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(54) **UNIVERSAL IMPLANT FILL CONNECTOR**

UNIVERSELLES VERBINDUNGSELEMENT ZUM AUFFÜLLEN VON IMPLANTATEN

CONNECTEUR UNIVERSEL DESTINE AU REMPLISSAGE D'IMPLANT

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a universal implant fill connector which allows a range of angular motion between the fill tubing and the implant.

2. Description of the Related Art

[0002] In various surgical procedures, an implant is placed within a body cavity for subsequent inflation and/or deflation with a fluid.

[0003] In plastic and reconstructive surgery, when a breast implant or tissue expander is placed in the dissected pocket, it is typically filled via a fill connector coupled to fill tubing which is attached to a filling material (e.g. saline solution) source. Another example is bariatric surgery where a gastric balloon or gastric band is implanted in or around the stomach for subsequent inflation.

[0004] There are currently three basic types of fill connectors used to connect the fluid source to the implant, the choice of which often depends on the implant and the particular surgical approach used. The first is a permanent attachment of the fill tubing to the implant. A common means for this attachment is to make a small opening within the body or shell of the implant and insert the tubing securing it by means of connecting materials such as sleeves, patch assemblies, adhesives or vulcanizing compounds.

[0005] The other two common connectors are for temporary attachment of the fill tubing to the implant by means of a valve in the implant which seals after the fill tubing is removed. One of these two temporary attachment means is most commonly used with saline-fill breast implant devices that include a diaphragm valve within the shell. The valve has an opening that requires a rigid male implement to be inserted in the opening thus opening the valve and allowing fluid transfer. This male implement is the fill tip end of the fill connector, which has on the opposite end one or more barbs which accept the flexible (e.g. silicone or vinyl) fill tubing. In use, the fill connector and fill tubing attach to the implant normal to the implant surface.

[0006] The other of the two connectors for temporary fill tubing attachment is designed for a leaf valve which consists of parallel sheets of material forming a channel along the surface of the implant into which a cannula or stylet may be inserted. When this valve is engaged, the fill tubing is generally tangent to the implant surface. In breast implant surgery where typically the fill tubing is a temporary attachment, a surgical approach using either the normal or tangential fill tube orientation is selected before the surgical procedure commences. As a result, an ad-hoc determination of which approach to use, which may be necessary because of unexpected developments that arise prior to or during the surgical procedure, is currently impossible. Thus, an accurate analysis of which surgical approach is best suited to a particular patient's particular need is necessary before surgery may proceed.

[0007] US 4,852,564 discloses flexible bellows-type end connector units for attaching medico-surgical tubes to breathing circuits / fluid flow devices.

[0008] Placement of implants in body cavities is usually performed without visual assistance and in small pockets or within dissected tissue planes. Implant orientation with respect to the tubing position and body opening cannot always be ascertained. Complications can arise because of blocked or linked tubing or premature detachment of the fill tubing from the implant due to excessive tangential and torsional forces on the inflexible connections. Difficulty in filling, improper fill volume, or inability to complete the filling procedure can all delay surgery, require explant, or require surgery to be aborted.

[0009] It is desirable to provide a filling system that can be used for surgical applications calling for either normal or tangential placement of the fill tubing in order to eliminate the requirement for time-consuming analysis before surgery and the potential complications of inflexibly oriented connections during surgery. Thus multiple valves and/or multiple fill tubing geometries may be provided with each implant (i.e. provide both a typical straight fill connector and a 90 degree "L" fill connector). This solution, however, still requires multiple product inventories and predetermined patient needs regarding the surgical approach used.

SUMMARY OF THE INVENTION

[0010] A fill connector could be modified at its barbed, or leakproof fill tubing connection, end to resolve these intra-operative problems and be universally adaptable for any implant or surgical approach. Several design possibilities exist but all entail incorporating a multi-directional connecting means to the implant. Any of these designs would be constructed out of commonly used biocompatible materials, i.e., plastics/elastomers, preferably those compatible with common sterilization processes.

[0011] In accordance with a first aspect of the present invention there is provided an inflatable implant and universal implant fill connector for coupling a fill tubing to a fill valve of an implant as defined in claim 1.

[0012] One particular embodiment includes a fill connector with a ball-joint connection having a leak proof fluid pathway therethrough such that the fill tubing may be rotated anywhere from tangential (approximately 0 degrees) to the implant surface up to normal (approximately 90 degrees) to the implant surface.

[0013] In a another embodiment, the ball-joint connection could also allow for 360 degree rotation of the fill tubing about an axis approximately normal to the implant surface (i.e., in the plane parallel to the surface of the implant).

[0014] An alternative to the ball-joint approach is to use a softer, more flexible material at the barbed end of a typical straight fill connector, while maintaining the standard material (typically polypropylene) at the valve engaging end.

[0015] Yet another alternative embodiment is to design the connector with a bellows having accordion-like pleats and appropriately thinner wall sections to allow ease of bending and repeatable multi-directional flexing.

[0016] In accordance with a second aspect of the present invention there is provided a method of connecting a fill tubing to an implant having an implant fill valve as defined in claim 12.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The invention will be more clearly described by way of reference to the accompanying drawings, wherein:

Figs. 1a and 1b are is a cross-sectional side view of a ball-joint embodiment of the invention;

Figs. 2a and 2b are a cross-sectional side view of a modified ball-joint embodiment of the invention which includes a swivel joint which allows 360 degree rotation about an axis approximately normal to the implant surface;

Fig. 3 is a side view of a flexible-tube embodiment of the invention; and

Fig. 4 is a side view of a bellows embodiment of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

[0018] Embodiments of the invention will be described in detail with reference to the accompanying drawings.

[0019] Figs. 1a and 1b show a fill connector which allows the fill tubing to rotate from a normal position, approximately perpendicular to the implant surface (Fig. la), to a tangent position, approximately parallel to the implant surface (Fig. 1b). The fill connector 100 is formed of barb member 1 and fill tip member 2. The socket 3 of barb member 1 is rotatably coupled around pivot 15 to the ball 11 of fill tip member 2. During use, fill tubing **6** is coupled to barb member **1** using a conventional pipe barb **4.** The bulb **8** of fill tip member **2** is inserted into diaphragm valve **12** of implant **9.**

[0020] The barb member **1** and fill tip member **2** may be rotated with respect to each other so that the angle a between the barb axis **4a** of barb **4** and the surface **10** of implant **9** may range from about 0° (approximately tangent as shown in Fig. 1b) to about 90° (approximately normal, as shown in Fig. 1a). Thus, the connector **100** may be rotated between a position where barb axis **4a** is approximately perpendicular to the fill tip axis **7a** and a position where barb axis **4a** is approximately parallel to fill tip axis **7a.** In a preferred embodiment, the dimensions of the connector are such that when α is approximately 0°, the overall projection of the connector (as measured from and normal to the implant surface **10**) is minimized, and the outer surface of fill tubing **6** rests upon implant surface **10.**

[0021] Socket passage **13** and ball passage **14** are shaped so that there is a sufficient sealing surface between socket **3** and ball **11** to provide a path that is leak proof at both the negative and positive pressures exerted during the implant fill process.

[0022] During use, air is evacuated from implant chamber **9a** through fill tip passage **7,** ball passage **14,** socket passage **13,** barb passage **5,** and through fill tubing **6.** Similarly, the implant filling material flows from fill tubing **6** through barb passage **5,** socket passage **13,** ball passage **14,** and fill tip passage **7** into implant chamber **9a.**

[0023] The sealing surfaces of the ball **11** and socket **3** as well as the ball passage **14** and socket passage **13** may be designed to allow rotation about the fill tip axis. Furthermore, at pivot **15,** the ball **11** and socket **3** may be provided with indentations and corresponding projections which allow the ball and socket to be lockable at different angles. As an alternative to the embodiment shown in Figs. 1a and 1b, the connector may be designed so that the ball is part of the barb member, and the socket is part of the fill tip member.

[0024] Figs. 2a and 2b show a modification of the fill connector embodiment described above which includes the function and structure of the rotatable ball-and-socket connector described above as well as including additional structure which allows rotation about an axis normal to the implant surface. The fill connector **200** is formed of barb member 1, swivel member **19,** and fill tip member **16.** Similar to that described above, the socket **3** of barb member **1** is rotatably coupled to the ball **11** of swivel member **19.** During use, fill tubing **6** is coupled to barb member **1** using barb **4.** As used herein, the term "barb" refers to any such conventional pipe barb or any appropriate mechanical, chemical, or thermal joint between the connector and the fill tubing which provides a leakproof connection at both the negative and positive pressures exerted during the implant fill process. The bulb **8** of fill tip member **16** is inserted into diaphragm valve **12** of implant **9.**

[0025] Similar to the embodiment described above, the barb member **1** and swivel member **19** may be rotated with respect to each other so that the angle α between the barb axis **4a** of barb **4** and the surface **10** of implant **9** may range from about 0° (approximately tangent, as shown in Fig 2b) to about 90° (approximately normal, as shown in Fig. 2a). Thus, the connector **200** may be rotated between a position where barb axis **4a** is approximately perpendicular to the fill tube axis **7a** and a position where barb axis **4a** is approximately parallel to the fill tube axis **7a.** In addition, the swivel member **19** and the fill tip member **16** may be rotated with respect to each other so that the angle β between the relative positions of the swivel member **19** and the fill tip member **16,** around the fill tip axis **7a,** may have a range of about 360°.

[0026] Also similar to that described above, socket passage **13** and ball passage **14** are shaped so that there is a sufficient sealing surface between socket **3** and ball **11** to provide a leak-proof path. In addition, swivel member sealing structure **17** and fill tip member sealing structure **18** are shaped to provide a swivel joint that is leak proof at both the negative and positive pressures exerted during the implant fill process. As shown in Figs. 2a and 2b, the swivel member sealing structure **17** may be a cylindrical indentation which acts as the external rotor of the swivel joint, and fill tip sealing structure **18** may be a cylindrical projection which acts as the internal stator of the swivel joint, or the swivel joint may be implemented so that the rotor and stator are conversely positioned, i.e., the swivel member sealing structure is located within the fill tip member sealing structure.

[0027] During use, air is evacuated from implant chamber **9a** through fill tip passage **7,** swivel member passage **19a,** socket passage **13,** barb passage **5,** and through fill tubing **6.** Similarly, the implant filling material flows from fill tubing 6 through barb passage **5,** socket passage **13,** swivel member passage **19a,** and fill tip passage **7** into implant chamber **9a.**

[0028] Another embodiment of the invention is illustrated in Fig. 3, which shows a flexible-tube fill connector which allows the fill tubing to be rotated from a tangent position, approximately parallel to the implant surface, to a normal position, approximately perpendicular to the implant surface. This embodiment also allows the fill tubing to be rotated about an axis normal to the implant surface. The fill connector **300** is formed of barb member **21** and fill tip member **20.** Fill tip member **20** is made of a rigid material (e.g., polypropylene), and barb member **21** is made of a softer, more flexible material. Fill tip member **20** and barb member **21** are rigidly connected at joint **22.** Joint **22** may be made using any appropriate mechanical or thermal process which provides a leak-proof seal at both the negative and positive pressures exerted during the implant fill process. During use, fill tubing **6** is coupled to barb member **21** by barb **4.** The bulb **8** of fill tip member **20** is inserted into diaphragm valve **12** of implant **9.**

[0029] The barb member **20** and fill tip member **21** may be rotated with respect to each other by flexing tube portion **21a** of barb member **21** so that the angle α between the barb axis 4a of barb 4 and the surface **10** of implant **9** may range from about 0° (approximately tangent) to about 90° (approximately normal). Outline **23** shows the location of barb member **21** and fill tubing **6** when they are rotated into a position where α is equal to approximately 90°. Consequently, connector **300** may be rotated between a position where barb axis **4a** is approximately perpendicular to fill tip axis **7a** and a position where barb axis **4a** is approximately parallel to fill tip axis **7a.** In addition, the barb member **20** and fill tip member **21** may be rotated with respect to each other by flexing tube portion **21a** of barb member **21** so that the angle β between the relative positions of the barb member 21 and the fill tip member **21,** around the fill tip axis **7a,** may have a range of about 360°.

[0030] During use, air is evacuated from implant chamber **9a** through fill tip passage **7,** tube portion passage **21b,** barb passage **5,** and through fill tubing **6.** Similarly, the implant filling material flows from fill tubing **6** through barb passage **5,** tube portion passage **21b,** and fill tip passage **7** into implant chamber **9a.**

[0031] A further embodiment of the invention is shown in Fig. 4, which shows a bellows fill connector which allows the fill tubing to be rotated from a tangent position, approximately parallel to the implant surface, to a normal position, approximately perpendicular to the implant surface. This embodiment also allows rotation of the fill tubing about an axis normal to the implant surface. In this embodiment, the fill connector **400** is formed of barb member **29,** bellows **25,** and fill tip member **24.** Bellows **25** includes a wall thickness **25a** and pleats **25b** which allow repeated multi-directional bending and flexing. Barb member **29** and bellows **25** are connected at joint **28a,** and fill tip member **24** and bellows **25** are connected at joint **28b.** Joints **28a** and **28b** may be made using any appropriate mechanical or thermal process which provides a leak-proof seal at both the negative and positive pressures exerted during the implant fill process. Alternatively, of barb member **29,** bellows **25,** and fill tip member **24** may be a single-piece molding. During use, fill tubing **6** is coupled to barb member **29** by barb **4.** The bulb **8** of fill tip member **24** is inserted into diaphragm valve **12** of implant **9.**

[0032] The barb member **29** and fill tip member **24** may be rotated with respect to each other by flexing bellows **25** so that the angle α between the barb axis **4a** of barb **4** and the surface **10** of implant **9** may range from about 0° (approximately tangent) to about 90° (approximately normal). Outline **27** shows the location of barb member **29,** bellows **25,** and fill tubing 6 when they are rotated into a position where α is equal to approximately 90°. Consequently, connector **400** may be rotated between a position where barb axis **4a** is approximately perpendicular to fill tip axis **7a** and a position where barb axis **4a** is approximately parallel to fill tip axis **7a.** In addition, the barb member **29** and fill tip member **24** may be rotated with respect to each other by flexing bellows **25** so that the angle β between the relative positions of the barb member **29** and the fill tip member **24,** around the fill tip axis **7a,** may have a range of about 360°.

[0033] During use, air is evacuated from implant chamber **9a** through fill tip passage **7,** bellows passage **26,** barb passage **5,** and through fill tubing **6.** Similarly, the implant filling material flows from fill tubing **6** through barb passage **5,** bellows passage **26,** and fill tip passage **7** into implant chamber **9a.**

[0034] The present invention has been described with respect to particular illustrative embodiments. It is to be understood that the invention is not limited to the above-described embodiments, and that various changes and modifications may be made by those of ordinary skill in the art without departing from the scope of the appended

claims.

Claims

1. An inflatable implant and universal implant fill connector for coupling a fill tubing to a diaphragm valve of an implant, comprising:

   an inflatable implant (9) having a shell defining therein an implant chamber (9a);
   a diaphragm valve (12) in the implant for inflating the implant chamber (9a);
   a barb member (1, 21, 29) for coupling to the fill tubing , the barb member having a passage therethrough, the barb member passing having a barb member axis;
   a fill tip member (2, 16, 20, 24) having a bulb (8) for temporarily coupling to the diaphragm valve, the fill tip member having a passage (7) therethrough, the fill tip passage having a fill tip axis (7a) that projects normally from the implant when the fill tip member is coupled to the diaphragm valve; and
   wherein the barb member and the fill tip member are connected via a leak proof connection (100, 200, 300, 400) that enables the barb member to be rotated through an angular range from a normal position where the barb member axis is approximately parallel to the fill tip axis to a tangential position where the barb member axis is approximately perpendicular to the fill tip axis, and that enables the barb member to be swivelled approximately 360 degrees about the fill tip axis.

2. The apparatus as claimed in claim 1, wherein the barb member may be rotated about two axes with respect to the diaphragm valve.

3. The apparatus as claimed in claim 1, wherein the barb member may be rotated about three or more axes with respect to the diaphragm valve.

4. The apparatus as claimed in claim 1, wherein the connector comprises a swivel joint.

5. The apparatus as claimed in claim 4, wherein the swivel joint comprises a rotor on one of the fill tip member or diaphragm valve received within a stator on the other of the fill tip member or diaphragm valve.

6. The apparatus as claimed in claim 1, wherein the barb member and the fill tip member are connected via a ball-and-socket joint.

7. The apparatus as claimed in claim 6, wherein a ball and a socket of the ball-and-socket joint are lockable at a position within the angular range.

8. The apparatus as claimed in claim 1, the barb member and the fill tip member are rigidly connected via a joint, and the barb member is made of a more flexible material than the fill tip that enables the barb member to be rotated from the normal position to a plurality of tangential positions.

9. The apparatus as claimed in claim 1, wherein the barb member and the fill tip member are connected via a bellows that enables the barb member to be rotated from the normal position to a plurality of tangential positions.

10. The apparatus as claimed in claim 9, wherein the barb member, fill tip member, and bellows are formed in a single-piece molding.

11. A method of connecting a fill tubing to an implant having a diaphragm valve, comprising:

    coupling a barb member to the fill tubing, the barb member having a passage therethrough, the barb member passage having a barb member axis;
    temporarily coupling a fill tip member to the diaphragm valve, the fill tip member having a passage therethrough, the fill tip passage having a fill tip axis that projects normally from the implant when the fill tip member is coupled to the diaphragm valve; and
    connecting the barb member to the fill tip member so that the barb may be rotated through an angular range from a normal position where the barb member axis is approximately parallel to the fill tip axis to a tangential position where the barb member axis is approximately perpendicular to the fill tip axis, and wherein the barb member may be swivelled approximately 360 degrees about the fill tip axis.

12. The connecting method as claimed in claim 11, wherein the fill tip member couples to the implant via a swivel joint that comprises a rotor on one of the fill tip member or diaphragm valve received within a stator on the other of the fill tip member or diaphragm valve.

13. The method as claimed in claim 11, wherein the barb member connects to the fill tip member via a ball and a socket of a ball-and-socket joint.

14. The method as claimed in claim 13, further comprising the step of locking the ball and said socket at a position within the angular range.

Patentansprüche

1. Ein aufblasbares Implantat und universeller Implantatfüllverbinder zur Kopplung eines Füllschlauches mit einem Membranventil eines Implantats, umfassend:

ein aufblasbares Implantat (9) aufweisend eine Hülle, darin eine Implantatkammer (9a) definierend;
ein Membranventil (12) im Implantat zum Aufblasen der Implantatkammer (9a);
ein Widerhakenelement (1, 21, 29) zur Kopplung des Füllschlauches, das Widerhakenelement einen hindurchgehenden Durchgang aufweisend, der Widerhakenelementdurchgang eine Widerhakenelementachse aufweisend;
ein Füllspitzenelement (2, 16, 20, 24) aufweisend einen Wulst (8) zur zeitweisen Kopplung mit dem Membranventil, das Füllspitzenelement einen hindurchgehenden Durchgang (7) aufweisend, der Füllspitzendurchgang eine Füllspitzenachse (7a) aufweisend, die senkrecht aus dem Implantat herausragt, wenn das Füllspitzenelement mit dem Membranventil gekoppelt ist; und
wobei das Widerhakenelement und das Füllspitzenelement über eine lecksichere Verbindung (100, 200, 300, 400) verbunden ist, die dem Widerhakenelement ermöglicht, gedreht zu werden, über einen Winkelbereich von einer Normalposition, wo die Widerhakenelementachse ungefähr parallel zur Füllspitzenachse ist, zu einer Tangentialposition, wo die Widerhakenelementachse ungefähr senkrecht zur Füllspitzenachse ist, und die ermöglicht, das Widerhakenelement ungefähr 360 Grad um die Füllspitzenachse zu schwenken.

2. Die Vorrichtung gemäß Anspruch 1, wobei das Widerhakenelement um zwei Achsen in Bezug zum Membranventil gedreht werden kann.

3. Die Vorrichtung gemäß Anspruch 1, wobei das Widerhakenelement um drei oder mehr Achsen in Bezug zum Membranventil gedreht werden kann.

4. Die Vorrichtung gemäß Anspruch 1, wobei der Verbinder ein Drehgelenk umfasst.

5. Die Vorrichtung gemäß Anspruch 4, wobei das Drehgelenk einen Drehkörper an dem einen Füllspitzenelement oder Membranventil umfasst, aufgenommen innerhalb eines Stators an dem anderen Füllspitzenelement oder Membranventil.

6. Die Vorrichtung gemäß Anspruch 1, wobei das Widerhakenelement und das Füllspitzenelement über ein Kugelgelenk verbunden sind.

7. Die Vorrichtung gemäß Anspruch 6, wobei die Kugel und die Aufnahme des Kugelgelenks in einer Position innerhalb des Winkelbereichs feststellbar sind.

8. Die Vorrichtung gemäß Anspruch 1, wobei das Widerhakenelement und das Füllspitzenelement unnachgiebig über ein Gelenk verbunden sind, und das Widerhakenelement aus einem flexibleren Material als die Füllspitze hergestellt ist, die es dem Widerhakenelement ermöglicht, von der Normalposition zu einer Vielzahl von Tangentialpositionen gedreht zu werden.

9. Die Vorrichtung gemäß Anspruch 1, wobei das Widerhakenelement und das Füllspitzenelement über einen Balg verbunden sind, der es dem Widerhakenelement ermöglicht, von der Normalposition zu einer Vielzahl von Tangentialpositionen gedreht zu werden.

10. Die Vorrichtung gemäß Anspruch 9, wobei das Widerhakenelement, Füllspitzenelement und der Balg in einer Einstück-Formgebung geformt werden.

11. Ein Verfahren zum Verbinden eines Füllschlauches mit einem Implantat, aufweisend ein Membranventil, umfassend:

Koppeln eines Widerhakenelements mit dem Füllschlauch, das Widerhakenelement einen hindurchgehenden Durchgang aufweisend, der Widerhakenelementdurchgang eine Widerhakenelementachse aufweisend;
zeitweises Koppeln eines Füllspitzenelements mit dem Membranventil, das Füllspitzenelement einen hindurchgehenden Durchgang aufweisend, der Füllspitzendurchgang eine Füllspitzenachse aufweisend, die senkrecht aus dem Implantat herausragt, wenn das Füllspitzenelement mit dem Membranventil gekoppelt ist; und
Verbinden des Widerhakenelements mit dem Füllspitzenelement, so dass der Widerhaken gedreht werden kann, über einen Winkelbereich von einer Normalposition, wo die Widerhakenelementachse ungefähr parallel zur Füllspitzenachse ist, zu einer Tangentialposition, wo die Widerhakenelementachse ungefähr senkrecht zur Füllspitzenachse ist, und wobei das Widerhakenelement ungefähr 360 Grad um die Füllspitzenachse geschwenkt werden kann.

12. Das Verbindungsverfahren gemäß Anspruch 11, wobei das Füllspitzenelement sich mit dem Implantat verbindet, über ein Drehgelenk, das einen Drehkörper an dem einen Füllspitzenelement oder Membranventil umfasst, aufgenommen innerhalb eines

Stators an dem jeweils anderen Füllspitzenelement oder Membranventil.

13. Das Verfahren gemäß Anspruch 11, wobei das Widerhakenelement sich mit dem Füllspitzenelement verbindet, über eine Kugel und eine Pfanne eines Kugelgelenks.

14. Das Verfahren gemäß Anspruch 13, weiterhin umfassend den Schritt des Feststellens der Kugel und der Pfanne in einer Position innerhalb des Winkelbereichs.

Revendications

1. Implant gonflable et connecteur universel de remplissage d'implant pour coupler un tube de remplissage à une valve de diaphragme d'un implant, comprenant :

un implant gonflable (9) ayant une coque définissant dans celui-ci, une chambre d'implant (9a) ;
une valve de diaphragme (12) dans l'implant pour le gonflage de la chambre d'implant (9a) ;
un élément à ardillon (1, 21, 29) pour couplage avec le tube de remplissage, l'élément à ardillon ayant une voie de passage dans celui-ci, le passage de l'élément à ardillon ayant un axe de l'élément à ardillon ;
un élément d'extrémité de remplissage (2, 16, 20, 24) ayant un bulbe (8) pour le couplage temporaire à une valve de diaphragme, l'élément d'extrémité de remplissage ayant un passage (7) dans celui-ci, le passage d'extrémité de remplissage ayant un axe d'extrémité de remplissage (7a) qui se projette normalement de l'implant lorsque l'élément d'extrémité de remplissage est couplé à la valve de diaphragme ; et
dans lequel l'élément à ardillon et l'élément d'extrémité de remplissage sont raccordés via un raccord anti-fuite (100, 200, 300, 400) qui permet à l'élément à ardillon de tourner dans une plage angulaire d'une position normale dans laquelle l'axe de l'élément à ardillon est à peu près parallèle à l'axe d'extrémité de remplissage, à une position tangentielle dans laquelle l'axe de l'élément à ardillon est à peu près perpendiculaire à l'axe d'extrémité de remplissage et qui permet à l'élément à ardillon de pivoter d'environ 360 degrés autour de l'axe d'extrémité de remplissage.

2. Appareil selon la revendication 1, dans lequel l'élément à ardillon peut tourner autour de deux axes par rapport à la valve de diaphragme.

3. Appareil selon la revendication 1, dans lequel l'élément à ardillon peut tourner autour de trois axes ou plus par rapport à la valve de diaphragme.

4. Appareil selon la revendication 1, dans lequel le connecteur comprend un joint articulé.

5. Appareil selon la revendication 4, dans lequel le joint articulé comprend un rotor sur un élément parmi l'élément d'extrémité de remplissage ou la valve de diaphragme reçue dans un stator sur l'autre élément parmi l'élément d'extrémité de remplissage ou la valve de diaphragme.

6. Appareil selon la revendication 1, dans lequel l'élément à ardillon et l'élément d'extrémité de remplissage sont raccordés par un joint à rotule.

7. Appareil selon la revendication 6, dans lequel une rotule du joint à rotule peut être verrouillée dans une position dans l'ordre de grandeur angulaire.

8. Appareil selon la revendication 1, dans lequel l'élément à ardillon et l'élément d'extrémité de remplissage sont raccordés de façon rigide via un joint et l'élément à ardillon est constitué d'un matériau plus flexible que l'extrémité de remplissage qui permet à l'élément à ardillon de tourner de la position normale à une pluralité de positions tangentielles.

9. Appareil selon la revendication 1, dans lequel l'élément à ardillon et l'élément d'extrémité de remplissage sont raccordés via un soufflet qui permet à l'élément à ardillon de tourner de la position normale à une pluralité de positions tangentielles.

10. Appareil selon la revendication 9, dans lequel l'élément d'extrémité de remplissage et le soufflet sont formés en un moulage monobloc.

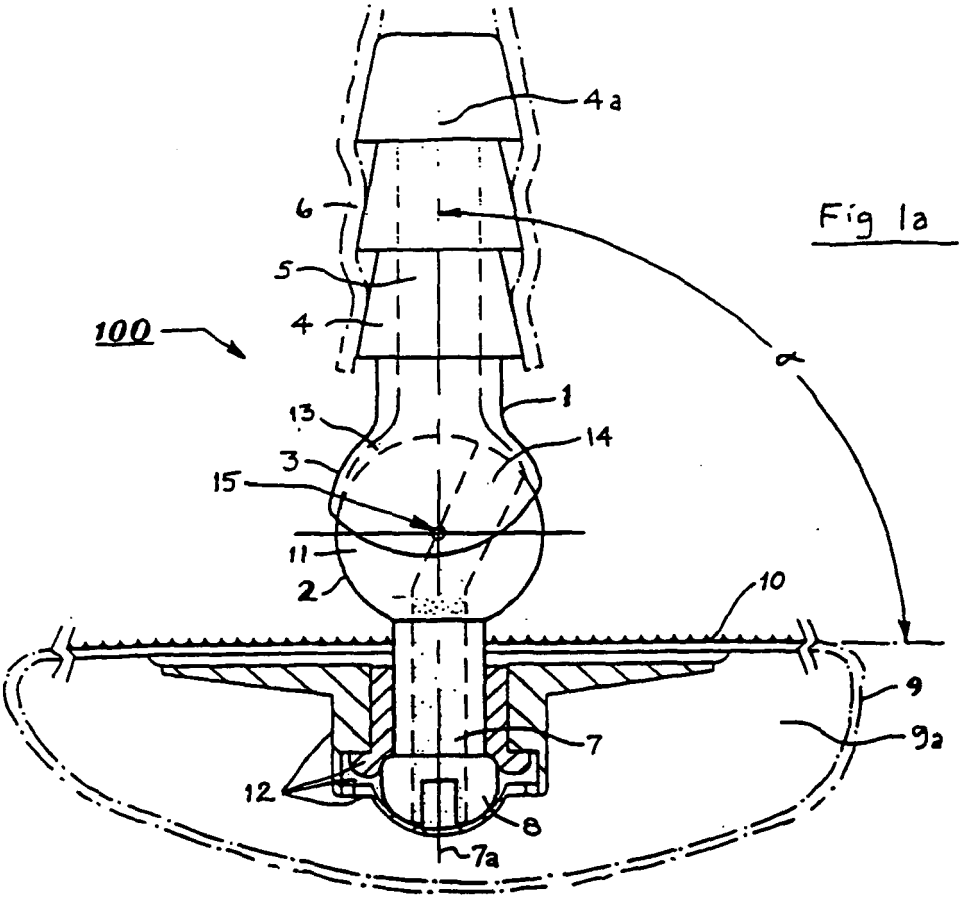
11. Procédé de raccordement d'un tube de remplissage à un implant, ayant une valve de diaphragme, comprenant
le couplage d'un élément à ardillon au tube de remplissage, l'élément à ardillon ayant un passage dans celui-ci, le passage de l'élément à ardillon ayant un axe de l'élément à ardillon ;
le couplage provisoire d'un élément d'extrémité de remplissage à une valve de diaphragme, l'élément d'extrémité de remplissage ayant un passage dans celui-ci, le passage d'extrémité de remplissage ayant un axe d'extrémité de remplissage qui se projette normalement de l'implant lorsque l'élément d'extrémité de remplissage est couplé à la valve de diaphragme ; et
le raccord de l'élément à ardillon à l'élément d'extrémité de remplissage, de sorte que l'ardillon puisse tourner sur un ordre de grandeur angulaire depuis

une position normale dans laquelle l'axe de l'élément à ardillon est à peu près parallèle à l'axe d'extrémité de remplissage à une position tangentielle dans laquelle l'axe de l'élément à ardillon est à peu près perpendiculaire à l'axe d'extrémité de remplissage, et dans laquelle l'élément à ardillon peut pivoter d'environ 360 degrés autour de l'axe d'extrémité de remplissage.

12. Procédé de raccordement selon la revendication 11, dans lequel l'élément d'extrémité de remplissage se couple à l'implant via un joint articulé qui comprend un rotor sur un élément parmi l'élément d'extrémité de remplissage ou une valve de diaphragme reçue dans un stator sur l'autre élément parmi l'élément d'extrémité de remplissage ou la valve de diaphragme.

13. Procédé selon la revendication 11, dans lequel l'élément à ardillon se raccorde à l'élément d'extrémité de remplissage par une rotule d'un joint à rotule.

14. Procédé selon la revendication 13, comprenant en outre l'étape de verrouillage du joint à rotule dans une position dans l'intervalle de grandeur angulaire.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6
5
4
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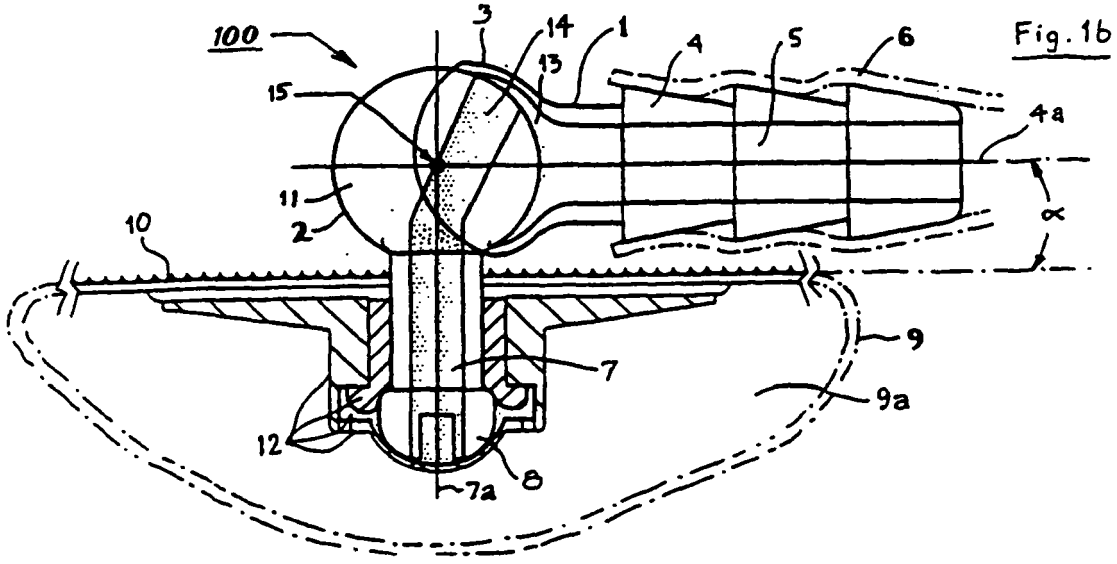
1
13
14
3
15
11
2
10
9
9a
7
12
8
7a
α

Fig 1a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14
1
13
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5
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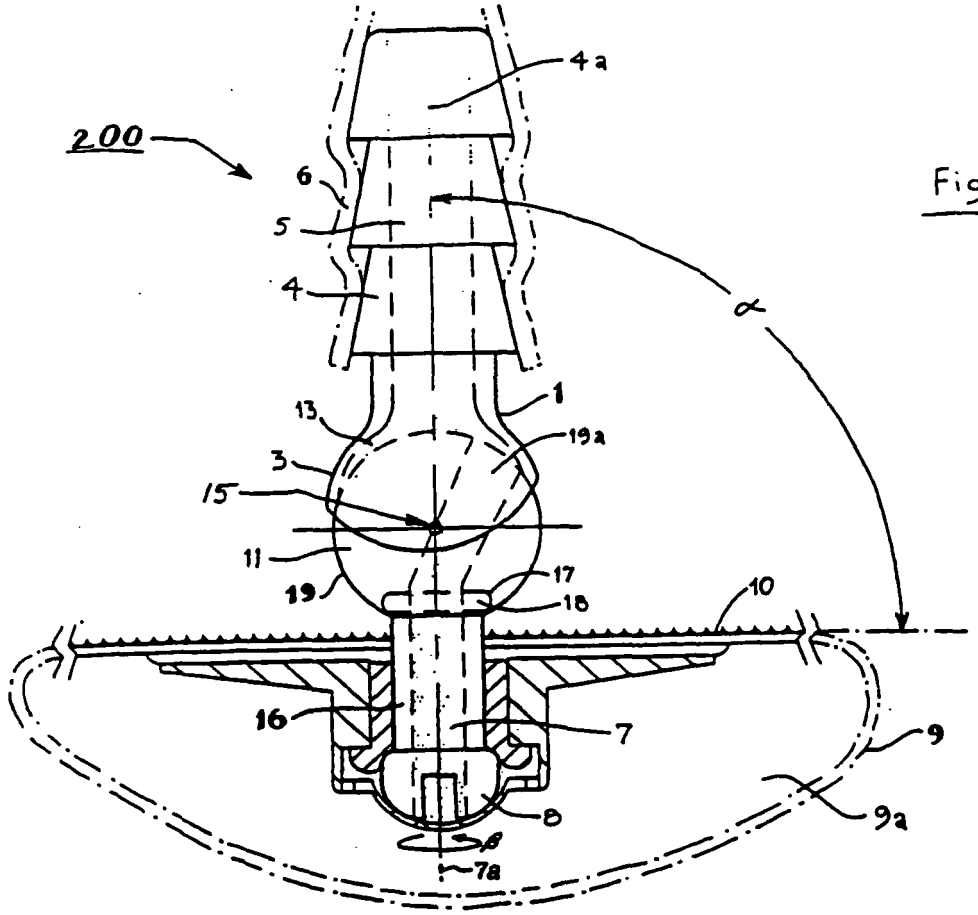
4a
11
2
10
α
9
7
9a
12
8
7a

Fig. 1b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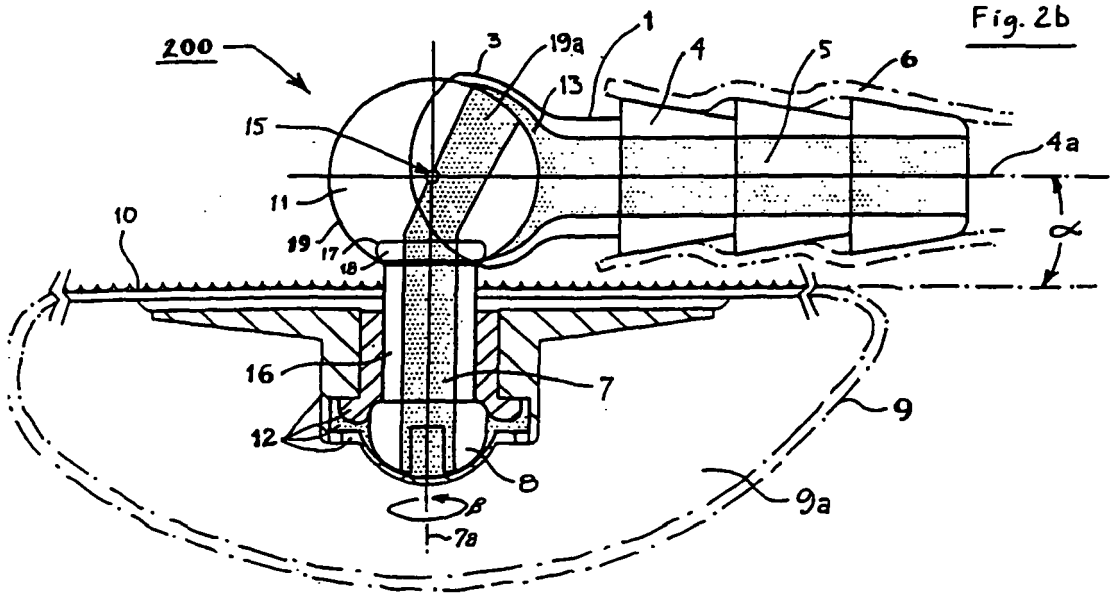
4a
6
5
4
α
1
13
19a
3
15
11
19
17
18
10
16
7
9
8
9a
β
7a

Fig. 2a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13
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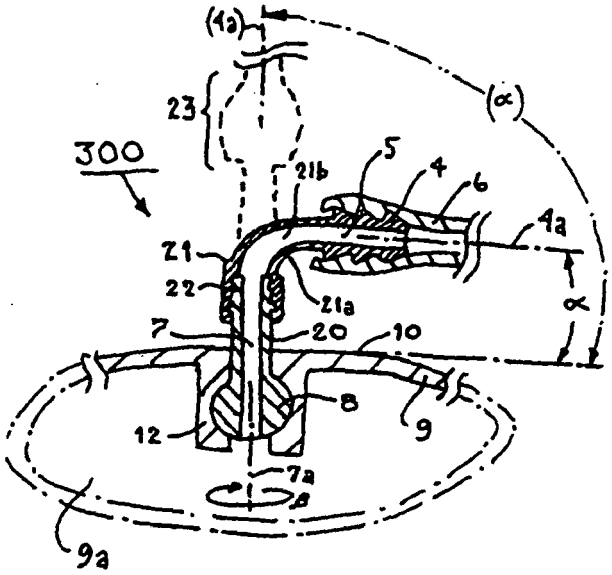
4a
11
10
19
17
18
α
16
7
9
12
8
9a
β
7a

Fig. 2b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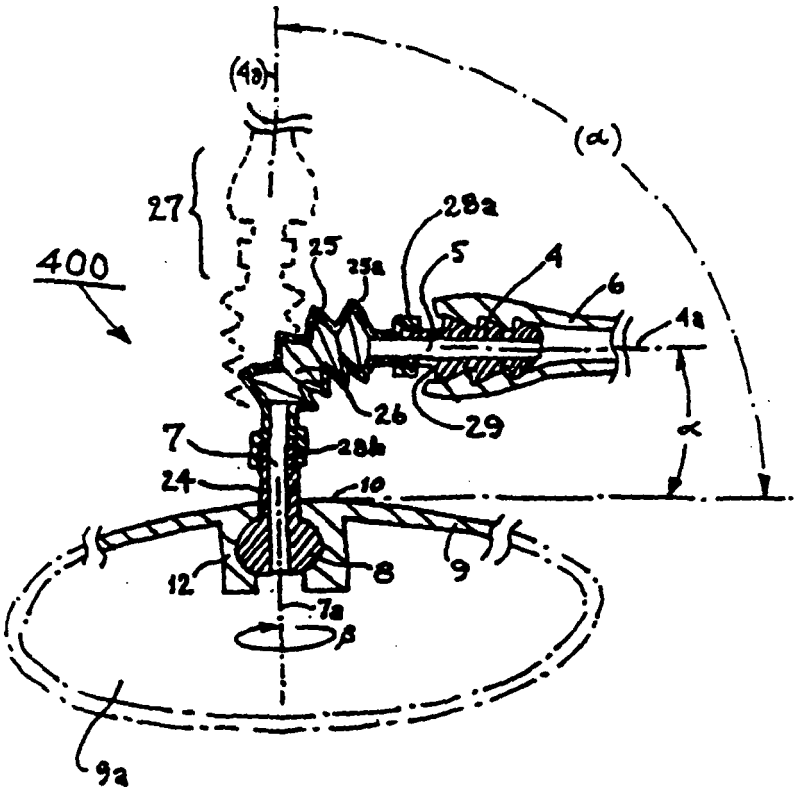
300
21b
5
4
6
4a
21
22
21a
α
7
20
10
8
9
12
7a
β
9a

Fig. 3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(α)
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28a
400
25
25a
5
4
6
4a
26
29
α
7
28b
24
10
8
9
12
7a
β
9a

Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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