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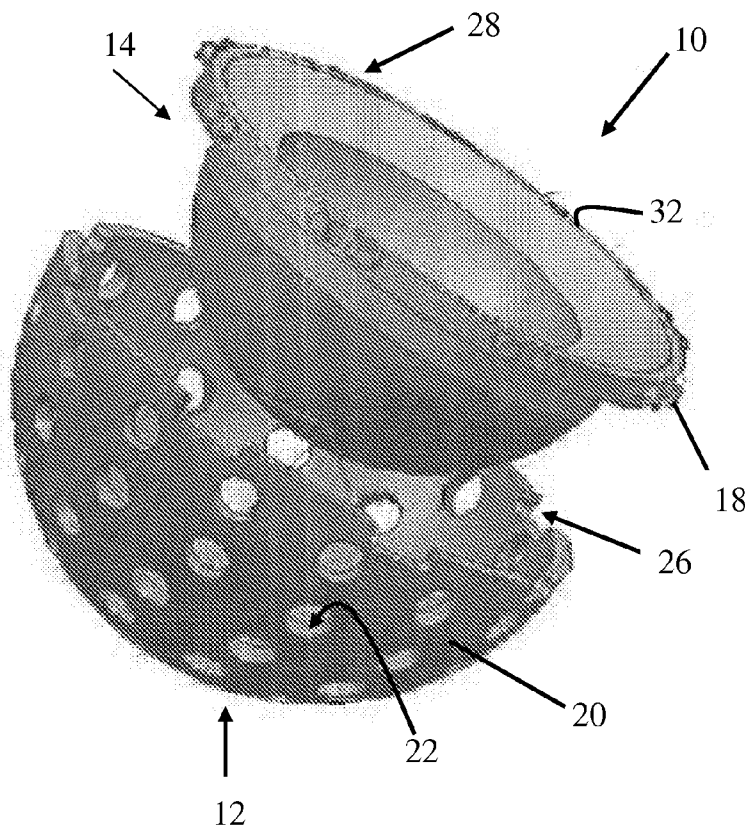
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(54) Title: ACETABULAR TRIAL SYSTEM



(57) Abstract: An acetabular trial system [10] comprises a first reamer [42], a second reamer [12] and a liner [14]. The first reamer [42] has a first diameter [50] and is configured to ream an acetabulum. The second reamer [12] has a second diameter [30] larger than the first diameter [50] and is configured to ream the acetabulum. The liner [14] is configured to mate to the second reamer [12] such that when an acetabulum is reamed by the first reamer [42], the second reamer [12] is sized as a trial shell component. The second reamer [12] is capable of impaction into the acetabulum and reception of the liner [14] such that the liner [14] and the second reamer [12] are configured to trial the acetabulum for size and orientation relative to a femoral component of a hip prosthesis.

WO 2007/121313 A2



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

ACETABULAR TRIAL SYSTEM

Cross-Reference to Related Applications

[0001] This application claims the benefit of U.S. Provisional Application No.
5 60/791,590, filed April 12, 2006. The disclosure of the provisional application is
incorporated by reference in its entirety.

Statement Regarding Federally Sponsored Research or Development.

[0002] Not Applicable.
10

Appendix.

[0003] Not Applicable.

Background of the Invention

15 *1. Field of the Invention*

[0004] This invention relates generally to acetabular implants and, more particularly,
to trial systems for the acetabulum.

2. Related Art

[0005] Many acetabular systems have a system and method of trialing the acetabulum
20 to ensure that the components' sizing and location are satisfactory. The method of trialing
the acetabulum usually consists of provisionally implanting a trial acetabular shell and a trial
liner. Some systems use different size trial shells and trial liners. Other systems include
spacers to be placed between the trial liner and the trial shell to eliminate additional shells
and liners within the trial system by building up the trial system using the spacers.

[0006] Some surgeons, in trialing the acetabular components of a hip implant, have used other methods and devices to size and locate the acetabular components. For example, some surgeons have reamed the acetabulum to a desired shape, and then used an additional, larger reamer to trial the acetabulum. The larger reamer may be one size larger than the reamer used on the acetabulum to check. The surgeon may check for circumferential coverage by inserting the larger reamer into the reamed acetabulum.

[0007] There remains a need in the art for an acetabular trial system that may properly size the acetabulum through the use of cutting tools.

[0008] In addition, the trial system may reduce both the number of tools in an operating room and operating room time by eliminating steps and/or making some steps easier.

Summary of the Invention

In one aspect of the invention, an acetabular trial system comprises a first reamer, a second reamer and a liner. The first reamer has a first diameter and is configured to ream an acetabulum. The second reamer has a second diameter larger than the first diameter and is configured to ream the acetabulum. The liner is configured to mate to the second reamer such that when an acetabulum is reamed by the first reamer, the second reamer is sized as a trial shell component. The second reamer is capable of impaction into the acetabulum and reception of the liner such that the liner and the second reamer are configured to trial the acetabulum for size and orientation relative to a femoral component of a hip prosthesis.

[0009] In another aspect of the invention, a method for trialing an acetabulum is provided. The method comprises the steps of cutting an acetabulum using a first reamer. The method further provides impacting a second reamer having a diameter greater than the diameter of the first reamer into the cut acetabulum. Another step mates a liner to the

second reamer such that the liner and the second reamer are configured to trial the acetabulum for size and orientation relative to a femoral component of a hip prosthesis.

[0010] An embodiment of the invention provides choosing the second reamer from a plurality of reamers having a plurality of diameters. Each of the plurality of reamers is
5 configured to ream an acetabulum. The liner and each of the plurality of reamers are configured to trial the acetabulum for size and orientation relative to a femoral component of a hip prosthesis.

[0011] Another embodiment of the invention provides choosing a spacer configured to mate to the liner and the second reamer. The method includes mating an outer mating
10 surface of the spacer to an inner surface of the second reamer. The method also includes mating an inner surface of the spacer to an outer surface of the liner. The spacer is configured to fill a radial distance between the inner surface of the second reamer and the outer surface of the liner.

[0012] Yet another embodiment of the invention provides mating a reamer adaptor
15 to the first reamer. The reamer adaptor may attach to a drill configured to rotate the first reamer within an acetabulum.

[0013] In yet another aspect of the invention, an acetabular trial system comprises a plurality of reamers and a liner. The plurality of reamers having a plurality of diameters. Each of the plurality of reamers is configured to ream an acetabulum. The liner is
20 configured to mate to at least one of the plurality of reamers such that when an acetabulum is reamed by one of the plurality of reamers, another of the plurality of reamers is sized as a trial shell component. The another of the plurality of reamers is capable of impaction into the acetabulum and reception of the liner such that the liner and the another of the plurality of reamers are configured to trial the acetabulum for size and orientation relative to a
25 femoral component of a hip prosthesis.

[0014] The invention has several advantages over prior devices and techniques. First, the number of instruments in an operating room for an artificial hip surgery may be reduced. Second, the time in the operating room may be reduced because fewer steps may be necessary to complete the surgery and/or the steps may be easier to perform.

5 [0015] An embodiment of the invention provides an acetabular trial system wherein the second reamer comprises a plurality of reamers having a plurality of diameters. Each of the plurality of reamers is configured to ream an acetabulum and further capable of impaction into the acetabulum and reception of the liner such that the liner and each of the plurality of reamers are configured to trial the acetabulum for size and orientation relative to
10 a femoral component of a hip prosthesis.

[0016] Another embodiment of the invention provides an acetabular trial system wherein the liner comprises a plurality of liners. Each of the plurality of liners is configured to mate to the second reamer. Each of the plurality of liners is further configured to receive a femoral head of a hip prosthesis.

15 [0017] Another embodiment of the invention further comprises a spacer configured to mate to the liner and the second reamer. The spacer comprises an outer mating surface, an inner mating surface, an outer mating surface, and a thickness. The outer mating surface is configured to mate the spacer to an inner surface of the second reamer. The inner mating surface is configured to mate the spacer to an outer surface of the liner. The thickness is
20 configured to fill a radial distance between the inner surface of the second reamer and the outer surface of the liner.

[0018] Another embodiment of the invention provides an acetabular trial system wherein the liner further comprises a plurality of liners. At least one of the plurality of liners is configured to fill the radial distance between the second reamer and the liner.

[0019] Yet another embodiment of the invention provides an acetabular trial system further comprising a reamer adaptor configured to mate to the first reamer such that the reamer adaptor may attach to a drill configured to rotate the first reamer within an acetabulum.

5 [0020] Another embodiment of the invention provides an acetabular trial system wherein the reamer adaptor is further configured to attach to a connector on the first reamer. The connector is further configured to mate to the liner.

[0021] Another embodiment of the invention provides an acetabular trial system wherein the second reamer has a roughened outer surface.

10 [0022] Another embodiment of the invention provides an acetabular trial system wherein the second reamer further comprises a recess and the liner further comprises a tab. The tab is configured to mate to the recess.

[0023] Another embodiment of the invention provides an acetabular trial system wherein the recess comprises a plurality of recesses and the tab comprises a plurality of tabs.

15 [0024] Yet another embodiment of the invention provides an acetabular trial system wherein the second reamer further comprises a tab and the liner further comprises a recess. The tab is configured to mate to the recess.

[0025] Another embodiment of the invention provides an acetabular trial system wherein the recess comprises a plurality of recesses and the tab comprises a plurality of tabs.

20 [0026] Further features, aspects, and advantages of the present invention, as well as the structure and operation of various embodiments of the present invention, are described in detail below with reference to the accompanying drawings.

Brief Description of the Drawings

[0027] The accompanying drawings, which are incorporated in and form a part of the specification, illustrate embodiments of the present invention and together with the description, serve to explain the principles of the invention. In the drawings:

5 Figure 1 is an exploded view of parts of a trial acetabular system for trialing an acetabulum.

Figure 2 is a view of the parts of Figure 1 assembled.

Figure 3 is an exploded view of parts of a trial acetabular system for reaming an acetabulum.

10 Figure 4 is a view of the parts of Figure 3 assembled.

Detailed Description of the Embodiments

[0028] Referring to the accompanying drawings in which like reference numbers indicate like elements, Figure 1 is an exploded view of parts of a trial acetabular system 10 for
15 trialing an acetabulum. The trial acetabular system 10 includes a reamer 12 and a trial liner 14. The liner 14 is seated within the reamer 12. The reamer 12 is placed within the reamed acetabulum (not shown). The reamer 12 serves as a trial acetabular shell component while the liner serves as a trial acetabular liner. Together, the system 10 is configured to orient the acetabular components of a hip implant relative to the femoral components of the hip implant.

20 [0029] The reamer 12 is sized with a larger diameter than the cutting tools used in cutting the acetabulum. The reamer 12 is impacted into the shaped acetabulum so that the reamer 12 is provisionally fixed to the acetabulum for measuring size and alignment before final fixation of the acetabular components of the implant.

[0030] The liner 14 is chosen so that the liner 14 is properly sized to receive the
25 femoral plant of the implant the surgeon has determined be used in the surgery. Thus, because

the femoral head size may be different for the same acetabular shell component, the reamer 12 may be configured to receive multiple trial liner 14 sizes. The liner 14 is further configured having a plurality of tabs 18 configured to retain the liner within the reamer 12, as described below.

5 **[0031]** The liner 14 may include a spacer 28 configured to mate to the reamer 12 at an inner diameter 30 (shown in Figure 2). The spacer has a thickness 32 which extends the liner 14 to the inner diameter 30 of the reamer 12. The spacer may be an integral component of the liner 14 or may be modularly attached to the liner 14 so that different spacers 28 of different thicknesses may be attached to the liner 14.

10 **[0032]** The acetabular reamer 12 includes a rough outer surface 20, cutting edges 22, and recesses 26. The recesses 26 are female connectors configured to receive the male connector tabs 18 of the liner 14. The liner 14 is mated to the reamer 12 by inserting the tabs 18 within the recesses 26. While this embodiment shows the female connector on the reamer 12 and the male connector on the liner 14, other embodiments may include the male
15 component on the reamer 12 and the female connector on the liner. In addition, other connectors, such as, but not limited to, screws, clips, compression rings, interference fits or the like may be used to mate the liner 14 to the reamer 12.

[0033] Turning now to Figure 2, Figure 2 is a view of the parts of Figure 1 assembled. The liner 14 is mated to the reamer 12. The liner 14 has a femoral head receiving indent
20 36. The indent 36 may receive a femoral head component of a hip prosthesis. The size of the indent 36 may be based upon the size of the femoral head the surgeon has chosen to use in the procedure. The trial liner 14, then, may be modular with respect to the reamer 12 so that one reamer 12 may be used with a plurality of liners 14. In order to further minimize the number of parts in the system 10, the spacer 28 may also include a plurality of spacers
25 such that a single liner 14 having an indent 36 may be mated to a plurality of reamers 12.

As an example, assuming five reamer sizes and five indent sizes on five liners, then each reamer would need to be paired to five different liners for a total of 25 parts. But, if five spacers, each matching the inner diameter of a reamer on the spacers' outer surface, and all the spacers matching the outer diameter of the liners on the spacer's inner surface were used, then five spacers could be used individually to mate all of the reamers to all of the liners, thereby requiring 15 total parts. As the number of sizes of reamers and liners increases, the difference in the number of required parts increases dramatically.

[0034] Turning now to Figures 3 and 4, Figure 3 is an exploded view of parts of a trial acetabular system for reaming an acetabulum. Figure 4 is a view of the parts of Figure 3 assembled. The parts include a reamer 42 and a reamer adaptor 44. The reamer adaptor 44 is configured having a plurality of tabs 46 configured to mate to a plurality of recesses 48 on the reamer 42. Together, the adaptor 44 and reamer 42 have an outer diameter 50. The outer diameter 50 is chosen by a surgeon so that the acetabular components may be effectively implanted into the acetabulum of a patient.

[0035] When the adaptor 44 is attached to the reamer 42, cross bar support members 52 of the adaptor 44 are configured to connect the reamer-adaptor assembly to a drill. While the cross bar members 52 are shown in this embodiment, other locking devices, mechanisms or methods may be used to connect the reamer to a drill. Cutting edges 56 of the reamer 42 are used to prepare the acetabulum to the desired diameter.

[0036] In this embodiment, the adaptor 44 attaches to the reamer 42 in the same recesses 48 where a liner would attach to the reamer 42. However, the adaptor 44 mates tangential to the radius while the liner of Figures 1 and 2 mates along a radius of the reamer 42. It may be beneficial to connect an adaptor tangential to the radius to minimize shear stresses transferred from the adaptor to the reamer, while it may be beneficial to seat the liner along the radius for clearance of the trial system.

[0037] After the reamer 42 has prepared the acetabulum, the second reamer 12, having a diameter greater than the diameter of the reamer used to ream the acetabulum, may be impacted into the acetabulum. By using a reamer as the trial shell, the roughened surface of the reamer, as well as the cutting surfaces, may provide a firmer grip of the trial to the bone.

5 The liner may then be inserted into the impacted reamer, and the orientation and size of the hip prostheses may be trialed. Other liners may be used if the surgeon determines he would rather a different femoral head, thus requiring a different liner. The surgeon may then prepare the femur and perform a trial reduction of the hip prosthesis to ensure proper placement and correct sizing of the prosthesis. When the surgeon has finalized the placement and sizes of the

10 hip prosthesis, then the trial liner and reamer are removed from the acetabulum and the prosthesis is implanted.

[0038] An acetabular trial system, then, comprises a first reamer, a second reamer and a liner. The first reamer has a first diameter and is configured to ream an acetabulum. The second reamer has a second diameter larger than the first diameter and is configured to

15 ream the acetabulum. The liner is configured to mate to the second reamer such that when an acetabulum is reamed by the first reamer, the second reamer is sized as a trial shell component. The second reamer is capable of impaction into the acetabulum and reception of the liner such that the liner and the second reamer are configured to trial the acetabulum for size and orientation relative to a femoral component of a hip prosthesis.

20 [0039] The method for trialing an acetabulum includes cutting an acetabulum using a first reamer. The method further provides impacting a second reamer having a diameter greater than the diameter of the first reamer into the cut acetabulum. Another step mates a liner to the second reamer such that the liner and the second reamer are configured to trial the acetabulum for size and orientation relative to a femoral component of a hip prosthesis.

[0040] While the trial reduction may be completed using only two reamers, it may be more common to provide a plurality of reamers to trial the acetabulum. The acetabular trial system then comprises a plurality of reamers and a liner. The plurality of reamers having a plurality of diameters. Each of the plurality of reamers is configured to ream an acetabulum. The liner is configured to mate to at least one of the plurality of reamers such that when an acetabulum is reamed by one of the plurality of reamers, another of the plurality of reamers is sized as a trial shell component. The another of the plurality of reamers is capable of impaction into the acetabulum and reception of the liner such that the liner and the another of the plurality of reamers are configured to trial the acetabulum for size and orientation relative to a femoral component of a hip prosthesis.

[0041] While a single liner may be used, another embodiment of the invention provides for a plurality of liners. Each of the plurality of liners is configured to mate to the second reamer. Each of the plurality of liners is further configured to receive a femoral head of a hip prosthesis. Together, a plurality of liners and reamers may be used to provide for more shell sizes and femoral head sizes in an implant. By using the plurality of reamers and liners, the reamers replace the need to provide trial shells in the trialing procedure.

[0042] In order to further reduce the number of components in the acetabular system, the system may include a spacer configured to mate to the liner and the second reamer. The spacer comprises an outer mating surface, an inner mating surface, an outer mating surface, and a thickness. The outer mating surface is configured to mate the spacer to an inner surface of the second reamer. The inner mating surface is configured to mate the spacer to an outer surface of the liner. The thickness is configured to fill a radial distance between the inner surface of the second reamer and the outer surface of the liner.

[0043] Another embodiment of the invention provides an acetabular trial system comprising a plurality of liners. At least one of the plurality of liners is configured to fill the

radial distance between the second reamer and the liner. In such an embodiment, for one given femoral head size, the plurality of liners will have varying diameters such that each of the liners may fit into one of a plurality of different reamer diameters.

[0044] An acetabular trial system may further comprise a reamer adaptor configured to mate to the first reamer. The reamer adaptor may attach to a drill configured to rotate the first reamer within an acetabulum. The reamer, then, may be used in one instance to prepare an acetabulum and in another instance where the diameter of the acetabulum is desired to be smaller than the diameter of the first reamer, to be used as a trial insert.

[0045] Another embodiment provides an acetabular trial system where the reamer adaptor is further configured to attach to a connector on the first reamer. The connector is further configured to mate to the liner. Thus, the adaptor may be configured to mate to a plurality of reamers. Because each of the reamers may also be used with the adaptor to cut an acetabulum, the reamers may have a roughened outer surface.

[0046] The reamer of an acetabular trial system may include a recess and the liner may further comprise a tab. The tab is configured to mate to the recess so that the liner is mated to the reamer. Alternatively, the reamer may include a tab and the liner may include the recess. In addition, the recess may include a plurality of recesses and the tab may include a plurality of tabs. The tabs and/or recesses on the reamer may also be configured to mate the reamer adaptor to the reamer.

[0047] The embodiments were chosen and described in order to best explain the principles of the invention and its practical application to thereby enable others skilled in the art to best utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated.

[0048] In view of the foregoing, it will be seen that the several advantages of the invention are achieved and attained.

[0049] As various modifications could be made in the constructions and methods herein described and illustrated without departing from the scope of the invention, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative rather than limiting. Thus, the breadth and scope
5 of the present invention should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the following claims appended hereto and their equivalents.

What is Claimed Is:

1. An acetabular trial system, comprising:
 - a first reamer, having a first diameter and configured to ream an acetabulum;
 - a second reamer having a second diameter larger than the first diameter and
 - 5 configured to ream the acetabulum; and
 - a liner configured to mate to the second reamer such that when an acetabulum is reamed by the first reamer, the second reamer is sized as a trial shell component, the second reamer being capable of impaction into the acetabulum and reception of the liner such that the liner and the second reamer are configured to trial the acetabulum for size and
 - 10 orientation relative to a femoral component of a hip prosthesis.

2. The acetabular trial system of claim 1, wherein the second reamer comprises a plurality of reamers having a plurality of diameters, each of the plurality of reamers configured to ream an acetabulum and further capable of impaction into the acetabulum
- 15 and reception of the liner such that the liner and each of the plurality of reamers are configured to trial the acetabulum for size and orientation relative to a femoral component of a hip prosthesis.

3. The acetabular trial system of claim 1 or 2, wherein the liner comprises a plurality
- 20 of liners, each of the plurality of liners being configured to mate to the second reamer, each of the plurality of liners being further configured to receive a femoral head of a hip prosthesis.

4. The acetabular trial system of any of claims 1-3, further comprising a spacer
- 25 configured to mate to the liner and the second reamer, the spacer comprising:

an outer mating surface configured to mate the spacer to an inner surface of the second reamer,

an inner surface configured to mate the spacer to an outer surface of the liner, and

a thickness configured to fill a radial distance between the inner surface of the
5 second reamer and the outer surface of the liner.

5. The acetabular trial system of any of claims 1-4, wherein the liner further comprises a plurality of liners, at least one of the plurality of liners being configured to fill a radial distance between the second reamer and the liner.

10

6. The acetabular trial system of any of claims 1-5, further comprising a reamer adaptor configured to mate to the first reamer such that the reamer adaptor may attach to a drill configured to rotate the first reamer within an acetabulum.

15 7. The acetabular trial system of any of claim 6, wherein the reamer adaptor is further configured to attach to a connector on the first reamer, the connector being further configured to mate to the liner.

20 8. The acetabular trial system of any of claims 1-7, wherein the second reamer has a roughened outer surface.

9. The acetabular trial system of any of claims 1-8, wherein the second reamer further comprises a recess and the liner further comprises a tab, the tab being configured to mate to the recess.

25

10. The acetabular trial system of claim 9, wherein the recess comprises a plurality of recesses and the tab comprises a plurality of tabs.

11. The acetabular trial system of any of claims 1-8, wherein the second reamer further
5 comprises a tab and the liner further comprises a recess, the tab being configured to mate to the recess.

12. The acetabular trial system of claim 11, wherein the recess comprises a plurality of recesses and the tab comprises a plurality of tabs.

10

13. A method for trialing an acetabulum comprising the steps of:

cutting an acetabulum using a first reamer;

impacting a second reamer having a diameter greater than the diameter of the first reamer into the cut acetabulum;

15 mating a liner to the second reamer such that the liner and the second reamer are configured to trial the acetabulum for size and orientation relative to a femoral component of a hip prosthesis.

14. The method of claim 13, further comprising the step of choosing the second
20 reamer from a plurality of reamers having a plurality of diameters, each of the plurality of reamers configured to ream an acetabulum such that the liner and each of the plurality of reamers are configured to trial the acetabulum for size and orientation relative to a femoral component of a hip prosthesis.

25

15. The method of claims 13 or 14, further comprising the steps of:
choosing a spacer configured to mate to the liner and the second reamer;
mating an outer mating surface of the spacer to an inner surface of the second
reamer; and
5 mating an inner surface of the spacer to an outer surface of the liner such that the
spacer is configured to fill a radial distance between the inner surface of the second reamer
and the outer surface of the liner.
16. The method of any of claims 13-15, further comprising the step of:
10 mating a reamer adaptor to the first reamer such that the reamer adaptor may attach
to a drill configured to rotate the first reamer within an acetabulum.

[1/2]

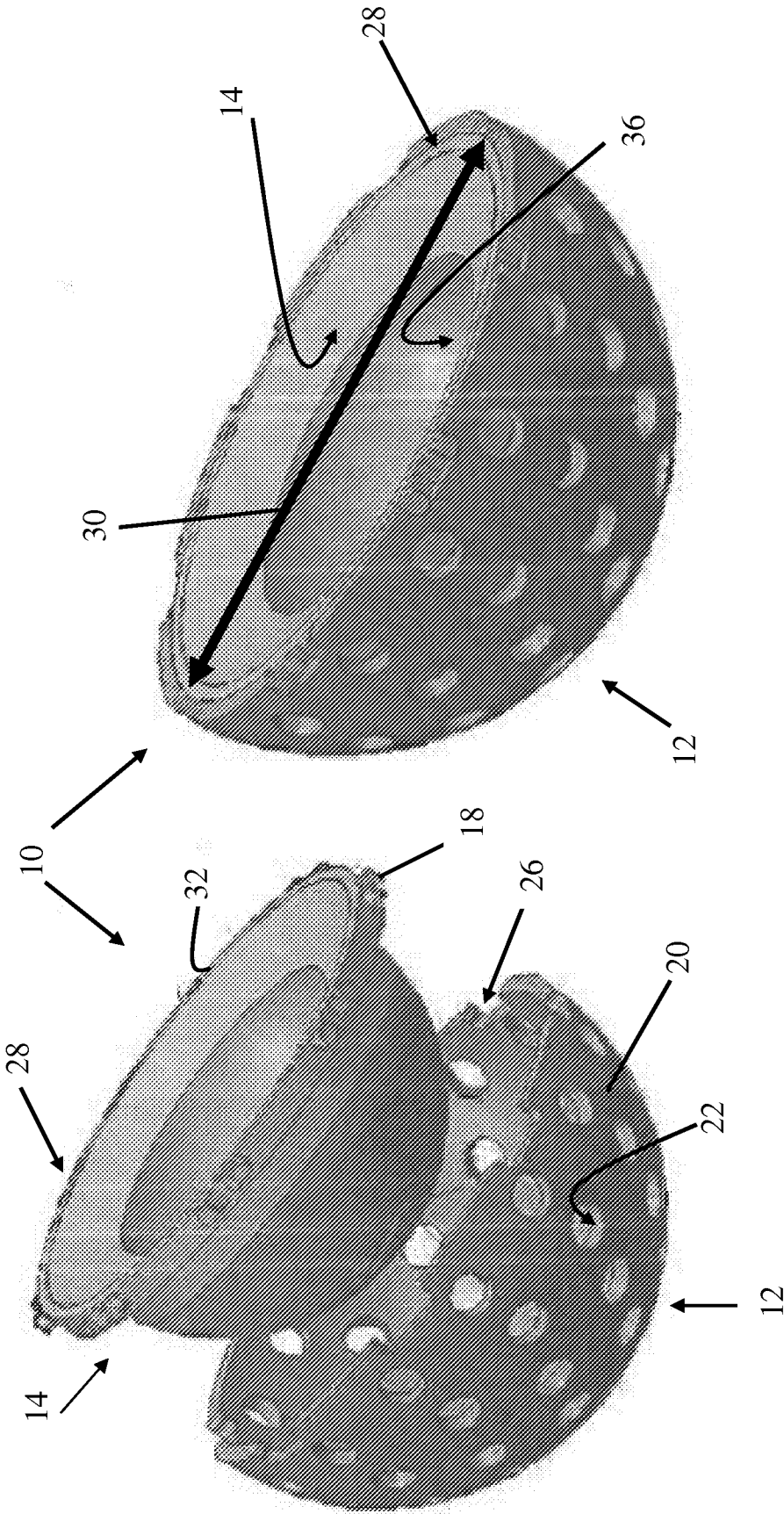


Figure 2

Figure 1

[2/2]

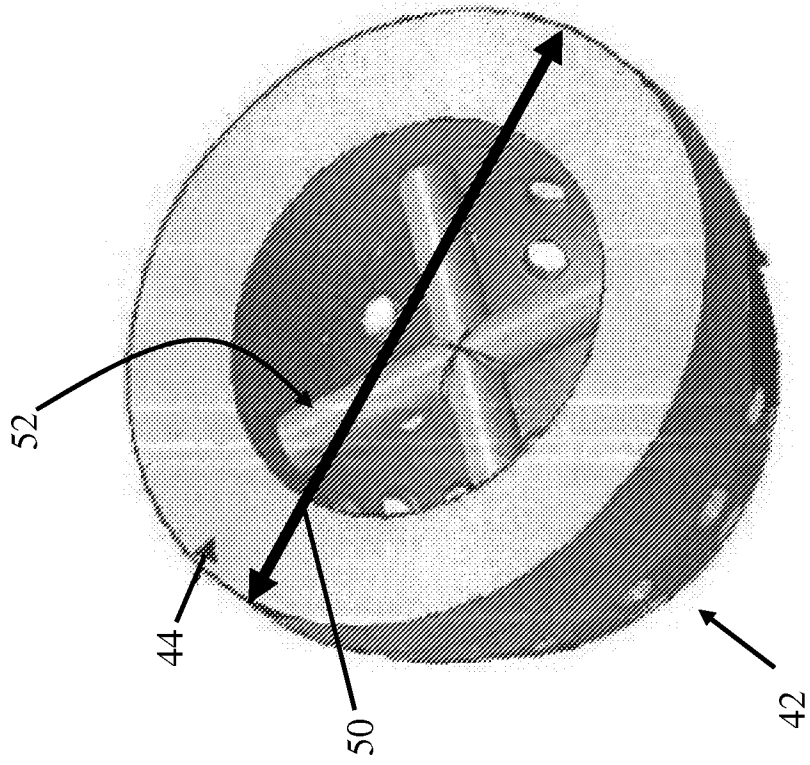


Figure 4

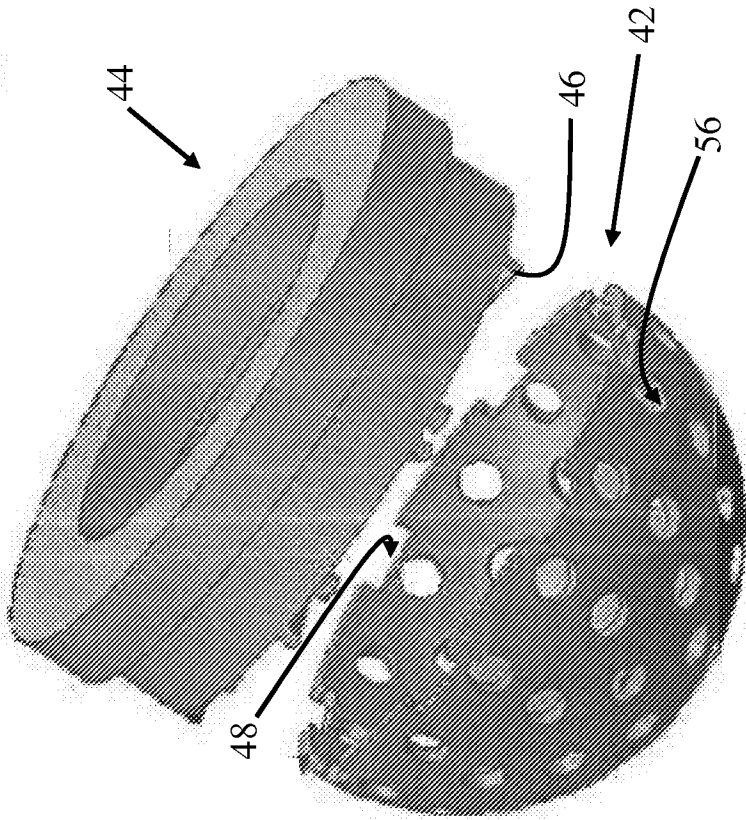


Figure 3