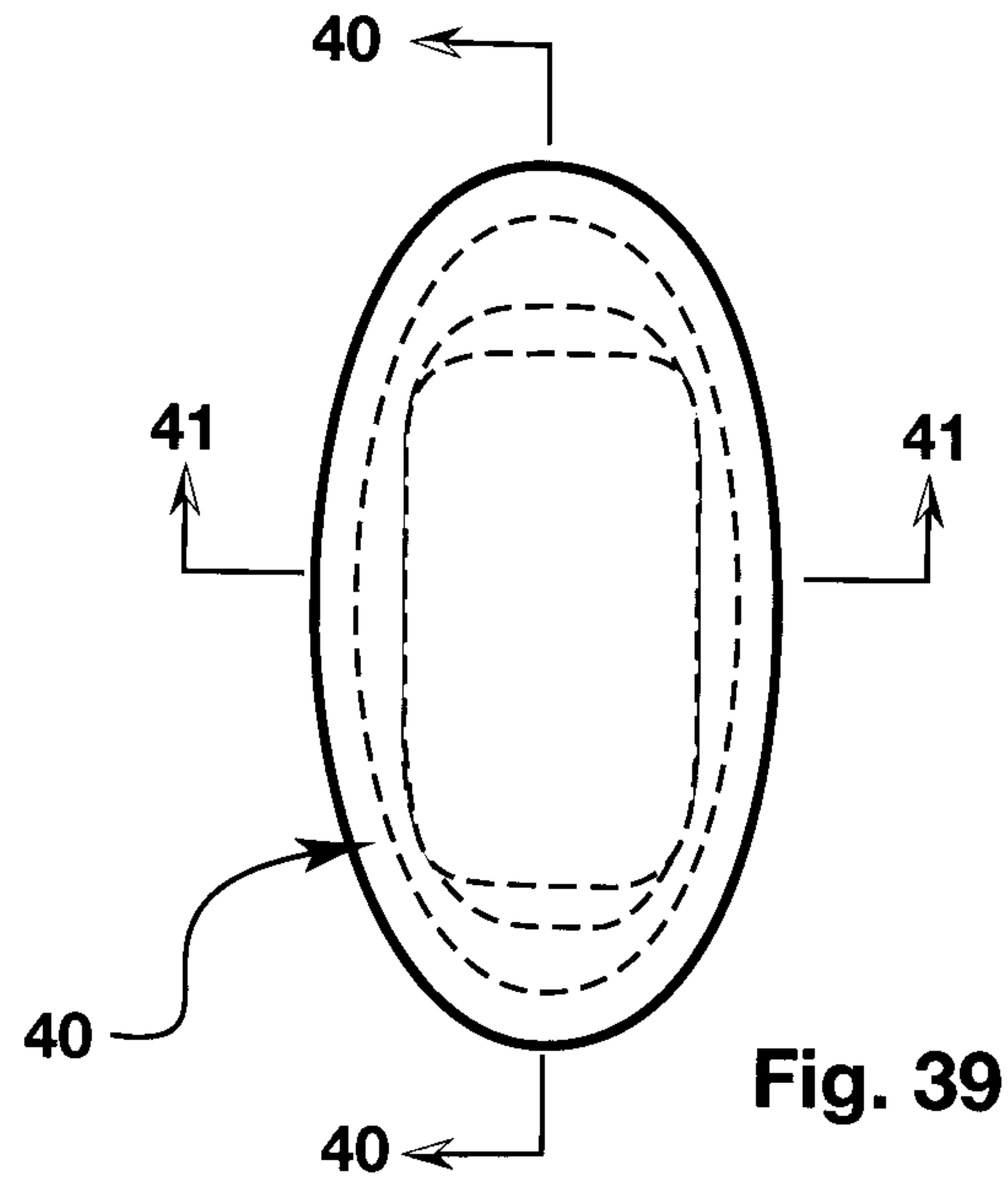


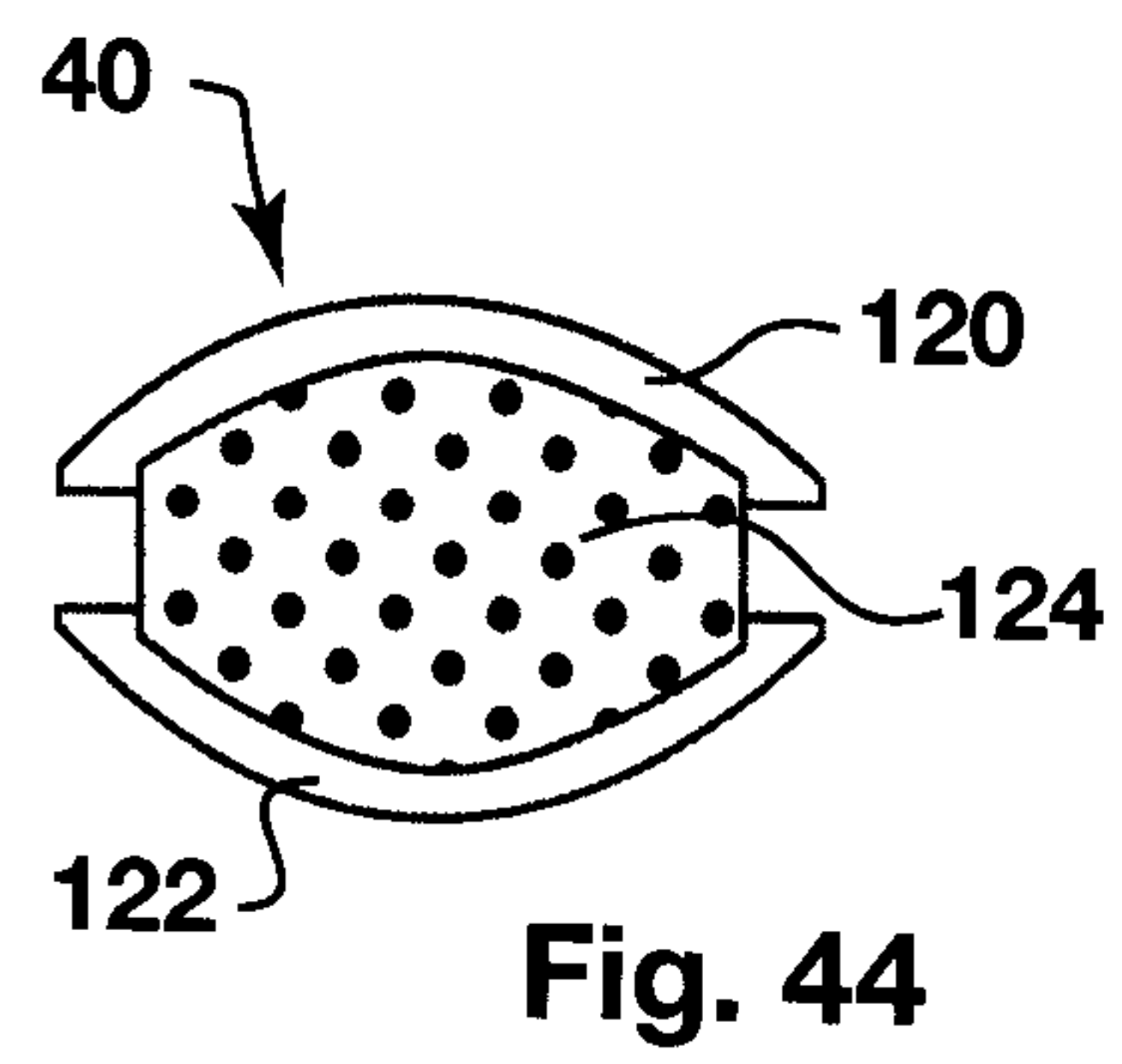
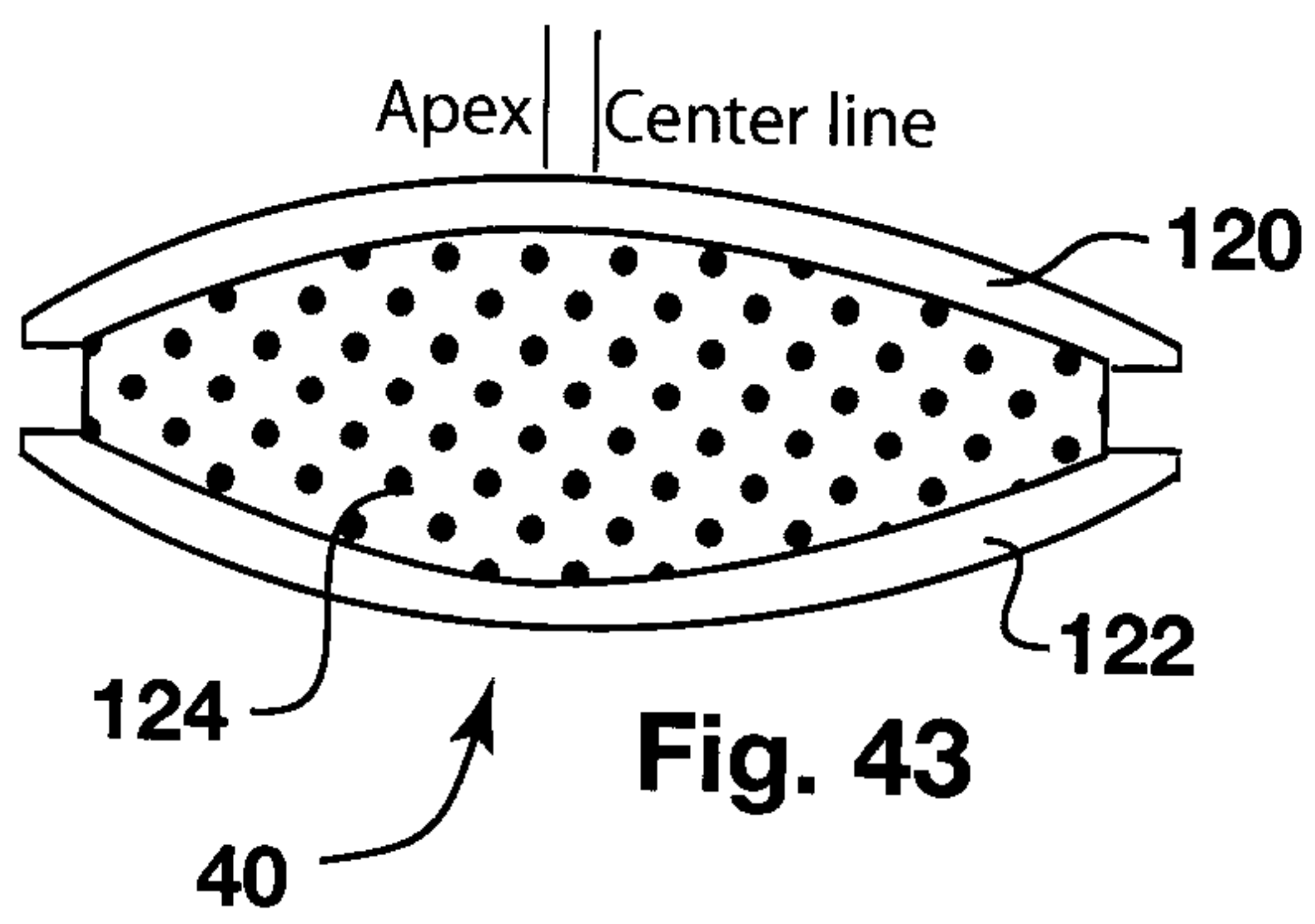
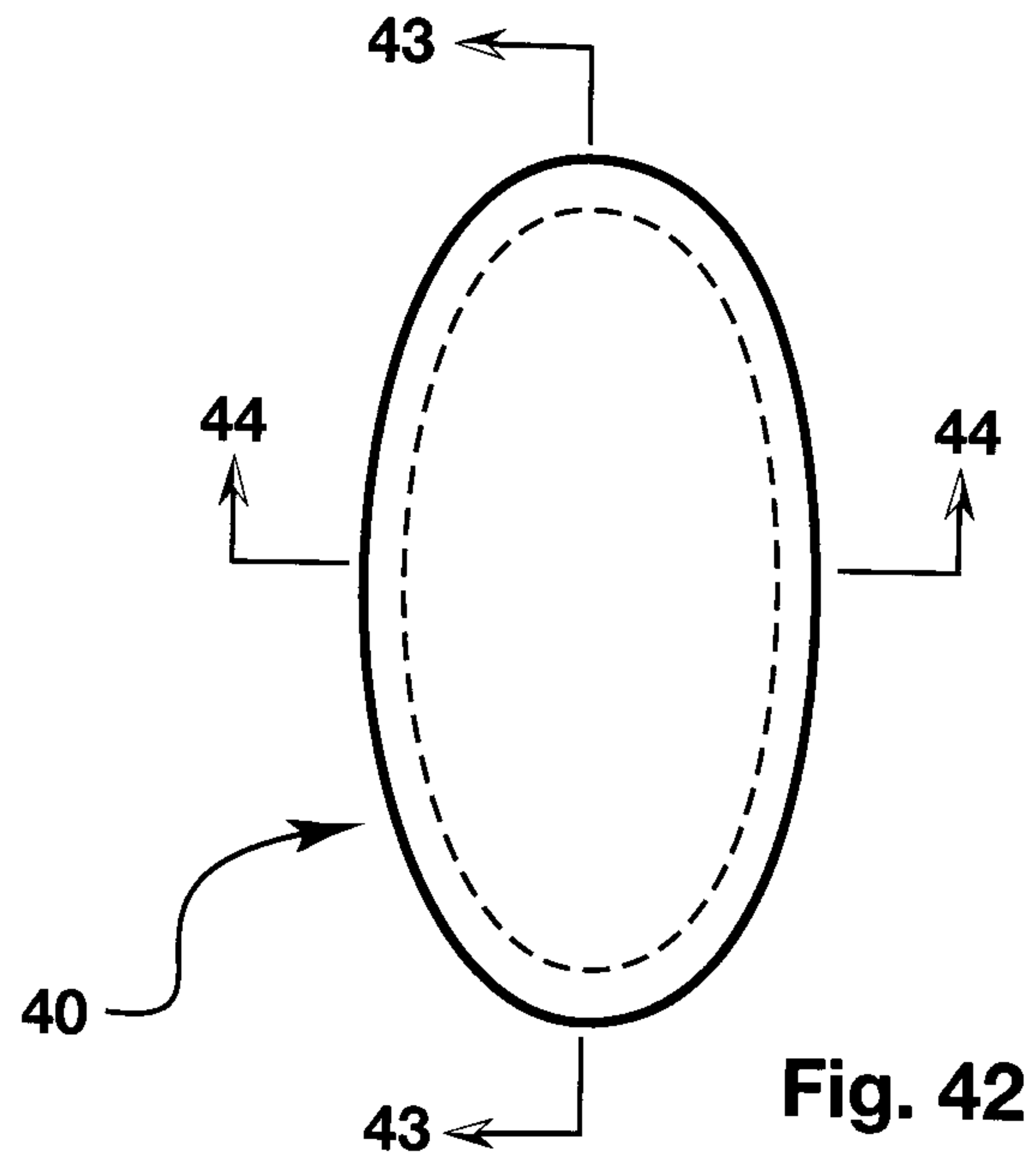
Fig. 36



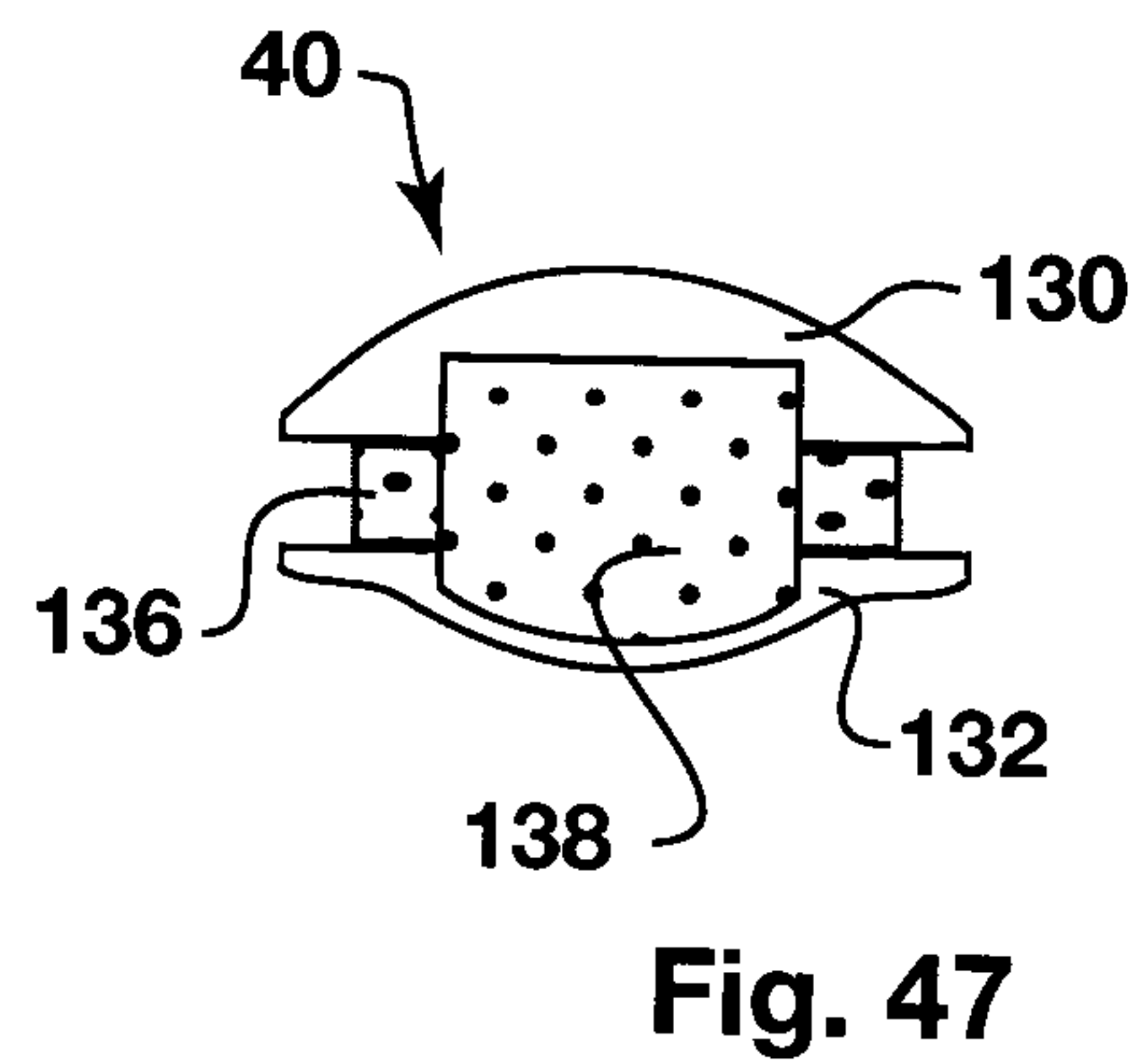
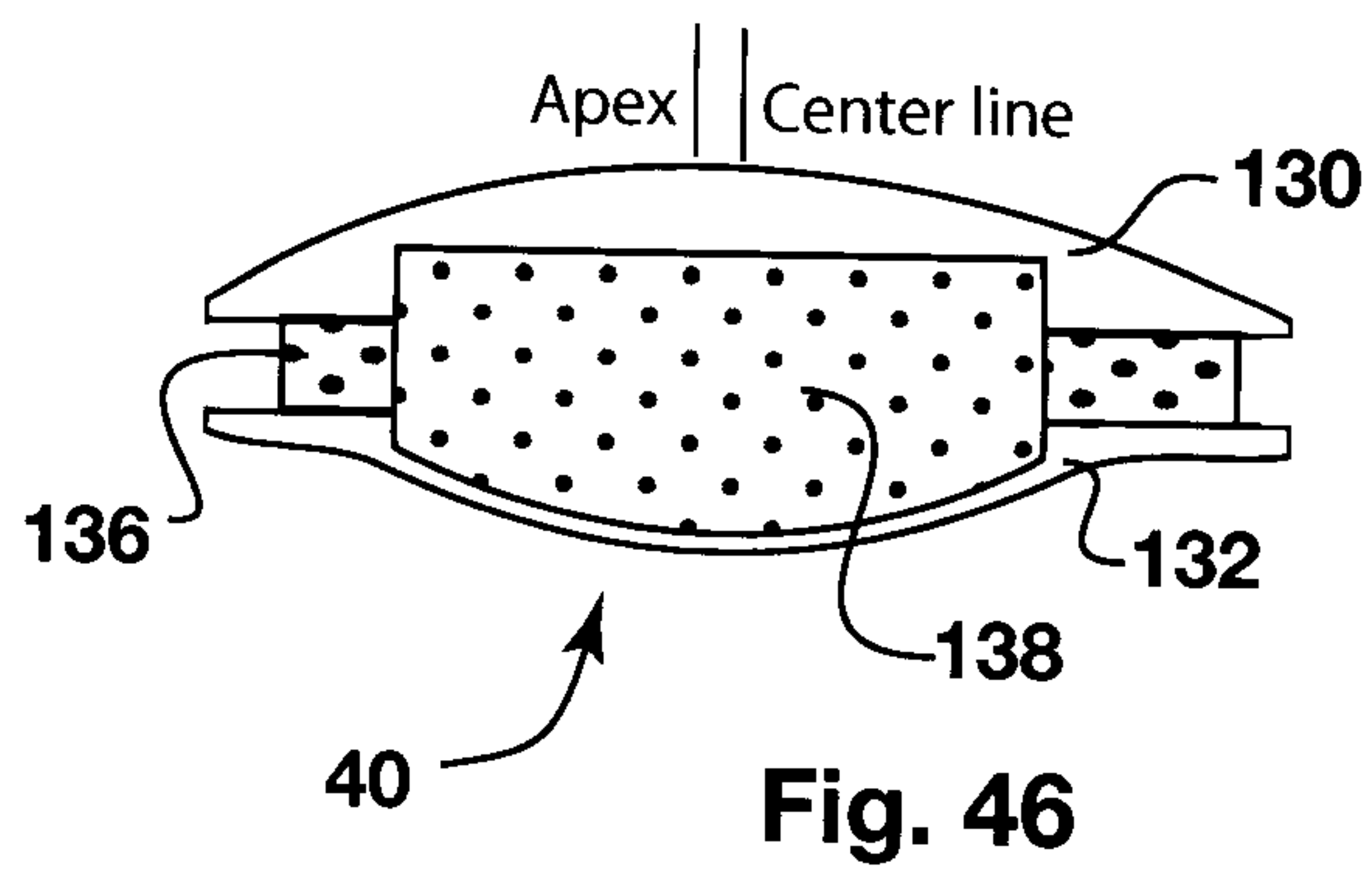
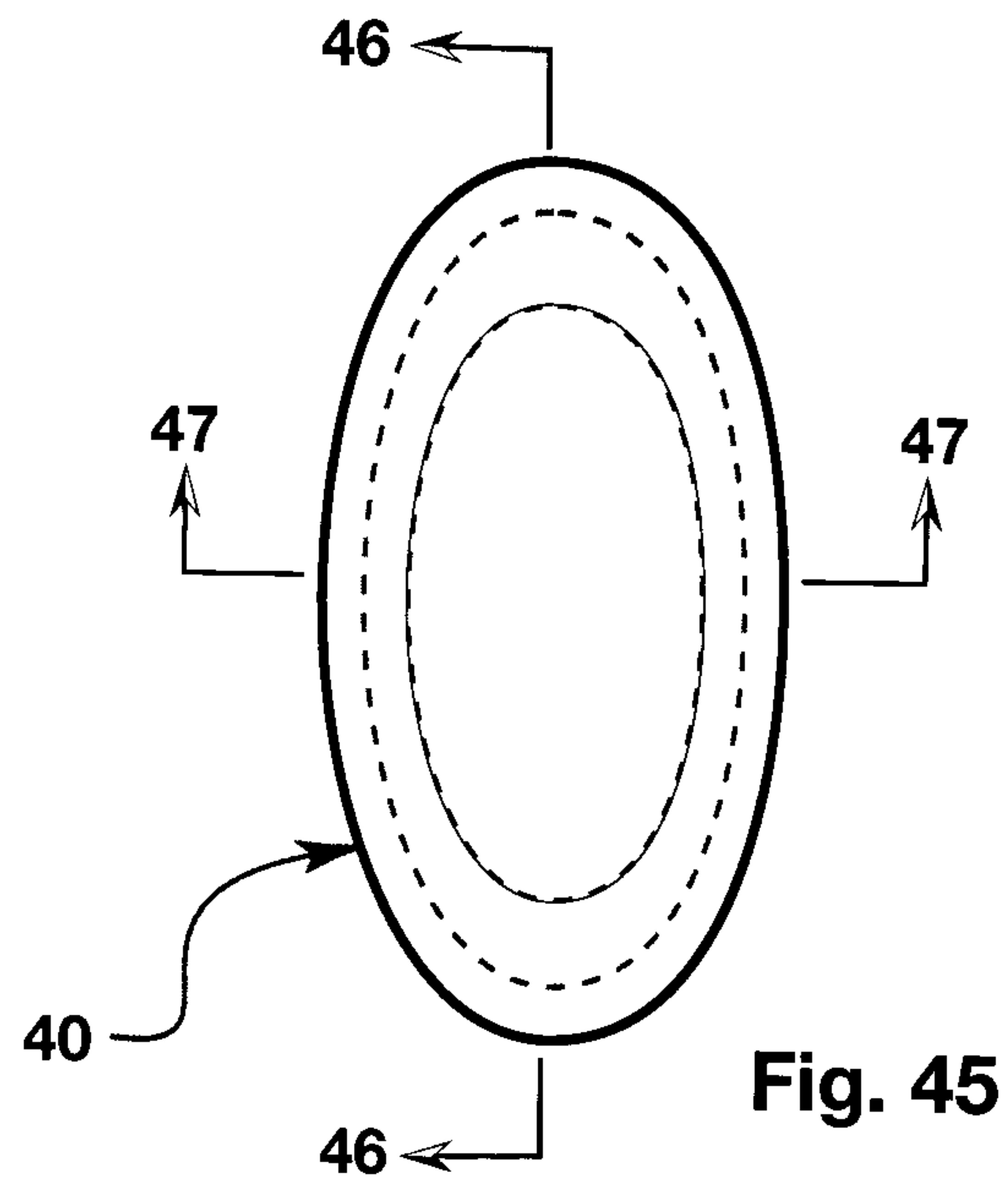
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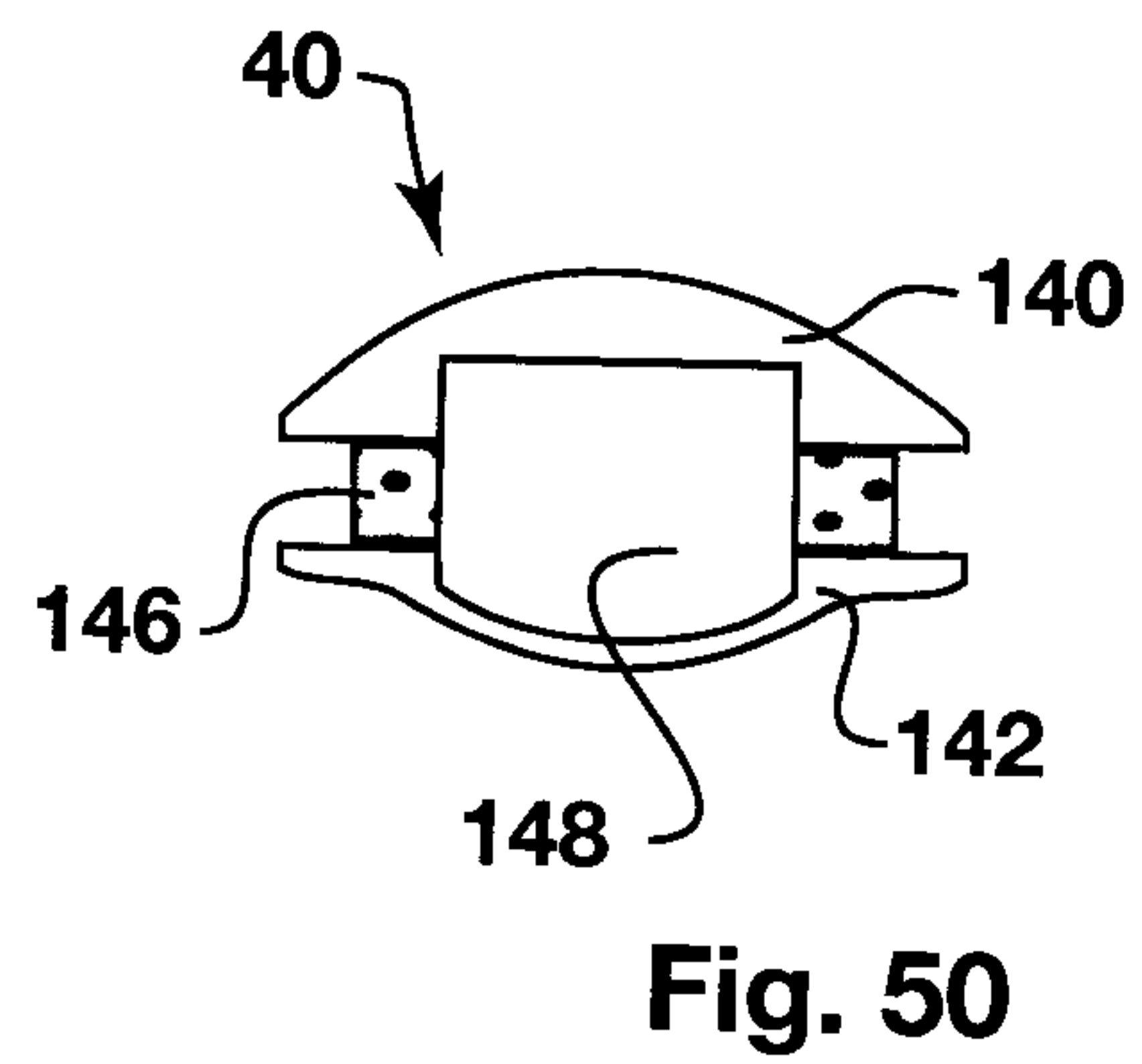
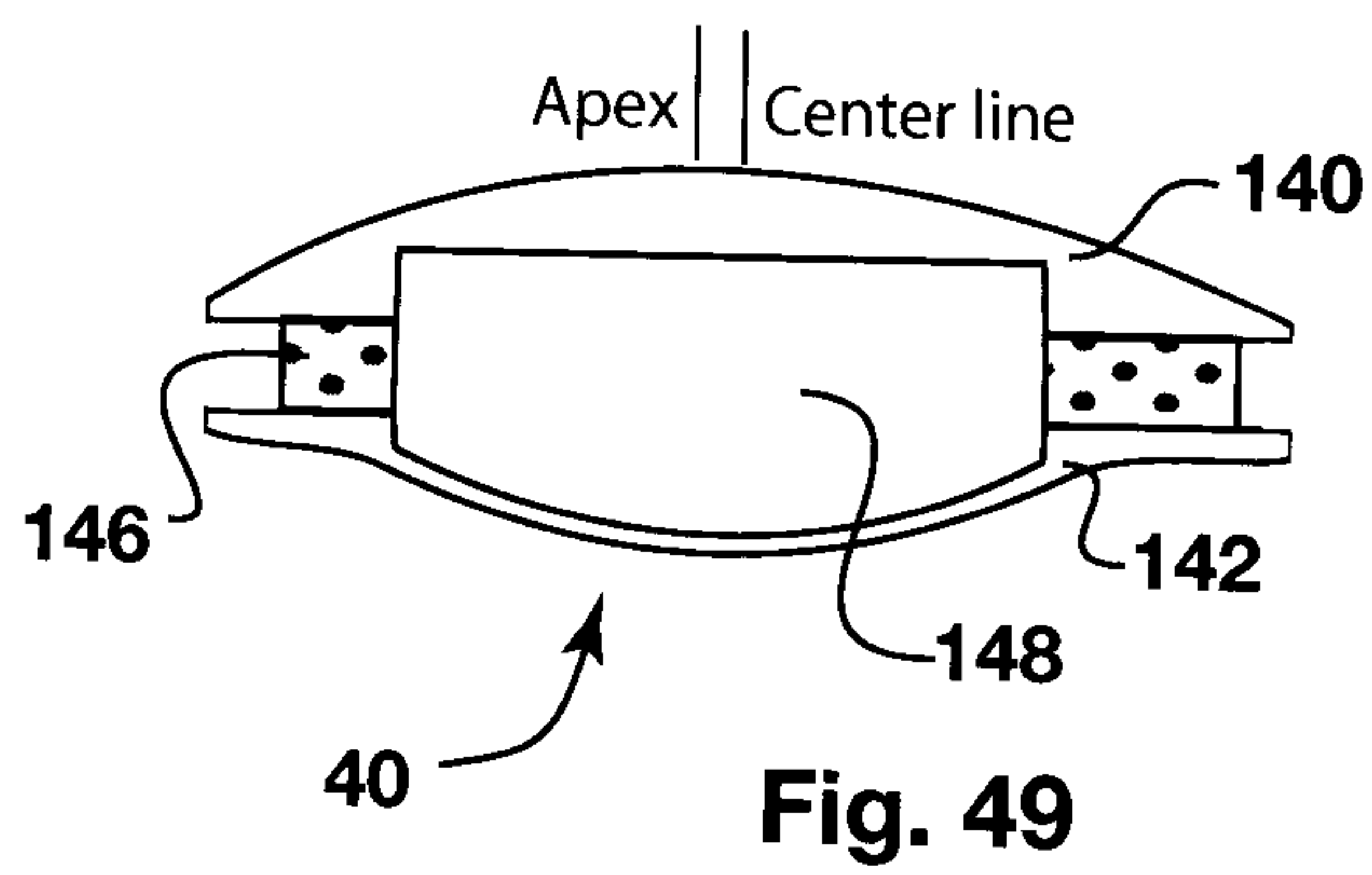
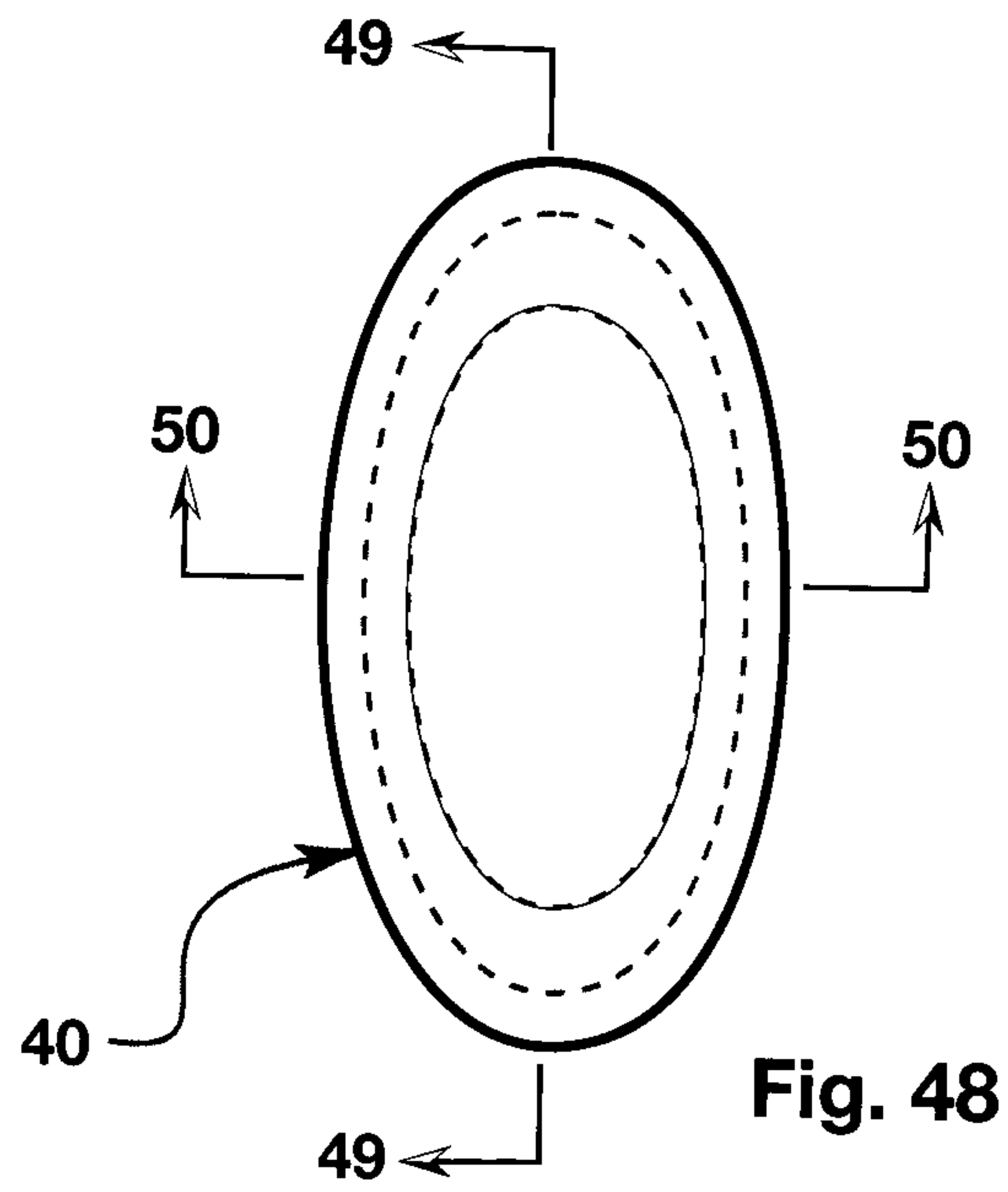
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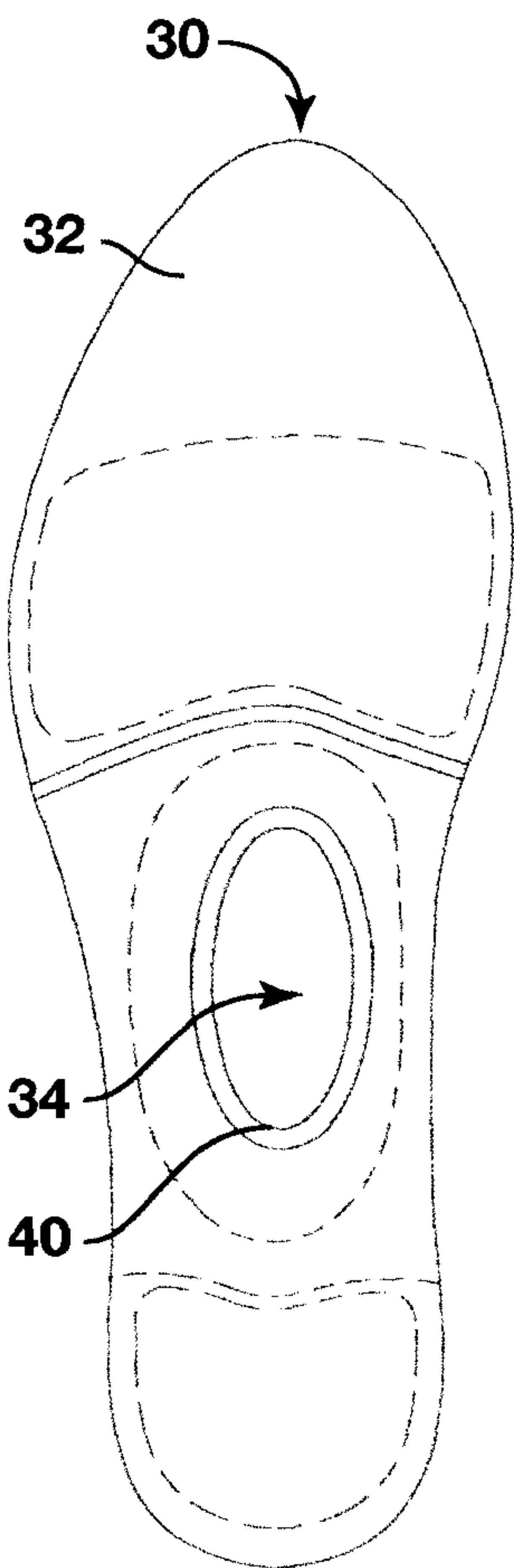


Fig. 1

TOP