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(71) Applicant *(for all designated States except US)*: **MED-EL ELEKTROMEDIZINISCHE GERAETE GMBH** [AT/US]; Furstenweg 77a, A-6020 Innsbruck (AT).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **JAMING, Bernhard** [AT/AT]; Gumppstrabe 8/5, A-6020 Innsbruck (AT). **ZIMMERLING, Martin** [AT/AT]; Fernblick 6, A-6082 Patsch (AT).

(74) Agents: **MURPHY, Timothy, M.** et al.; Bromberg & Sunstein, Llp, 125 Summer Street, Boston, MA 02110 (US).

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(54) **Title:** SURGICAL TOOL FOR PREPARING A BONE FOR A DEVICE WITH A CONVEX ELEMENT

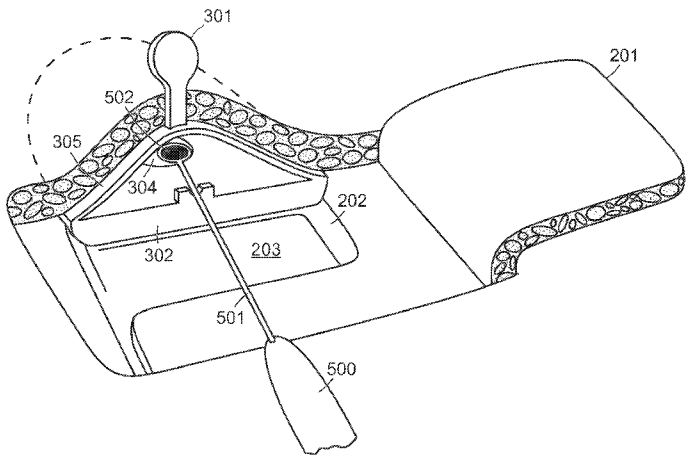


FIG. 5

(57) **Abstract:** A surgical tool lifts an overlying layer of skin away from underlying bone to prepare the bone to accommodate a convex element of an implantable device. The tool includes a lifting shell for insertion between the skin and the bone so as to lift the skin away from bone. A tool base supports the lifting shell and is supported by the bone. A drill template opening in the tool base provides access for preparing the bone to accommodate the convex element.

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SURGICAL TOOL FOR PREPARING A BONE FOR A DEVICE WITH A CONVEX ELEMENT

[0001] This application claims priority from U.S. Provisional Patent Application 61/019,689, filed January 8, 2008, which is incorporated herein by reference.

Field of the Invention

[0002] The present invention relates to surgical tools, and more specifically to a surgical tool for implanting a device with a convex element.

Background Art

[0003] We have entered an age in which various medical conditions are treatable based on implantation inside a patient of a special device or system. For example, cochlear implants are electronic systems designed to provide useful hearing and improved communication ability to individuals who are profoundly hearing impaired and unable to achieve speech understanding with conventional hearing aids. A typical system includes an implantable stimulator containing electronic circuitry, a coil for power and information transfer, and a stimulation electrode array which is inserted into the inner ear (and perhaps a counter electrode).

[0004] Fig. 1A shows a side view and Fig. 1B shows an elevated bottom perspective view of one specific example of an implantable device **100** having a convex element, in this case, a portion of a cochlear implant system. The implantable device **100** includes a coil housing **101** containing receiving coils for receiving a power and/or data signal from an external transmitting coil (not shown). Attached to the coil housing **101** is a stimulator housing **102**, which in the case of a cochlear implant system contains modules for developing an electrode stimulation signal for stimulating cochlear nerve tissue. Centered within the coil housing **101** is a convex element **103**, which in the case of a cochlear implant system would typically be a magnet housing containing a positioning magnet that coordinates with a corresponding magnetic element in the external transmitting coil arrangement to hold it in a proper operating position for transferring the signal across the skin into the receiving coils. Also connected to the stimulator housing **102** as an electrode

lead **104** which in the case of a cochlear implant system connects to an electrode array (not shown) that applies the stimulation signal to the cochlear nerve tissue.

[0005] Currently, a surgeon implanting a device with a convex element uses a surgical spreader device to lift a skin flap including the periosteum and then determine and mark the location to provide a recess in the bone structure to accommodate the convex element. Once the location is marked, a drill can be used to drill a recess into the bone at the marked location.

Summary of the Invention

[0006] Embodiments of the present invention are directed to a surgical tool that lifts an overlying layer of skin away from underlying bone to prepare the bone to accommodate a convex element of an implantable device. The tool includes a lifting shell for insertion between the skin and the bone so as to lift the skin away from bone. A tool base supports the lifting shell and is supported by the bone. A drill template opening in the tool base provides access to prepare the bone to accommodate the convex element.

[0007] In further specific embodiments, the surgical tool includes a gripping handle for a surgeon to push on the tool for insertion between the skin and the bone. The tool may also include a stopper bar attached perpendicularly to the tool base for limiting how far the tool may be inserted. And there may be a shaft guide atop the stopper bar with a center recess for receiving a drill shaft used for preparing the bone.

[0008] In specific embodiments, preparing the bone includes creating a recess in the bone to accommodate the convex element. For example, the recess may be created by a spherical burring end of a drill.

[0009] The implantable device may specifically be part of a cochlear implant system. For example, the convex element may be a magnet housing of the cochlear implant system.

Brief Description of the Drawings

[0010] Fig. 1A shows a side view and Fig. 1B shows an elevated bottom perspective view

of one specific example of an implantable device having a convex element.

[0011] Fig. 2 shows an example of a typical implant site which has been prepared for surgical implantation of an implantable device.

[0012] Fig. 3 shows an example of a surgical tool for implantation of a device with a convex element.

[0013] Fig. 4 shows how the surgical tool is inserted.

[0014] Fig. 5 shows use of a drill to create a recess for the convex element using the surgical tool.

[0015] Fig. 6 shows placement of the implanted device place in the completed site.

Detailed Description of Specific Embodiments

[0016] Fig. 2 shows an example of a typical implant site **200** which has been prepared for surgical implantation of an implantable device **100**. A skin flap **201** including the periosteum has been incised in the patient's skin **205** and lifted back from the underlying bone **206**. A housing recess **202** is created in the underlying bone **206** down to some predetermined depth so as to form a bone bed **203** at the bottom of the housing recess **202**. Optionally, an electrode channel **204** may also be prepared to receive a portion of the electrode lead **104**.

[0017] Fig. 3 shows an example of a surgical tool **300** for implantation of a device with a convex element. At the top is a gripping handle **301** held by the surgeon. Opposite to the handle **301** is a stopper bar **302** (1-2 mm in height), with a tool opening **306** defined between them by a bell-shaped lifter shell **305.** The lifter shell **305** tapers down and away from the tool opening **306** until it meets the tool base **307** so as to define an insertion edge **308**. Underneath the lifter shell **305**, the tool base **307** includes a drill template opening **304** which is located the proper distance in from the tool opening **306** and the edge of the stopper bar **302** so as to correspond to a recess needs to be prepared to receive the convex

element **103**. Also, at the top of the stopper bar **302** is a shaft guide **303** with a center recess for receiving a drill shaft that creates the recess for the convex element **103**.

[0018] Fig. 4 shows how the surgical tool **300** is inserted. The surgeon does not need to lift the skin flap with a separate spreader, but holding the tool by its handle **301** the insertion edge **308** is pushed between the patient's skin **205** and the underlying bone **206**. This causes the bell-shape of the lifting shell **305** to lift the patient's skin **205** up and away from the underlying bone **206.** Insertion of the tool **300** is stopped by the stopper bar **302** engaging the side wall of the housing recess **202**. With the insertion tool **300** thus inserted, the drill template opening **304** is then in proper position over the underlying bone **206** with respect to the housing recess **202**.

[0019] Once the insertion tool **300** has been inserted into proper position, a surgical drill **500** is used with a drill shaft **501** driving spherical burring end **502** at the drill template opening **304**, as shown in Fig. 5. This creates a recess for the convex element **103**, and, as shown in Fig. 6, the coil housing **101** and its convex element **103** are then slipped into place as well as the stimulator housing **102** into its corresponding housing recess **202** and the electrode lead **104** into the electrode channel **204**. Once the remainder of the surgery is complete, the skin flap **201** and periosteum can be returned back into place and stitches made in the incision.

[0020] By correctly selecting a proper diameter of the spherical burring end **502** and thickness of the drill shaft **501**, only a small incision is needed in order to create a recess for a convex element **103** of an implantable device **100** which is at the correct location and has the correct size and shape. When the surgeon drills the recess into the underlying bone **206** there is less risk of inadvertently damaging the skin flap **201** and periosteum with the drill **500**. In addition, the skin flap **201** and periosteum are stretched out only to the minimum extent possible so that there is less risk of overstretching and loss of elasticity and tonicity in the skin flap **201** and periosteum.

[0021] Although various exemplary embodiments of the invention have been disclosed, it should be apparent to those skilled in the art that various changes and modifications can be

made which will achieve some of the advantages of the invention without departing from the true scope of the invention.

What is claimed is:

1. A surgical tool for lifting an overlying layer of skin away from underlying bone to prepare the bone to accommodate a convex element of an implantable device, the tool comprising:

a lifting shell for insertion between the skin and the bone so as to lift the skin away from bone;

a tool base supporting the lifting shell and supported by the bone; and

a drill template opening in the tool base providing access to prepare the bone to accommodate the convex element.

2. A tool according to claim 1, further comprising:

a gripping handle for a surgeon to push on the tool for insertion between the skin and the bone.

3. A tool according to claim 1, further comprising:

a stopper bar attached perpendicularly to the tool base for limiting how far the tool may be inserted.

4. A tool according to claim 3, further comprising:

a shaft guide atop the stopper bar with a center recess for receiving a drill shaft used for preparing the bone.

5. A tool according to claim 1, wherein preparing the bone includes creating a recess in the bone to accommodate the convex element.

6. A tool according to claim 5, wherein the recess is created by a spherical burring end of a drill.

7. A tool according to claim 1, wherein the implantable device includes a portion of a cochlear implant system.

8. A tool according to claim 7, wherein the convex element is a magnet housing of the

cochlear implant system.

9. A surgical tool for lifting an overlying layer of skin away from underlying bone to prepare the bone to accommodate a convex element of an implantable device, the tool comprising:

insertion means for inserting the tool between the skin and the bone so as to lift the skin away from bone;

supporting means for supporting the insertion means and supported by the bone; and

access means in the supporting means for providing access to prepare the bone to accommodate the convex element.

10. A tool according to claim 9, further comprising:

gripping means for a surgeon to push on the tool for insertion between the skin and the bone.

11. A tool according to claim 9, further comprising:

stopping means attached perpendicularly to the supporting means for limiting how far the tool may be inserted.

12. A tool according to claim 11, further comprising:

shaft guide means atop the stopping means for receiving drilling means for preparing the bone.

13. A tool according to claim 12, wherein preparing the bone includes creating a recess in the bone to accommodate the convex element.

14. A tool according to claim 13, wherein the recess is created by a burring means end of a drilling means.

15. A tool according to claim 9, wherein the implantable device includes a portion of a cochlear implant system.

16. A tool according to claim 15, wherein the convex element is a magnet housing of the cochlear implant system.

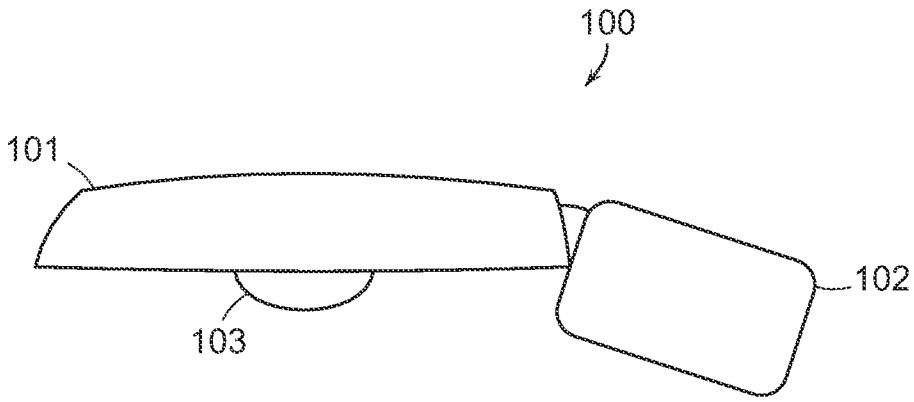


FIG. 1A

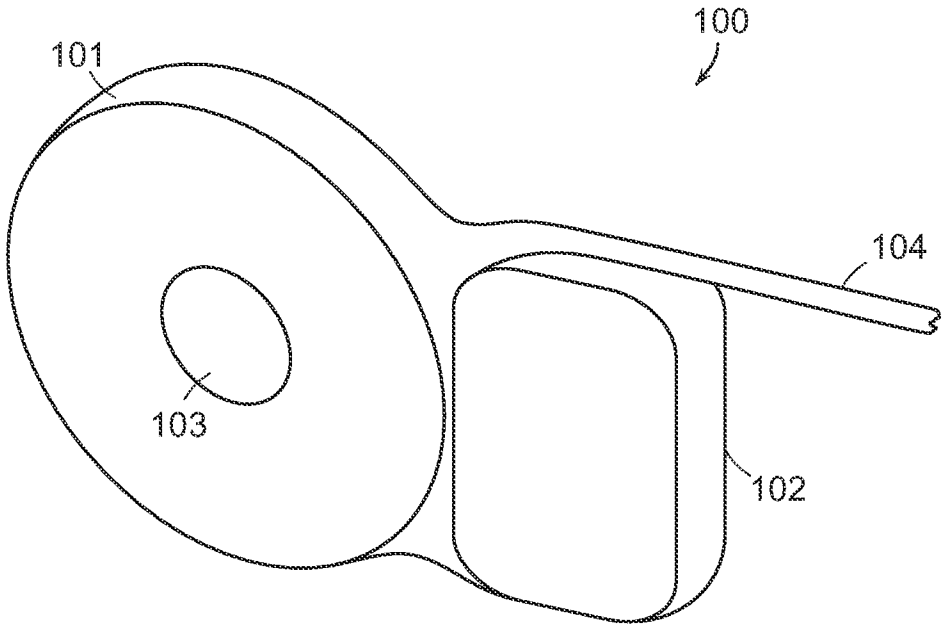


FIG. 1B

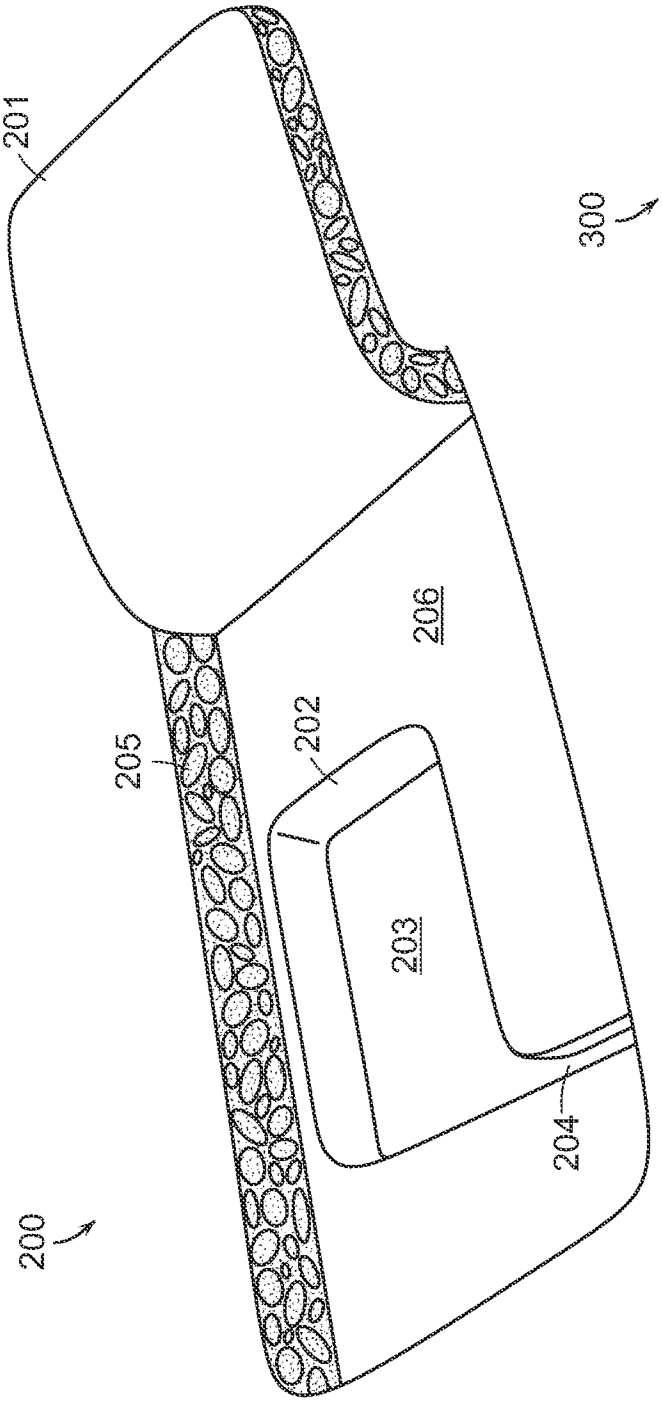


FIG. 2

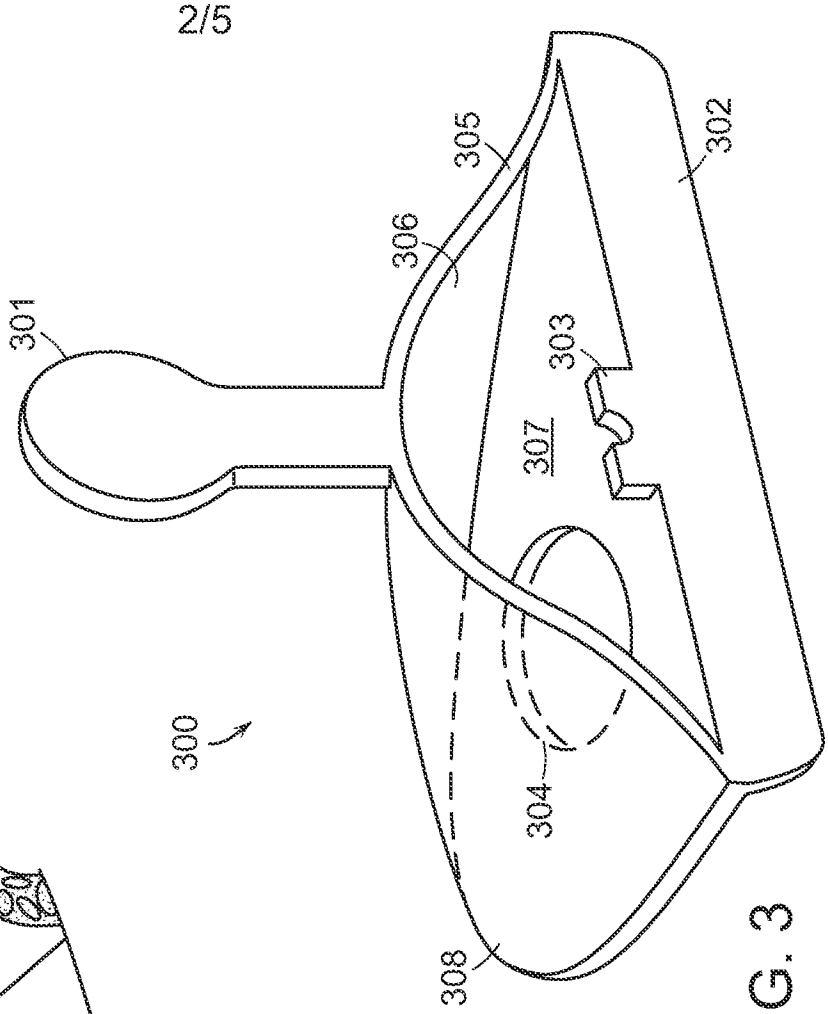


FIG. 3

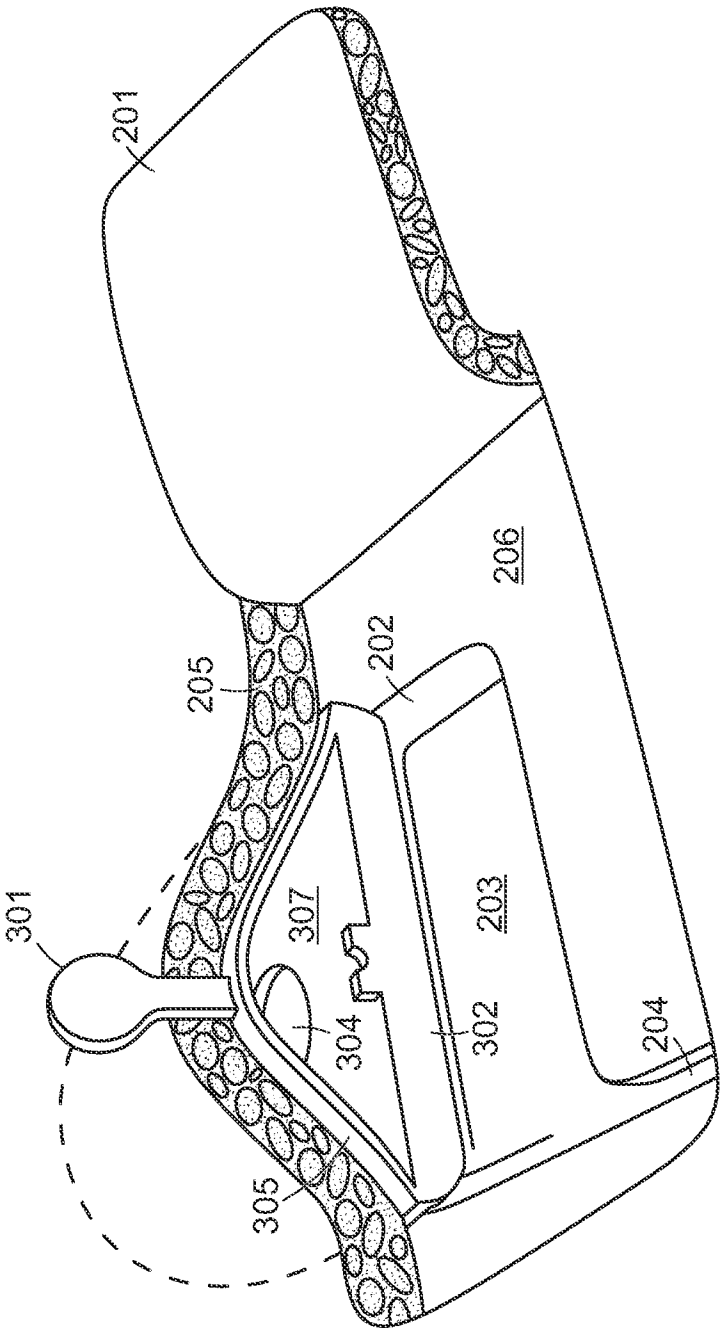


FIG. 4

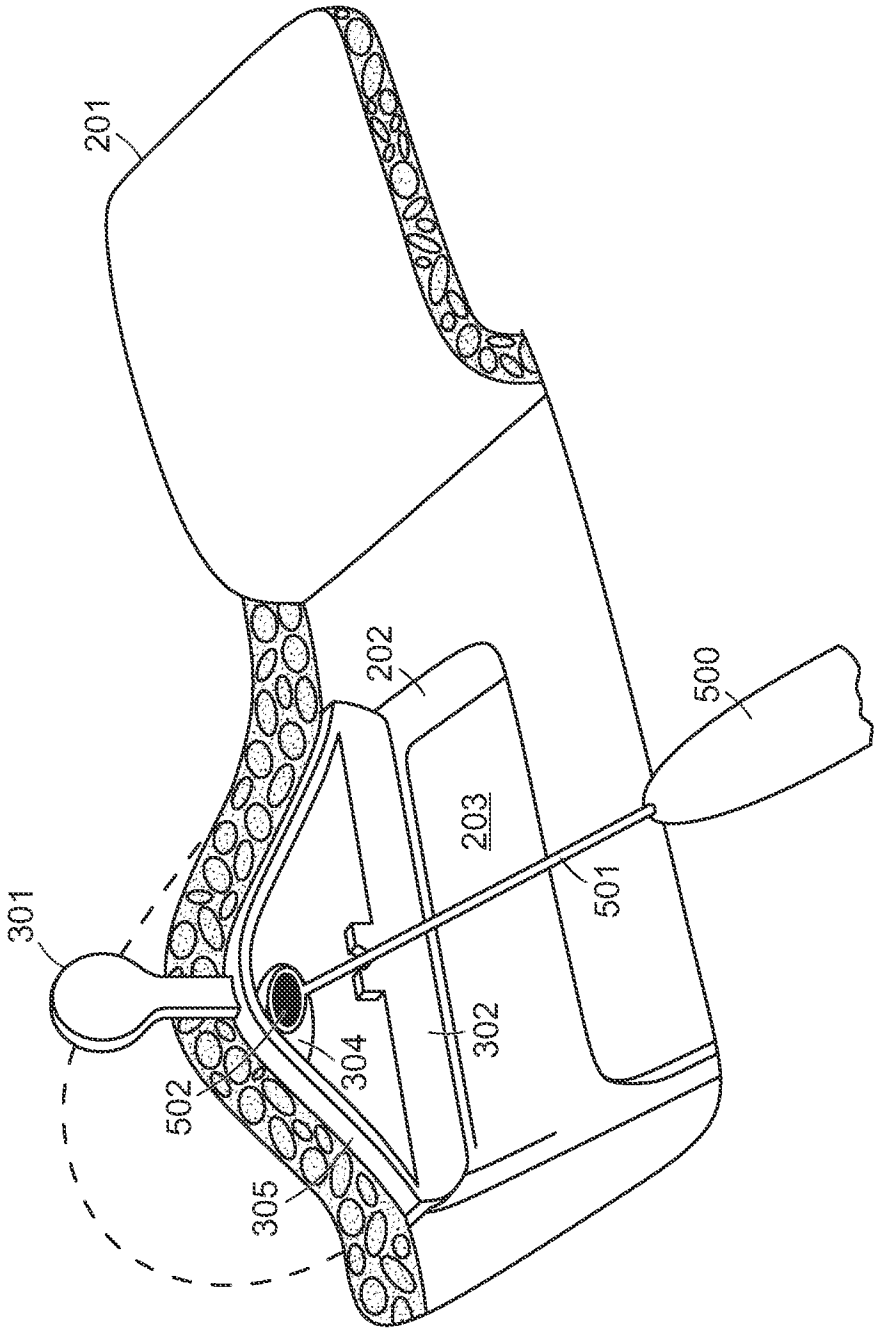


FIG. 5

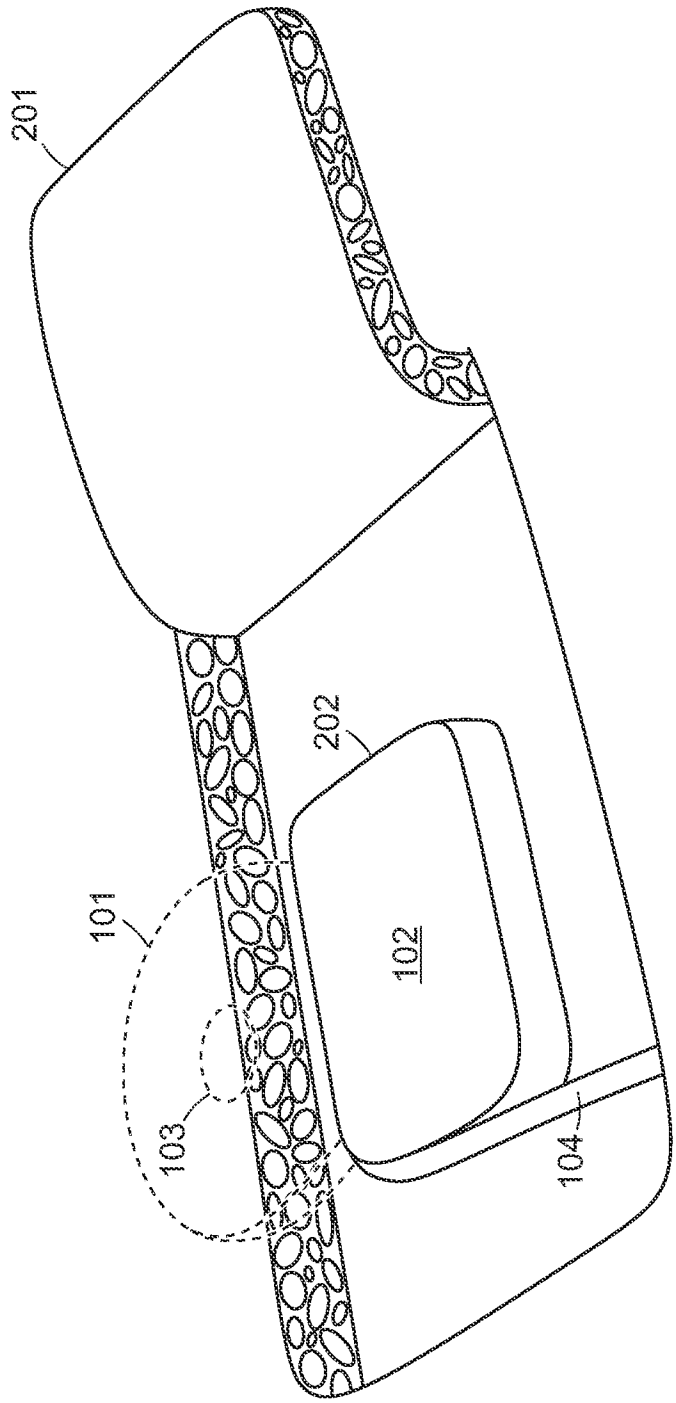


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/030417

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B17/17 A61B17/02

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)
A61B

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/287583 A1 (MANGIARDI JOHN R [US]) 21 December 2006 (2006-12-21) the whole document	1-3,5-16
X	DE 200 12 506 U1 (EXPLORENT GMBH [DE]) 30 August 2001 (2001-08-30) the whole document	1,2,5-16

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* 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 document 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

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"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.

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Date of the actual completion of the international search	Date of mailing of the international search report
7 April 2009	06/05/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Fax: (+31–70) 340–3016	Hamann, Joachim

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2009/030417

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006287583 A1	21-12-2006	NONE	
DE 20012506 U1	30-08-2001	NONE	