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US-A1- 2012 109 326
US-B1- 6 409 767

DESCRIPTION

BACKGROUND OF THE INVENTION

[0001] Ankle pain arises from various conditions including osteoarthritis, post-traumatic arthritis, and rheumatoid arthritis. Generally, a total ankle replacement system, such as S.T.A.R.[®] or the Scandinavian Total Ankle Replacement System (Howmedica Osteonics, Mahwah, NJ), includes three components: a first component generally conforming to the talus, a second component generally conforming to the tibia, and a third component being a mobile bearing surface positioned between the first and second components. Such systems may offer a non-cemented implant for replacing a damaged joint while maintaining the range of motion of the ankle.

[0002] In certain instances, the talar component of current ankle systems may sit atop the talus, leaving clearance or space between the resected bone and the component. This clearance could reduce fixation of the implant with the bone, and may allow synovial fluid to seep under the implant, which can result in the loosening of the implant. Thus, there is a need in the art for a talar component that increases the chance of achieving a flush fit with the talus regardless of the shape of the talus, the shape of the resected bone surfaces, etc.

[0003] Document WO 2007/103826 A2 discloses a talar component of an ankle joint prosthesis for engagement with a talus bone, comprising a medial side wall and a lateral side wall, opposite the medial side wall, each side wall terminating at a distal edge, wherein the distal edges are adapted to drive into the talus bone.

BRIEF SUMMARY OF THE INVENTION

[0004] The present disclosure relates generally to implants, systems, and methods for ankle repair surgery, including total ankle replacement and partial ankle replacement. In particular, the present disclosure relates to a talar component for use in total or partial ankle repair. According to the invention, there is provided a talar component of an ankle joint prosthesis as defined in the appended claims.

[0005] In one embodiment of the present disclosure, a talar component of an ankle joint prosthesis for engagement with a talus bone includes a medial side wall and a lateral side wall, opposite the medial side wall, each side wall terminating at a distal edge, the distal edges adapted to drive into the talus bone.

[0006] In other embodiments, the distal edges may be self-cutting edges. The distal edges may be knife-edge, or they may be serrated. With the component implanted in the talus bone, the side walls may form a seal between the talus bone and the component. The talar

component may include an inferior surface, in which the inferior surface, medial wall and lateral wall define an inferior volume with the inferior surface positioned facing the talus bone. The seal may enclose a portion of the inferior volume not containing the talus bone, or otherwise a portion of the inferior volume above a surface of the talus bone. The inferior surface may be substantially concave. The talar component may include at least one anchor extending distally from the inferior surface along a longitudinal axis. In one embodiment, the talar component may be symmetrical about an axis extending in the anterior-posterior direction of the component. In an alternate embodiment, one of the medial and lateral side walls may extend farther distally than the other. Each side wall may have a thickness that tapers to form the distal edges. After implantation, for each side wall substantially all of the entire length of the distal edge may maintain contact with the talus bone. The seal between the component and the bone may be adapted to prevent fluid from flowing between the inferior surface of the component and the bone.

[0007] In some embodiments, the talar component further comprises an inferior surface, the inferior surface and opposing side walls define an inferior volume and, with the component engaged with the talus bone, the inferior surface and opposing side walls form a seal enclosing a portion of the inferior volume above a surface of the talus bone. For each side wall substantially an entire length of the side wall may maintain contact with the talus bone after implantation. The seal between the component and the bone may be adapted to prevent fluid from flowing between the inferior surface and the bone.

[0008] In another embodiment of the present disclosure, a talar component of an ankle joint prosthesis includes a concave inferior surface adapted to fit on a talus bone and opposing side walls including self-cutting edges, the inferior surface and opposing side walls defining an inferior volume, with the side walls at least partially positioned within the talus bone, the inferior surface and opposing side walls form a seal enclosing a portion of the inferior volume not containing the talus bone (if present) and/or otherwise encloses a volume above a surface of the talus bone situated within the inferior volume.

[0009] In other embodiments, for each side wall substantially all of the side wall maintains contact with the talus bone after implantation. A seal between the component and the bone may be formed and be adapted to prevent fluid from flowing between the inferior surface and the bone. Each side wall may have a thickness, the thicknesses tapering to form respective distal edges. One of the side walls may be a medial side wall and the other side wall may be a lateral side wall. One of the medial and lateral side walls may extend farther distally than the other. In an alternate embodiment, the talar component may be symmetrical about an axis extending in the anterior-posterior direction of the component. The talar component may include at least one anchor extending distally from the inferior surface along a longitudinal axis. The distal edges may drive into the bone, thus forming and maintaining the contact with the talus bone, to participate in forming the seal.

[0010] In yet another embodiment of the present disclosure, a method of implanting a talar component during ankle surgery includes cutting at least medial and lateral cuts in a talus

bone, and driving a self-cutting edge of a lateral side wall of the talar component into the lateral cut and a self-cutting edge of a medial side wall of the talar component into the medial cut.

[0011] In other embodiments, the medial and lateral cuts may be oversized such that, during the driving step, the medial and lateral cuts are separated from one another a distance sufficient to provide or preserve portions of the talus bone to be engaged by and to accept the self-cutting edges. During the driving step, at least one anchor extending from the talar component may be driven into the talus bone. After the driving step, the side walls may form a seal between the talus bone and the talar component. The talar component may include an inferior surface such that the inferior surface, medial side wall and lateral side wall define an inferior volume, wherein the seal encloses a portion of the inferior volume not containing the talus bone, (if present) and/or otherwise encloses a volume above a surface of the talus bone situated within the inferior volume.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a side view of bones of the foot and ankle;

Fig. 2 is a perspective view of components of an ankle joint prosthesis;

Fig. 3 is a perspective side view of a talar component of an ankle joint prosthesis according to an embodiment of the present disclosure;

Fig. 4 is a top view of the talar component of Fig. 3;

Fig. 5 is a side view of the talar component of Fig. 3;

Fig. 6 is a perspective bottom view of the talar component of Fig. 3;

Fig. 7 is a bottom view of the talar component of Fig. 3;

Fig. 8 is a cross-sectional view of the talar component of Fig. 3, viewed from the posterior end; and

Fig. 9 is a cross-sectional view of a side wall of the talar component of Fig. 3, viewed from the anterior end.

DETAILED DESCRIPTION

[0013] In the present disclosure, the term "proximal" generally means closer to the heart and the term "distal" generally means farther away from the heart. The term "posterior" means a

position towards the rear of the body and the term "anterior" means a position toward the front of the body. The term "superior" means a position closer to the head and the term "inferior" means a position closer to the feet.

[0014] Fig. 1 illustrates a simplified side view of the bones of the foot and ankle, including the distal tibia 10, the talus 20, and the distal fibula 30. In one example, the distal tibia 10 and the proximal talus 20 may be arthritic and need replacing with a partial or full joint replacement implant. FIG.2 illustrates an example of a full joint replacement implant 100 including a tibial component 40, a talar component 50, and a mobile bearing 60 (e.g., typically formed of ultra-high molecular weight polyethylene or other plastic) interposed between the tibial and talar components (e.g., typically formed of metal or the like).

[0015] The present disclosure includes a talar component which may be used as a partial joint replacement implant or as part of a total replacement ankle implant. Figs. 3-9 show one embodiment of such a talar component 150 for use in a total replacement ankle implant such as implant 100. Talar component 150 includes superior and inferior surfaces 152, 154, respectively, anterior and posterior edges 156, 158, respectively, and opposing medial and lateral side walls 160 extending at least partially between the anterior and posterior edges. From the top view, as shown in Fig. 4, talar component 150 may taper outwardly from posterior edge 158 to anterior edge 156, such that the distance between side walls 160 is greater nearer to the anterior edge than the posterior edge. However, as is commonly known in the art, the particular shape of component 150 may be different depending on particular sizes of the implant, such as implants of an intended size for a particular anatomy of a particular patient, and the like. In any event, the shape of talar component 150 is designed to cover the talar dome and the medial and lateral facets of the ankle as well as provide for a full range of motion in at least the anterior and posterior directions.

[0016] Continuing with the illustrated embodiment of FIGS. 3-9, the superior surface 152 of component 150 forms the articulation surface and has a shape complementary to the curvature of the other components of the full joint replacement implant, such as the bearing component, and in the illustrated embodiment, the superior surface is generally convex. A raised ridge 165 may optionally be positioned on the superior surface 152 and may project proximally from superior surface 152. Ridge 165 may extend in the anterior-posterior direction on the superior surface. Ridge 165 may be positioned anywhere on the superior surface as desired, such as substantially in the medial-lateral center of the superior surface and may further have a generally curved shape. If present, ridge 165 is designed to help constrain the motion of the bearing component in the medial-lateral direction. For example, during plantar flexion (e.g., flexion) or dorsiflexion (e.g., extension) of the ankle implant, ridge 165 would track within a complementary channel in the bearing component.

[0017] Continuing with this embodiment of FIGS. 3-9, inferior surface 154 is generally concave to conform to the talar dome of the natural ankle, and the adjacent side walls 160 defines an inferior volume. In this manner, the talar component is designed to minimize the amount of bone removal during surgery. Thus, while the inferior surface is designed to comport with the

talar dome as closely as possible, since every anatomy is slightly different, the inferior surface 154 may not conform exactly to the talar dome, which may result in volume(s) of open space between the implant and the bone within the defined inferior volume.

[0018] As shown in Figs. 5 and 6, talar component 150 may also include at least one anchor 168, 170 extending distally from inferior surface 154 to a distal tip. In the illustrated embodiment, two anchors 168 are positioned spaced apart near anterior edge 156, two anchors 168 are positioned spaced apart near posterior edge 158, and one anchor 170 is positioned substantially centrally on the inferior surface 154. This positioning of the anchors is substantially symmetrical in the lateral-medial direction, which may help to minimize rocking or tilting of the talar component relative to the talus 20. In the illustrated embodiment, anchor 170 is larger in size than anchors 168; however, in other embodiments, the anchors may be any size relative to each other. For example, anchor 170 may be the same size or smaller than anchors 168, and anchors 168 may all be different sizes relative to each other. Anchors 168, 170 aid in the fixation of talar component 150 to the bone, and may particularly assist in initial fixation. In alternative embodiments, talar component 150 may include more or less anchors arranged in a variety of positions on the inferior surface 154, and may not include any anchors. Further, while the illustrated anchors 168, 170 are star-shaped, each anchor may have any shape desired. Still further, while the illustrated anchors extend along axes that are generally parallel to one another and perpendicular to the component 150 body, each anchor may extend in any direction relative to the component body and/or one another as desired.

[0019] Continuing with the illustrated embodiment, side walls 160 extend to and terminate at distal bone-cutting edges 161. As best shown in Figs. 8-9, each side wall 160 has a thickness, measured from outer surface 162 to inner surface 163 of the side walls, the thickness tapering to form bone-cutting edges 161. Bone-cutting edges 161 may have a sharpness capable of driving into bone, e.g., functioning as self-cutting edges. Edges 161 may be any type of edge that enables the edge to cut or drive into the bone, e.g. knife-edge, serrated, *etc.*

[0020] Edges 161 and side walls 160 may drive into the bone to provide a flush fit with the talus with substantially little to no clearance or space between side walls 160 and the talus. The bone contacted by edges 161 may be the natural talus or could be the prepared cut surfaces of the talus, as discussed below. The fit is flush such that substantially all of side walls 160 (e.g., along length of side walls 160) of talar component 150 maintains contact with the talus after implantation which may form a seal to prevent synovial fluid from flowing under talar component 150 into any volume of open space which may be present between the bone and inferior surface 154 due to difference between the shape of the inferior surface 154 and the talus 20, as discussed above. The prevention of synovial fluid from seeping under the implant provides greater fixation of the implant to the bone and increases the longevity of the implant within the patient. Further, the fit between edges 161 and the bone 20 may supplement fixation by anchors 168, 170, or in some instances, could be sufficiently secure that anchors 168, 170 need not be present on the component 150.

[0021] The fit between edges 161 and bone 20 may be particularly strong in instances where

bone-cutting edges 161 could facilitate osteointegration between the talar component 150 and the bone. The anchorage of the talar component 150, and in particular the anchorage of edges 161, may enable the formation of bony tissue around the component to provide greater structural and functional connection between the component and the bone.

[0022] In another embodiment, one or both of side walls 160 may extend further distally than in the illustrated embodiment. In such a case, one or both of the bone-cutting edges 161 may be positioned further distally, relative to the inferior surface 154 of the talar component 150 such that the edges 161 may extend deeper into the talus 20 which may provide for increased fixation and increased surface area for potential osteointegration, as discussed further below.

[0023] In yet another embodiment, talar component 150 may also include sharp bone-cutting edges on anterior and posterior edges 156, 158 (or, such cutting surface could be in place of edges 161, whereby medial/lateral walls 160 do not include cutting edges). In instances where all four sides 156, 158, 160 include cutting edges, such a talar component may have still further engagement ability with the talus to provide for improved sealing of any volume of open space between the inferior surface 154 and the bone 20, and further, could result in osteointegration around the perimeter of the component 150.

[0024] Talar component 150 may be comprised of metal, such as titanium, ceramic, glass, polymer, or any other material known for use in the human body. The component 150 may also comprise one or more surface treatments, on any or all of inferior surface 154, edges 156, 158 and side walls 160, to encourage biological fixation, such as porous coating, plasma spray coating, e.g. titanium plasma spray coating, hydroxyapatite, or tricalcium phosphate.

[0025] The present disclosure also includes a method of implanting talar component 150 on a prepared talus. In one embodiment, the method generally includes cutting at least medial and lateral cuts on talus 20 to form a prepared talus, digging a bone-cutting edge 161 of a side wall 160 into one of the medial and lateral cuts and digging the second bone-cutting edge 161 of the second side wall into the other of the medial and lateral cuts. The medial and lateral cuts may be oversized to provide greater space for the bone-cutting edges to dig into the cut to form a seal between the side walls and the bone. In other words, such cuts would typically be insufficient to allow space for medial/lateral side walls of an implant to be positioned on the bone, but side walls 160 of component 150, with cutting edges 161, are able to dig into the remaining cut surfaces of the bone to help provide a secure and complete connection between the side walls 160 and the bone 20 along the lengths of the side walls 160. If present, upon pressing component 150 onto the prepared talus, anchors 168, 170 would also be forced into the talus 20 to provide added fixation of the component 150 to the talus. Further, while anchors 168, 170 may be self-tapping, the operator may prepare the talus as desired by decortication of the talus, preparation of pilot holes or bone holes for accepting the anchors, or the like.

[0026] The present disclosure may also include various systems and kits based on the components discussed above. While it is envisioned that these various components may be utilized, packaged, sold, or designed in any number of systems and kits, representative

embodiments will be discussed in detail below.

[0027] The present disclosure can include a kit which can be packaged in a single package as a system or in multiple packages that can be selected as needed by the operator to form a system. For example, such a kit may include at least one talar component 150, at least one tibial component, such as tibial component 40, and at least one mobile bearing, such as bearing 60. Any combination of components including the talar component may be included in a single package or in separate packaging which are later brought together as a kit. If multiple components of any of the specific components are present, such components may differ in size, material, configuration, and the like, such that the operator can select a particular component from a variety of available components depending on need based on surrounding anatomy, bone size, bone density, and the like. Any such kit may also include a surgical procedure which may include instructions or protocol for using the components and may include aspects of any of the above-discussed embodiments, though other variations are also envisioned within the scope of the present disclosure.

[0028] In another embodiment, the present disclosure includes a system for the repair of an ankle including at least one talar component, at least one mobile bearing, and at least one tibial component, and a surgical procedure. The surgical procedure may include instructions or protocol for using the components and may include aspects of any of the above-discussed embodiments, though other variations are also envisioned within the scope of the present disclosure.

[0029] Although the invention herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention. It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised.

REFERENCES CITED IN THE DESCRIPTION

Cited references

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Patent documents cited in the description

- WO2007103826A2 [0003]

PATENTKRAV

1. Taluskomponent (150) af en ankelledprotese til indgreb i en talusknogle, hvilken
5 komponent omfatter en medial sidevæg (160) og en lateral sidevæg (160), modsat den mediale sidevæg,

kendetegnet ved, at hver sidevæg ender ved en distal knogleskærende kant (161),
og hver har en tykkelse, hvilken tykkelse spidser til for at danne de distale
10 knogleskærende kanter, således at de distale knogleskærende kanter kan drives ind i talusknogle.

2. Taluskomponent ifølge krav 1, hvor, med komponenten i indgreb i talusknogle,
sidevæggene danner en tætning mellem talusknogle og komponenten.
15

3. Taluskomponent ifølge krav 2, der endvidere omfatter en nedre flade (154), hvor
den nedre flade, mediale væg og laterale væg definerer et nedre volumen, hvilket
nedre positionerede volumen vender ind mod talusknogle.

20 4. Taluskomponent ifølge krav 3, hvor tætningen indeslutter en del af det nedre
volumen over en overflade af talusknogle.

5. Taluskomponent ifølge et af kravene 3 eller 4, hvor den nedre flade i alt væsentligt
er konkav.
25

6. Taluskomponent ifølge et hvilket som helst af kravene 3-5, der endvidere omfatter
mindst én forankring (168, 170), der strækker sig distalt fra den nedre flade langs
en længdeakse.

30 7. Taluskomponent ifølge et hvilket som helst af de foregående krav, hvor
taluskomponenten er symmetrisk omkring en akse, der strækker sig i
komponentens anteriore-posteriore retning.

8. Taluskomponent ifølge et hvilket som helst af kravene 1-6, hvor én af den mediale og laterale sidevæg strækker sig yderligere distalt for hinanden.
- 5 9. Taluskomponent ifølge krav 1, der endvidere omfatter en nedre flade, den nedre flade og de modstående sidevægge definerer et nedre volumen og, med komponenten i indgreb i talusknoglen, den nedre flade og de modstående sidevægge danner en tætning, der indeslutter en del af det nedre volumen over en overflade af talusknoglen.
- 10 10. Taluskomponent ifølge krav 9, hvor for hver sidevæg i alt væsentligt en fuld længde af sidevæggen bevarer kontakt med talusknoglen efter implantation.
11. Taluskomponent ifølge et af kravene 9 eller 10, hvor tætningen mellem 15 komponenten og knoglen er tilpasset til at forhindre fluid i at strømme mellem den nedre flade og knoglen.
12. Taluskomponent ifølge krav 1, der endvidere indbefatter en interior kant (156) og en posterior kant (158) og skarpe knogleskærende kanter på den anteriore og 20 posteriore kant.
13. Taluskomponent (150) af en ankelledprotese til indgreb i en talusknogle, der omfatter en medial sidevæg (160) og en lateral sidevæg (160), modsat den mediale sidevæg, 25
- kendetegnet ved, at hver sidevæg ender ved en distal knogleskærende kant (161), hvilke distale knogleskærende kanter er selvskærende kanter, med knivsgæg eller takkede for at kunne drives ind i talusknoglen.

DRAWINGS

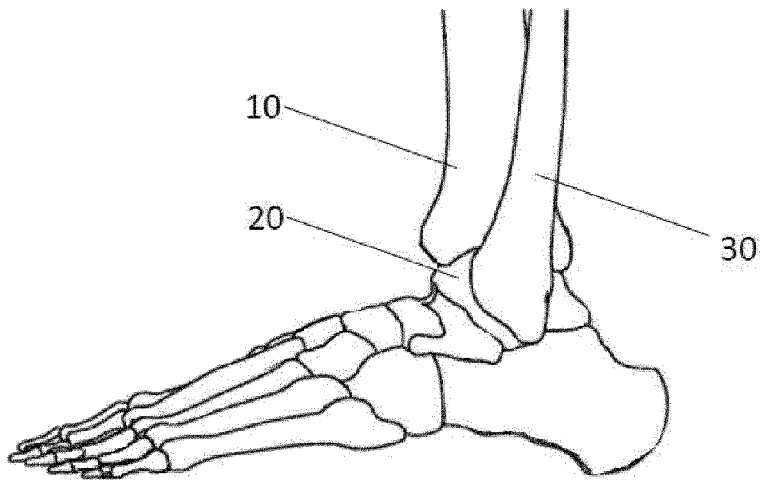


Fig. 1

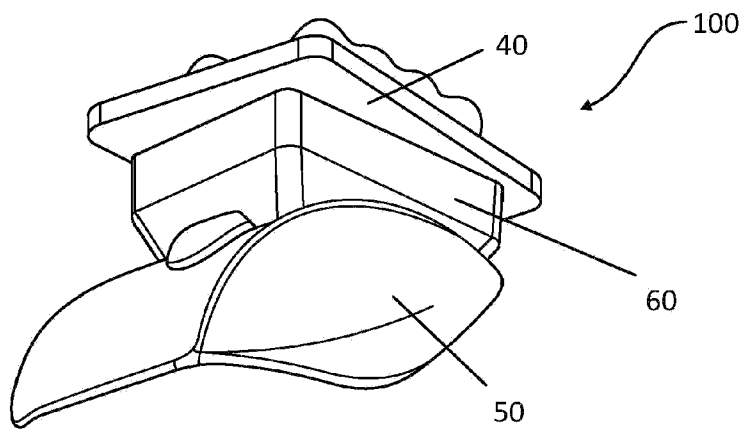


Fig. 2
(PRIOR ART)

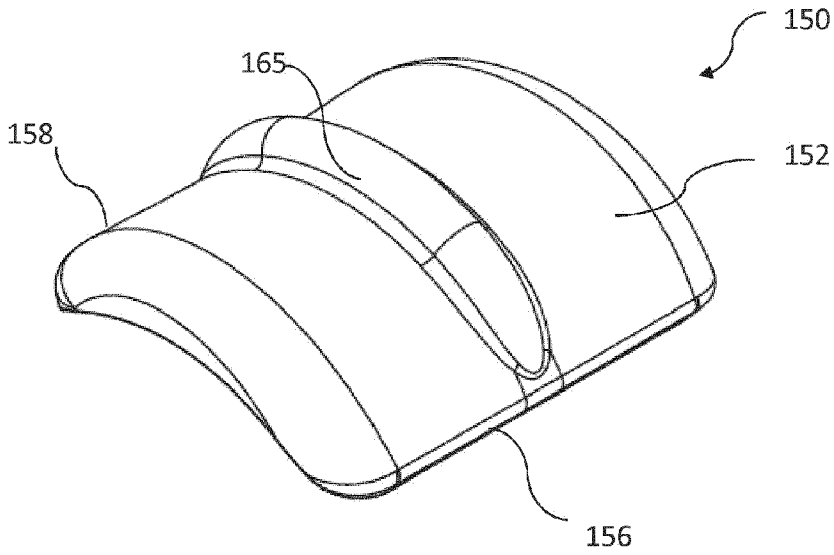


Fig. 3

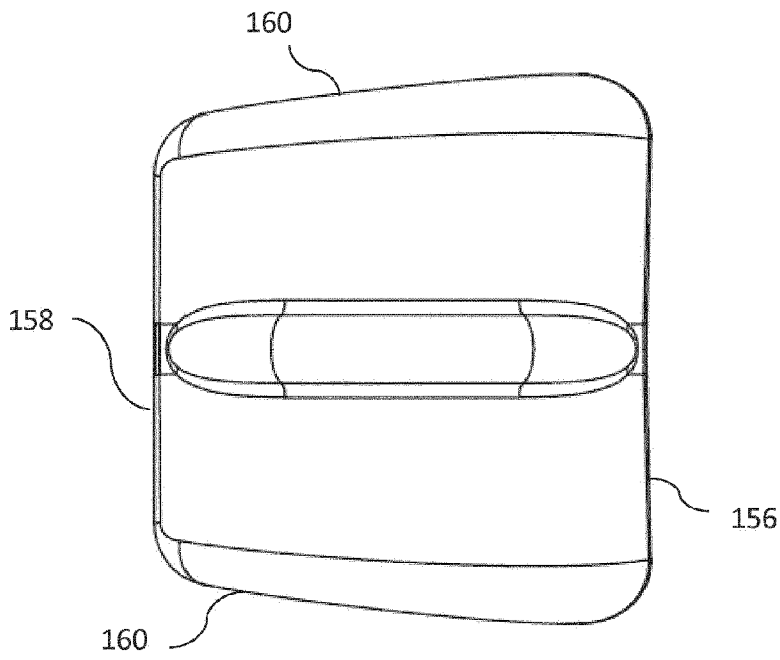


Fig. 4

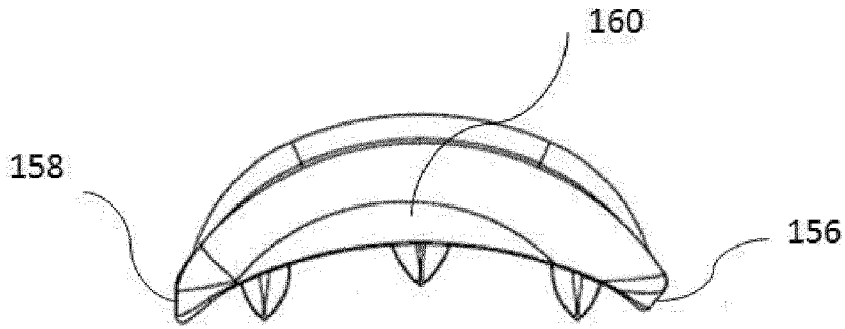


Fig. 5

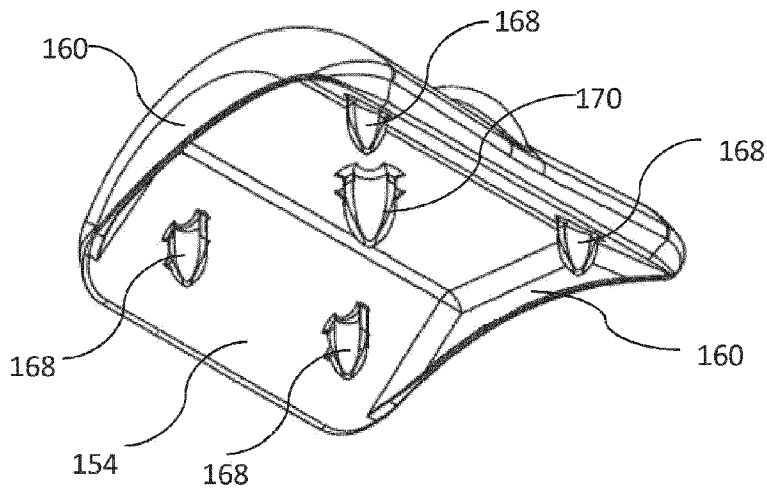


Fig. 6

156

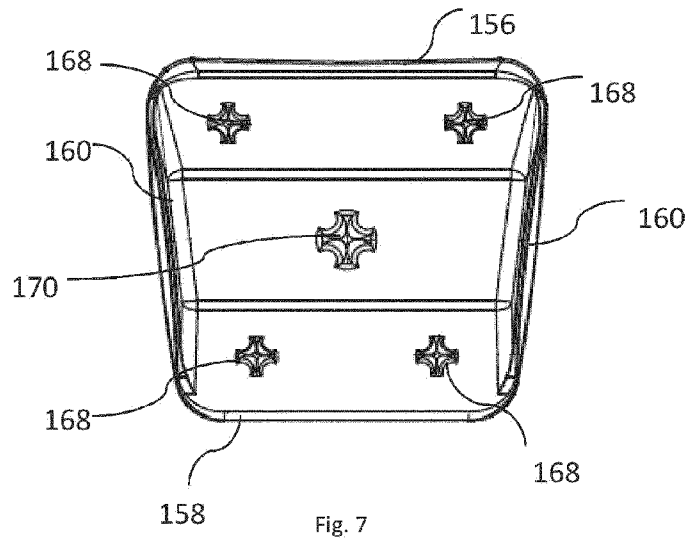


Fig. 7

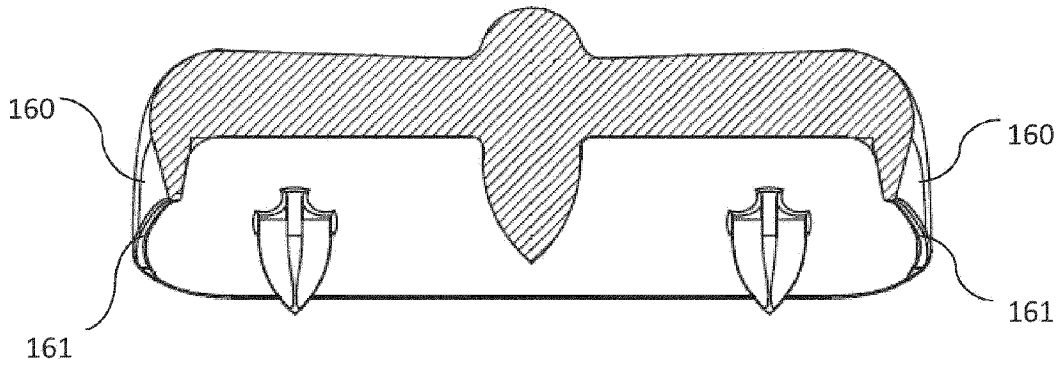


Fig. 8

