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Application Number: 17435333 Document Date: 08/31/2021

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Form Revision Date: March 1, 2019

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 20995

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

Shoulder Innovations, Inc.

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature		Date (Optional)	
Name	Robert Ball		
Title	Chairman		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SHOLD.013NP
	Application Number	
Title of Invention	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Donald	E.	Running	

Residence Information (Select One) ● US Residency Non US Residency Active US Military Service

City	State/Province	Country of Residence
Missoula	MT	US

Mailing Address of Inventor:

Address 1	13827 Port Sheldon Street
Address 2	
City	Holland
State/Province	MI
Postal Code	49424
Country	US

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Robert	J.	Ball	

Residence Information (Select One) ◉ US Residency Non US Residency Active US Military Service

City	State/Province	Country of Residence
Holland	MI	US

Mailing Address of Inventor:

Address 1	13827 Port Sheldon Street
Address 2	
City	Holland
State/Province	MI
Postal Code	49424
Country	US

Inventor 3 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Jason		Slone	

Residence Information (Select One) ◉ US Residency Non US Residency Active US Military Service

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SHOLD.013NP
	Application Number	
Title of Invention	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS	

City	Silver Lake	State/Province	IN	Country of Residence	US

Mailing Address of Inventor:

Address 1	13827 Port Sheldon Street		
Address 2			
City	Holland	**State/Province**	MI
Postal Code	49424	**Country**	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	20995		
Email Address	efiling@knobbe.com	Add Email	Remove Email

Application Information:

Title of the Invention	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS		
Attorney Docket Number	SHOLD.013NP	**Small Entity Status Claimed**	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	21	**Suggested Figure for Publication (if any)**	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SHOLD.013NP
	Application Number	
Title of Invention	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS	

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	● Customer Number	US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	20995		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	a 371 of international	PCT/US2020/022094	2020-03-11
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2020/022094	Claims benefit of provisional	62/816708	2019-03-11

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SHOLD.013NP
	Application Number	
Title of Invention	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS	

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

Remove

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SHOLD.013NP
	Application Number	
Title of Invention	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SHOLD.013NP
	Application Number	
Title of Invention	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1 — Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

● Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.	Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	SHOULDER INNOVATIONS, INC.		
Mailing Address Information For Applicant:			
Address 1	13827 Port Sheldon Street		
Address 2			
City	Holland	**State/Province**	MI
Country	US	Postal Code	49424
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SHOLD.013NP
	Application Number	
Title of Invention	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS	

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

Signature:

Remove

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Andrew Kimmel/			Date (YYYY-MM-DD)	2021-08-31
First Name	Andrew	Last Name	Kimmel	Registration Number	58855

Additional Signature may be generated within this form by selecting the Add button. Add

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SHOLD.013NP
	Application Number	
Title of Invention	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS	

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1 The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent CooperationTreaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS
First Named Inventor/Applicant Name:	Donald E. Running
Filer:	Andrew I. Kimmel/Debbie Munson
Attorney Docket Number:	SHOLD.013NP

Filed as Small Entity

Filing Fees for U.S. National Stage under 35 USC 371

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
BASIC NATIONAL STAGE FEE	2631	1	160	160
Pages:				
Claims:				
Miscellaneous-Filing:				
OATH/DECL > 30 MOS FROM 371 COMMENCEMENT	2617	1	80	80
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**240**

Electronic Acknowledgement Receipt

EFS ID:	43652718
Application Number:	17435333
International Application Number:	PCT/US2020/022094
Confirmation Number:	1067
Title of Invention:	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS
First Named Inventor/Applicant Name:	Donald E. Running
Customer Number:	20995
Filer:	Andrew I. Kimmel/Evelyn Salcido
Filer Authorized By:	Andrew I. Kimmel
Attorney Docket Number:	SHOLD.013NP
Receipt Date:	31-AUG-2021
Filing Date:	
Time Stamp:	18:08:30
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$240
RAM confirmation Number	E20218UI09142088
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		SHOLD-013NP_SPECIFICATION.pdf	79065 c454d21dbd9cfff050d90dc7ed92893d9cd24e9e	yes	17

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Specification	1	14
	Claims	15	16
	Abstract	17	17

Warnings:

Information:

2	Drawings-other than black and white line drawings	SHOLD-013NP_DRAWINGS.pdf	9927351 9fb23e856fdf45a27c13352423c59170888a63f8	no	21

Warnings:

Information:

3		SHOLD-013NP_POA.pdf	1148565 e2b658908af1c24d30fd24523997f8a80306fcb0	yes	2

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	1
	Power of Attorney	2	2

Warnings:

Information:

4	Application Data Sheet	SHOLD-013NP_ADS1.pdf	1256242 7d1c979add591a2a1769cf44d3be042a2bab9997	no	9
Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	40261 a72658b6c3048c393e85bcc3637b7cb2316012cd	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	12451484	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

TOTAL REVERSE SHOULDER SYSTEMS AND METHODS

BACKGROUND

[0001] This application is the national phase of International Application No. PCT/US2020/022094, filed March 11, 2020, which claims the benefit of priority from U.S. Provisional No. 62/816,708, filed March 11, 2019, which is hereby incorporated by reference in its entirety.

[0002] Shoulder replacement is a commonly performed medical procedure for treatment of osteoarthritis, rheumatoid arthritis, as well as for treatment of certain deformities related to oncological indications as well as trauma. There are two primary types of articulations available to surgeons for treatment: anatomic and reverse. With anatomic, the surgeon replaces the articular surfaces with industrial materials such that the articulating surfaces are substantially the same shape as the natural anatomy. A stem can be commonly fixed inside the canal of the humerus, a metallic articular head can be rigidly fixed to the proximal aspect of the same, the articular head having a convex articular surface adapted to articulate with the glenoid implant. The glenoid implant can include on its back side (medial side) certain pegs or posts or fins adapted to be rigidly fixed within the glenoid fossa of the scapula and on its front side a concave or flat articular surface adapted to articulate with the humeral head of the humeral implant.

[0003] When a reverse prosthesis is used, the articular surface is reversed in that the metallic ball is rigidly fixed to the glenoid fossa of the scapula, and the concave articular surface is rigidly fixed to the humeral bone, thereby reversing the fashion of articulation of the prosthesis.

[0004] The surgeon chooses between the two types of prostheses by assessing a number of conditions of the patient including level of pain, patient activity level, deformity or severity of the boney degradation, the strength of surrounding soft tissues, and present or absence of prior surgery, and particularly the health and strength of the rotator cuff muscle and tendon. Disease of the rotator cuff is common among patients with arthritis of the shoulder. In this circumstance, it is commonly observed that the absence of insufficiency of

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the rotator cuff leads to a condition where the anatomic shoulder replacement prosthesis is not sufficiently stabilized by surrounding soft tissue. In this case, a reverse shoulder replacement prosthesis can be preferred in some cases due to the higher inherent stability of the articulation. In addition, the reverse prosthesis can advantageously utilize the remaining muscles in a way they can be more effective in the absence of the other soft tissue structures by adjusting the position of the articular surfaces within the joint.

SUMMARY

[0005] In some embodiments, disclosed herein is a reverse shoulder system, comprising any number of a glenoid baseplate comprising a longitudinal axis, the glenoid baseplate further comprising a stem and a central channel within a sidewall of the stem, the stem comprising a longitudinal axis. The longitudinal axis of the glenoid baseplate can be angled with respect to the longitudinal axis of the stem, wherein the longitudinal axis of the glenoid baseplate is not perpendicular with respect to the longitudinal axis of the stem.

[0006] In some configurations, the glenoid baseplate comprises a generally disc-shaped portion extending radially outward from the central channel.

[0007] In some configurations, the stem comprises a sidewall that extends superiorly with respect to the disc portion.

[0008] In some configurations, the glenoid baseplate comprises a peripheral edge.

[0009] In some configurations, the peripheral edge comprises spaced-apart anti-rotation features.

[0010] In some configurations, the anti-rotation features comprise slots.

[0011] In some configurations, an inferior portion of the peripheral edge comprises a porous coating.

[0012] In some configurations, an inferior surface of the generally disc-shaped portion comprises a porous coating, but a superior surface does not comprise a porous coating.

[0013] In some configurations, the peripheral edge and/or an inferior surface of the baseplate comprises a conical geometry.

[0014] In some configurations, an inferior surface of the baseplate is concave.

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[0015] In some configurations, the stem comprises a Morse taper lock superior to a superior-most portion of the generally disc-shaped portion of the glenoid baseplate.

[0016] In some configurations, the system further comprises a glenosphere.

[0017] In some configurations, the glenosphere comprises a superior dome-shaped surface comprising a rotational control feature configured such that an inserter tool can lock the glenosphere and the baseplate to allow for rotation of the glenosphere and the baseplate together.

[0018] In some configurations, the rotational control feature comprises a spline.

[0019] In some configurations, the system further comprises a central set screw and locking nut.

[0020] In some configurations, the system further comprises a central compression screw non-integral with the baseplate and configured for placement adjacent and distal to the central set screw.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] These drawings are illustrative embodiments and do not present all possible embodiments of this invention.

[0022] FIG. 1 illustrates an embodiment of components of a total reverse shoulder system.

[0023] FIG. 2 illustrates various embodiments of humeral trays that can be utilized with total reverse shoulder systems, according to some embodiments.

[0024] FIG. 3 illustrates a variety of humeral bearing components that can be utilized with total reverse shoulder systems, according to some embodiments.

[0025] FIG. 4 illustrates schematically an embodiment of a glenoid baseplate configured to be inset into the glenoid.

[0026] FIG. 5 illustrates schematically an embodiment of a glenoid baseplate 500 configured to be inset into the glenoid.

[0027] FIG. 6 illustrates a threaded locking insert for a central channel of a stem/post, according to some embodiments.

[0028] FIG. 7 illustrates various views of glenospheres, according to some embodiments.

[0029] FIG. 8 illustrates a schematic cross-section of a fully assembled glenosphere with a locking bolt, according to some embodiments.

[0030] FIGS. 8A-8U illustrate a glenoid surgical technique, according to some embodiments.

[0031] FIG. 9 illustrates an embodiment of a sizer/angle guide.

[0032] FIG. 10 illustrates an embodiment of a stem drill guide.

[0033] FIG. 11 schematically illustrates a stem angle change with a rotational adjustment.

[0034] FIG. 12 schematically illustrates views of a glenoid baseplate inserter (alone on the left and together with a baseplate on the right), according to some embodiments.

[0035] FIG. 13 schematically illustrates views of a calibrated central drill, according to some embodiments.

[0036] FIG. 14 schematically illustrates views of fixed angle peripheral drill guides, according to some embodiments.

[0037] FIG. 15 schematically illustrates views of variable angle peripheral drill guides, according to some embodiments.

[0038] FIG. 16 schematically illustrates side and top views of central screws, according to some embodiments.

[0039] FIG. 17 schematically illustrates side and top views of fixed angle peripheral compression screws, according to some embodiments.

[0040] FIG. 18 schematically illustrates side and top views of variable angle peripheral screws, according to some embodiments.

[0041] FIG. 19 schematically illustrates views of a glenosphere inserter, according to some embodiments.

DETAILED DESCRIPTION

[0042] In some embodiments, disclosed herein are various embodiments of a total reverse shoulder system, including a variety of humeral trays, humeral bearings, inset glenoid baseplates, threaded locking inserts, and glenospheres. Glenoid surgical techniques are also described, which can utilize various tools including but not limited to sizer/angle guides, stem drill guides, glenoid baseplate inserters, calibrated central drills, peripheral drill guides with fixed or variable angles, central screws, fixed angle peripheral compression screws, variable angle peripheral screws, and glenosphere inserters. Dimensions listed on the accompanying Figures are non-limiting examples only.

[0043] FIG. 1 illustrates an embodiment of components of a total reverse shoulder system, including a glenosphere 200 and a glenoid baseplate 102 which can be partially or completely inset in some embodiments. The glenoid baseplate 102 can be a generally disc-shaped structure and include a central aperture defining a surface of (e.g., integral with an elongate stem), or configured to fit an elongate stem or post therethrough. The glenoid baseplate 102 can include a longitudinal axis that is at an angle to a longitudinal axis of the elongate stem 100. The longitudinal axis of the glenoid baseplate 102 can be at an angle, such as generally oblique with respect to the longitudinal axis of the elongate stem 100. In some embodiments, the angle is an acute angle, and not a right angle. The angle between the two intersecting longitudinal axes of the respective baseplate 102 and the stem 100 could be, for example, about, at least about, or no more than about 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, or more or less degrees, or ranges including any two of the foregoing values.

[0044] FIG. 2 illustrates various embodiments of humeral trays that can be utilized with total reverse shoulder systems, according to some embodiments. The humeral trays can include various inner diameters IDs and outer diameters ODs, including 30mm, 32mm, 34mm, 36mm, 38mm, 40mm, 42mm, or more or less IDs and/or ODs, and ranges including any two of the foregoing values. The trays can include one or more pegs, such as a central peg extending from a medial surface. The trays can be neutral, or include extensions (e.g., in thickness) that can be, for example, +2, 4, 6, 8, 10, 12mm, or ranges including any two of the foregoing values. The trays can include various cross-sections, including oval or

round cross-sections. The trays can be compatible with the same poly bearing surfaces in some cases. In some embodiments, a kit can include at least four different sizes of trays (34mm oval neutral; 34mm oval +6mm extension; 38mm round neutral; 38mm round +6mm extension.

[0045] FIG. 3 illustrates a variety of humeral bearing components that can be utilized with total reverse shoulder systems, according to some embodiments, including humeral trays as illustrated and described in connection with FIG. 2. The bearing components can include, for example, a peripheral ring 302 and a central recessed portion that can be outlined radially outwardly by an inner edge of the peripheral ring, and an inner bowl-shaped portion 304. The peripheral ring can include indicia, such as a slot or other marking 399 illustrating the highest point of the bearing component. Also illustrated is the recessed poly dome 395, and a partial or full annular barb 397 around the outer circumference of the bearing component. The bearing component can include a variety of geometries include neutral, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 degree angles to horizontal, or ranges including any two of the foregoing values. In some embodiments, the bearing component does not change the joint center. In some embodiments, the bearing component can include 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45mm, or more or less spherical diameters, or ranges including any two of the foregoing values. In some embodiments, systems and methods can include an offset of 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10mm, or ranges including any two of the foregoing values.

[0046] FIG. 4 illustrates schematically an embodiment of a glenoid baseplate configured to be inset into the glenoid G as illustrated. The longitudinal axis of the baseplate can be angled with respect to the longitudinal axis of the stem/post as described, for example, with respect to FIG. 1, and can include a version change 499 to compensate for posterior bony defects. In some embodiments, the glenoid baseplate includes a central channel therethrough defining a surface of (e.g., integral with an elongate stem), or configured to fit configured to house a stem/post as shown. The glenoid baseplate can include a generally conical shape with a concave undersurface configured to rest within a reamed surface of glenoid bone, which advantageously allows for a single rotary reamer to be utilized, in contrast to conventional glenoid baseplates with flat undersurfaces that require a two-step

reaming process. The post 493 can have a length of about, at least about, or no more than about 5, 5.5, 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5, 10, 10.5, 11, 11.5, 12, 12.5, 13, 13.5, 14, 14.5, 15mm or more or less, or ranges including any two of the foregoing values. In some embodiments, the central channel and/or stem can include a female Morse taper 497 of about 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, or more or less degrees, including ranges incorporating any two of the foregoing values. As shown in the right illustration of FIG. 4, the baseplate can be configured to pivot around the stem/taper at arrow 495 for version correction and to allow for a direct bone-implant interface without requiring augmentation. In some embodiments, the system can be configured to provide version angle corrections of, for example, about 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20 degrees or more or less, or ranges including any two of the foregoing values. In some embodiments, the baseplate could have a diameter of about, at least about, or no more than about 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40mm, or more or less, or ranges including any two of the foregoing values. The baseplate can advantageously pivot around the central stem with a Morse taper for version correction and allows for a direct bone-implant interface.

[0047] FIG. 5 illustrates schematically an embodiment of a glenoid baseplate 500 configured to be inset into the glenoid (not shown in FIG. 5). The longitudinal axis of the baseplate 500 can be angled with respect to the longitudinal axis of the stem/post 510 as described, for example, with respect to FIGS. 1 and 4 above. The baseplate 500 could have a generally arcuate peripheral edge. The peripheral edge could include spaced-apart anti-rotational slots 521 directed generally transverse to a longitudinal plane of the baseplate 500. In some embodiments, the peripheral edge of the baseplate 500 can taper (e.g., decrease) in diameter from a superior to inferior dimension. A central channel can extend through the baseplate 500, as well as include a superiorly-extending sidewall or lip 511 somewhat similar to the side slopes of a volcano. The central channel can define a surface of (e.g., integral with an elongate stem), or configured to fit be configured to house the stem/post 510 therethrough. The baseplate 500 can also include a plurality of regularly or irregularly spaced-apart secondary (peripheral) channels 555 spaced radially outward from the central channel of the baseplate and configured to house fixed and variable angle screws therethrough. The secondary channels 555 can be asymmetric and include superiorly-extending portions 556

that can extend into and interrupt the superiorly-extending sidewall or lip 511 of the central channel of the baseplate 500. The baseplate 500 can include a porous coating 585 on the entire, or only a part of the peripheral edge and/or an inferior surface (e.g., undersurface) of the baseplate 500 to promote bone ingrowth, for example.

[0048] Still referring to FIG. 5, the stem/post 510 could have an internal taper, such as a Morse taper, of about, at least about, or no more than about 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 degrees, or more or less, or ranges including any two of the foregoing values. The stem/post 510 can also include a rotational control feature 545 along an outer diameter of the stem/post 510, and in some embodiments superiorly with respect to the uppermost surface of the sidewall 511 of the central channel of the glenoid baseplate 500 as shown. The rotational control feature 545 could be non-circular or non-arcuate, such as a hexagonal shape as shown for example. The stem/post 510 can also include a central channel and include a Morse taper lock 535 configured to mate with a glenosphere (not shown). The Morse taper lock can extend superiorly with respect to the uppermost surface of the sidewall 511 of the central channel of the glenoid baseplate 500. The central channel of the stem/post 510 can be configured to house a primary screw (not shown) therethrough, which can be a variable angle primary screw, and optionally locking.

[0049] FIG. 6 illustrates a threaded locking insert 600 for a central channel of a stem/post, according to some embodiments. The insert 600 can include an outer male thread 602 and configured to go into the central channel of a baseplate. The outer diameter of the insert can also include a hexagonal geometry portion 604 at the superior end, of about, at least about, or no more than about 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 mm or more or less, or ranges including any two of the foregoing values. The hexagonal geometry portion 604 can be configured to serve as a rotational control feature in some embodiments. The insert 600 can also include a female thread 608 configured to receive a supplemental glenosphere locking screw (not shown), and a spherical surface 612, for example, at its inferior end to lock a variable angle screw.

[0050] FIG. 7 illustrates various views of glenospheres, according to some embodiments. The left image illustrates a glenosphere with a rotational control feature 702, which can include a spline, such as an asymmetric spline, and configured to advantageously

allow for rotational control about the spline and allow an inserter tool to lock and rotate the glenosphere together with another component, such as a baseplate. The glenosphere can also include one or more indicia, such as an eccentric rotational mark 704. The glenosphere can include a generally dome-shaped surface 714, a cavity 706 with an inferior-facing opening 708, and a hollow post including a morse taper lock 711 into the baseplate. The glenosphere could be a full hemisphere, or short of a full hemisphere by a distance 720 of about, at least about, or no more than about 0.5 mm, 0.75 mm, 1 mm, 1.25 mm, 1.5 mm, 1.75 mm, 2 mm, 2.25 mm, 2.5 mm, 2.75 mm, 3 mm, or more or less, or ranges including any two of the foregoing values.

[0051] Still referring to FIG. 7, in some embodiments, the glenosphere can include an articulating diameter of about, at least about, or no more than about 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50 mm, or more or less, or ranges including any two of the foregoing values. In some embodiments, systems and methods can include an offset and/or eccentric dimension of 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 mm, or ranges including any two of the foregoing values. In some embodiments, the glenosphere has a neutral geometry. In some embodiments, a glenosphere 724 is offset by about +3 mm or about 6 mm, for example. In some embodiments, a glenosphere 722 has an eccentric dimension of between about 2 mm and about 4 mm. In some embodiments, a secondary locking screw can be utilized together with the glenosphere.

[0052] FIG. 8 illustrates a schematic cross-section of a fully assembled glenosphere with a locking bolt, according to some embodiments, along with the baseplate. The glenosphere can include a central channel therethrough including a rotational control feature 702 at, for example, a superior-most portion that can be as described elsewhere herein. The central channel can also include a threaded surface 808 for an inserter/head extractor, such as inferior to the rotational control feature 702, and optionally be configured to accommodate a secondary locking screw at 810, to push and/or rotate with the post of the baseplate. A post of the glenosphere can be placed at least partially within a central channel of the baseplate as illustrated. A central set screw/locking nut 814 can be connected to, and in some cases removably attachable to a central channel, e.g., of the glenoid baseplate, and have an end adjacent or directly touching an end of a central compression screw 816, which can

include a diameter of, for example, of about, at least about, or no more than about 4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5, 10 mm, or more or less, or ranges including any two of the foregoing values. The central compression screw can be configured to angulate with respect to the baseplate, and advantageously allow for the use of a locking screw.

[0053] Figures 8A-8U illustrate a glenoid surgical technique, according to some embodiments, which can include any number of the following actions. FIG. 8A illustrates a glenoid surface with an A3-E3 defect. A sizer/angle guide can be placed as in FIG. 8B. A wire guide/wire can be placed in FIG. 8C. The wire guide and sizer/angle guide can be removed, as in FIG. 8D. The glenoid surface can then be reamed for the baseplate, as in FIGS. 8E and 8F. The stem drill guide can then be placed and adjusted in FIG. 8G. A hole for a stem can then be drilled in FIGS. 8H and 8I. The baseplate can then be inserted, as shown in FIG. 8J, and the threaded rod removed, as shown in FIG. 8K. A central cavity can be drilled, and the length of a central screw to be placed determined, in FIG. 8L. The drill can be removed in FIG. 8M, and the screw and screwdriver placed through the shaft, and the screw tightened in FIG. 8N. The baseplate inserter handle can be removed in FIG. 8O, and holes can be drilled for the peripheral locking screws in FIG. 8P. Holes can be drilled for variable angle screws, as shown in FIG. 8Q. The peripheral screws can be inserted and tightened in FIG. 8R. The central set screws and secondary locking nuts can be inserted and tightened in FIG. 8S. The glenosphere can be inserted in FIG. 8T, and the locking bolt inserted and tightened in FIG. 8U.

[0054] FIG. 9 illustrates an embodiment of a sizer/angle guide including an inferior tilt mechanism 902. The mechanism could be fixed to a set angle (e.g., about 0, 5, 10, 15, 20, 25 degrees, or ranges including any two of the foregoing values), or adjustable in some embodiments. The mechanism could be round or oval shaped in some embodiments, and include a slot (e.g., posterior or posterior inferior) to allow for removal. The inferior tilt mechanism 902 could include a set screw with a calibrated window, or individual depth screws in some cases.

[0055] FIG. 10 illustrates an embodiment of a stem drill guide, that can include a diameter of about, at least about, or no more than about 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 mm or more or less, or ranges including any

two of the foregoing values. The drill guide could include a version angle of, for example, about 0, 5, 10, 15, 20, 25 degrees or more or less, or ranges including any two of the foregoing vales. In some embodiments, the larger the version angle, the more stem tilt is generated as rotation occurs.

[0056] FIG. 11 schematically illustrates a stem angle change with a rotational adjustment (e.g., about 30 degrees), and an angled version plate (e.g., about 15 degrees) as a non-limiting example. Anterior-posterior and inferior-superior views are illustrated.

[0057] FIG. 12 schematically illustrates views of a glenoid baseplate inserter (alone on the left and together with a baseplate on the right), according to some embodiments. The baseplate inserter can be configured for any number of: positive rotational control; slim design to allow visualization through screw holes to know when seated; and/or a multi-function handle allows for drilling central screw hole, and inserting a central screw.

[0058] FIG. 13 schematically illustrates views of a calibrated central drill, according to some embodiments. Calibrated marks/indicia 902 at spaced-apart desired increments (e.g., 5mm increments in some embodiments) near the proximal end of the instrument can help to determine the length of a central screw that may be needed. The calibration length can start at, for example, about, at least about, or no more than about 15 mm, 20 mm, 25 mm, 30 mm, 35 mm, 40 mm, or more or less, including any two of the foregoing values and may advantageously allow for a surgical step to be cut out.

[0059] FIG. 14 schematically illustrates views of fixed angle peripheral drill guides, according to some embodiments. The drill guides can be configured to fit over a geometry, such as a polygonal shaped portion (e.g., octagon) on the top of the baseplate, and the operator can then determine which fixed angle screws to drill.

[0060] FIG. 15 schematically illustrates views of variable angle peripheral drill guides, according to some embodiments.

[0061] FIG. 16 schematically illustrates side and top views of central screws, according to some embodiments, including a head 1601, threaded shaft 1602, and distal tapered portion. In one embodiment, the screw can have a 6.5mm head, and 6mm threaded shaft, although various size ranges and increments are possible, including about, at least about, or no more than about 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5, 10 mm, or more

or less head and/or threaded shaft diameters, or ranges including any two of the foregoing values. In some embodiments, a central screw can include a total or working length of about, at least about, or no more than about 10, 11, 12, 13, 14, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70 mm, or more or less, or ranges including any two of the foregoing values. In some embodiments, anodization of the screw can optionally be present to help differentiate the screws. The screw head could have various internal feature geometries 1603, including a T20 hexalobe configuration in some embodiments.

[0062] FIG. 17 schematically illustrates side and top views of fixed angle peripheral compression screws, according to some embodiments, including a head 1701, double-lead thread 1703 proximal to a threaded shaft 1702, and distal tapered portion. The screws can be various size ranges and increments, and include T20 hexalobe or other internal head feature geometries 1704 as described elsewhere herein. In one embodiment, the head could be about 5.7 mm in diameter, with a 4.5 mm threaded shaft diameter, or dimensions listed elsewhere herein, such as in connection with FIG. 16 for example.

[0063] FIG. 18 schematically illustrates side and top views of variable angle peripheral screws, according to some embodiments, including a head 1801, threaded shaft 1802, and distal tapered portion. The screws can be various size ranges and increments, and include T20 hexalobe or other internal head feature geometries 1803 as described elsewhere herein. In one embodiment, the head could be about 5.7 mm in diameter, with a 4.5 mm threaded shaft diameter, or dimensions listed elsewhere herein, such as in connection with FIGS. 16 or 17 for example.

[0064] FIG. 19 schematically illustrates views of a glenosphere inserter, according to some embodiments, which can include a distal end with a feature complementary to a spline on the glenosphere, such as described in connection with FIG. 7, for example. The glenosphere inserter can be configured to, for example, advantageously provide positive attachment to the glenosphere; allow for solid rotational control while inserting; and/or may involve a secondary impaction step after removal.

[0065] In some embodiments, embodiments of the invention can be used or modified with use with particular advantages of using inset glenoid fixation technology in anatomic shoulder arthroplasty, such as described, for example, in U.S. Pat. Nos. 8,007,538

and/or 8,778,028 to Gunther, which are hereby incorporated by reference in their entireties. Furthermore, embodiments of the invention can be used or modified with use with systems and methods as disclosed, for example, in U.S. Pub. No. 2018/0368982 to Ball, which is hereby incorporated by reference in its entirety.

[0066] Various other modifications, adaptations, and alternative designs are of course possible in light of the above teachings. Therefore, it should be understood at this time that within the scope of the appended claims the invention may be practiced otherwise than as specifically described herein. It is contemplated that various combinations or subcombinations of the specific features and aspects of the embodiments disclosed above may be made and still fall within one or more of the inventions. Further, the disclosure herein of any particular feature, aspect, method, property, characteristic, quality, attribute, element, or the like in connection with an embodiment can be used in all other embodiments set forth herein. Accordingly, it should be understood that various features and aspects of the disclosed embodiments can be combined with or substituted for one another in order to form varying modes of the disclosed inventions. Thus, it is intended that the scope of the present inventions herein disclosed should not be limited by the particular disclosed embodiments described above. Moreover, while the invention is susceptible to various modifications, and alternative forms, specific examples thereof have been shown in the drawings and are herein described in detail. It should be understood, however, that the invention is not to be limited to the particular forms or methods disclosed, but to the contrary, the invention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the various embodiments described and the appended claims. Any methods disclosed herein need not be performed in the order recited. The methods disclosed herein include certain actions taken by a practitioner; however, they can also include any third-party instruction of those actions, either expressly or by implication. For example, actions such as "insetting an implant into a glenoid cavity" includes "instructing the insetting of an implant into the glenoid cavity." The ranges disclosed herein also encompass any and all overlap, sub-ranges, and combinations thereof. Language such as "up to," "at least," "greater than," "less than," "between," and the like includes the number recited. Numbers preceded by a term such as "approximately", "about", and "substantially" as used herein include the recited numbers (e.g., about 10% =

10%), and also represent an amount close to the stated amount that still performs a desired function or achieves a desired result. For example, the terms "approximately", "about", and "substantially" may refer to an amount that is within less than 10% of, within less than 5% of, within less than 1% of, within less than 0.1% of, and within less than 0.01% of the stated amount.

WHAT IS CLAIMED IS:

1. A reverse shoulder system, comprising:

a glenoid baseplate comprising a longitudinal axis,

the glenoid baseplate further comprising a stem and a central channel within a sidewall of the stem, the stem comprising a longitudinal axis,

wherein the longitudinal axis of the glenoid baseplate is angled with respect to the longitudinal axis of the stem, wherein the longitudinal axis of the glenoid baseplate is not perpendicular with respect to the longitudinal axis of the stem.

2. The system of Claim 1, wherein the glenoid baseplate comprises a generally disc-shaped portion extending radially outward from the central channel.

3. The system of Claim 2, wherein the stem comprises a sidewall that extends superiorly with respect to the disc portion.

4. The system of Claim 1, wherein the glenoid baseplate comprises a peripheral edge.

5. The system of Claim 4, wherein the peripheral edge comprises spaced-apart anti-rotation features.

6. The system of Claim 5, wherein the anti-rotation features comprise slots.

7. The system of Claim 4, wherein an inferior portion of the peripheral edge comprises a porous coating.

8. The system of Claim 1, wherein an inferior surface of the generally disc-shaped portion comprises a porous coating, but a superior surface does not comprise a porous coating.

9. The system of Claim 4, wherein the peripheral edge and/or an inferior surface of the baseplate comprises a conical geometry.

10. The system of Claim 1, wherein an inferior surface of the baseplate is concave.

11. The system of Claim 1, wherein the stem comprises a Morse taper lock superior to a superior-most portion of the generally disc-shaped portion of the glenoid baseplate.

12. The system of Claim 1, further comprising a glenosphere.

13. The system of Claim 12, wherein the glenosphere comprises a superior dome-shaped surface comprising a rotational control feature configured such that an inserter tool can lock the glenosphere and the baseplate to allow for rotation of the glenosphere and the baseplate together.

14. The system of Claim 13, wherein the rotational control feature comprises a spline.

15. The system of Claim 12, further comprising a central set screw and locking nut.

16. The system of Claim 15, further comprising a central compression screw non-integral with the baseplate and configured for placement adjacent and distal to the central set screw.

TOTAL REVERSE SHOULDER SYSTEMS AND METHODS

A reverse shoulder system can include, for example, a glenoid baseplate comprising a longitudinal axis, the glenoid baseplate further including a stem and a central channel within a sidewall of the stem. The stem can include a longitudinal axis. The longitudinal axis of the glenoid baseplate can be angled with respect to the longitudinal axis of the stem, wherein the longitudinal axis of the glenoid baseplate is not perpendicular with respect to the longitudinal axis of the stem. Other components including a glenosphere, tools, and methods of use are also disclosed.

32414032
32418685
54070653

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7
714
706
704
720
722
724
711

Figure 8

FIG. 8A

FIG. 8B

FIG. 8C

Fig. 8D

Fig. 8E

Fig. 8F

Fig. 8G

FIG. 8H

FIG. 8I

Fig. 8J

FIG. 8K

Fig. 8L

Fig. 8M

Fig. 8N

Fig. 8O

Fig. 8P

Fig. 8Q

FIG. 8R

Fig. 8S

Fig. 8T

Fig. 8U

Figure 9

Figure 10

Figure 11

Figure 12

Figure 13

Figure 14

Figure 15

Figure 16

Figure 17

Figure 18

Figure 19

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NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	Unassigned
Filing Date	Herewith
First Named Inventor	Donald E. Running
Title	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS
Art Unit	Unassigned
Examiner Name	Unassigned
Attorney Docket Number	SHOLD.013NP

SIGNATURE of Applicant or Patent Practitioner

Signature	/Andrew I. Kimmel/	Date (Optional)	
Name	Andrew I. Kimmel	Registration Number	58855
Title (if Applicant is a juristic entity)	Attorney for Applicant		
Applicant Name (if Applicant is a juristic entity)	Shoulder Innovations, Inc.		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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PCT REQUEST

(Original in Electronic Form)

0	**For receiving Office use only**	
0-1	International Application No.	PCT/US20/22094
0-2	International Filing Date	11 March 2020 (11.03.2020)
0-3	Name of receiving Office and "PCT International Application"	PCT INTERNATIONAL APPLICATION RO/US
0-4	**Form PCT/RO/101 PCT Request**	
0-4-1	Prepared Using	**ePCT-Filing for data package download Version 4.6.012 MT/FOP 20200302/1.1**
0-5	**Petition**	
	The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	**Receiving Office (specified by the applicant)**	**United States Patent and Trademark Office (USPTO) (RO/US)**
0-7	**Applicant's or agent's file reference**	**SHOLD-013WO**
I	**Title of Invention**	**TOTAL REVERSE SHOULDER SYSTEMS AND METHODS**
II	**Applicant**	
II-1	This person is	**Applicant only**
II-2	Applicant for	**All designated States**
II-4	Name	**SHOULDER INNOVATIONS, INC.**
II-5	Address	**13827 Port Sheldon Street Holland, Michigan 49424 United States of America**
II-6	State of nationality	**US**
II-7	State of residence	**US**
II-10	e-mail	**instructions@knobbe.com**
II-10(a)	E-mail authorization The receiving Office, the International Searching Authority, the International Bureau and the International Preliminary Examining Authority are authorized to use this e-mail address, if the Office or Authority so wishes, to send notifications issued in respect of this international application:	**exclusively in electronic form (no paper notifications will be sent)**
III-1	**Applicant and/or inventor**	
III-1-1	This person is	**Inventor only**
III-1-3	Inventor for	**All designated States**
III-1-4	Name (LAST, First)	**RUNNING, Donald, E.**
III-1-5	Address	**13827 Port Sheldon Street Holland, Michigan 49424 United States of America**
III-1-10	e-mail	**instructions@knobbe.com**

PCT REQUEST

(Original in Electronic Form)

III-2	**Applicant and/or inventor**	
III-2-1	This person is	**Inventor only**
III-2-3	Inventor for	**All designated States**
III-2-4	Name (LAST, First)	**BALL, Robert, J.**
III-2-5	Address	**13827 Port Sheldon Street Holland, Michigan 49424 United States of America**
III-2-10	e-mail	**instructions@knobbe.com**
III-3	**Applicant and/or inventor**	
III-3-1	This person is	**Inventor only**
III-3-3	Inventor for	**All designated States**
III-3-4	Name (LAST, First)	**SLONE, Jason**
III-3-5	Address	**13827 Port Sheldon Street Holland, Michigan 49424 United States of America**
III-3-10	e-mail	**instructions@knobbe.com**
IV-1	**Agent or common representative; or address for correspondence** The person identified below is hereby/ has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	**Agent**
IV-1-1	Name (LAST, First)	**ALTMAN, Daniel, E.**
IV-1-2	Address	**KNOBBE, MARTENS, OLSON & BEAR, LLP 2040 Main Street, 14th Floor Irvine, California 92614 United States of America**
IV-1-3	Telephone No.	**(949) 760-0404**
IV-1-4	Facsimile No.	**(949) 760-9502**
IV-1-5	e-mail	**instructions@knobbe.com**
IV-1-5(a)	E-mail authorization The receiving Office, the International Searching Authority, the International Bureau and the International Preliminary Examining Authority are authorized to use this e-mail address, if the Office or Authority so wishes, to send notifications issued in respect of this international application:	**exclusively in electronic form (no paper notifications will be sent)**
IV-1-6	Agent's registration No.	**34,115**
V	**DESIGNATIONS**	
V-1	**The filing of this request constitutes under Rule 4.9(a), the designation of all Contracting States bound by the PCT on the international filing date, for the grant of every kind of protection available and, where applicable, for the grant of both regional and national patents.**	

PCT REQUEST

(Original in Electronic Form)

VI-1	**Priority claim of earlier national application**		
VI-1-1	Filing date	**11 March 2019 (11.03.2019)**	
VI-1-2	Number	**62/816,708**	
VI-1-3	Country or Member of WTO	**US**	
VI-2	**Priority document request**		
	The International Bureau is requested to obtain from a digital library a certified copy of the earlier application(s) identified above as item(s), using, where applicable, the access code(s) indicated:	**VI-1 Access code: 9457**	
VI-3	**Incorporation by reference :**		
	where an element of the international application referred to in Article 11(1)(iii)(d) or (e) or a part of the description, claims or drawings referred to in Rule 20.5(a) is not otherwise contained in this international application but is completely contained in an earlier application whose priority is claimed on the date on which one or more elements referred to in Article 11(1)(iii) were first received by the receiving Office, that element or part is, subject to confirmation under Rule 20.6, incorporated by reference in this international application for the purposes of Rule 20.6.		
VII-1	**International Searching Authority Chosen**	**United States Patent and Trademark Office (USPTO) (ISA/US)**	
VIII	**Declarations**	Number of declarations	
VIII-1	Declaration as to the identity of the inventor	-	
VIII-2	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent	-	
VIII-3	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application	-	
VIII-4	Declaration of inventorship (only for the purposes of the designation of the United States of America)	-	
VIII-5	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	-	
IX	**Check list**	Number of sheets	Electronic file(s) attached
IX-1	Request (including declaration sheets)	**4**	✓
IX-2	Description	**14**	✓
IX-3	Claims	**2**	✓
IX-4	Abstract	**1**	✓
IX-5	Drawings	**21**	✓
IX-6a	Sequence listing part of the description (also to be used for the purposes of international search)	-	-
IX-7	TOTAL	**42**	
	Accompanying Items	Paper document(s) attached	Electronic file(s) attached
IX-8	Fee calculation sheet	-	✓
IX-20	**Figure of the drawings which should accompany the abstract**	**1**	
IX-21	**Language of filing of the international application**	**English**	

PCT REQUEST

(Original in Electronic Form)

X-1	**Signature of applicant, agent or common representative**	**/Daniel Altman, Reg. No. 34,115/**
X-1-1	Name (LAST, First)	**ALTMAN, Daniel, E.**
X-1-3	Capacity (if such capacity is not obvious from reading the request)	**Agent**

11 March 2020 (11.03.2020)

FOR RECEIVING OFFICE USE ONLY

10-1	**Date of actual receipt of the purported international application**	11 March 2020 (11.03.2020)
10-2	**Drawings:**	
10-2-1	Received	
10-2-2	Not received	
10-3	**Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application**	
10-4	**Date of timely receipt of the required corrections under PCT Article 11(2)**	
10-5	**International Searching Authority**	**ISA/US**
10-6	**Transmittal of search copy delayed until search fee is paid**	

FOR INTERNATIONAL BUREAU USE ONLY

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THE UNITED STATES OF AMERICA

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UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

April 06, 2020

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE UNDER 35 USC 111.

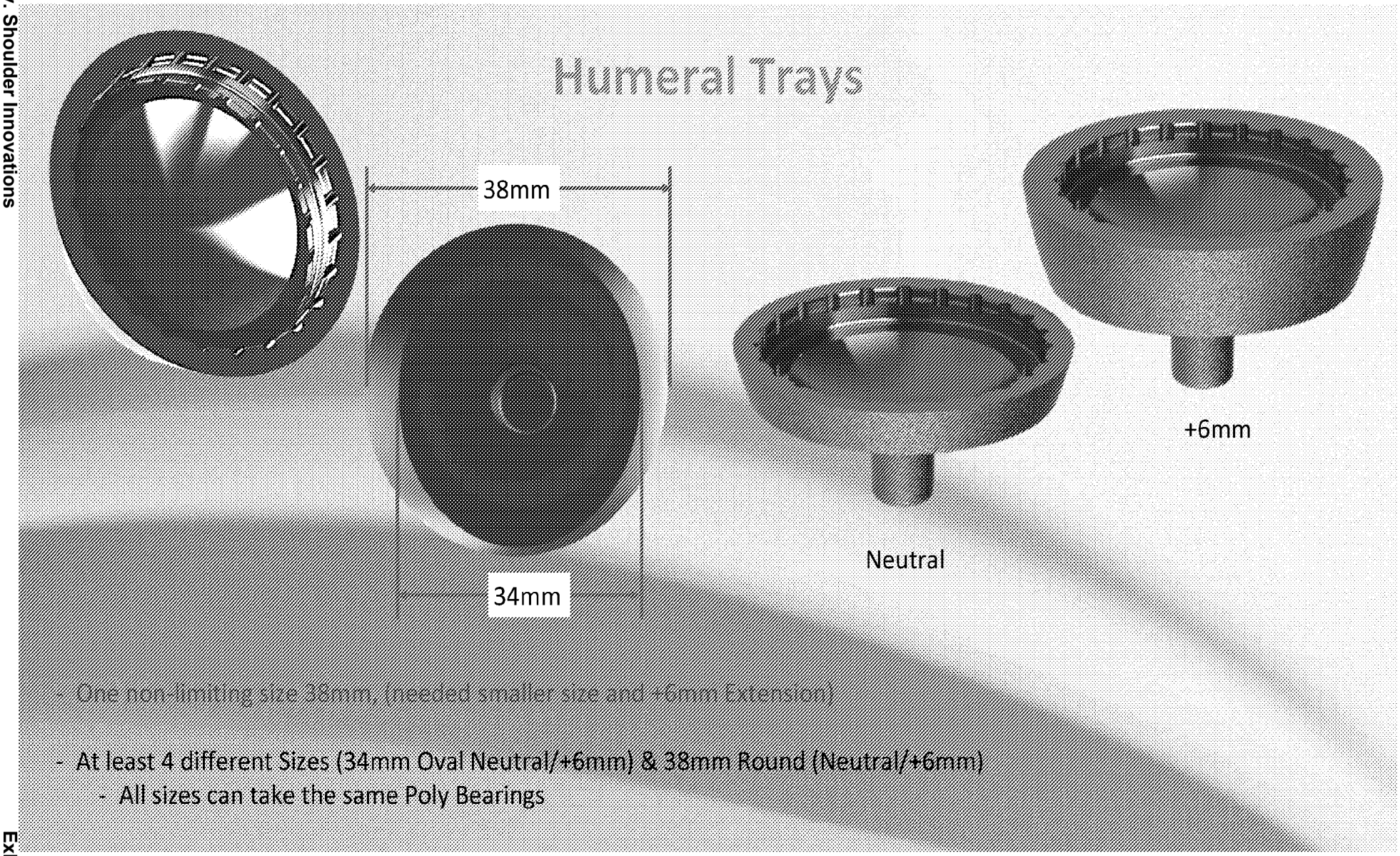
APPLICATION NUMBER: *62/816,708*
FILING DATE: *March 11, 2019*

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS *US62/816,708*

Certified by

Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office

Total Reverse Shoulder


Humeral Trays
38mm
34mm
Neutral
+6mm
- One non-limiting size 34mm, (needed smaller size and +6mm extension)
- At least 4 different Sizes (34mm Oval Neutral/+6mm) & 38mm Round (Neutral/+6mm)
- All sizes can take the same Poly Bearings

Humeral Bearing
Humeral Head
Humeral Stem
- Example angles: Neutral, 5 Degree, 10 Degree
- 2 Offset Option examples: (+3mm/+6mm)
- Example sizes: 33mm Spherical Dia in addition
- to the 36,39,&42mm
- Example 36, 39, 42mm spherical diameters

Inset Glenoid Baseplate

Version Change for Posterior Defects

e.g., 4 Degree Female Morse Taper

(40mm Post Length as one example)

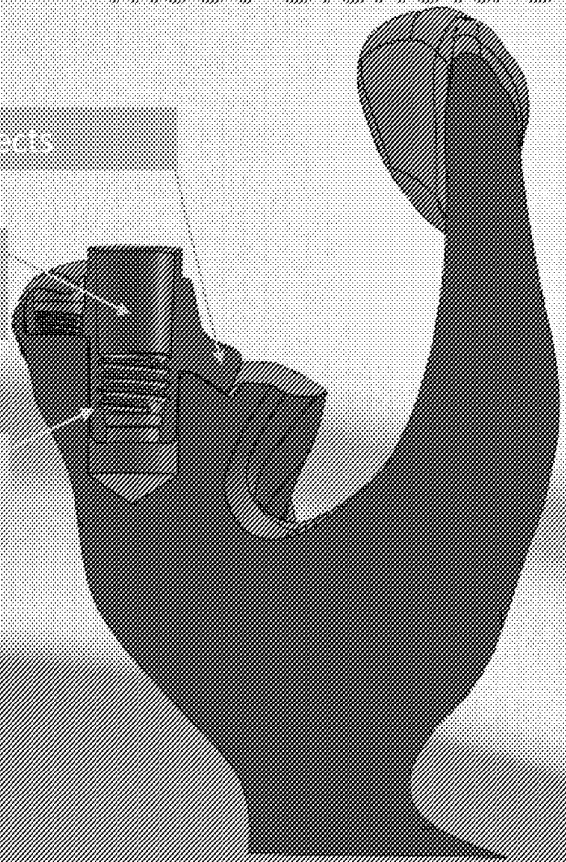
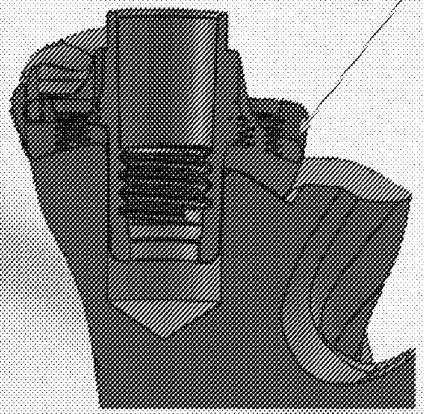


Plate pivots around stem/Taper for Version Correction (no need for augment) Direct Bone-Implant Interface

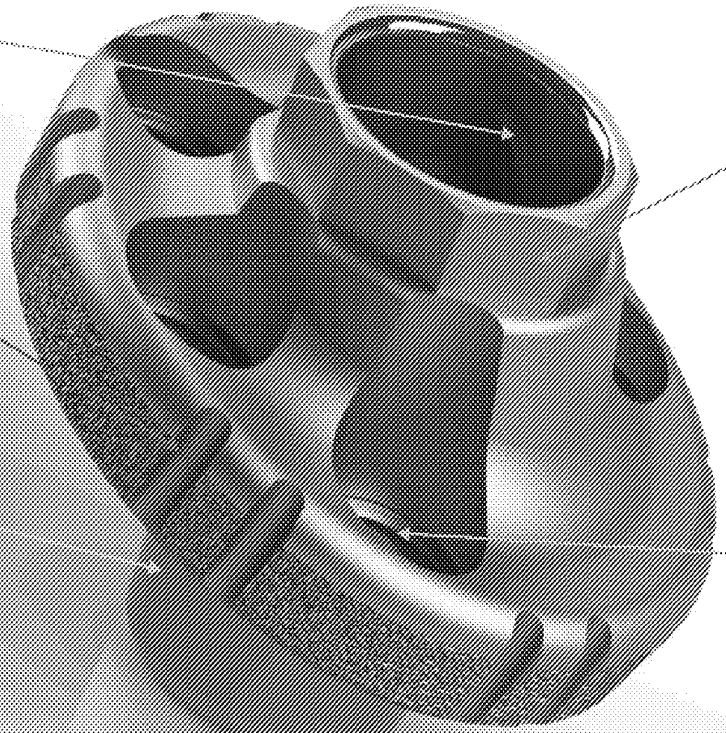


- Examples of 4 angle corrections (0,5,10 & 15 Degree)
- Examples of 2 Diameters (24mm & 29mm)

- Examples of 4 angle corrections (0,5,10 & 15 Degree)

- Examples of 4 Stem Angle Options (0,10,15,20 Degree)

Inset Glenoid Baseplate



- Examples of two sizes 24 & 29mm
- Optional Secondary Locking Feature for Glenosphere
- Primary Screw is variable angle, optionally locking
- Taper Periphery on Baseplate acceptable
- Porous Coating on the sides and underneath.

Current Design

- Examples of Two sizes 24mm & 29mm
- Locking Feature for Glenosphere
- Primary Screw is limited angle but can lock
- Porous Coating on the sides and underneath.
- Fixed and Variable Angle Peripheral Screws

Threaded Locking Insert
e.g. 4mm Hex
Female Thread to Receive Shoulder Screw
Male Thread to go into Baseplate
Spherical Surface to Lock
Variable Angle Screw

Rotational Control Feature
Glenospheres
Eccentric 24-32mm Option for added flexibility
- Articulating Diameter examples: 33mm, 36mm, 39mm, & 42mm
- Examples of Options, (Neutral, Eccentric (2-4mm), and Offset (+3mm & +6mm))
- Secondary Locking Screw Optional

Glenospheres
Fully Assembled Glenosphere w/ Locking Bolt
Rotational Control Feature
Threaded for Inserter/Head Extender
Secondary Locking Screw Option
Central Set Screw/Locking Nut
Hex 6.5mm Central Compression Screw

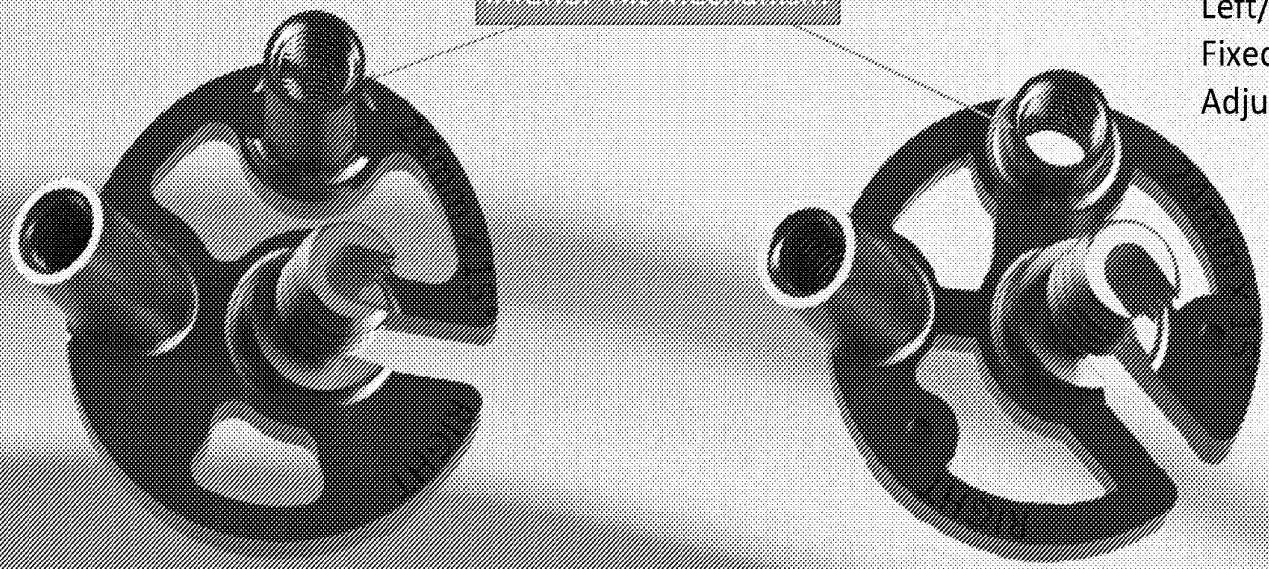
Glenoid Surgical Technique

A3-E3 Defect
Size / Angle Guide
Wire Guide/ Place Wire
Remove Wire Guide and Sizer/Angle Guide
Ream for Baseplate
Place/Adjust Stem Drill Guide
Drill hole for Stem
Insert Baseplate
Remove Threaded Rod

Drill/Determine Length of Central Screw
Remove Drill
Place Screw & Screw Driver through Shaft & Tighten
Remove Baseplate Inserter Handle
Drill for Peripheral Locking Screws
Drill for Variable Angle Screws
Insert & Tighten Peripheral Screws
Insert and Tighten Central Set Screw/Secondary Locking Nut
Insert Glenosphere
Insert and Tighten Locking Bolt

Catalyst v. Shoulder Innovations
PGR2025-00001

Sizer/Angle Guide

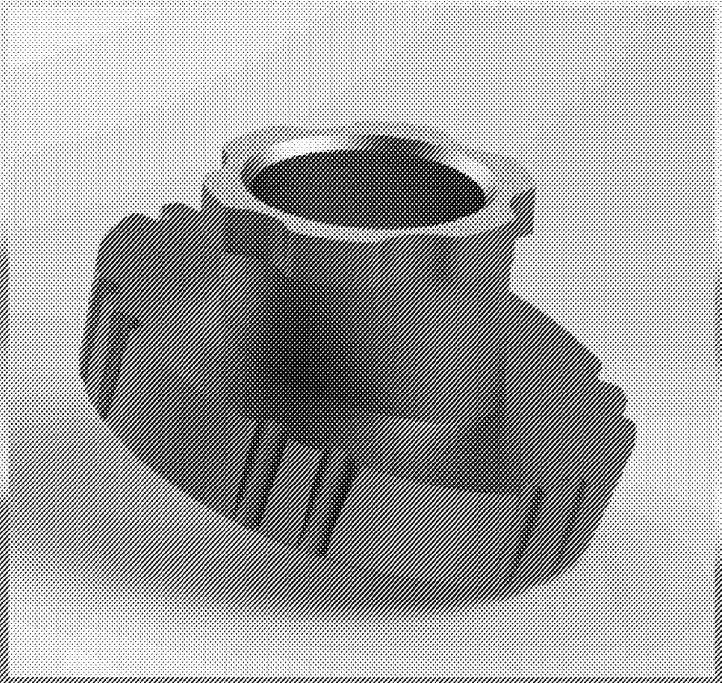


Left/Right Specific
Fixed Version (e.g., 0,5,10,15Deg)
Adjustable Inferior Tilt

Shape- (Egg shape or Round) as some examples
Slot for removal (Posterior or Posterior Inferior)
Inferior Tilt Mechanism (Set Screw with Calibrated Window or Individual Depth Screws)

Exhibit 2003
Page 73

Stem Drill Guide



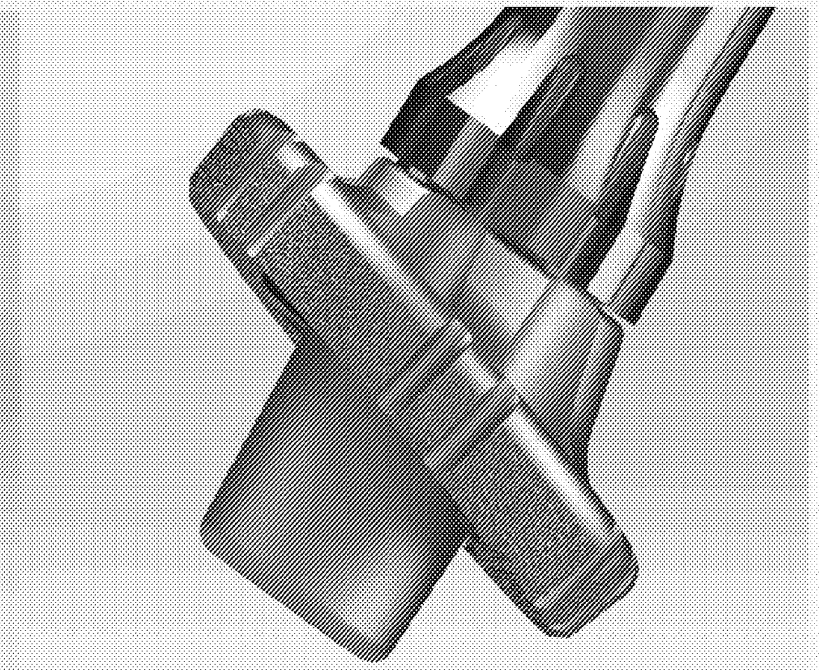
Diameters (e.g., 24,29 mm)
Version (e.g., 0,5,10,&15 Deg)

The larger the version angle the more stem tilt generated as you rotate

Stem Angle Change with 30Degree Rotational Adjustment and a 15 Degree Version Plate as one Example

Glenoid Baseplate Inserter





- Positive Rotational Control
- Slim design to allow visualization through screw holes to know when seated.
- Multi-function handle allows for drilling central screw hole, and Inserting central screw.

Catalyst v. Shoulder Innovations
PGR2025-00001

Calibrated Central Drill

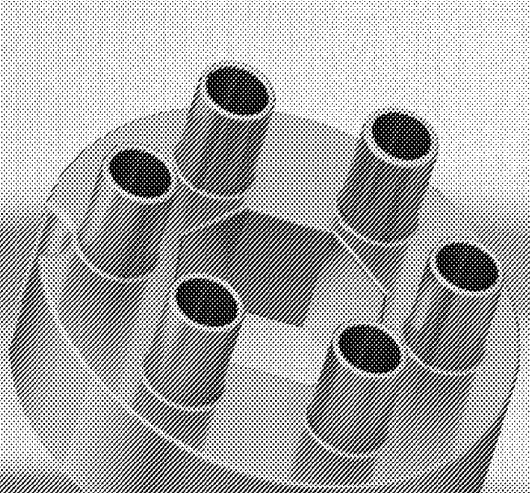


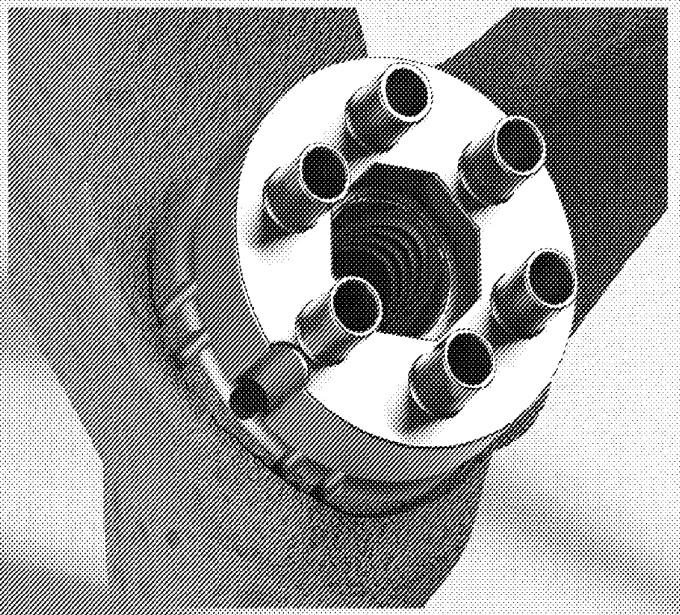
Calibrated marks of 5mm increments to help determine length of Central screw needed.

- Calibration Length can start at, e.g., 20mm or 30mm?
- Can potentially cut out a surgical step

Exhibit 2003
Page 77

Peripheral Drill Guides - Fixed Angle

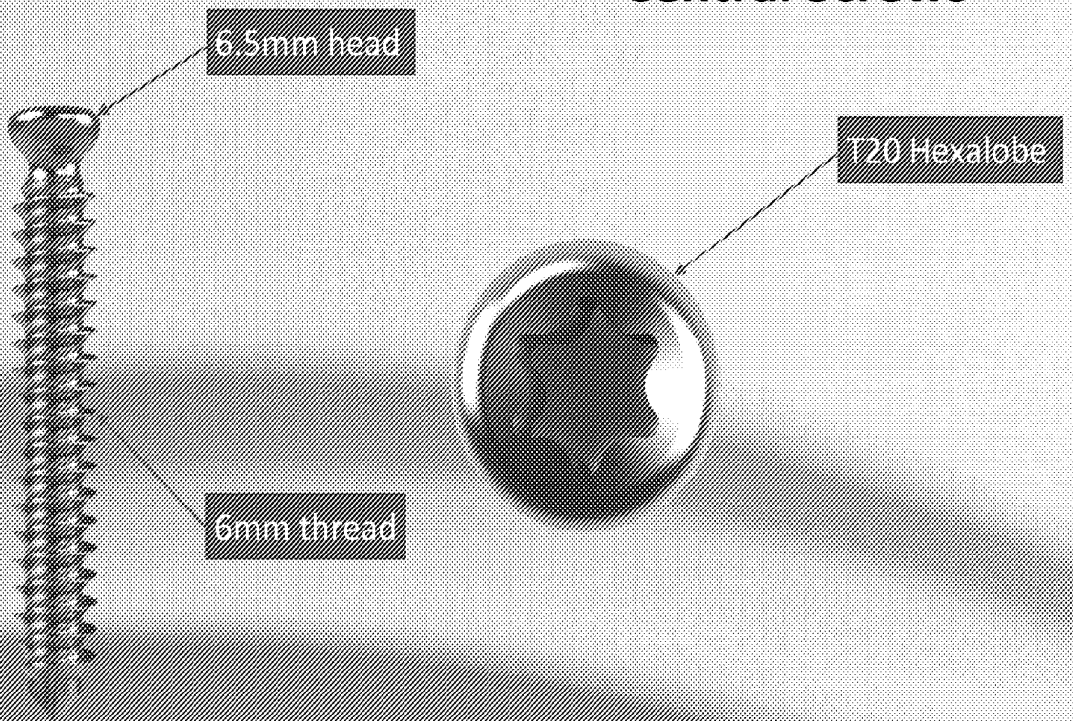




- Fits over octagon on the top of baseplate
- Choose which fixed angle screws to drill

Peripheral Drill Guides – Variable Angle

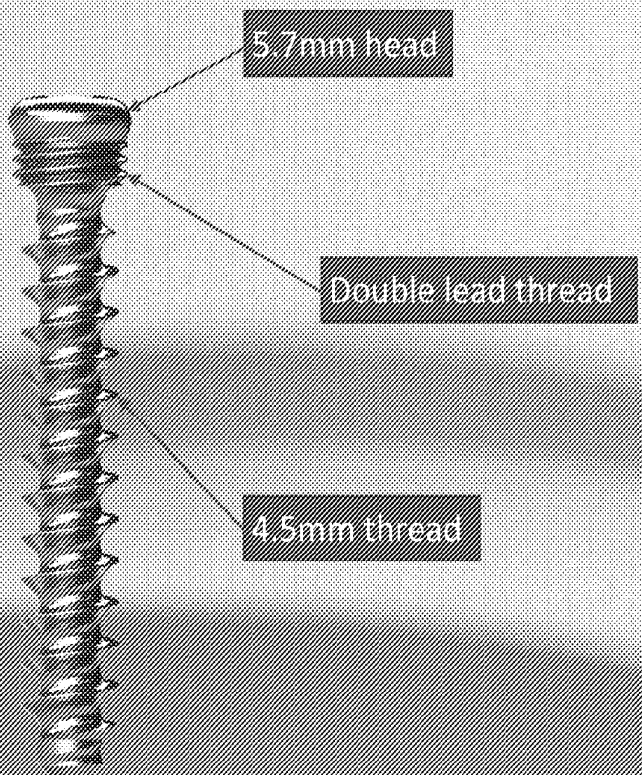
Central Screws

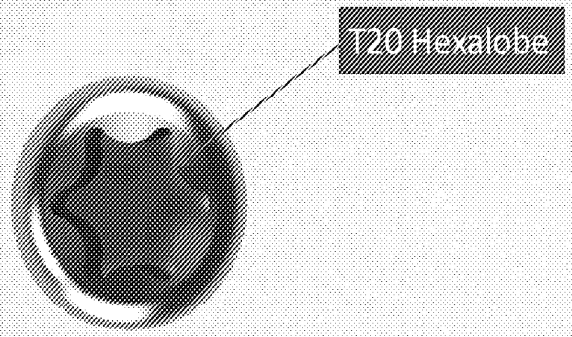


Examples of compatible implant systems:
Diameter: 6.5mm
Length: 20, 25, 30, 35, 40, 45, 50mm

- Various size ranges
- Various size increments
- Screw length can include head height or just working length
- Anodization possible to help differentiate the screws

Fixed Angle Peripheral Compression Screws

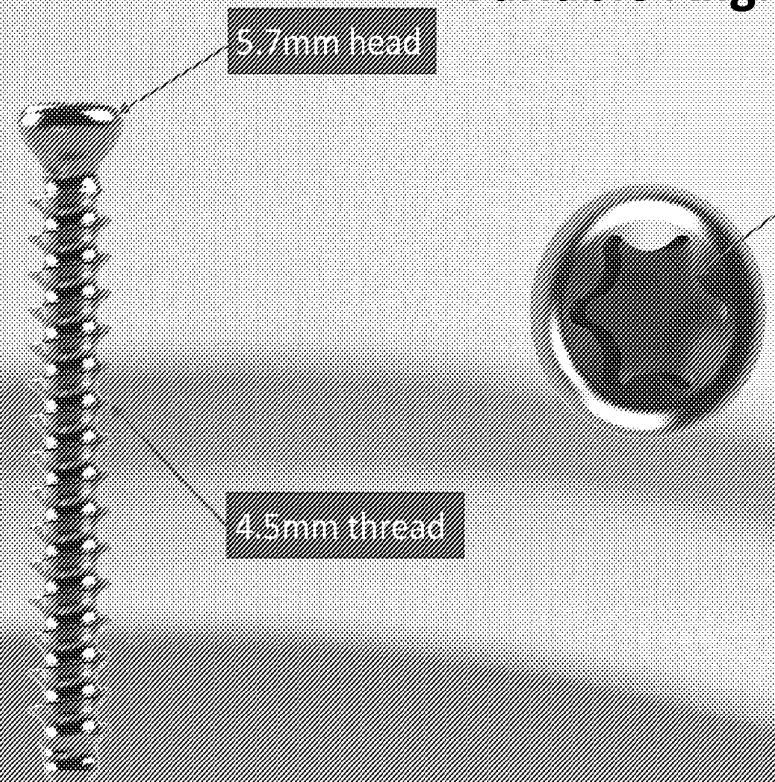




Examples of compatible implant systems
Diameter: 4.75mm
Length: 15, 20, 25, 30, 35, 40, 45mm

- Various size ranges
- Various size increments

Variable Angle Peripheral Screws



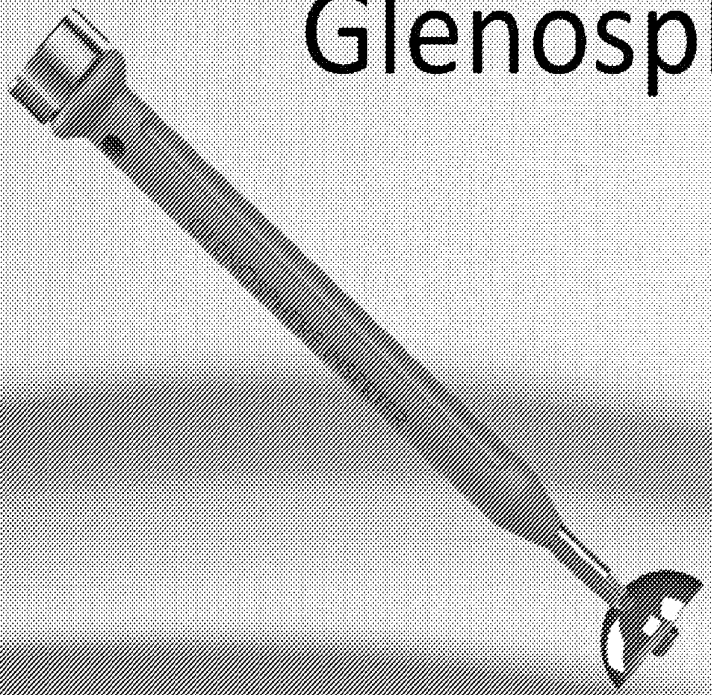
Examples of compatible implant systems:

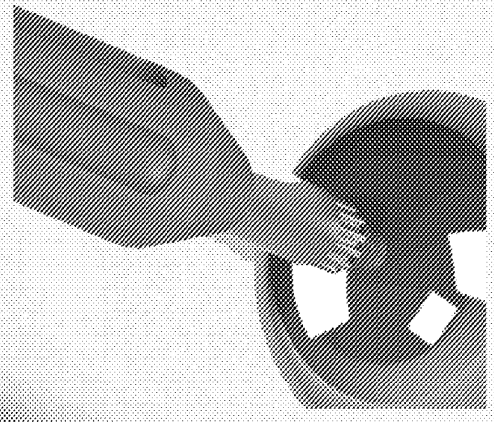
Diameter: 4.75mm
Length: 15, 20, 25, 30, 35, 40, 45mm

Diameter: 5mm
Length: 14, 18, 22, 26, 30, 34, 38, 42, 46, 50, 54mm

- Various size ranges
- Various size increments

Glenosphere Inserter





- Provides Positive attachment to Glenosphere
- Allows for solid rotational control while inserting
- May involve a secondary impaction step after removal

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SHOLD.013PR
	Application Number	
Title of Invention	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 — Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	To be		Determined	

Residence Information (Select One) ● US Residency Non US Residency Active US Military Service

City		State/Province		Country of Residence	

Mailing Address of Inventor:

Address 1	
Address 2	
City	State/Province
Postal Code	Country

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	20995		
Email Address	efiling@knobbe.com	Add Email	Remove Email

Application Information:

Title of the Invention	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS		
Attorney Docket Number	SHOLD.013PR	**Small Entity Status Claimed**	☒
Application Type	Provisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	22	**Suggested Figure for Publication (if any)**	

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. OMB 0651-0032
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SHOLD.013PR
	Application Number	
Title of Invention	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	● Customer Number	US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	20995		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status			Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SHOLD.013PR
	Application Number	
Title of Invention	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS	

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

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Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

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Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	SHOLD.013PR
	Application Number	
Title of Invention	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS	

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When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

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B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

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	Application Number	
Title of Invention	TOTAL REVERSE SHOULDER SYSTEMS AND METHODS	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1 Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

● Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.	Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	Shoulder Innovations, Inc.		
Mailing Address Information For Applicant:			
Address 1	425 North Main Street		
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City	Ann Arbor	**State/Province**	MI
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Phone Number		Fax Number	
Email Address			

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Assignee Information including Non-Applicant Assignee Information:

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Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

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Address 2			
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Signature:

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Signature	/Bryan Wahl/			Date (YYYY-MM-DD)	2019-03-11
First Name	Bryan	Last Name	Wahl	Registration Number	58878

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This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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APPENDIX

TOTAL SHOULDER PROSTHESIS HAVING INSET GLENOID IMPLANT CONVERTIBLE FROM ANATOMIC TO REVERSE

[0001] This application claims the benefit under 35 U.S.C. § 119(e) as a nonprovisional of U.S. Prov. App. No. 62/485839 filed on April 14, 2017, which is hereby incorporated by reference in its entirety.

BACKGROUND

[0002] Shoulder Replacement is a commonly performed medical procedure for treatment of osteoarthritis, rheumatoid arthritis, as well as for treatment of certain deformities related to oncological indications as well as trauma. There are two primary types of articulations available to surgeons for treatment: anatomic and reverse. With anatomic, the surgeon replaces the articular surfaces with industrial materials such that the articulating surfaces are substantially the same shape as the natural anatomy. A stem can be commonly fixed inside the canal of the humerus, a metallic articular head can be rigidly fixed to the proximal aspect of the same, the articular head having a convex articular surface adapted to articulate with the glenoid implant. The glenoid implant can include on its back side (medial side) certain pegs or posts or fins adapted to be rigidly fixed within the glenoid fossa of the scapula and on its front side a concave or flat articular surface adapted to articulate with the humeral head of the humeral implant.

[0003] When a reverse prosthesis is used, the articular surface is reversed in that the metallic ball is rigidly fixed to the glenoid fossa of the scapula, and the concave articular surface is rigidly fixed to the humeral bone, thereby reversing the fashion of articulation of the prosthesis.

[0004] The surgeon chooses between the two types of prostheses by assessing a number of conditions of the patient including level of pain, patient activity level, deformity or severity of the boney degradation, the strength of surrounding soft tissues, and present or absence of prior surgery, and particularly the health and strength of the rotator cuff muscle and tendon. Disease of the rotator cuff is common among patients with arthritis of the shoulder. In this circumstance, it is commonly observed that the absence of insufficiency of

the rotator cuff leads to a condition where the anatomic shoulder replacement prosthesis is not sufficiently stabilized by surrounding soft tissue. In this case, a reverse shoulder replacement prosthesis can be preferred in some cases due to the higher inherent stability of the articulation. In addition, the reverse prosthesis can advantageously utilize the remaining muscles in a way they can be more effective in the absence of the other soft tissue structures by adjusting the position of the articular surfaces within the joint.

[0005] It is not uncommon that a surgeon selects to use an anatomic prosthesis and is provides effective treatment to the patient though the shoulder replacement operation. However, over time and during use of the prosthesis, the patient's rotator cuff complex can become insufficient, tear, or generally be diseased such that it can no longer perform its function associated with normal joint kinematics. In this case, the surgeon can elect to perform a second operation to remove the anatomic prosthesis, and replace the anatomic prosthesis with a reverse prosthesis.

[0006] Several attempts have been made to attempt to address the need of conversion of the articular surface without interruption of the fixation. Primarily, these are created using a two (or more) system, where there is a metallic fixation component which is rigidly fixed to the glenoid fossa, and a polyethylene (PE) articular component which is secondarily fixed to the metallic component, and provides the concave articular surface adapted to articular with the humeral prosthesis. While referred to herein as a PE component, some embodiments do not require the use of polyethylene and can be made of other biocompatible materials depending on the desired clinical result. The PE component is commonly fixed to the metallic fixation component by conventional industrial techniques such as snap fit mechanisms, snap rings, compression pins, overmolding of the PE and other such means.

[0007] A challenge of this particular articulation in some cases is that the glenoid fossa is relatively small, and commonly there is much reduced presence of bone in patients with arthritis. In this context, the surgeon has limited positioning and bone to work with in order to fit within the patient. In addition, the surgeon must be careful not to overstuff the joint, meaning implant components that move the new articulating surface far from its original position such that the soft tissues is unnaturally tensioned, which can lead to

instability, accelerated where, soft tissue failure, pain, reduced range of motion, or fracture of the prosthesis and surrounding bone. Facing these conditions, the prosthesis typically needs to be designed to remain relatively thin (commonly, 1 piece, where PE glenoid implants typically have a 4mm thick articular surface). In order to design these modular components, there can be little additional packaging space provided into which to fit the attachment mechanisms necessary for use without adversely affecting the performance of the overall joint replacement procedure. Thus, typically, these designs lead to "over-optimization" of the fixation and articular portions in order to provide sufficient attachment mechanisms such that either: the PE is too thin to be sufficiently strong, the metallic components are too small to provide sufficient fixation, or the overall mechanism is insufficiently rigid causing there to be secondary wear surfaces, and generation of wear particles leading to PE disease.

[0008] A problem that can exist is that in the case where the surgeon wants to change the prosthesis type, the anatomic prosthesis is commonly well fixed and adapted to the patient's body such that removal of the prosthesis can be very destructive, and leave natural bone remaining that is perhaps insufficient to support the fixation of the reverse prosthesis. What is needed is a prosthesis system that provides a means by which the articulating surfaces of the implant can be exchanged such that the anatomic surfaces can be converted to reverse surfaces, while not exchanging the fixation components.

[0009] What is also needed is a simple means by which the surgeon can implant an inset anatomic articulating glenoid implant whereby at a later date, can remove the anatomic articulating surface and replace it with a reverse articulating surface such that the primary means of fixation remains well fixed in the glenoid fossa at the moment of articular exchange.

SUMMARY

[0010] In some embodiments, disclosed herein is a method of performing a reversible anatomic shoulder replacement procedure. The method can include any number of: reaming a cavity into the glenoid; and inserting an anatomic glenoid articular implant into the glenoid cavity, the glenoid anatomic articular implant comprising a medial surface configured

to mate with the glenoid cavity, a central peg extending medially from the medial surface, a lateral surface configured to articulate with a humeral component; and an intermediate component between the lateral surface and the medial surface, the intermediate component having an outer diameter reversibly attached to a snap ring attached to a fixation ring, the snap ring and the fixation ring at least partially implanted within the glenoid cavity. The anatomic glenoid articular implant can be partially or fully inset into the glenoid cavity. The cavity could be circular, oval, or another shape.

[0011] Also disclosed herein is a method of converting an anatomic to a reverse shoulder prosthesis, including any number of: identifying a patient with an anatomic glenoid articular implant within a glenoid cavity, the anatomic articular implant comprising a medial surface mated with the glenoid cavity, a central peg extending medially from the medial surface, a lateral surface articulating with a humeral component; and a central component between the lateral surface and the medial surface, the central component having an outer diameter reversibly attached to a snap ring and a fixation ring, the snap ring and the fixation ring at least partially implanted within the glenoid cavity; inserting a implant removal tool through the lateral articulating surface of the anatomic glenoid articular implant sufficient to collapse the snap ring; removing the anatomic glenoid articular implant while leaving the fixation ring in place within the glenoid cavity; and inserting a reverse shoulder implant into the glenoid cavity sufficient to actuate the snap ring such that the reverse shoulder implanted is reversibly fixed to the fixation ring. Inserting the removal tool can include driving pins, a drill bit, or another tool of the removal tool through the lateral articulating surface of the anatomic glenoid articular implant.

[0012] In some embodiments, also disclosed herein is a reversible anatomic shoulder replacement system, that can include any number of: a fixation ring configured to be positioned within the glenoid cavity, the fixation ring comprising a peripheral edge comprising an outer diameter and a plurality of spaced-apart radially inward indents in the peripheral edge, the fixation ring comprising a groove configured to house a snap ring therein; a snap ring comprising an expanded configuration and a collapsed configuration; and an anatomic articular implant comprising a medial surface configured to mate with the glenoid cavity, a central peg extending medially from the medial surface, a lateral surface

configured to articulate with a humeral component; and an intermediate component between the lateral surface and the medial surface, the intermediate component having an outer diameter reversibly attached to the snap ring and the fixation ring, the snap ring and the fixation ring configured to be at least partially implanted within the glenoid cavity. The groove can include anti-rotation tabs. The peripheral edge of the fixation ring can be configured to facilitate bone ingrowth, e.g., via an osteoinductive or osteoconductive surface. The groove can be a circumferential groove. The lateral surface can include any appropriate material, such as polyethylene.

[0013] Also disclosed herein is a reverse shoulder replacement kit for an anatomic shoulder replacement system, that can include any number of: an implant removal tool configured to bore through a medial surface of the anatomic glenoid articular implant sufficient to collapse a snap ring; and remove an anatomic glenoid articular implant while leaving a fixation ring in place within the glenoid cavity; and a reverse shoulder implant configured to be implanted into the glenoid cavity, the reverse shoulder implant comprising a generally cylindrical component comprising a medial surface configured to mate with the glenoid cavity, a central receptacle for housing an articular post therethrough, and a plurality of peripheral screw holes; a lateral surface, and a central post extending away from the lateral surface, wherein the reverse shoulder implant is configured to reversibly mate with the snap ring and fixation ring embedded in the glenoid cavity to anchor the reverse shoulder implant.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1 illustrates a lower perspective view of an embodiment of a fixation support which can be an annular fixation ring in some embodiments that can be fixed at least partially within a prepared glenoid cavity.

[0015] FIG. 2 illustrates an upper perspective view of an embodiment of a support, e.g., an annular ring 100.

[0016] FIGS. 3 and 4 illustrate an embodiment of an anatomic articular component 200 for a glenoid cavity which can be made of polyethylene or another appropriate material.

[0017] FIGS. 5 and 6 illustrate different perspective views of an embodiment of a reversible anatomic articular assembly 300 including the anatomic articular component 200, fixation ring 100, and location for placement of a snap ring 400.

[0018] FIG. 7 illustrates a perspective view of an embodiment of a reverse fixation disc 700 including a central fixation post 706 that can include a longitudinal axis aligned along the center of the reverse fixation disc as shown.

[0019] FIGS. 8 and 9 illustrate perspective views of a reverse fixation disc 700 including peripheral screw holes 704, fixation ring 100 and snap ring 400, the snap ring 400 which can have the same mechanism as the anatomic assembly described herein.

[0020] FIGS. 10A-C illustrate part of a method of implanting an anatomic prosthesis into a reamed glenoid cavity, according to some embodiments of the invention.

[0021] FIGS. 11A-D and 12A-B illustrate a method of removing an anatomic prosthesis while leaving a fixation ring in place embedded in the glenoid cavity, as well as embodiments of components for use in the method, according to some embodiments.

[0022] FIGS. 13A-13B, illustrates a method of implanting a replacement reverse prosthesis in the glenoid cavity, and mating the prosthesis with the implanted fixation ring.

DETAILED DESCRIPTION

[0023] In particular, some embodiments of the invention are focused on advantageously exchanging the articular surface of the glenoid from a concave shape to a convex shape, without removing the components or interface having to do with fixation of the implant into the glenoid fossa.

[0024] In some embodiments, embodiments of the invention can be used or modified with use with particular advantages of using inset glenoid fixation technology in anatomic shoulder arthroplasty, such as described, for example, in U.S. Pat. Nos. 8,007,538 and/or 8,778,028 to Gunther, which are hereby incorporated by reference in their entireties.

[0025] What is further described are methods by which the surgeon can achieve the use of the inset glenoid technology with an anatomic articulation, while after having the ability to convert the technology to a reverse articulation, without requiring removal the rigid fixation between the inset fixation and the scapula bone (in other words, allowing the rigid

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fixation support between the inset fixation and the scapula bone to remain in place during conversion from an anatomic to a reverse prosthesis).

[0026] Some embodiments of the invention can utilize an inset glenoid articulation implant described by Gunther et al. including in U.S. Pat. No. 8,007,538 or 8,778,028. However, some embodiments of the invention can also utilize onlay glenoid articulation implants. The peripheral rim of the implant can in some cases have an important role in the fixation stability of the implant and its resistance to motion relative to the glenoid bone during articulation. In addition, it is recognized that a known "rule of thumb" in the industry is that the bearing component of the glenoid implant, such as the polyethylene (PE) component, should be at least about 3mm thick at its thinnest position in order to achieve a sufficient material strength to minimize risk of accelerated implant failure. Of course, this rule is only a guide, but has proven helpful in assessing longevity of implant designs. With these points in mind, it is recognized that in some embodiments the design of the implant (which can be inset in some embodiments) might be improved upon by providing a step in the outer diameter of the inset glenoid implant at its most medial aspect while being able to maintain a minimum PE thickness of about or at least about 2mm, 2.5mm, 3mm, 3.5mm, 4mm, or ranges incorporating any of the aforementioned values. In the space that this step provides is placement of an annular ring which can be rigidly fixed on the outer diameter of the articular implant such that the outer diameter of the inset glenoid implant remains a contiguous surface, albeit in some embodiments made a plurality of materials: the lateral aspect being part of the PE articulation, the medial aspect being the outer diameter of the annular ring, which can be metallic in some cases. The annular ring and the PE articular component can be attached to one another through the use of a snap ring mechanism or other ways, some of which are described elsewhere herein.

[0027] The annular ring can be configured such that its outer diameter presents a surface to the surrounding bone which can be adapted to be biologically attractive for the growth of surrounding bone tissue. This technology can be achieved by several means such as, for example, various coatings or secondary manufacturing operations, mechanical modification through machining operations, creation of an adapted surface using 3D printing manufacturing, or other means. One advantage of the surface on the outer diameter is such

that over the course of the healing process following surgery, bone grows and adapts itself to this annular ring so as to provide rigid attachment of surrounding bone to the annular ring. Thus, at the moment of articular component exchange, the ring is well fixed to bone, and following removal of the PE articulation component, the ring remains well fixed within the glenoid bone, and can be useful as a support surface in attachment of a new reverse articulating surface to the bone.

[0028] FIG. 1 illustrates a lower perspective view of an embodiment of a fixation support which can be an annular fixation ring in some embodiments that can be fixed at least partially within a prepared glenoid cavity. The annular ring 100 can include a central cavity 106 and a plurality of radially inward indents 102 in the outer circumference of the peripheral edge 104 of the annular ring 100 as shown and be sized and configured for fixation screw clearance. The ring 100 could have any number of indents 102 such as 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, or more, or ranges including at least two of the aforementioned values. The indents 102 could be regularly or irregularly spaced apart along the circumference in some embodiments, and have a curved shape as shown or other shapes. As shown, the peripheral edge 104 can include a coating or other surface, e.g., osteoinductive or osteoconductive surface to facilitate bone ingrowth and fixation into the cavity. The surface could include, for example, cortical bone, cancellous bone, particulate matter, a powder form, granules, chips, a synthetic bone substitute, growth factors and/or bone growth promoting proteins, or combinations thereof. The annular ring 100 can also include a groove or slot 108 that can be oriented along the outer circumference of the central cavity 106 (e.g., inner diameter of the ring) and configured to house a snap ring therein (not shown).

[0029] FIG. 2 illustrates an upper perspective view of an embodiment of a support, e.g., an annular ring 100, showing the indents 102 as previously described. Also shown is the groove or slot 108 configured to house a snap ring as well as radially-inward extending anti-rotation tabs 112. The outer diameter of the peripheral edge 104 of the annular ring 100 can match that of a bearing, e.g., polyethylene component in some embodiments.

[0030] FIGS. 3 and 4 illustrate an embodiment of an anatomic articular component 200 for a glenoid cavity which can be made of polyethylene or another appropriate material. The anatomic articular component 200 can include a concave

articulating surface 202 as shown, as well as a central fixation post or peg 204, which can be only a single post or peg in some cases, and be aligned coaxially with the center of the implant. The peripheral edge of the implant could have a generally cylindrical shape in some embodiments, and/or have a circular, oval, or other cross-section. The articular component 200 can also include a feature configured to mate with the fixation support, such as a cylindrical component 206 lateral to the articular surface 202 that can have an outer diameter that corresponds to the inner diameter of the fixation support (not shown) as well as a slot or groove (not shown) configured to house a snap ring (not shown). The outer diameter of the component 206 can be in some cases less than, such as about or at least about 5%, 10%, 20%, 30%, 40%, 50%, or more less than that of the outer diameter of the articulating surface 202 of the anatomic articular component 200, or ranges including any two of the aforementioned values.

[0031] FIGS. 5 and 6 illustrate different perspective views of an embodiment of a reversible anatomic articular assembly 300 including the anatomic articular component 200, fixation ring 100, and location for placement of a snap ring 400 as previously described and illustrated.

[0032] FIG. 7 illustrates a perspective view of an embodiment of a reverse fixation implant, e.g., disc 700 including a central fixation post 706 that can include a longitudinal axis aligned along the center of the reverse fixation disc as shown. The medial surface 702 of the disc can include a central receptacle 708 for an articular post, as well as a plurality, e.g., 2, 3, 4, or more screw holes 704 oriented more peripherally with respect to the peripheral edge 706 of the disc, which can be generally cylindrical as shown, or another suitable geometry.

[0033] FIGS. 8 and 9 illustrate perspective views of a reverse fixation disc 700 including peripheral screw holes 704, fixation ring 100 and snap ring 400, the snap ring 400 which can have the same mechanism as the anatomic assembly described herein. Also shown is the other end of the receptacle 708 for the articular post that can extend through the implant. The apertures 704 (e.g., screw holes) can be axially aligned and configured to correspond with each of the indents 102 of the fixation ring 100 with the indents 102 as previously described, to house fixation screws therethrough.

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[0034] FIGS. 10A-10C illustrates part of a method of implanting an anatomic prosthesis into a reamed glenoid cavity, according to some embodiments of the invention. A pocket P can be prepared, such as by reaming, in the glenoid G (shown in FIG. 10A), which can be an appropriate shape, such as circular as shown, ovoid, or other geometries, with a central distal extending hole H for a central peg in some embodiments, as shown in FIG. 10C. The anatomic implant, one embodiment of which is shown in FIG. 10B along with the fixation ring and snap ring, can be implanted into the cavity, shown schematically in FIG. 10C such as in a partially or completely inset manner, with about or at least about 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, or 100% of the thickness of the peripheral edge of the implant inset below the prepared glenoid surface, or ranges including any two of the aforementioned values. The attachment of the ring to the PE implant can be preferably achieved in a reversible fashion using techniques and tools available to a surgeon such that the operation can be performed in situ, or in place within the patient. In order to accomplish this, a snap ring mechanism can be utilized such that another component, such as an angular metallic ring is positioned between the bearing component, e.g., PE component and the snap ring and/or metallic ring.

[0035] FIG. 11A schematically illustrates an anatomic articular implant 300 inserted into bone, such as the glenoid cavity. FIG. 11B schematically illustrates a side view, and FIG. 11C a top view, of an implant that can be as previously described. As shown in FIGS. 11A-D and 12 in some embodiments, at the moment the surgeon seeks to remove the PE component from the annular ring, the snap ring 400 (shown in phantom in FIG. 11C) can be collapsed in order to eliminate its interference fit between the annular ring and the PE component. This can be performed through the use of a guide 600 shown in FIG. 11D which can be placed over the surface of the PE component which can be in situ. In some embodiments, the guide 600 can have an elongate shaft 601 and a distal end 604 including an annular sidewall 606 defining a cavity 608 and an open distal end configured to have an inner diameter that can match, substantially match, or be the same size or larger than the outer diameter of the peripheral edge of the bearing component of the implant, such that the annular sidewall 606 and cavity 608 is placed over the glenoid implant. Release pins 602, a

drill, or other tool can be axially advanced into apertures 607 of the guide 600 to facilitate release of the snap ring from the glenoid implant.

[0036] The guide 600 provides positioning of a plurality of holes, e.g., about or at least about two, three, four, five, or more holes positioning around the periphery of the PE implanted such that which a drill or pin 602 is mechanically driven into the guide holes 607, they are aligned to force the snap ring 400 in an radially inward fashion to allow for release of the snap ring. FIG. 12A schematically illustrates the guide 600 being advanced toward the glenoid implant 300 in situ in the glenoid G, along with pins 602 that can be placed in apertures 607 of the guide 600. Once a number of pins 602, e.g., three pins are driven through the guide and PE component, the snap ring is collapsed, and the PE component and snap ring can be removed from the annular fixation ring as an assembly, as shown in FIG. 12B. At this point, what remains is the annular fixation ring well fixed within the glenoid fossa. In some embodiments, the fixation ring may not be fully counter-sunk, and be partially rather than fully inset, within the glenoid surface, and/or stand proud of the glenoid surface. With time, the fixation ring can have some bony ingrowth.

[0037] As shown in FIG. 13A, in some embodiments, an implant such as a disc, e.g., a metallic disc (e.g., as shown in FIGS. 7-9 for example) can then be placed into the previously implanted fixation ring 100 including a groove 108 configured to fit a new snap ring 400 as previously described. The implant 1300 can include a glenosphere 1302 with an offset peg 1303 configured to fit with baseplate 1304 with shaft 1306 (schematically shown in section view), and snap ring 400. The baseplate can have a longitudinal axis A2 that is offset from the longitudinal axis of the glenosphere A1 in some embodiments. FIG. 13B illustrates the reverse implant assembled and deployed within the glenoid cavity. Methods as disclosed herein can have several non-limiting potential advantages, including the following:

1. an outer diameter adapted to provide for a snap ring fit between the disc and annular ring in the same manner as the PE component and the annular ring;
2. a peg, pin, screw or other fixation means which is adapted to fit deeper into the central portion of the glenoid fossa to provide additional fixation means,
3. a central tapered hole into which a reverse ball articulating component can be placed and rigidly fixed; and

4. several peripheral holes through which screws can be driven to further increase the rigidity of fixation between the fixation disc and bone.

[0038] Following the removal of the anatomic, e.g., PE component, the surgeon can further prepare the glenoid fossa for the reverse fixation disc by drilling a centrally positioned hole. The hole can be adapted to receive a pin, post, screw, or other feature which is integrally attached to the medial aspect of the fixation disc. As the fixation disc can be positioned within the annular ring, the central fixation protrusion can be positioned within this hole in the glenoid bone such that further fixation rigidity is obtained.

[0039] Following the placement of the fixation disc in the annular ring, the surgeon can drill additional holes in the glenoid bone through peripheral holes in the fixation disc, which provides the ability to drive fixation screws through the fixation disc into the glenoid bone, even further improving rigidity, in addition to providing rotational stability. Due to the size constrains of the components, it can be advantageous to design the annular ring in a fashion that provides sufficient clearance through which these fixation screws can pass. To this end, the annular ring can be designed such that at on its periphery are several (four) indents of circular shape that provides clearance for passing of the peripheral screws.

[0040] Once the fixation disc is well fixed to the glenoid bone, the spherical articular component is introduced to the fixation disc. On its medial aspect, the articular component can have a cone-shaped protrusion which can be adapted to fit rigidly into a cone shaped hole centrally located within the fixation disc. This can provide a rigid fixation means by which the articular component is fixed to the fixation components using a technique and mechanism well known in the art.

[0041] Some embodiments of the modular, convertible shoulder system as disclosed for example herein can include several unique advantages not considered elsewhere, including but not limited to one or more of the following:

- The use of an annular fixation ring can further improve the fixation potential of inset glenoid technology as described herein. The ring can increase the rigidity of the overall PE glenoid construct, reducing its deflection under load, and improves fixation rigidly.

- The outer aspect of the annular ring can provide a surface which adheres to bone biologically and mechanically which provides further improvement of the rigidity of the fixation over time and in response to load in consideration of Wolf's law.
- This improved rigidity and fixation can be provided with no sacrifice of the 3mm minimum material thickness of the PE component, so that joint mechanics can be maintained with no change in the overall stack height of the anatomic prosthesis.
- The attachment mechanism between the PE articular and annular ring can be reversible in situ, meaning the PE component can be removed from the annular ring which the ring remains in the bone, and can be performed in a manner which is nondestructive to the ring or the surrounding bone.
- The annular ring can be shaped so as to provide a receptacle into which a reverse articulation can be inserted and rigidly fixed.
- The ring can provide clearance so that further rigidity can be obtained by passing screws through the reverse fixation disc, annular ring, and bone.
- The fixation disc can provide a female receptacle into which the articular sphere's attachment post can be positioned. Providing a female receptacle is shown in some cases to be an easy surgical technique and very robust attachment mechanism.

[0042] Various other modifications, adaptations, and alternative designs are of course possible in light of the above teachings. Therefore, it should be understood at this time that within the scope of the appended claims the invention may be practiced otherwise than as specifically described herein. It is contemplated that various combinations or subcombinations of the specific features and aspects of the embodiments disclosed above may be made and still fall within one or more of the inventions. Further, the disclosure herein of any particular feature, aspect, method, property, characteristic, quality, attribute, element, or the like in connection with an embodiment can be used in all other embodiments set forth herein. Accordingly, it should be understood that various features and aspects of the disclosed embodiments can be combined with or substituted for one another in order to form

varying modes of the disclosed inventions. Thus, it is intended that the scope of the present inventions herein disclosed should not be limited by the particular disclosed embodiments described above. Moreover, while the invention is susceptible to various modifications, and alternative forms, specific examples thereof have been shown in the drawings and are herein described in detail. It should be understood, however, that the invention is not to be limited to the particular forms or methods disclosed, but to the contrary, the invention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the various embodiments described and the appended claims. Any methods disclosed herein need not be performed in the order recited. The methods disclosed herein include certain actions taken by a practitioner; however, they can also include any third-party instruction of those actions, either expressly or by implication. For example, actions such as "insetting an implant into a glenoid cavity" includes "instructing the insetting of an implant into the glenoid cavity." The ranges disclosed herein also encompass any and all overlap, sub-ranges, and combinations thereof. Language such as "up to," "at least," "greater than," "less than," "between," and the like includes the number recited. Numbers preceded by a term such as "approximately", "about", and "substantially" as used herein include the recited numbers (e.g., about 10% = 10%), and also represent an amount close to the stated amount that still performs a desired function or achieves a desired result. For example, the terms "approximately", "about", and "substantially" may refer to an amount that is within less than 10% of, within less than 5% of, within less than 1% of, within less than 0.1% of, and within less than 0.01% of the stated amount.

WHAT IS CLAIMED IS:

1. A method of performing a reversible anatomic shoulder replacement procedure, comprising:

reaming a cavity into the glenoid; and

inserting an anatomic glenoid articular implant into the glenoid cavity, the glenoid anatomic articular implant comprising a medial surface configured to mate with the glenoid cavity, a central peg extending medially from the medial surface, a lateral surface configured to articulate with a humeral component; and an intermediate component between the lateral surface and the medial surface, the intermediate component having an outer diameter reversibly attached to a snap ring attached to a fixation ring, the snap ring and the fixation ring at least partially implanted within the glenoid cavity.

2. The method of Claim 1, wherein the anatomic glenoid articular implant is partially inset into the glenoid cavity.

3. The method of Claim 1, wherein the anatomic glenoid articular implant is fully inset into the glenoid cavity.

4. The method of Claim 1, wherein the cavity comprises a circular cavity.

5. The method of Claim 1, wherein the cavity comprises an oval cavity.

6. A method of converting an anatomic to a reverse shoulder prosthesis, comprising:

identifying a patient with an anatomic glenoid articular implant within a glenoid cavity, the anatomic articular implant comprising a medial surface mated with the glenoid cavity, a central peg extending medially from the medial surface, a lateral

surface articulating with a humeral component; and a central component between the lateral surface and the medial surface, the central component having an outer diameter reversibly attached to a snap ring and a fixation ring, the snap ring and the fixation ring at least partially implanted within the glenoid cavity;

inserting a implant removal tool through the lateral articulating surface of the anatomic glenoid articular implant sufficient to collapse the snap ring;

removing the anatomic glenoid articular implant while leaving the fixation ring in place within the glenoid cavity; and

inserting a reverse shoulder implant into the glenoid cavity sufficient to actuate the snap ring such that the reverse shoulder implanted is reversibly fixed to the fixation ring.

7. The method of Claim 6, wherein inserting the removal tool comprises driving pins of the removal tool through the lateral articulating surface of the anatomic glenoid articular implant.

8. A reversible anatomic shoulder replacement system, comprising:

a fixation ring configured to be positioned within the glenoid cavity, the fixation ring comprising a peripheral edge comprising an outer diameter and a plurality of spaced-apart radially inward indents in the peripheral edge, the fixation ring comprising a groove configured to house a snap ring therein;

a snap ring comprising an expanded configuration and a collapsed configuration; and

an anatomic articular implant comprising a medial surface configured to mate with the glenoid cavity, a central peg extending medially from the medial surface, a lateral surface configured to articulate with a humeral component; and an intermediate component between the lateral surface and the medial surface, the intermediate component having an outer diameter reversibly attached to the snap ring and the fixation ring, the snap ring and the fixation ring configured to be at least partially implanted within the glenoid cavity.

9. The system of Claim 8, wherein the groove comprises anti-rotation tabs.

10. The system of Claim 8, wherein the peripheral edge of the fixation ring is configured to facilitate bone ingrowth.

11. The system of Claim 10, wherein the peripheral edge of the fixation ring comprises an osteoinductive or osteoconductive surface.

12. The system of Claim 8, wherein the groove is a circumferential groove.

13. The system of Claim 8, wherein the lateral surface comprises polyethylene.

14. A reverse shoulder replacement kit for an anatomic shoulder replacement system, comprising:

an implant removal tool configured to bore through a medial surface of the anatomic glenoid articular implant sufficient to collapse a snap ring; and remove an anatomic glenoid articular implant while leaving a fixation ring in place within the glenoid cavity; and

a reverse shoulder implant configured to be implanted into the glenoid cavity, the reverse shoulder implant comprising a generally cylindrical component comprising a medial surface configured to mate with the glenoid cavity, a central receptacle for housing an articular post therethrough, and a plurality of peripheral screw holes; a lateral surface, and a central post extending away from the lateral surface,

wherein the reverse shoulder implant is configured to reversibly mate with the snap ring and fixation ring embedded in the glenoid cavity to anchor the reverse shoulder implant.

ABSTRACT OF THE DISCLOSURE

Disclosed are prosthesis systems and methods that provide ways by which the articulating surfaces of the implant can be exchanged such that the anatomic surfaces can be converted to reverse surfaces, while not exchanging the fixation components. Also disclosed herein are methods by which the surgeon can implant an inset anatomic articulating glenoid implant whereby at a later date, can remove the anatomic articulating surface and replace it with a reverse articulating surface such that the primary means of fixation remains well fixed in the glenoid fossa at the moment of articular exchange.

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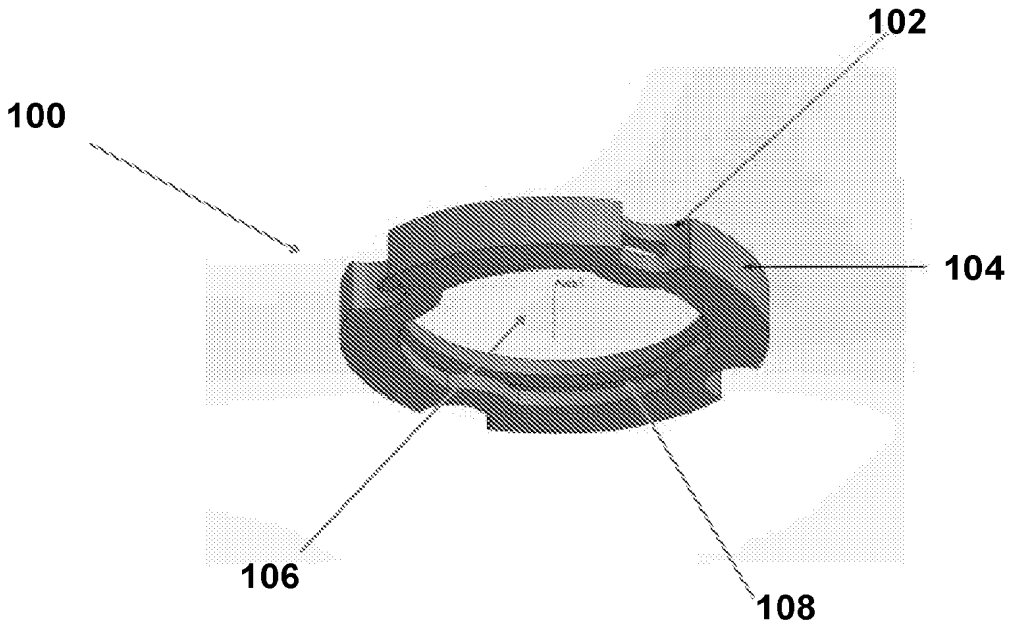


FIG. 1

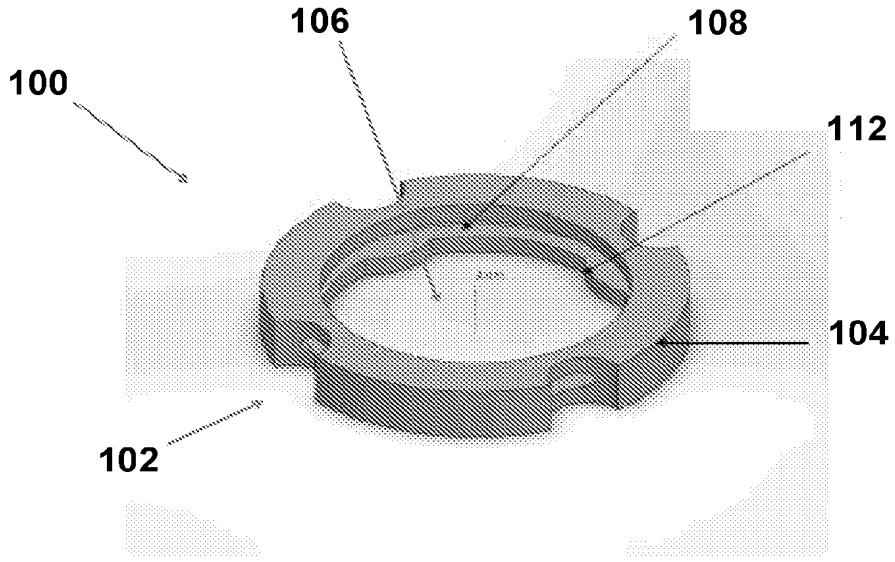


FIG. 2

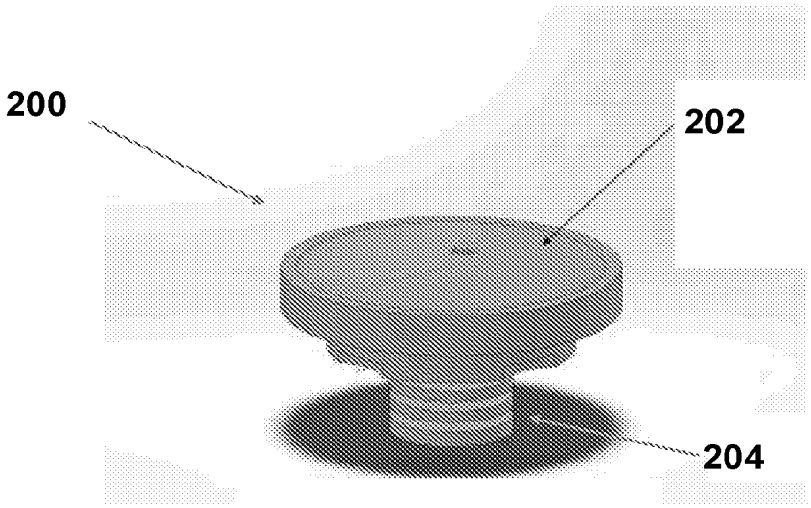


FIG. 3

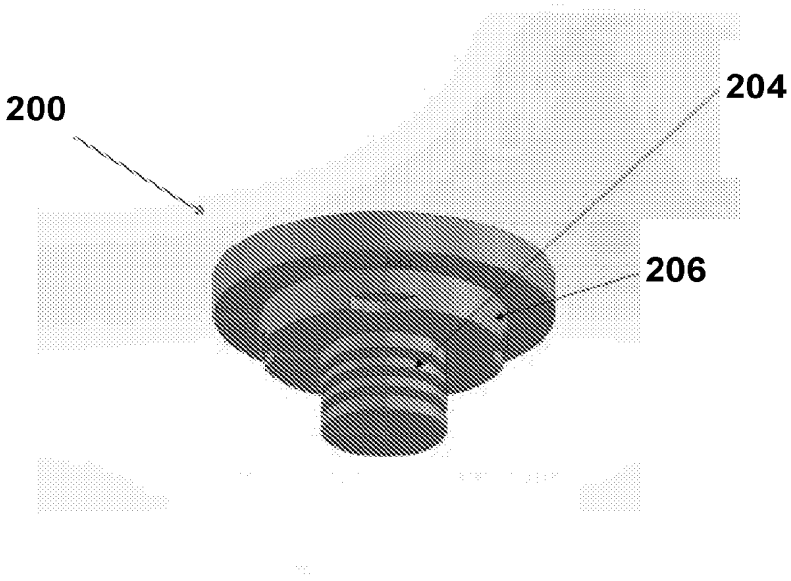


FIG. 4

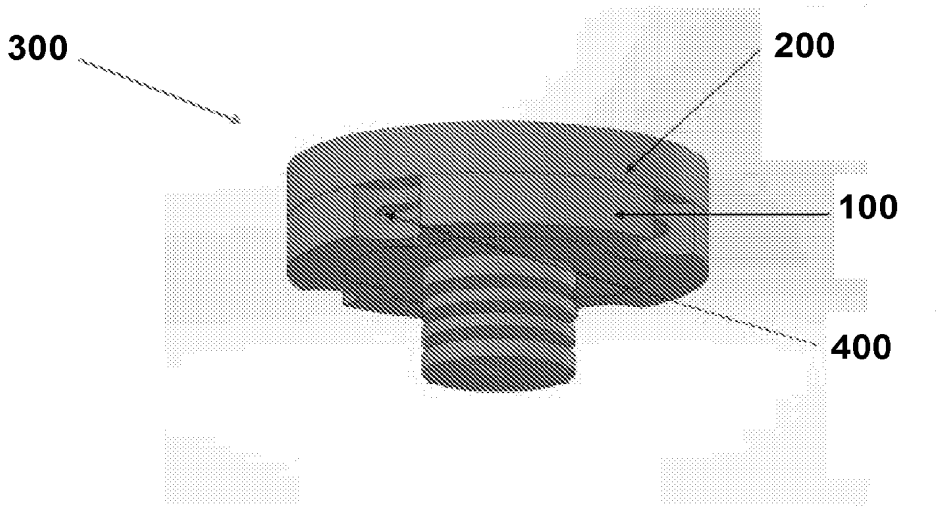


FIG. 5

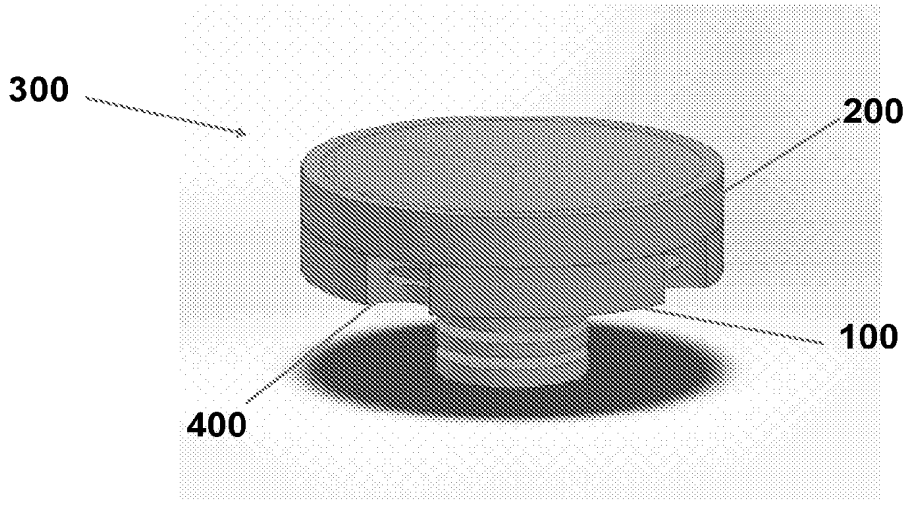


FIG. 6

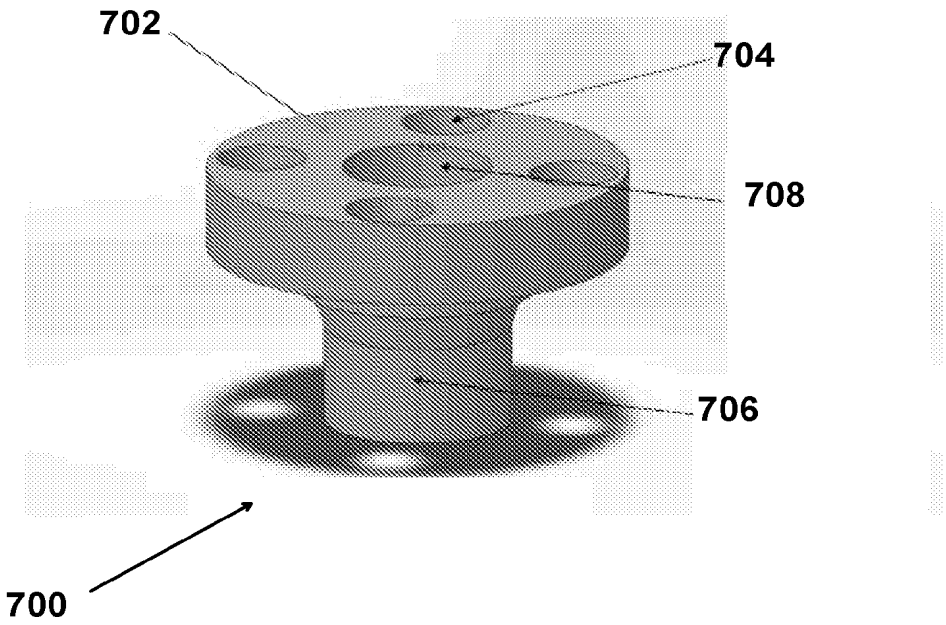


FIG. 7

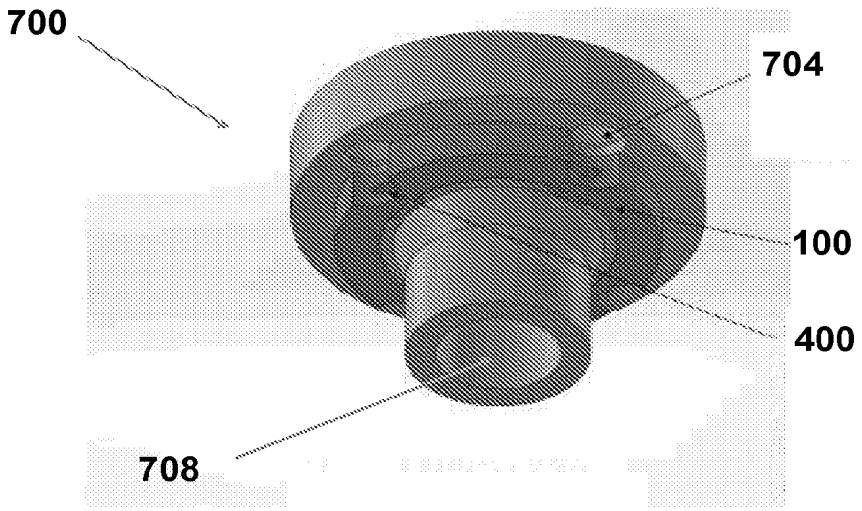


FIG. 8

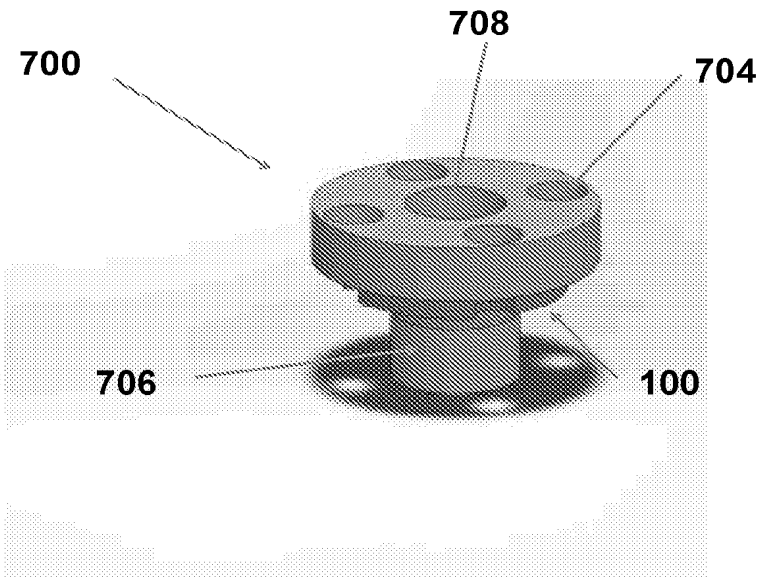


FIG. 9

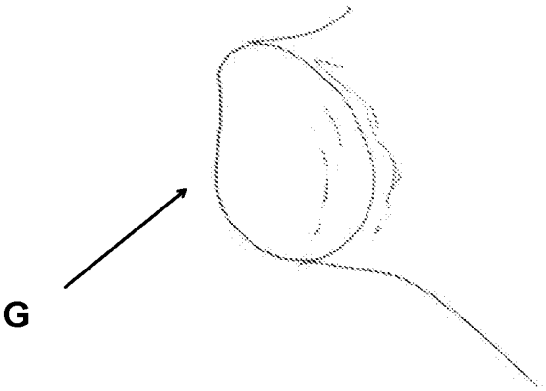


FIG. 10A

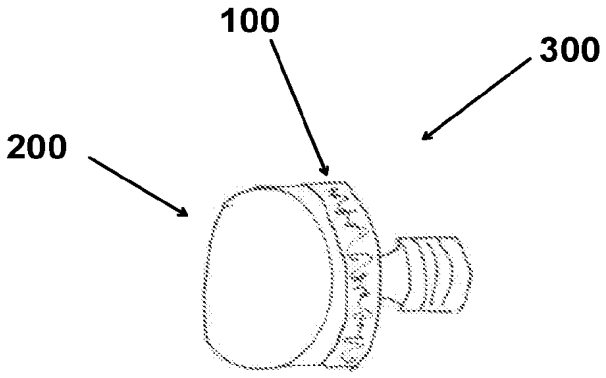


FIG. 10B

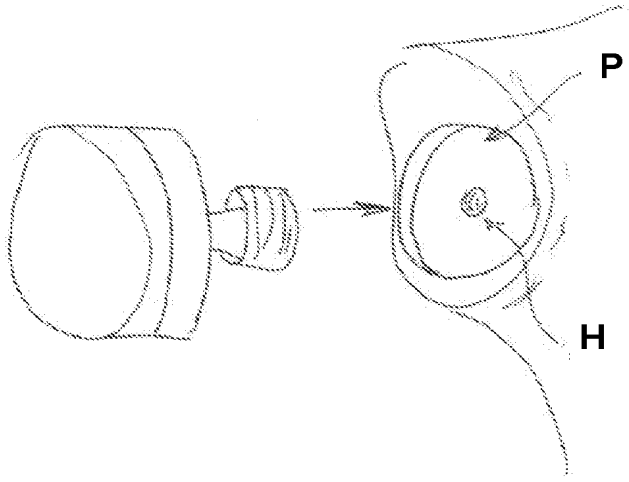


FIG. 10C

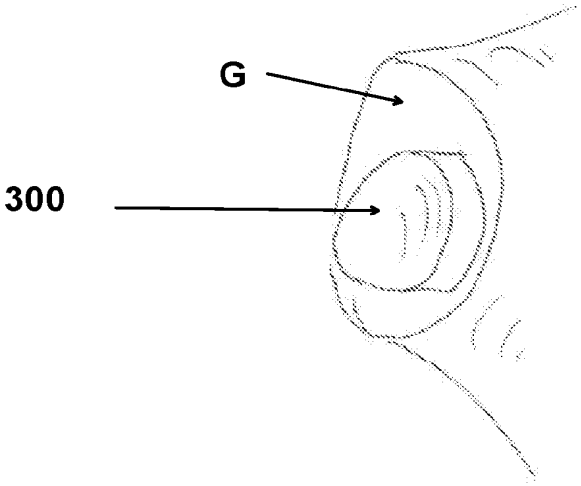


FIG. 11A

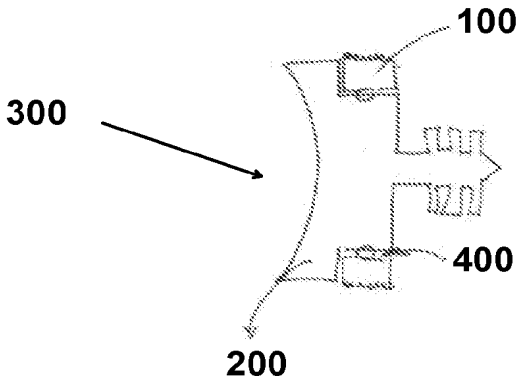


FIG. 11B

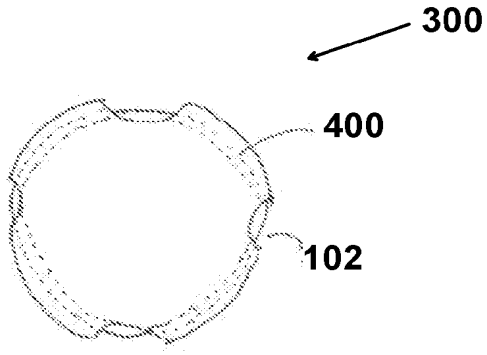


FIG. 11C

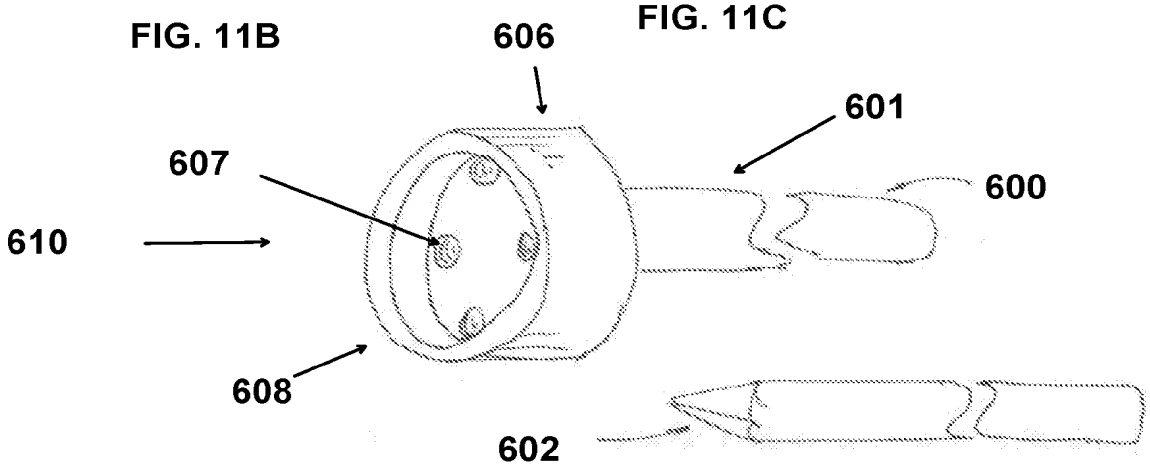


FIG. 11D

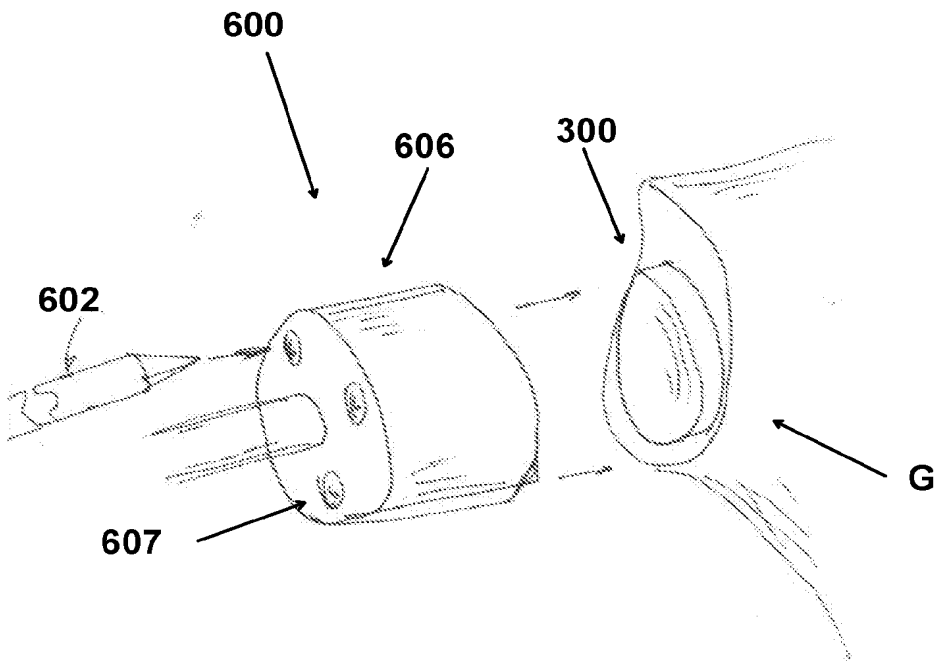


FIG. 12A

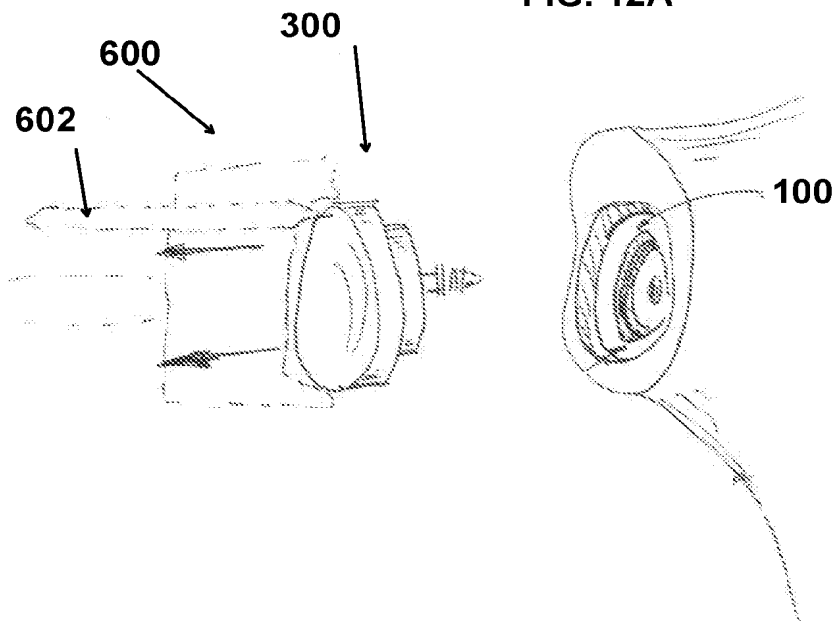


FIG. 12B

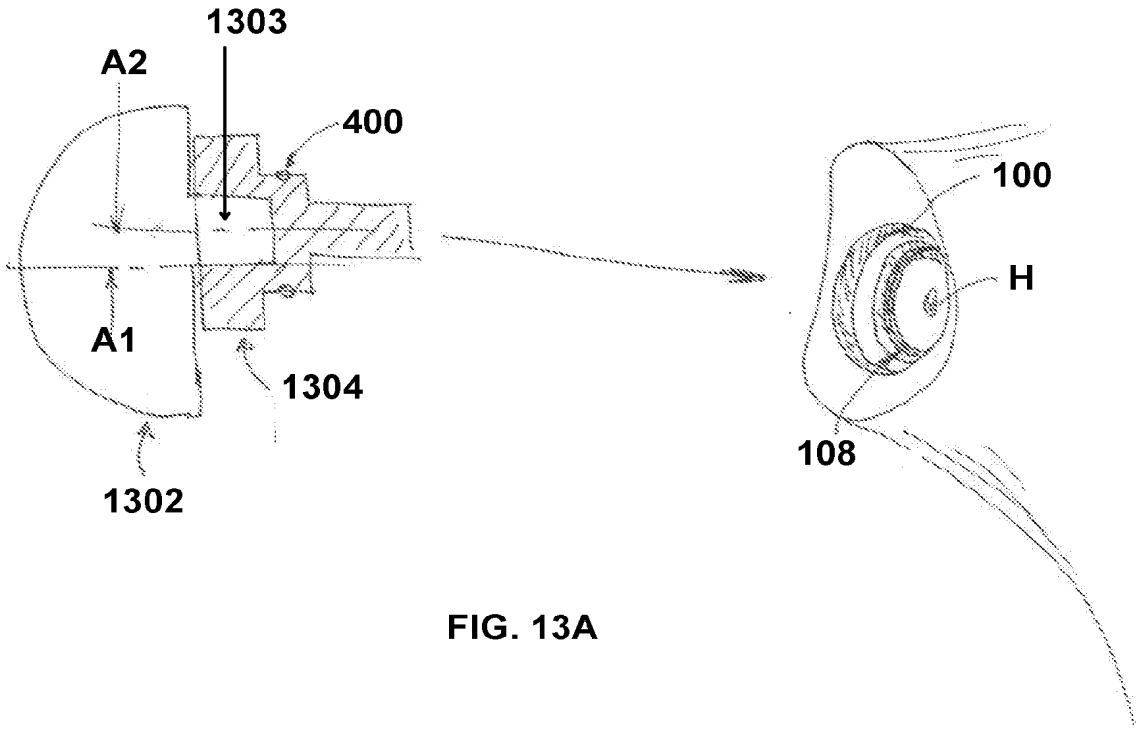


FIG. 13A

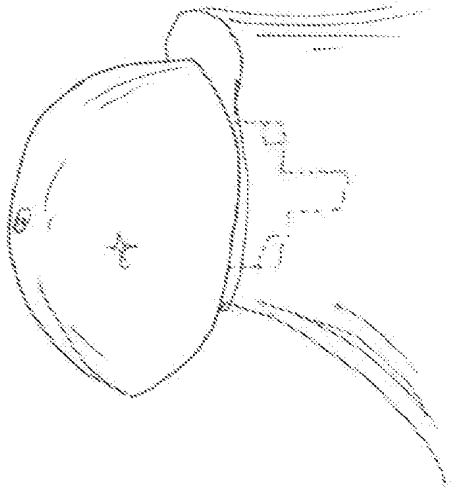


FIG. 13B

TOTAL REVERSE SHOULDER SYSTEMS AND METHODS

BACKGROUND

[0001] Shoulder Replacement is a commonly performed medical procedure for treatment of osteoarthritis, rheumatoid arthritis, as well as for treatment of certain deformities related to oncological indications as well as trauma. There are two primary types of articulations available to surgeons for treatment: anatomic and reverse. With anatomic, the surgeon replaces the articular surfaces with industrial materials such that the articulating surfaces are substantially the same shape as the natural anatomy. A stem can be commonly fixed inside the canal of the humerus, a metallic articular head can be rigidly fixed to the proximal aspect of the same, the articular head having a convex articular surface adapted to articulate with the glenoid implant. The glenoid implant can include on its back side (medial side) certain pegs or posts or fins adapted to be rigidly fixed within the glenoid fossa of the scapula and on its front side a concave or flat articular surface adapted to articulate with the humeral head of the humeral implant.

[0002] When a reverse prosthesis is used, the articular surface is reversed in that the metallic ball is rigidly fixed to the glenoid fossa of the scapula, and the concave articular surface is rigidly fixed to the humeral bone, thereby reversing the fashion of articulation of the prosthesis.

[0003] The surgeon chooses between the two types of prostheses by assessing a number of conditions of the patient including level of pain, patient activity level, deformity or severity of the boney degradation, the strength of surrounding soft tissues, and present or absence of prior surgery, and particularly the health and strength of the rotator cuff muscle and tendon. Disease of the rotator cuff is common among patients with arthritis of the shoulder. In this circumstance, it is commonly observed that the absence of insufficiency of the rotator cuff leads to a condition where the anatomic shoulder replacement prosthesis is not sufficiently stabilized by surrounding soft tissue. In this case, a reverse shoulder replacement prosthesis can be preferred in some cases due to the higher inherent stability of the articulation. In addition, the reverse prosthesis can advantageously utilize the remaining

muscles in a way they can be more effective in the absence of the other soft tissue structures by adjusting the position of the articular surfaces within the joint.

[0004] It is not uncommon that a surgeon selects to use an anatomic prosthesis and is provides effective treatment to the patient though the shoulder replacement operation. However, over time and during use of the prosthesis, the patient's rotator cuff complex can become insufficient, tear, or generally be diseased such that it can no longer perform its function associated with normal joint kinematics. In this case, the surgeon can elect to perform a second operation to remove the anatomic prosthesis, and replace the anatomic prosthesis with a reverse prosthesis.

[0005] Several attempts have been made to attempt to address the need of conversion of the articular surface without interruption of the fixation. Primarily, these are created using a two (or more) system, where there is a metallic fixation component which is rigidly fixed to the glenoid fossa, and a polyethylene (PE) articular component which is secondarily fixed to the metallic component, and provides the concave articular surface adapted to articular with the humeral prosthesis. While referred to herein as a PE component, some embodiments do not require the use of polyethylene and can be made of other biocompatible materials depending on the desired clinical result. The PE component is commonly fixed to the metallic fixation component by conventional industrial techniques such as snap fit mechanisms, snap rings, compression pins, overmolding of the PE and other such means.

[0006] A challenge of this particular articulation in some cases is that the glenoid fossa is relatively small, and commonly there is much reduced presence of bone in patients with arthritis. In this context, the surgeon has limited positioning and bone to work with in order to fit within the patient. In addition, the surgeon must be careful not to overstuff the joint, meaning implant components that move the new articulating surface far from its original position such that the soft tissues is unnaturally tensioned, which can lead to instability, accelerated where, soft tissue failure, pain, reduced range of motion, or fracture of the prosthesis and surrounding bone. Facing these conditions, the prosthesis typically needs to be designed to remain relatively thin (commonly, 1 piece, where PE glenoid implants typically have a 4mm thick articular surface). In order to design these modular components, there can be little additional packaging space provided into which to fit the attachment

mechanisms necessary for use without adversely affecting the performance of the overall joint replacement procedure. Thus, typically, these designs lead to "over-optimization" of the fixation and articular portions in order to provide sufficient attachment mechanisms such that either: the PE is too thin to be sufficiently strong, the metallic components are too small to provide sufficient fixation, or the overall mechanism is insufficiently rigid causing there to be secondary wear surfaces, and generation of wear particles leading to PE disease.

[0007] A problem that can exist is that in the case where the surgeon wants to change the prosthesis type, the anatomic prosthesis is commonly well fixed and adapted to the patient's body such that removal of the prosthesis can be very destructive, and leave natural bone remaining that is perhaps insufficient to support the fixation of the reverse prosthesis. What is needed is a prosthesis system that provides a means by which the articulating surfaces of the implant can be exchanged such that the anatomic surfaces can be converted to reverse surfaces, while not exchanging the fixation components.

[0008] What is also needed is a simple means by which the surgeon can implant an inset anatomic articulating glenoid implant whereby at a later date, can remove the anatomic articulating surface and replace it with a reverse articulating surface such that the primary means of fixation remains well fixed in the glenoid fossa at the moment of articular exchange.

DETAILED DESCRIPTION

[0009] In some embodiments, disclosed herein are various embodiments of a total reverse shoulder system, including a variety of humeral trays, humeral bearings, inset glenoid baseplates, threaded locking inserts, and glenospheres. Glenoid surgical techniques are also described, which can utilize various tools including but not limited to sizer/angle guides, stem drill guides, glenoid baseplate inserters, calibrated central drills, peripheral drill guides with fixed or variable angles, central screws, fixed angle peripheral compression screws, variable angle peripheral screws, and glenosphere inserters. Dimensions listed on the accompanying Figures are non-limiting examples only.

[0010] In some embodiments, embodiments of the invention can be used or modified with use with particular advantages of using inset glenoid fixation technology in

anatomic shoulder arthroplasty, such as described, for example, in U.S. Pat. Nos. 8,007,538 and/or 8,778,028 to Gunther, which are hereby incorporated by reference in their entireties.

[0011] Furthermore, embodiments of the invention can be used or modified with use with systems and methods as disclosed, for example, in U.S. Pub. No. 2018/0368982 to Ball, which is hereby incorporated by reference in its entirety, and appended hereto as an Appendix.

[0012] Various other modifications, adaptations, and alternative designs are of course possible in light of the above teachings. Therefore, it should be understood at this time that within the scope of the appended claims the invention may be practiced otherwise than as specifically described herein. It is contemplated that various combinations or subcombinations of the specific features and aspects of the embodiments disclosed above may be made and still fall within one or more of the inventions. Further, the disclosure herein of any particular feature, aspect, method, property, characteristic, quality, attribute, element, or the like in connection with an embodiment can be used in all other embodiments set forth herein. Accordingly, it should be understood that various features and aspects of the disclosed embodiments can be combined with or substituted for one another in order to form varying modes of the disclosed inventions. Thus, it is intended that the scope of the present inventions herein disclosed should not be limited by the particular disclosed embodiments described above. Moreover, while the invention is susceptible to various modifications, and alternative forms, specific examples thereof have been shown in the drawings and are herein described in detail. It should be understood, however, that the invention is not to be limited to the particular forms or methods disclosed, but to the contrary, the invention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the various embodiments described and the appended claims. Any methods disclosed herein need not be performed in the order recited. The methods disclosed herein include certain actions taken by a practitioner; however, they can also include any third-party instruction of those actions, either expressly or by implication. For example, actions such as "insetting an implant into a glenoid cavity" includes "instructing the insetting of an implant into the glenoid cavity." The ranges disclosed herein also encompass any and all overlap, sub-ranges, and combinations thereof. Language such as "up to," "at least," "greater than," "less than," "between," and the like includes the number recited. Numbers preceded by a term such as "approximately",

"about", and "substantially" as used herein include the recited numbers (e.g., about 10% = 10%), and also represent an amount close to the stated amount that still performs a desired function or achieves a desired result. For example, the terms "approximately", "about", and "substantially" may refer to an amount that is within less than 10% of, within less than 5% of, within less than 1% of, within less than 0.1% of, and within less than 0.01% of the stated amount.

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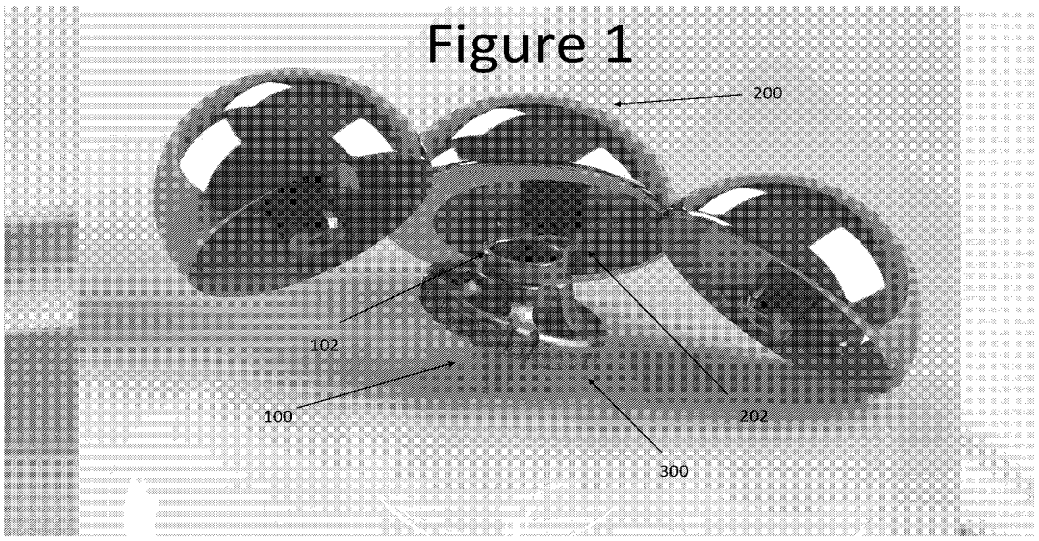
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Figure 1



(57) Abstract: A reverse shoulder system can include, for example, a glenoid baseplate comprising a longitudinal axis, the glenoid baseplate further including a stem and a central channel within a sidewall of the stem. The stem can include a longitudinal axis. The longitudinal axis of the glenoid baseplate can be angled with respect to the longitudinal axis of the stem, wherein the longitudinal axis of the glenoid baseplate is not perpendicular with respect to the longitudinal axis of the stem. Other components including a glenosphere, tools, and methods of use are also disclosed.

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TOTAL REVERSE SHOULDER SYSTEMS AND METHODS

BACKGROUND

[0001] This application claims the benefit under 35 U.S.C. § 119(e) as a nonprovisional application of U.S. Prov. App. No. 62/816,708, which is hereby incorporated by reference in its entirety.

[0002] Shoulder replacement is a commonly performed medical procedure for treatment of osteoarthritis, rheumatoid arthritis, as well as for treatment of certain deformities related to oncological indications as well as trauma. There are two primary types of articulations available to surgeons for treatment: anatomic and reverse. With anatomic, the surgeon replaces the articular surfaces with industrial materials such that the articulating surfaces are substantially the same shape as the natural anatomy. A stem can be commonly fixed inside the canal of the humerus, a metallic articular head can be rigidly fixed to the proximal aspect of the same, the articular head having a convex articular surface adapted to articulate with the glenoid implant. The glenoid implant can include on its back side (medial side) certain pegs or posts or fins adapted to be rigidly fixed within the glenoid fossa of the scapula and on its front side a concave or flat articular surface adapted to articulate with the humeral head of the humeral implant.

[0003] When a reverse prosthesis is used, the articular surface is reversed in that the metallic ball is rigidly fixed to the glenoid fossa of the scapula, and the concave articular surface is rigidly fixed to the humeral bone, thereby reversing the fashion of articulation of the prosthesis.

[0004] The surgeon chooses between the two types of prostheses by assessing a number of conditions of the patient including level of pain, patient activity level, deformity or severity of the boney degradation, the strength of surrounding soft tissues, and present or absence of prior surgery, and particularly the health and strength of the rotator cuff muscle and tendon. Disease of the rotator cuff is common among patients with arthritis of the shoulder. In this circumstance, it is commonly observed that the absence of insufficiency of the rotator cuff leads to a condition where the anatomic shoulder replacement prosthesis is

not sufficiently stabilized by surrounding soft tissue. In this case, a reverse shoulder replacement prosthesis can be preferred in some cases due to the higher inherent stability of the articulation. In addition, the reverse prosthesis can advantageously utilize the remaining muscles in a way they can be more effective in the absence of the other soft tissue structures by adjusting the position of the articular surfaces within the joint.

SUMMARY

[0005] In some embodiments, disclosed herein is a reverse shoulder system, comprising any number of a glenoid baseplate comprising a longitudinal axis, the glenoid baseplate further comprising a stem and a central channel within a sidewall of the stem, the stem comprising a longitudinal axis. The longitudinal axis of the glenoid baseplate can be angled with respect to the longitudinal axis of the stem, wherein the longitudinal axis of the glenoid baseplate is not perpendicular with respect to the longitudinal axis of the stem.

[0006] In some configurations, the glenoid baseplate comprises a generally disc-shaped portion extending radially outward from the central channel.

[0007] In some configurations, the stem comprises a sidewall that extends superiorly with respect to the disc portion.

[0008] In some configurations, the glenoid baseplate comprises a peripheral edge.

[0009] In some configurations, the peripheral edge comprises spaced-apart anti-rotation features.

[0010] In some configurations, the anti-rotation features comprise slots.

[0011] In some configurations, an inferior portion of the peripheral edge comprises a porous coating.

[0012] In some configurations, an inferior surface of the generally disc-shaped portion comprises a porous coating, but a superior surface does not comprise a porous coating.

[0013] In some configurations, the peripheral edge and/or an inferior surface of the baseplate comprises a conical geometry.

[0014] In some configurations, an inferior surface of the baseplate is concave.

[0015] In some configurations, the stem comprises a Morse taper lock superior to a superior-most portion of the generally disc-shaped portion of the glenoid baseplate.

[0016] In some configurations, the system further comprises a glenosphere.

[0017] In some configurations, the glenosphere comprises a superior dome-shaped surface comprising a rotational control feature configured such that an inserter tool can lock the glenosphere and the baseplate to allow for rotation of the glenosphere and the baseplate together.

[0018] In some configurations, the rotational control feature comprises a spline.

[0019] In some configurations, the system further comprises a central set screw and locking nut.

[0020] In some configurations, the system further comprises a central compression screw non-integral with the baseplate and configured for placement adjacent and distal to the central set screw.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] These drawings are illustrative embodiments and do not present all possible embodiments of this invention.

[0022] FIG. 1 illustrates an embodiment of components of a total reverse shoulder system.

[0023] FIG. 2 illustrates various embodiments of humeral trays that can be utilized with total reverse shoulder systems, according to some embodiments.

[0024] FIG. 3 illustrates a variety of humeral bearing components that can be utilized with total reverse shoulder systems, according to some embodiments.

[0025] FIG. 4 illustrates schematically an embodiment of a glenoid baseplate configured to be inset into the glenoid.

[0026] FIG. 5 illustrates schematically an embodiment of a glenoid baseplate 500 configured to be inset into the glenoid.

[0027] FIG. 6 illustrates a threaded locking insert for a central channel of a stem/post, according to some embodiments.

[0028] FIG. 7 illustrates various views of glenospheres, according to some embodiments.

[0029] FIG. 8 illustrates a schematic cross-section of a fully assembled glenosphere with a locking bolt, according to some embodiments.

[0030] FIGS. 8A-8U illustrate a glenoid surgical technique, according to some embodiments.

[0031] FIG. 9 illustrates an embodiment of a sizer/angle guide.

[0032] FIG. 10 illustrates an embodiment of a stem drill guide.

[0033] FIG. 11 schematically illustrates a stem angle change with a rotational adjustment.

[0034] FIG. 12 schematically illustrates views of a glenoid baseplate inserter (alone on the left and together with a baseplate on the right), according to some embodiments. .

[0035] FIG. 13 schematically illustrates views of a calibrated central drill, according to some embodiments. .

[0036] FIG. 14 schematically illustrates views of fixed angle peripheral drill guides, according to some embodiments. .

[0037] FIG. 15 schematically illustrates views of variable angle peripheral drill guides, according to some embodiments.

[0038] FIG. 16 schematically illustrates side and top views of central screws, according to some embodiments.

[0039] FIG. 17 schematically illustrates side and top views of fixed angle peripheral compression screws, according to some embodiments.

[0040] FIG. 18 schematically illustrates side and top views of variable angle peripheral screws, according to some embodiments.

[0041] FIG. 19 schematically illustrates views of a glenosphere inserter, according to some embodiments.

DETAILED DESCRIPTION

[0042] In some embodiments, disclosed herein are various embodiments of a total reverse shoulder system, including a variety of humeral trays, humeral bearings, inset glenoid baseplates, threaded locking inserts, and glenospheres. Glenoid surgical techniques are also described, which can utilize various tools including but not limited to sizer/angle guides, stem drill guides, glenoid baseplate inserters, calibrated central drills, peripheral drill guides with fixed or variable angles, central screws, fixed angle peripheral compression screws, variable angle peripheral screws, and glenosphere inserters. Dimensions listed on the accompanying Figures are non-limiting examples only.

[0043] FIG. 1 illustrates an embodiment of components of a total reverse shoulder system, including a glenosphere 200 and a glenoid baseplate 102 which can be partially or completely inset in some embodiments. The glenoid baseplate 102 can be a generally disc-shaped structure and include a central aperture defining a surface of (e.g., integral with an elongate stem), or configured to fit an elongate stem or post therethrough. The glenoid baseplate 102 can include a longitudinal axis that is at an angle to a longitudinal axis of the elongate stem 100. The longitudinal axis of the glenoid baseplate 102 can be at an angle, such as generally oblique with respect to the longitudinal axis of the elongate stem 100. In some embodiments, the angle is an acute angle, and not a right angle. The angle between the two intersecting longitudinal axes of the respective baseplate 102 and the stem 100 could be, for example, about, at least about, or no more than about 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, or more or less degrees, or ranges including any two of the foregoing values.

[0044] FIG. 2 illustrates various embodiments of humeral trays that can be utilized with total reverse shoulder systems, according to some embodiments. The humeral trays can include various inner diameters IDs and outer diameters ODs, including 30mm, 32mm, 34mm, 36mm, 38mm, 40mm, 42mm, or more or less IDs and/or ODs, and ranges including any two of the foregoing values. The trays can include one or more pegs, such as a central peg extending from a medial surface. The trays can be neutral, or include extensions (e.g., in thickness) that can be, for example, +2, 4, 6, 8, 10, 12mm, or ranges including any two of the foregoing values. The trays can include various cross-sections, including oval or

round cross-sections. The trays can be compatible with the same poly bearing surfaces in some cases. In some embodiments, a kit can include at least four different sizes of trays (34mm oval neutral; 34mm oval +6mm extension; 38mm round neutral; 38mm round +6mm extension.

[0045] FIG. 3 illustrates a variety of humeral bearing components that can be utilized with total reverse shoulder systems, according to some embodiments, including humeral trays as illustrated and described in connection with FIG. 2. The bearing components can include, for example, a peripheral ring 302 and a central recessed portion that can be outlined radially outwardly by an inner edge of the peripheral ring, and an inner bowl-shaped portion 304. The peripheral ring can include indicia, such as a slot or other marking 399 illustrating the highest point of the bearing component. Also illustrated is the recessed poly dome 395, and a partial or full annular barb 397 around the outer circumference of the bearing component. The bearing component can include a variety of geometries include neutral, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 degree angles to horizontal, or ranges including any two of the foregoing values. In some embodiments, the bearing component does not change the joint center. In some embodiments, the bearing component can include 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45mm, or more or less spherical diameters, or ranges including any two of the foregoing values. In some embodiments, systems and methods can include an offset of 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10mm, or ranges including any two of the foregoing values.

[0046] FIG. 4 illustrates schematically an embodiment of a glenoid baseplate configured to be inset into the glenoid G as illustrated. The longitudinal axis of the baseplate can be angled with respect to the longitudinal axis of the stem/post as described, for example, with respect to FIG. 1, and can include a version change 499 to compensate for posterior bony defects. In some embodiments, the glenoid baseplate includes a central channel therethrough defining a surface of (e.g., integral with an elongate stem), or configured to fit configured to house a stem/post as shown. The glenoid baseplate can include a generally conical shape with a concave undersurface configured to rest within a reamed surface of glenoid bone, which advantageously allows for a single rotary reamer to be utilized, in contrast to conventional glenoid baseplates with flat undersurfaces that require a two-step

reaming process. The post 493 can have a length of about, at least about, or no more than about 5, 5.5, 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5, 10, 10.5, 11, 11.5, 12, 12.5, 13, 13.5, 14, 14.5, 15mm or more or less, or ranges including any two of the foregoing values. In some embodiments, the central channel and/or stem can include a female Morse taper 497 of about 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, or more or less degrees, including ranges incorporating any two of the foregoing values. As shown in the right illustration of FIG. 4, the baseplate can be configured to pivot around the stem/taper at arrow 495 for version correction and to allow for a direct bone-implant interface without requiring augmentation. In some embodiments, the system can be configured to provide version angle corrections of, for example, about 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5, 20 degrees or more or less, or ranges including any two of the foregoing values. In some embodiments, the baseplate could have a diameter of about, at least about, or no more than about 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40mm, or more or less, or ranges including any two of the foregoing values. The baseplate can advantageously pivot around the central stem with a Morse taper for version correction and allows for a direct bone-implant interface.

[0047] FIG. 5 illustrates schematically an embodiment of a glenoid baseplate 500 configured to be inset into the glenoid (not shown in FIG. 5). The longitudinal axis of the baseplate 500 can be angled with respect to the longitudinal axis of the stem/post 510 as described, for example, with respect to FIGS. 1 and 4 above. The baseplate 500 could have a generally arcuate peripheral edge. The peripheral edge could include spaced-apart anti-rotational slots 521 directed generally transverse to a longitudinal plane of the baseplate 500. In some embodiments, the peripheral edge of the baseplate 500 can taper (e.g., decrease) in diameter from a superior to inferior dimension. A central channel can extend through the baseplate 500, as well as include a superiorly-extending sidewall or lip 511 somewhat similar to the side slopes of a volcano. The central channel can defining a surface of (e.g., integral with an elongate stem), or configured to fit be configured to house the stem/post 510 therethrough. The baseplate 500 can also include a plurality of regularly or irregularly spaced-apart secondary (peripheral) channels 555 spaced radially outward from the central channel of the baseplate and configured to house fixed and variable angle screws therethrough. The secondary channels 555 can be asymmetric and include superiorly-

extending portions 556 that can extend into and interrupt the superiorly-extending sidewall or lip 511 of the central channel of the baseplate 500. The baseplate 500 can include a porous coating 585 on the entire, or only a part of the peripheral edge and/or an inferior surface (e.g., undersurface) of the baseplate 500 to promote bone ingrowth, for example.

[0048] Still referring to FIG. 5, the stem/post 510 could have an internal taper, such as a Morse taper, of about, at least about, or no more than about 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 degrees, or more or less, or ranges including any two of the foregoing values. The stem/post 510 can also include a rotational control feature 545 along an outer diameter of the stem/post 510, and in some embodiments superiorly with respect to the uppermost surface of the sidewall 511 of the central channel of the glenoid baseplate 500 as shown. The rotational control feature 545 could be non-circular or non-arcuate, such as a hexagonal shape as shown for example. The stem/post 510 can also include a central channel and include a Morse taper lock 535 configured to mate with a glenosphere (not shown). The Morse taper lock can extend superiorly with respect to the uppermost surface of the sidewall 511 of the central channel of the glenoid baseplate 500. The central channel of the stem/post 510 can be configured to house a primary screw (not shown) therethrough, which can be a variable angle primary screw, and optionally locking.

[0049] FIG. 6 illustrates a threaded locking insert 600 for a central channel of a stem/post, according to some embodiments. The insert 600 can include an outer male thread 602 and configured to go into the central channel of a baseplate. The outer diameter of the insert can also include a hexagonal geometry portion 604 at the superior end, of about, at least about, or no more than about 1, 2, 3, 4, 5, 6, 7, 8, 9, 10mm or more or less, or ranges including any two of the foregoing values. The hexagonal geometry portion 604 can be configured to serve as a rotational control feature in some embodiments. The insert 600 can also include a female thread 608 configured to receive a supplemental glenosphere locking screw (not shown), and a spherical surface 612, for example, at its inferior end to lock a variable angle screw.

[0050] FIG. 7 illustrates various views of glenospheres, according to some embodiments. The left image illustrates a glenosphere with a rotational control feature 702, which can include a spline, such as an asymmetric spline, and configured to advantageously

allow for rotational control about the spline and allow an inserter tool to lock and rotate the glenosphere together with another component, such as a baseplate. The glenosphere can also include one or more indicia, such as an eccentric rotational mark 704. The glenosphere can include a generally dome-shaped surface 714, a cavity 706 with an inferior-facing opening 708, and a hollow post including a morse taper lock 711 into the baseplate. The glenosphere could be a full hemisphere, or short of a full hemisphere by a distance 720 of about, at least about, or no more than about 0.5mm, 0.75mm, 1mm, 1.25mm, 1.5mm, 1.75mm, 2mm, 2.25mm, 2.5mm, 2.75mm, 3mm, or more or less, or ranges including any two of the foregoing values.

[0051] Still referring to FIG. 7, in some embodiments, the glenosphere can include an articulating diameter of about, at least about, or no more than about 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50mm, or more or less, or ranges including any two of the foregoing values. In some embodiments, systems and methods can include an offset and/or eccentric dimension of 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10mm, or ranges including any two of the foregoing values. In some embodiments, the glenosphere has a neutral geometry. In some embodiments, a glenosphere 724 is offset by about +3mm or about 6mm, for example. In some embodiments, a glenosphere 722 has an eccentric dimension of between about 2mm and about 4mm. In some embodiments, a secondary locking screw can be utilized together with the glenosphere.

[0052] FIG. 8 illustrates a schematic cross-section of a fully assembled glenosphere with a locking bolt, according to some embodiments, along with the baseplate. The glenosphere can include a central channel therethrough including a rotational control feature 702 at, for example, a superior-most portion that can be as described elsewhere herein. The central channel can also include a threaded surface 808 for an inserter/head extractor, such as inferior to the rotational control feature 702, and optionally be configured to accommodate a secondary locking screw at 810, to push and/or rotate with the post of the baseplate. A post of the glenosphere can be placed at least partially within a central channel of the baseplate as illustrated. A central set screw/locking nut 814 can be connected to, and in some cases removably attachable to a central channel, e.g., of the glenoid baseplate, and have an end adjacent or directly touching an end of a central compression screw 816, which can

include a diameter of, for example, of about, at least about, or no more than about 4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5, 10mm, or more or less, or ranges including any two of the foregoing values. The central compression screw can be configured to angulate with respect to the baseplate, and advantageously allow for the use of a locking screw.

[0053] Figures 8A-8U illustrate a glenoid surgical technique, according to some embodiments, which can include any number of the following actions. FIG. 8A illustrates a glenoid surface with an A3-E3 defect. A sizer/angle guide can be placed as in FIG. 8B. A wire guide/wire can be placed in FIG. 8C. The wire guide and sizer/angle guide can be removed, as in FIG. 8D. The glenoid surface can then be reamed for the baseplate, as in FIGS. 8E and 8F. The stem drill guide can then be placed and adjusted in FIG. 8G. A hole for a stem can then be drilled in FIGS. 8H and 8I. The baseplate can then be inserted, as shown in FIG. 8J, and the threaded rod removed, as shown in FIG. 8K. A central cavity can be drilled, and the length of a central screw to be placed determined, in FIG. 8L. The drill can be removed in FIG. 8M, and the screw and screw driver placed through the shaft, and the screw tightened in FIG. 8N. The baseplate inserter handle can be removed in FIG. 8O, and holes can be drilled for the peripheral locking screws in FIG. 8P. Holes can be drilled for variable angle screws, as shown in FIG. 8Q. The peripheral screws can be inserted and tightened in FIG. 8R. The central set screws and secondary locking nuts can be inserted and tightened in FIG. 8S. The glenosphere can be inserted in FIG. 8T, and the locking bolt inserted and tightened in FIG. 8U.

[0054] FIG. 9 illustrates an embodiment of a sizer/angle guide including an inferior tilt mechanism 902. The mechanism could be fixed to a set angle (e.g., about 0, 5, 10, 15, 20, 25 degrees, or ranges including any two of the foregoing values), or adjustable in some embodiments. The mechanism could be round or oval shaped in some embodiments, and include a slot (e.g., posterior or posterior inferior) to allow for removal. The inferior tilt mechanism 902 could include a set screw with a calibrated window, or individual depth screws in some cases.

[0055] FIG. 10 illustrates an embodiment of a stem drill guide, that can include a diameter of about, at least about, or no more than about 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40mm or more or less, or ranges including any

two of the foregoing values. The drill guide could include a version angle of, for example, about 0, 5, 10, 15, 20, 25 degrees or more or less, or ranges including any two of the foregoing vales. In some embodiments, the larger the version angle, the more stem tilt is generated as rotation occurs.

[0056] FIG. 11 schematically illustrates a stem angle change with a rotational adjustment (e.g., about 30 degrees), and an angled version plate (e.g., about 15 degrees) as a non-limiting example. Anterior-posterior and inferior-superior views are illustrated.

[0057] FIG. 12 schematically illustrates views of a glenoid baseplate inserter (alone on the left and together with a baseplate on the right), according to some embodiments. The baseplate inserter can be configured for any number of: positive rotational control; slim design to allow visualization through screw holes to know when seated; and/or a multi-function handle allows for drilling central screw hole, and inserting a central screw.

[0058] FIG. 13 schematically illustrates views of a calibrated central drill, according to some embodiments. Calibrated marks/indicia 902 at spaced-apart desired increments (e.g., 5mm increments in some embodiments) near the proximal end of the instrument can help to determine the length of a central screw that may be needed. The calibration length can start at, for example, about, at least about, or no more than about 15mm, 20mm, 25mm, 30mm, 35mm, 40mm, or more or less, including any two of the foregoing values and may advantageously allow for a surgical step to be cut out.

[0059] FIG. 14 schematically illustrates views of fixed angle peripheral drill guides, according to some embodiments. The drill guides can be configured to fit over a geometry, such as a polygonal shaped portion (e.g., octagon) on the top of the baseplate, and the operator can then determine which fixed angle screws to drill.

[0060] FIG. 15 schematically illustrates views of variable angle peripheral drill guides, according to some embodiments.

[0061] FIG. 16 schematically illustrates side and top views of central screws, according to some embodiments, including a head 1601, threaded shaft 1602, and distal tapered portion. In one embodiment, the screw can have a 6.5mm head, and 6mm threaded shaft, although various size ranges and increments are possible, including about, at least about, or no more than about 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5, 10mm, or more

or less head and/or threaded shaft diameters, or ranges including any two of the foregoing values. In some embodiments, a central screw can include a total or working length of about, at least about, or no more than about 10, 11, 12, 13, 14, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70mm, or more or less, or ranges including any two of the foregoing values. In some embodiments, anodization of the screw can optionally be present to help differentiate the screws. The screw head could have various internal feature geometries 1603, including a T20 hexalobe configuration in some embodiments.

[0062] FIG. 17 schematically illustrates side and top views of fixed angle peripheral compression screws, according to some embodiments, including a head 1701, double-lead thread 1703 proximal to a threaded shaft 1702, and distal tapered portion. The screws can be various size ranges and increments, and include T20 hexalobe or other internal head feature geometries 1704 as described elsewhere herein. In one embodiment, the head could be about 5.7mm in diameter, with a 4.5mm threaded shaft diameter, or dimensions listed elsewhere herein, such as in connection with FIG. 16 for example.

[0063] FIG. 18 schematically illustrates side and top views of variable angle peripheral screws, according to some embodiments, including a head 1801, threaded shaft 1802, and distal tapered portion. The screws can be various size ranges and increments, and include T20 hexalobe or other internal head feature geometries 1803 as described elsewhere herein. In one embodiment, the head could be about 5.7mm in diameter, with a 4.5mm threaded shaft diameter, or dimensions listed elsewhere herein, such as in connection with FIGS. 16 or 17 for example.

[0064] FIG. 19 schematically illustrates views of a glenosphere inserter, according to some embodiments, which can include a distal end with a feature complementary to a spline on the glenosphere, such as described in connection with FIG. 7, for example. The glenosphere inserter can be configured to, for example, advantageously provide positive attachment to the glenosphere; allow for solid rotational control while inserting; and/or may involve a secondary impaction step after removal.

[0065] In some embodiments, embodiments of the invention can be used or modified with use with particular advantages of using inset glenoid fixation technology in anatomic shoulder arthroplasty, such as described, for example, in U.S. Pat. Nos. 8,007,538

and/or 8,778,028 to Gunther, which are hereby incorporated by reference in their entireties. Furthermore, embodiments of the invention can be used or modified with use with systems and methods as disclosed, for example, in U.S. Pub. No. 2018/0368982 to Ball, which is hereby incorporated by reference in its entirety.

[0066] Various other modifications, adaptations, and alternative designs are of course possible in light of the above teachings. Therefore, it should be understood at this time that within the scope of the appended claims the invention may be practiced otherwise than as specifically described herein. It is contemplated that various combinations or subcombinations of the specific features and aspects of the embodiments disclosed above may be made and still fall within one or more of the inventions. Further, the disclosure herein of any particular feature, aspect, method, property, characteristic, quality, attribute, element, or the like in connection with an embodiment can be used in all other embodiments set forth herein. Accordingly, it should be understood that various features and aspects of the disclosed embodiments can be combined with or substituted for one another in order to form varying modes of the disclosed inventions. Thus, it is intended that the scope of the present inventions herein disclosed should not be limited by the particular disclosed embodiments described above. Moreover, while the invention is susceptible to various modifications, and alternative forms, specific examples thereof have been shown in the drawings and are herein described in detail. It should be understood, however, that the invention is not to be limited to the particular forms or methods disclosed, but to the contrary, the invention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the various embodiments described and the appended claims. Any methods disclosed herein need not be performed in the order recited. The methods disclosed herein include certain actions taken by a practitioner; however, they can also include any third-party instruction of those actions, either expressly or by implication. For example, actions such as "insetting an implant into a glenoid cavity" includes "instructing the insetting of an implant into the glenoid cavity." The ranges disclosed herein also encompass any and all overlap, sub-ranges, and combinations thereof. Language such as "up to," "at least," "greater than," "less than," "between," and the like includes the number recited. Numbers preceded by a term such as "approximately", "about", and "substantially" as used herein include the recited numbers (e.g., about 10% =

10%), and also represent an amount close to the stated amount that still performs a desired function or achieves a desired result. For example, the terms "approximately", "about", and "substantially" may refer to an amount that is within less than 10% of, within less than 5% of, within less than 1% of, within less than 0.1% of, and within less than 0.01% of the stated amount.

WHAT IS CLAIMED IS:

1. A reverse shoulder system, comprising:

a glenoid baseplate comprising a longitudinal axis,

the glenoid baseplate further comprising a stem and a central channel within a sidewall of the stem, the stem comprising a longitudinal axis,

wherein the longitudinal axis of the glenoid baseplate is angled with respect to the longitudinal axis of the stem, wherein the longitudinal axis of the glenoid baseplate is not perpendicular with respect to the longitudinal axis of the stem.

2. The system of Claim 1, wherein the glenoid baseplate comprises a generally disc-shaped portion extending radially outward from the central channel.

3. The system of Claim 2, wherein the stem comprises a sidewall that extends superiorly with respect to the disc portion.

4. The system of Claim 1, wherein the glenoid baseplate comprises a peripheral edge.

5. The system of Claim 4, wherein the peripheral edge comprises spaced-apart anti-rotation features.

6. The system of Claim 5, wherein the anti-rotation features comprise slots.

7. The system of Claim 4, wherein an inferior portion of the peripheral edge comprises a porous coating.

8. The system of Claim 1, wherein an inferior surface of the generally disc-shaped portion comprises a porous coating, but a superior surface does not comprise a porous coating.

9. The system of Claim 4, wherein the peripheral edge and/or an inferior surface of the baseplate comprises a conical geometry.

10. The system of Claim 1, wherein an inferior surface of the baseplate is concave.

11. The system of Claim 1, wherein the stem comprises a Morse taper lock superior to a superior-most portion of the generally disc-shaped portion of the glenoid baseplate.

12. The system of Claim 1, further comprising a glenosphere.

13. The system of Claim 12, wherein the glenosphere comprises a superior dome-shaped surface comprising a rotational control feature configured such that an inserter tool can lock the glenosphere and the baseplate to allow for rotation of the glenosphere and the baseplate together.

14. The system of Claim 13, wherein the rotational control feature comprises a spline.

15. The system of Claim 12, further comprising a central set screw and locking nut.

16. The system of Claim 15, further comprising a central compression screw non-integral with the baseplate and configured for placement adjacent and distal to the central set screw.

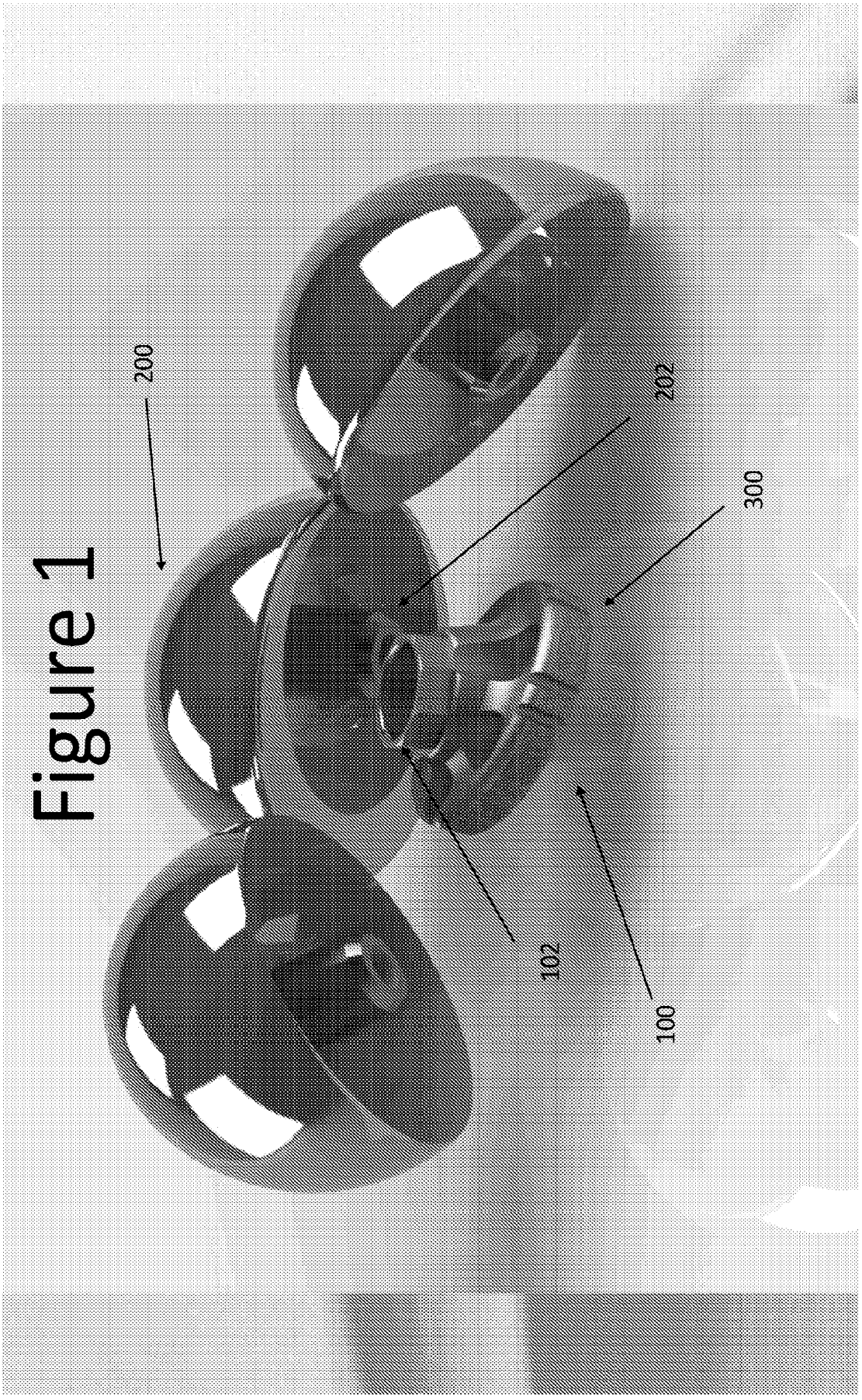


Figure 1

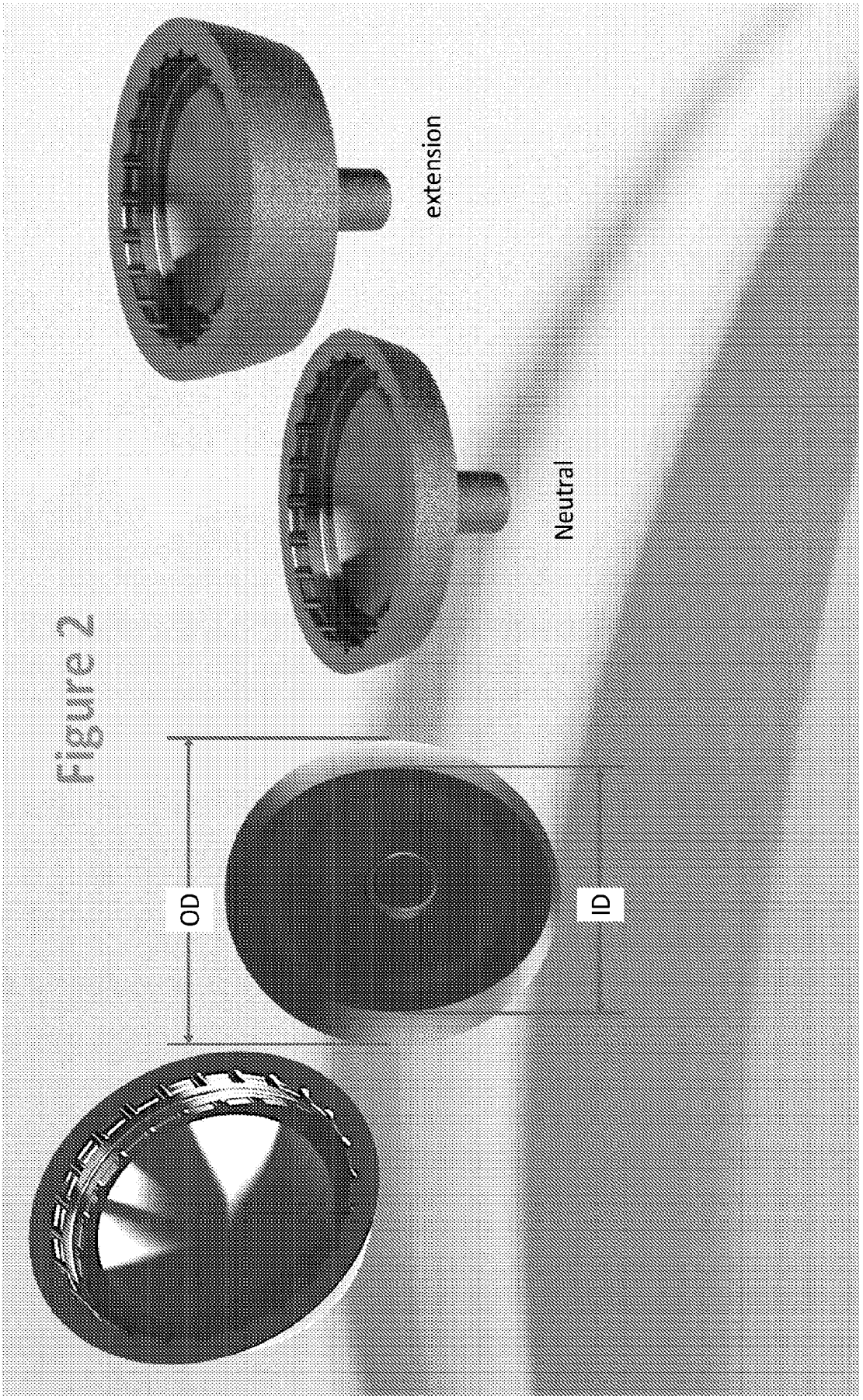


Figure 2

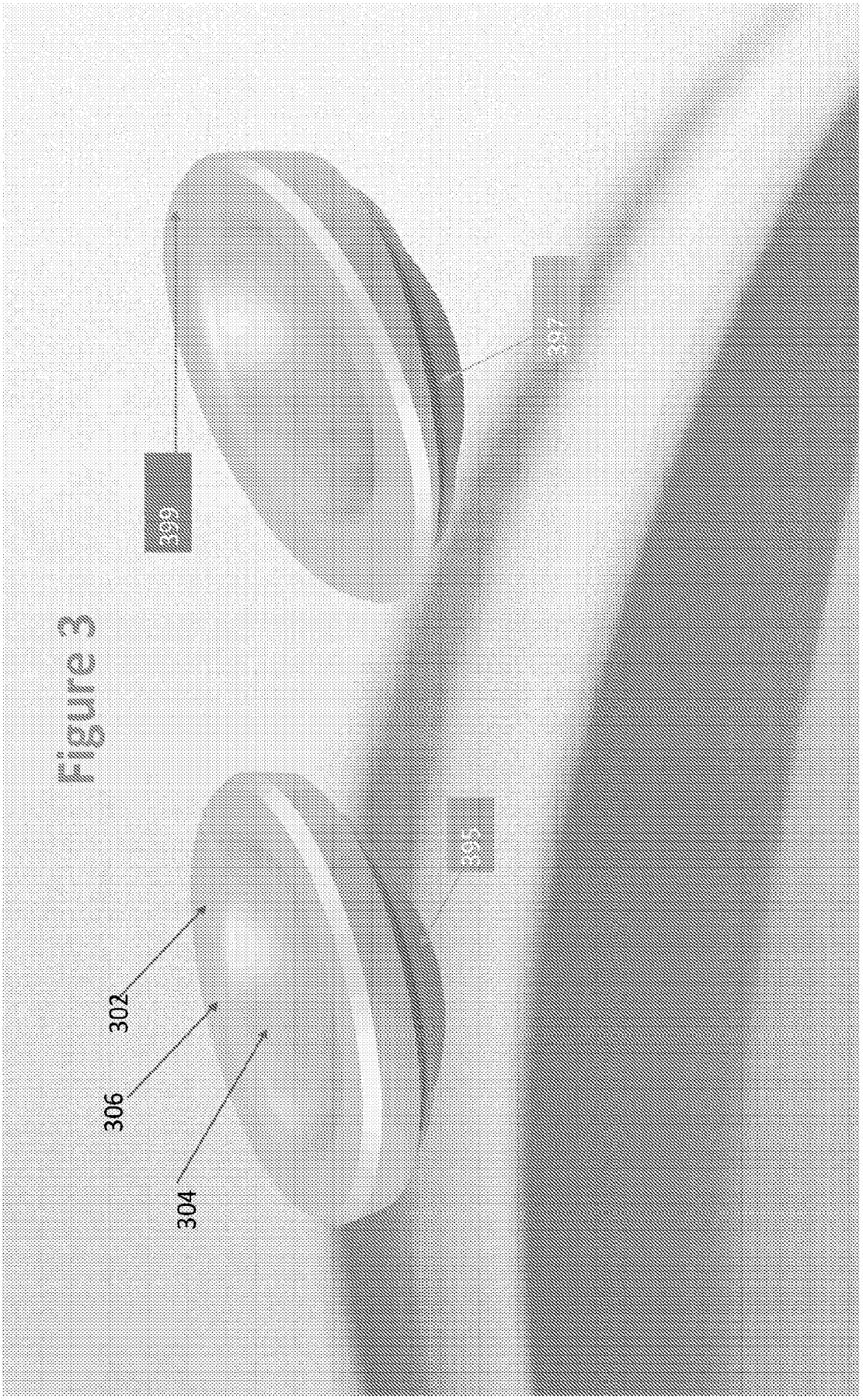


Figure 3

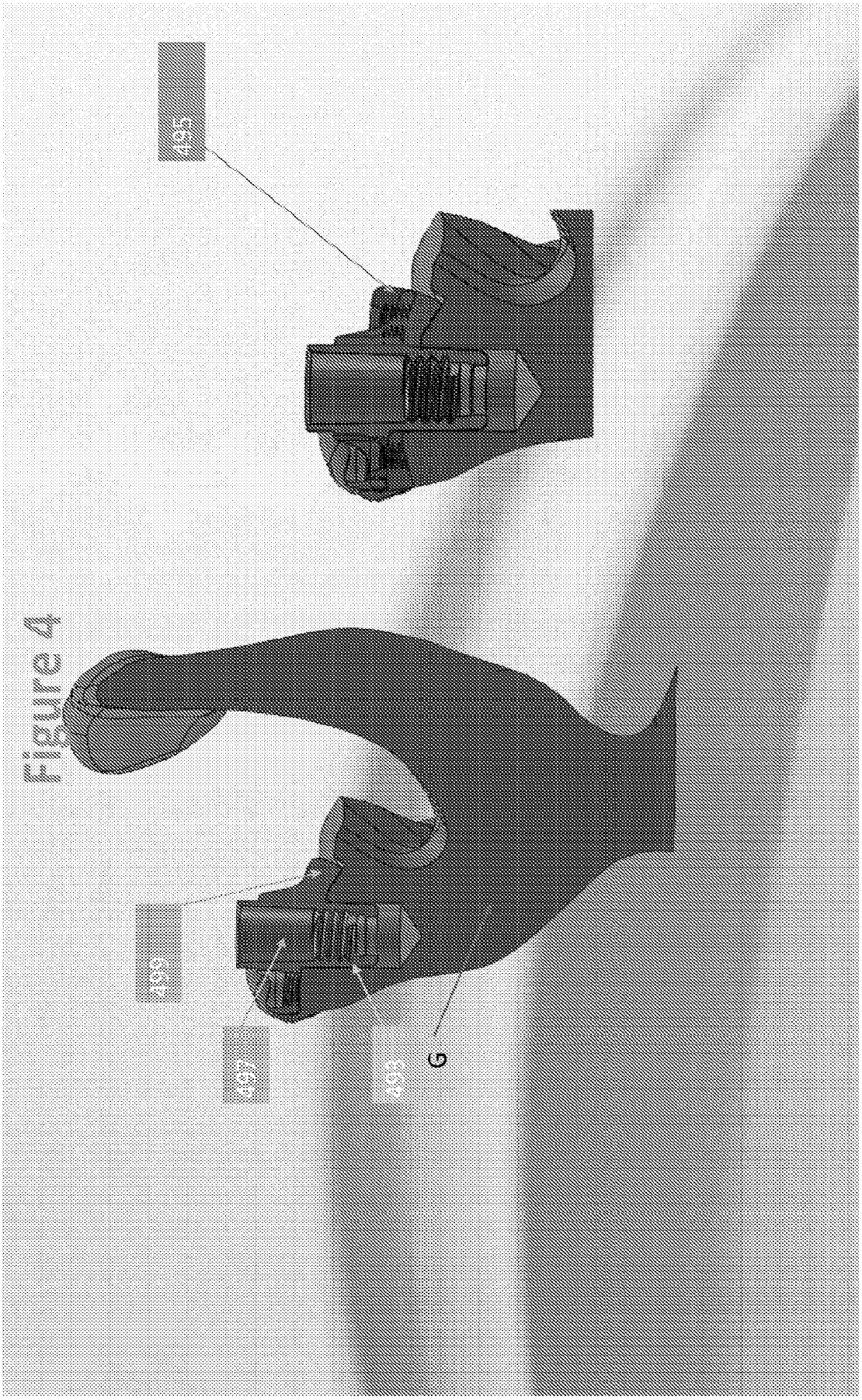


Figure 4

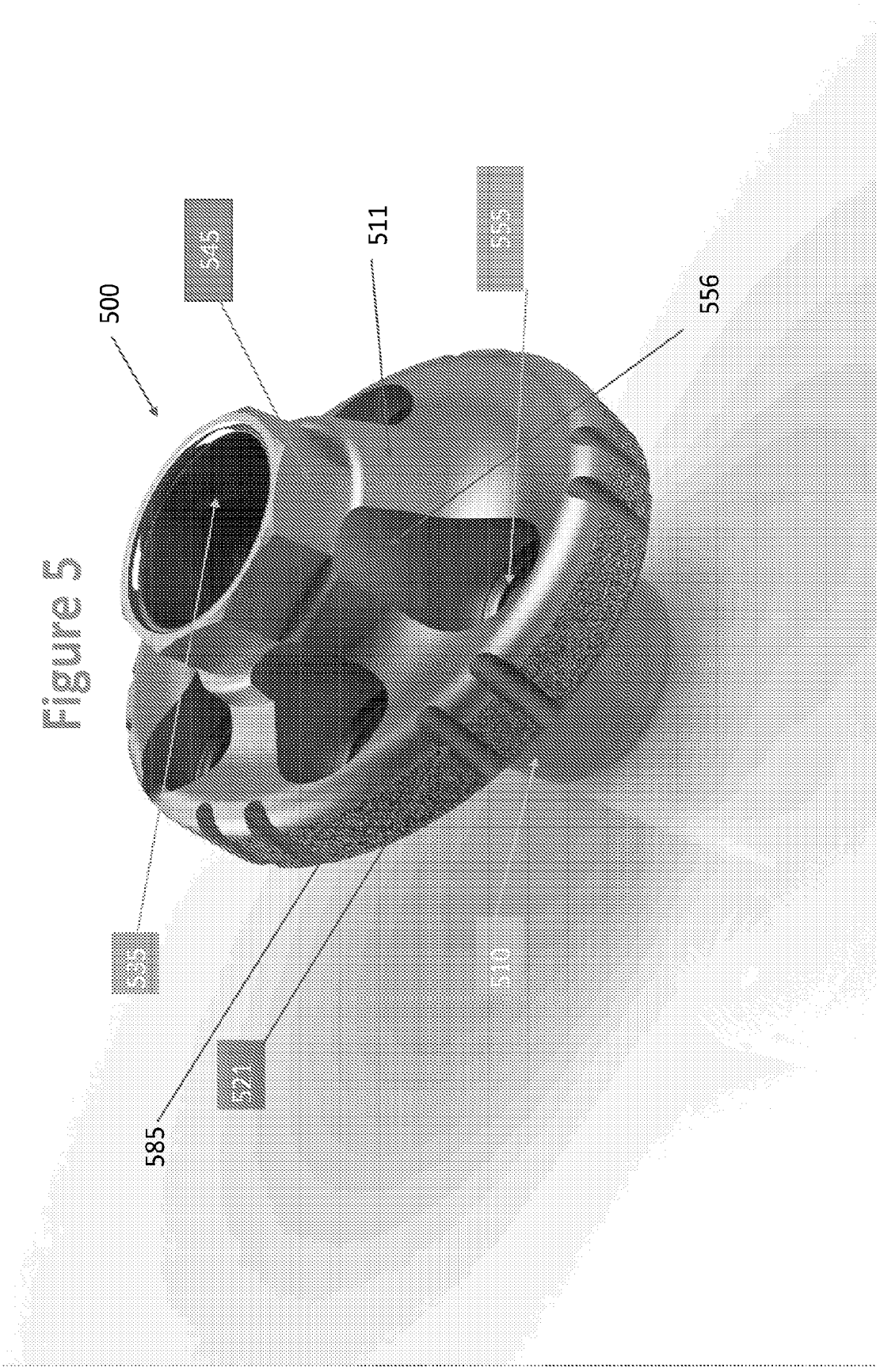


Figure 5

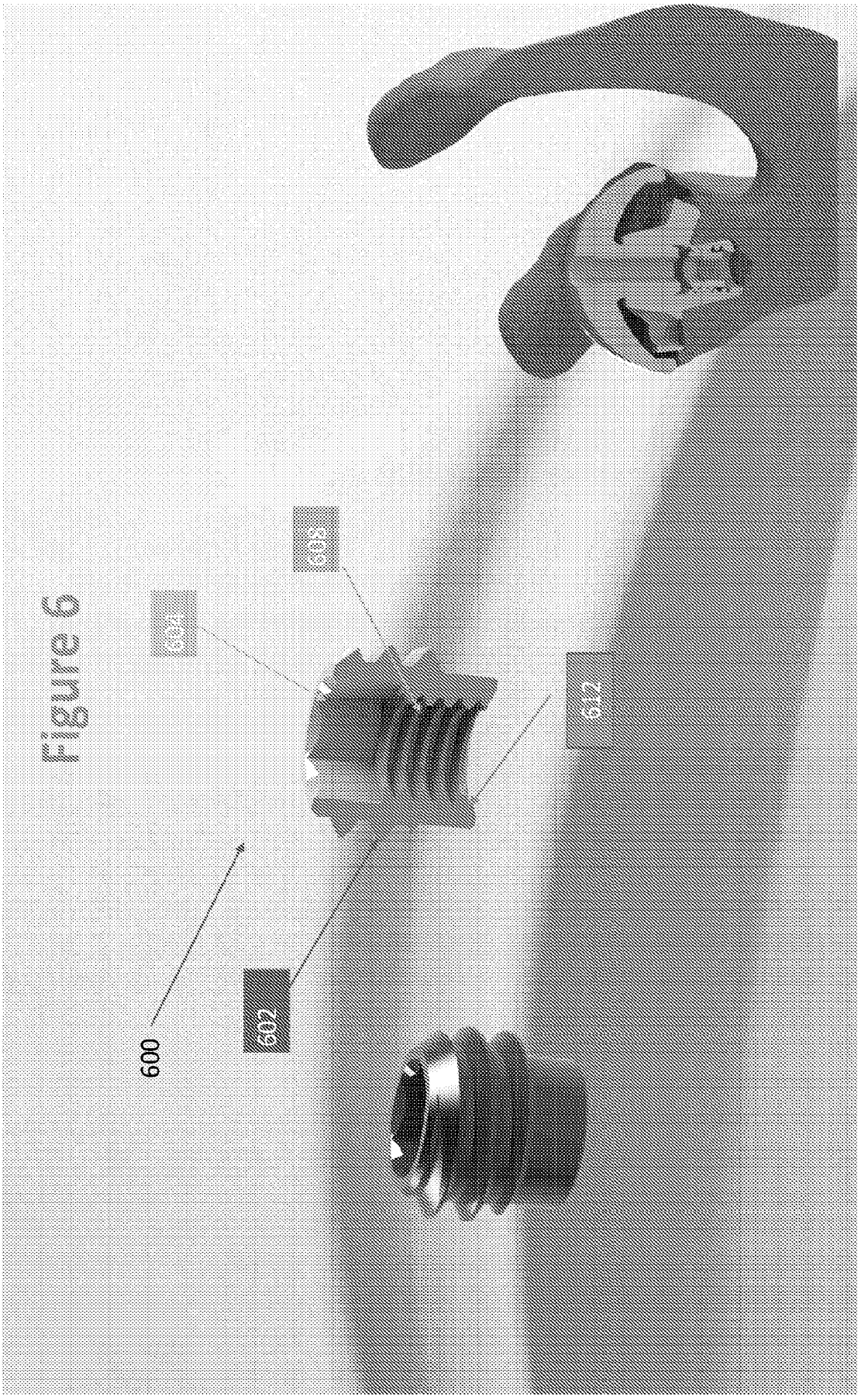
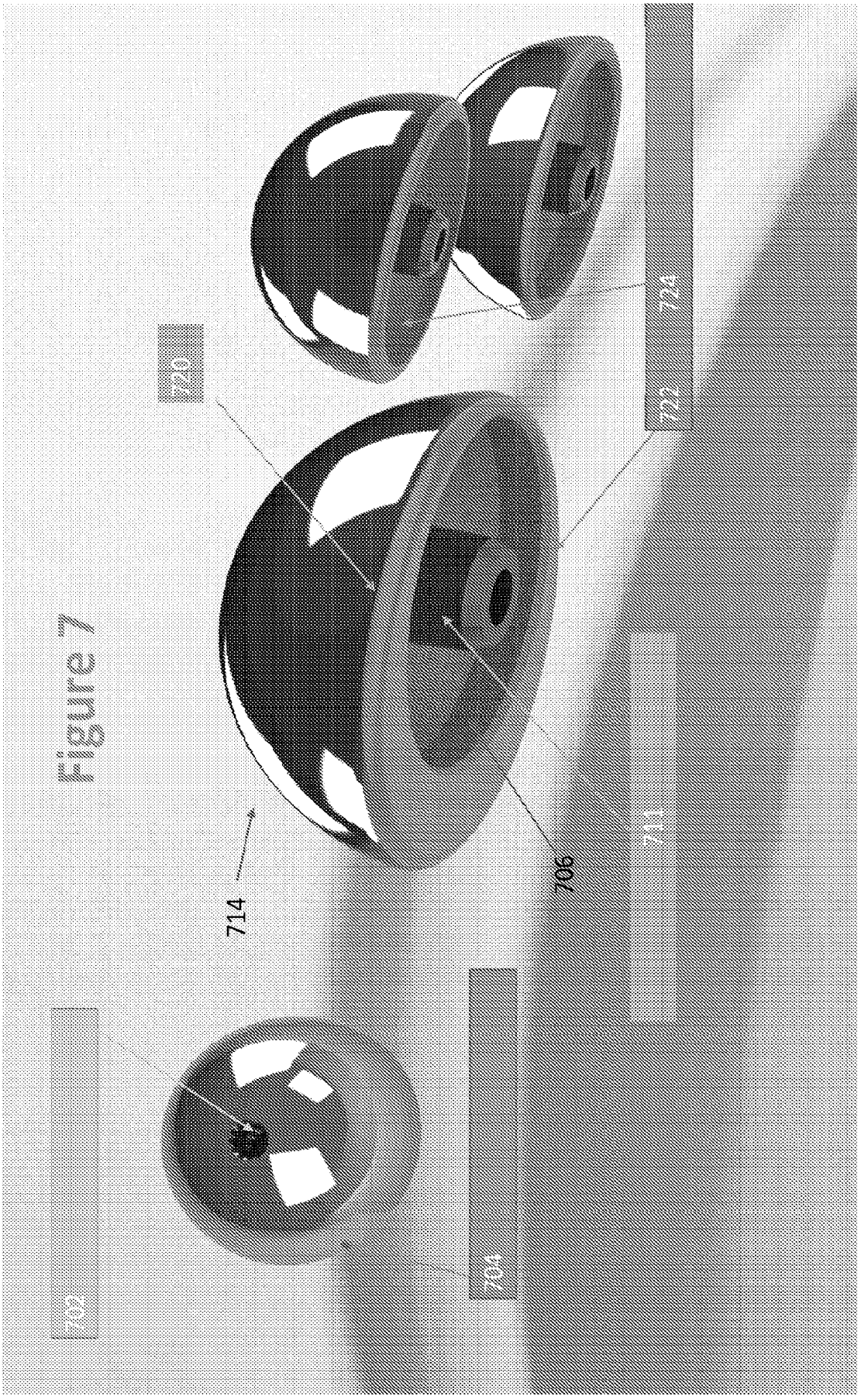


Figure 6


Figure 7
702
704
706
710
712
714
720
722
724

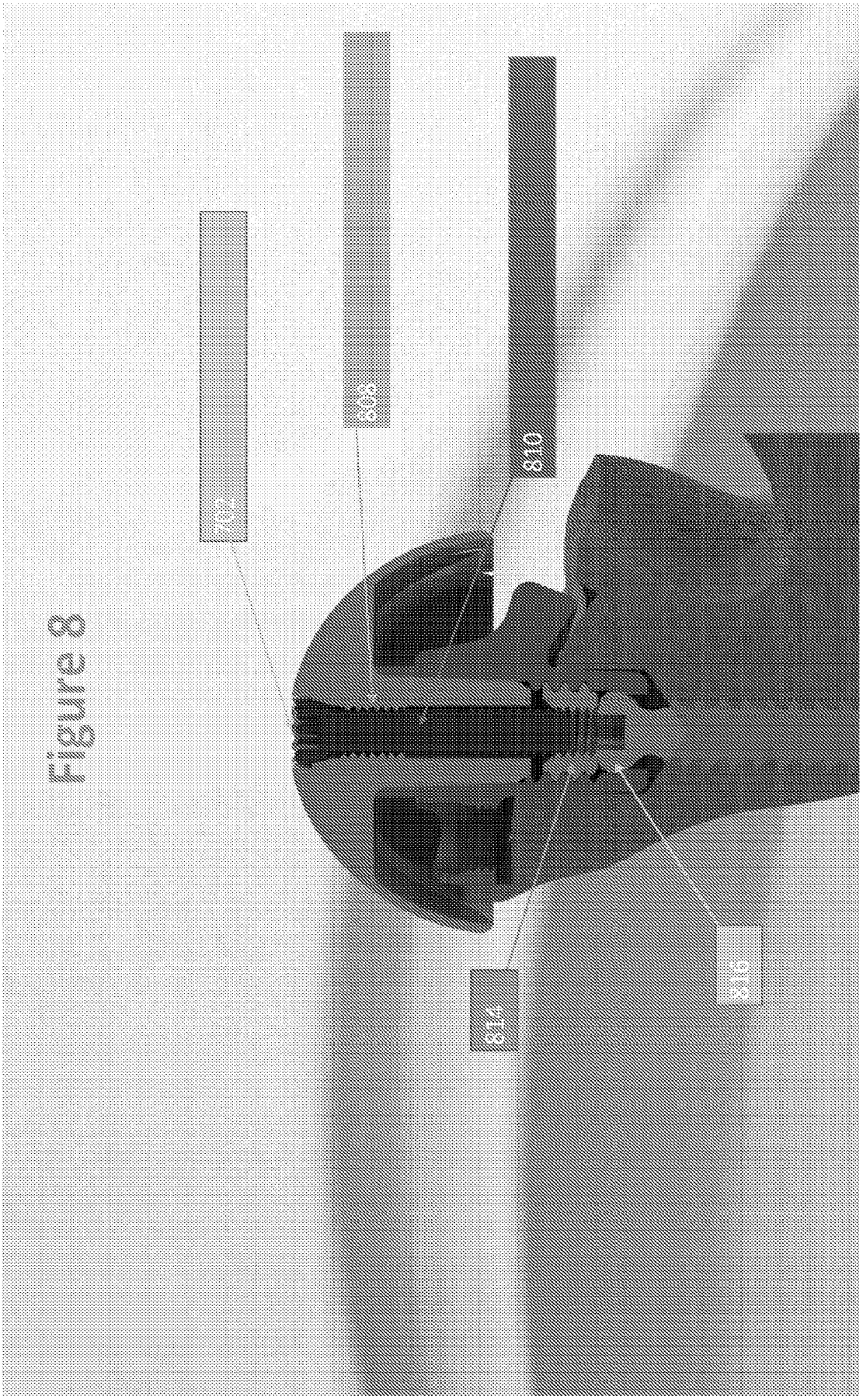
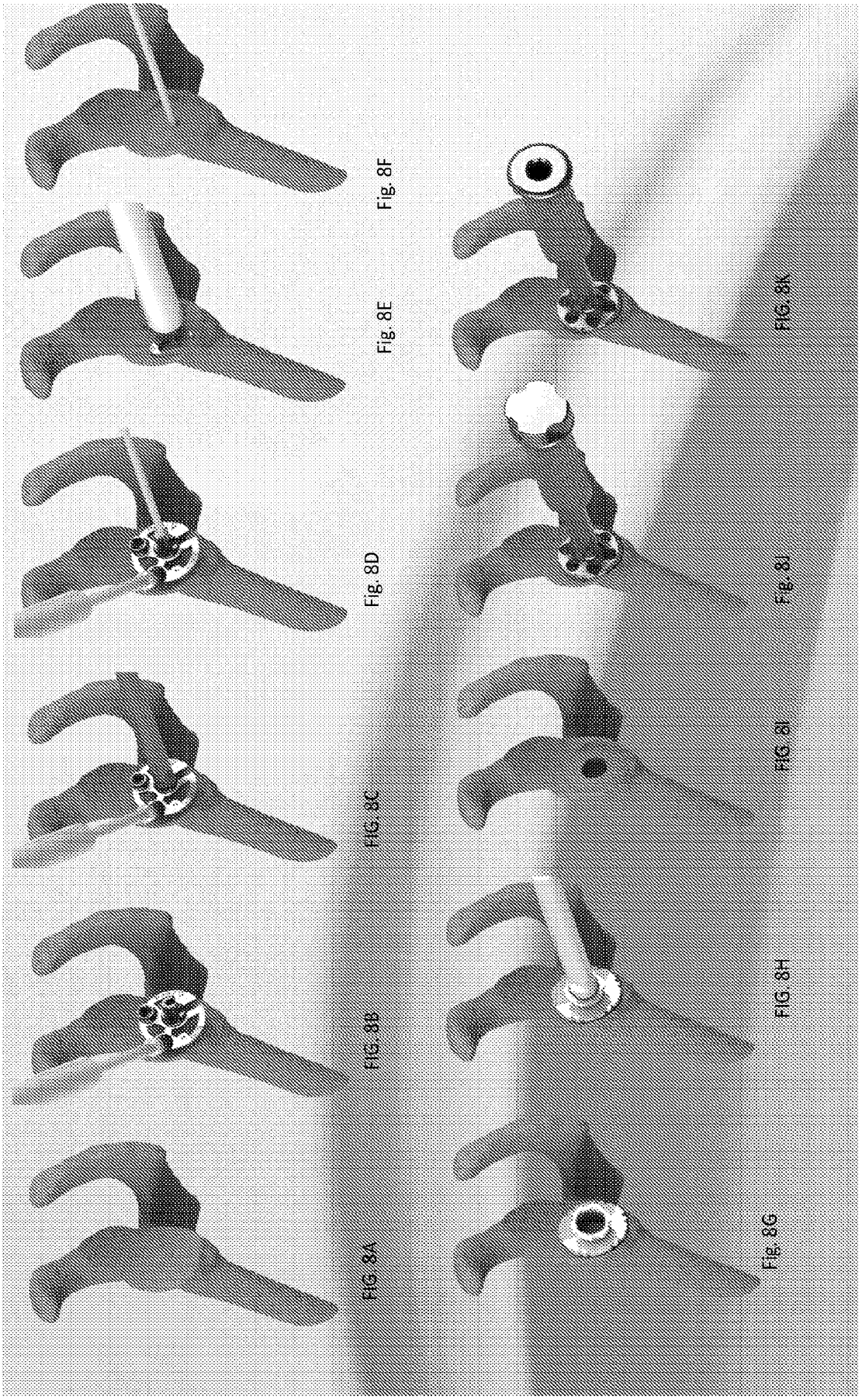
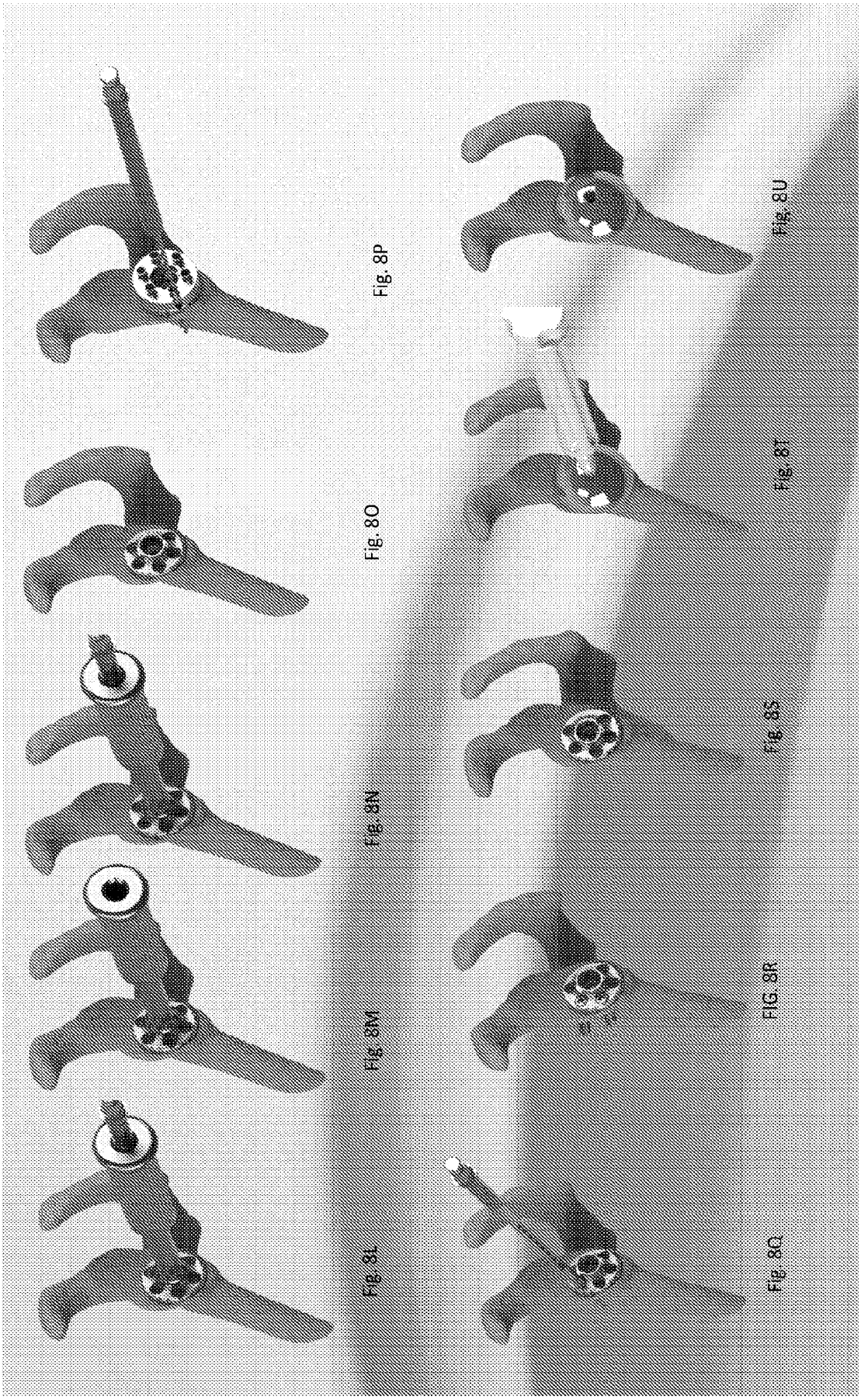


Figure 8


FIG. 8A
FIG. 8B
FIG. 8C
Fig. 8D
Fig. 8E
Fig. 8F
Fig. 8G
FIG. 8H
FIG. 8I
Fig. 8J
FIG. 8K


Fig. 8L
Fig. 8M
Fig. 8N
Fig. 8O
Fig. 8P
FIG. 8Q
FIG. 8R
Fig. 8S
Fig. 8T
Fig. 8U

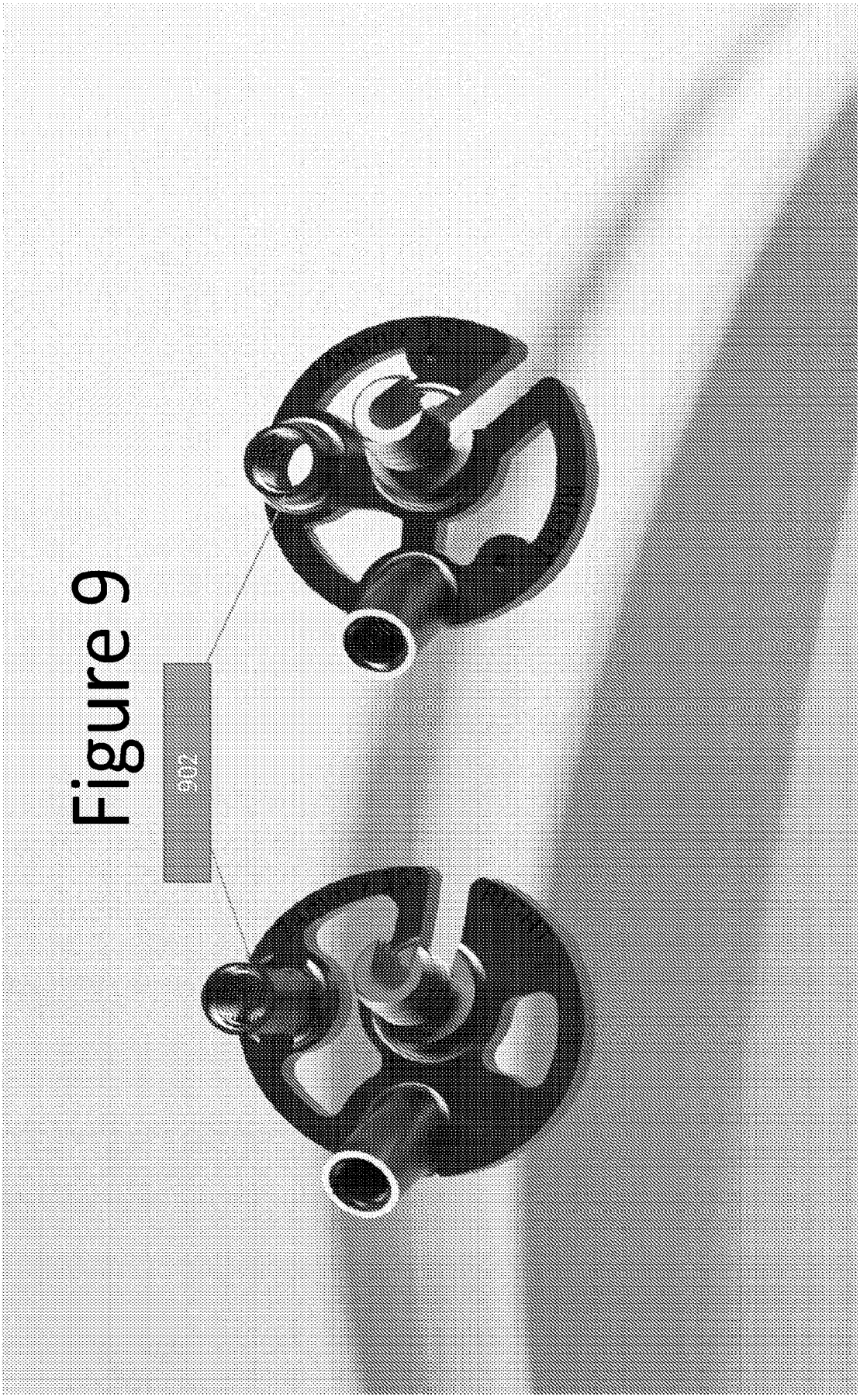


Figure 9

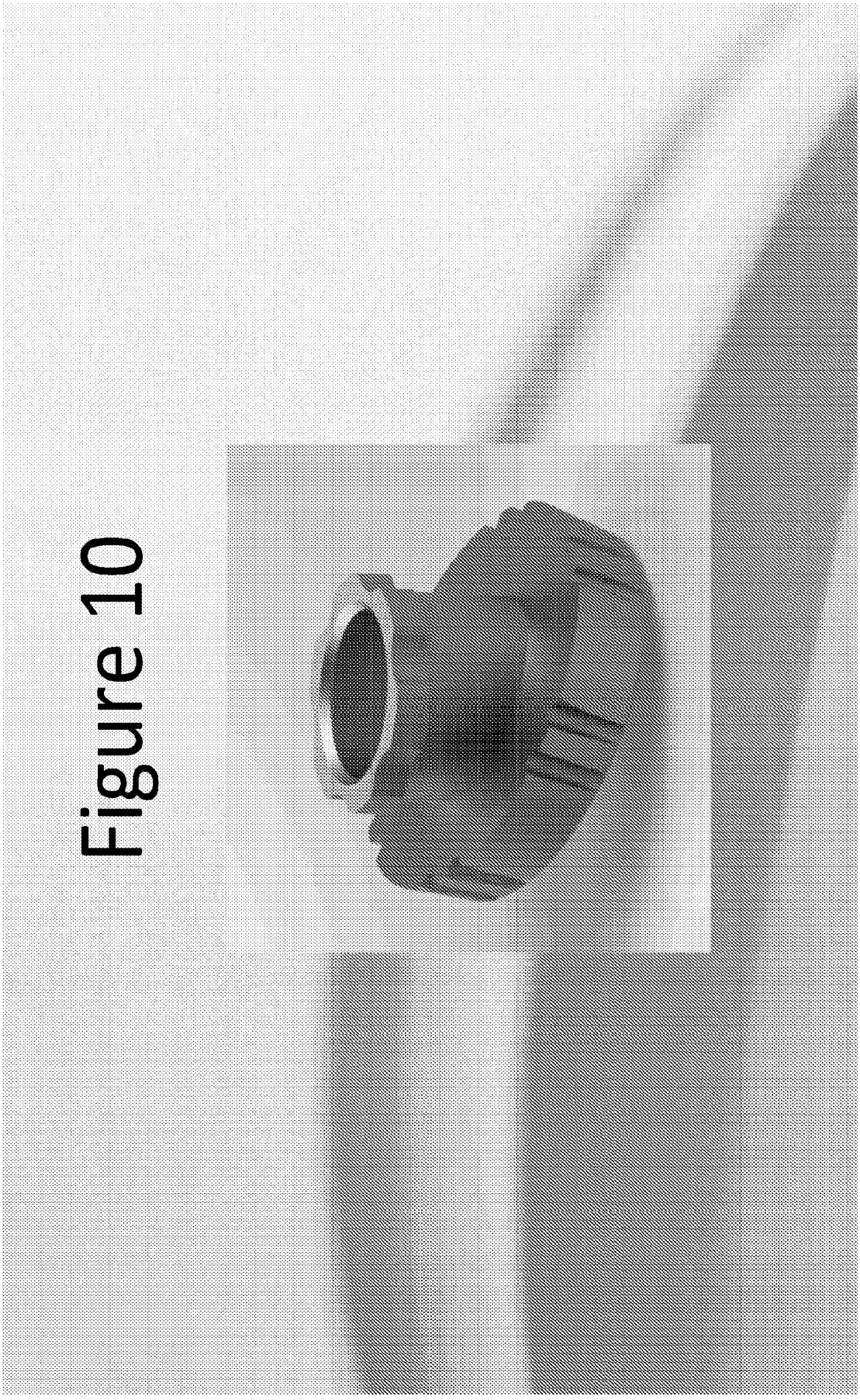


Figure 10

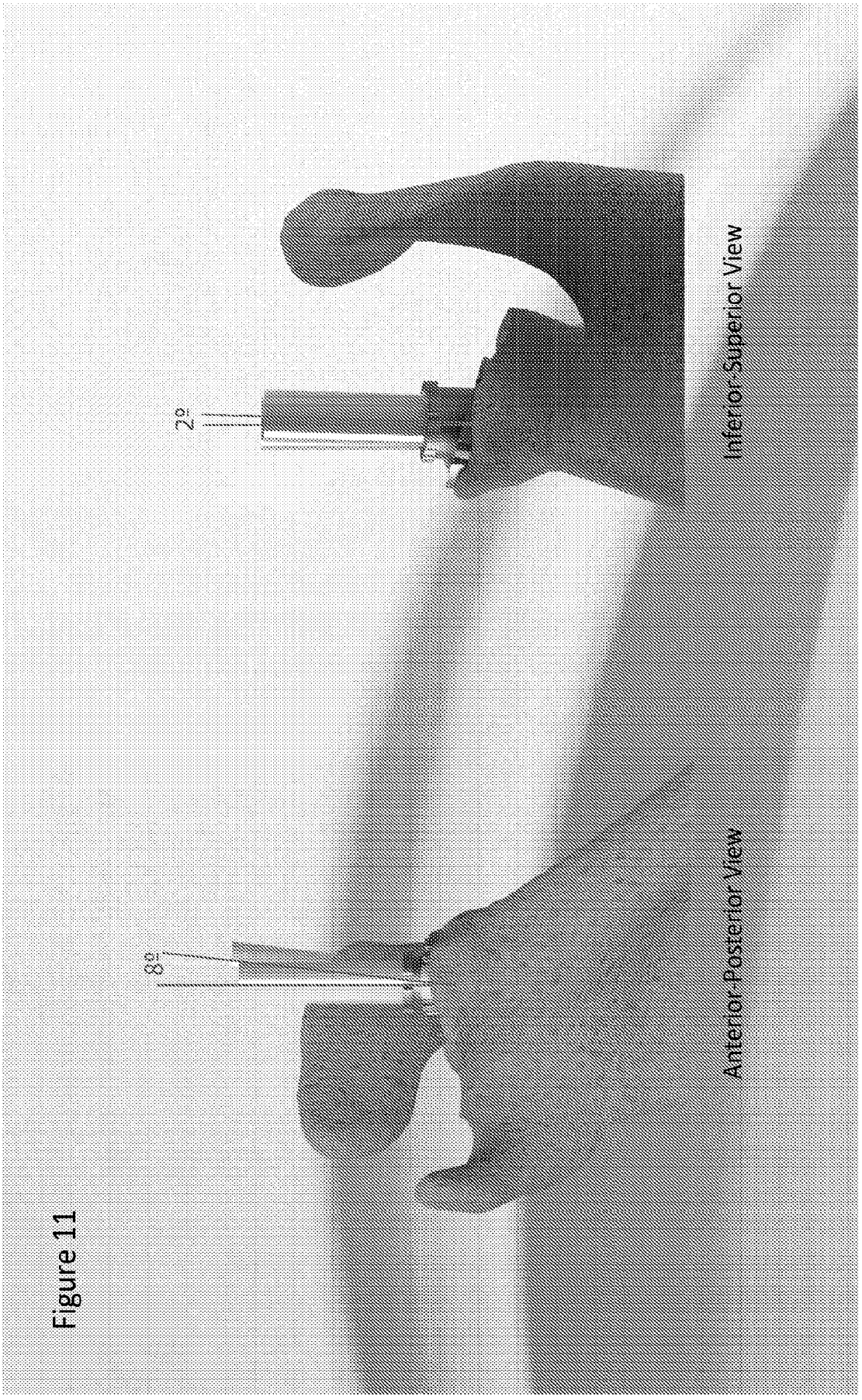
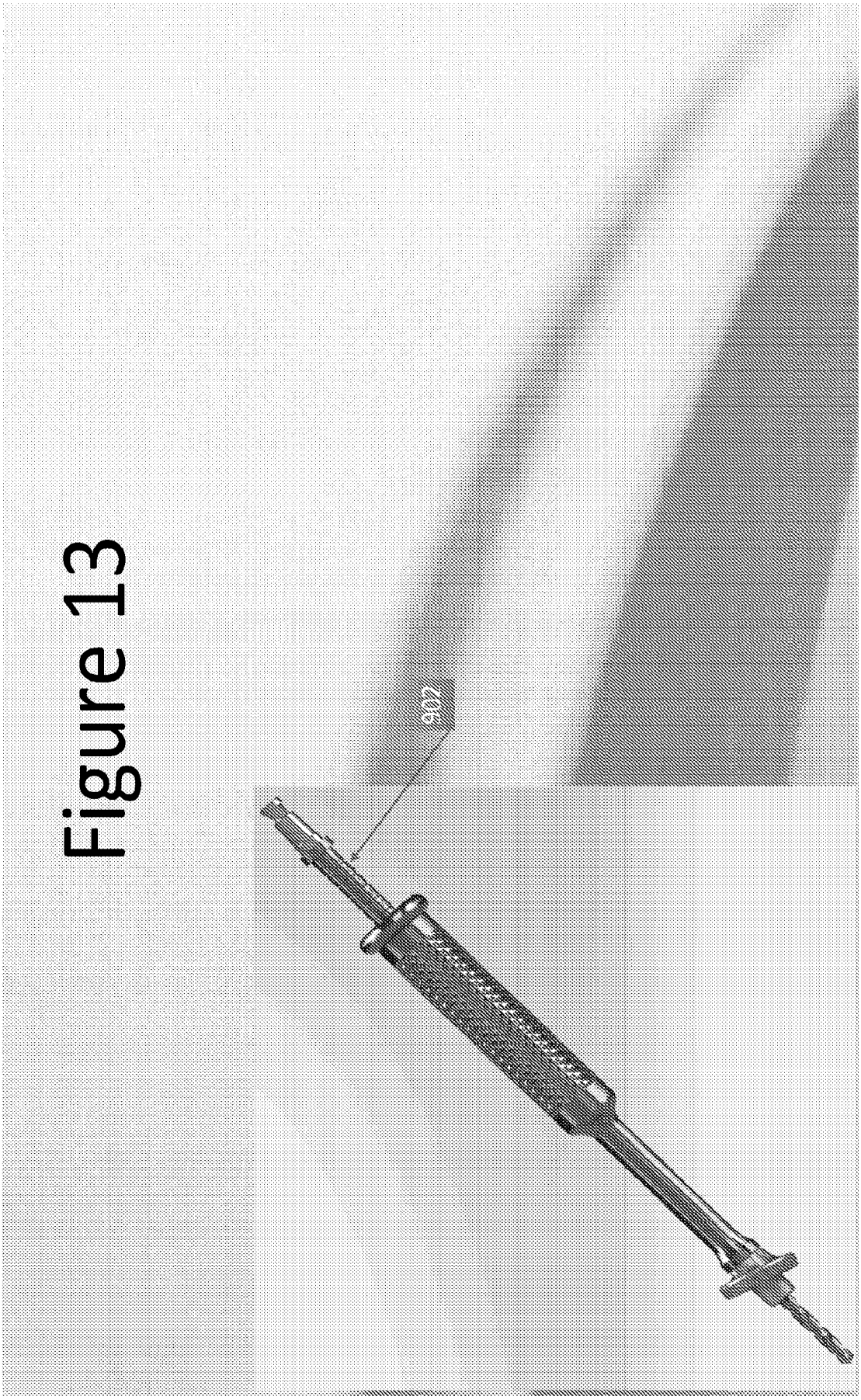


Figure 11



Figure 12

Figure 13



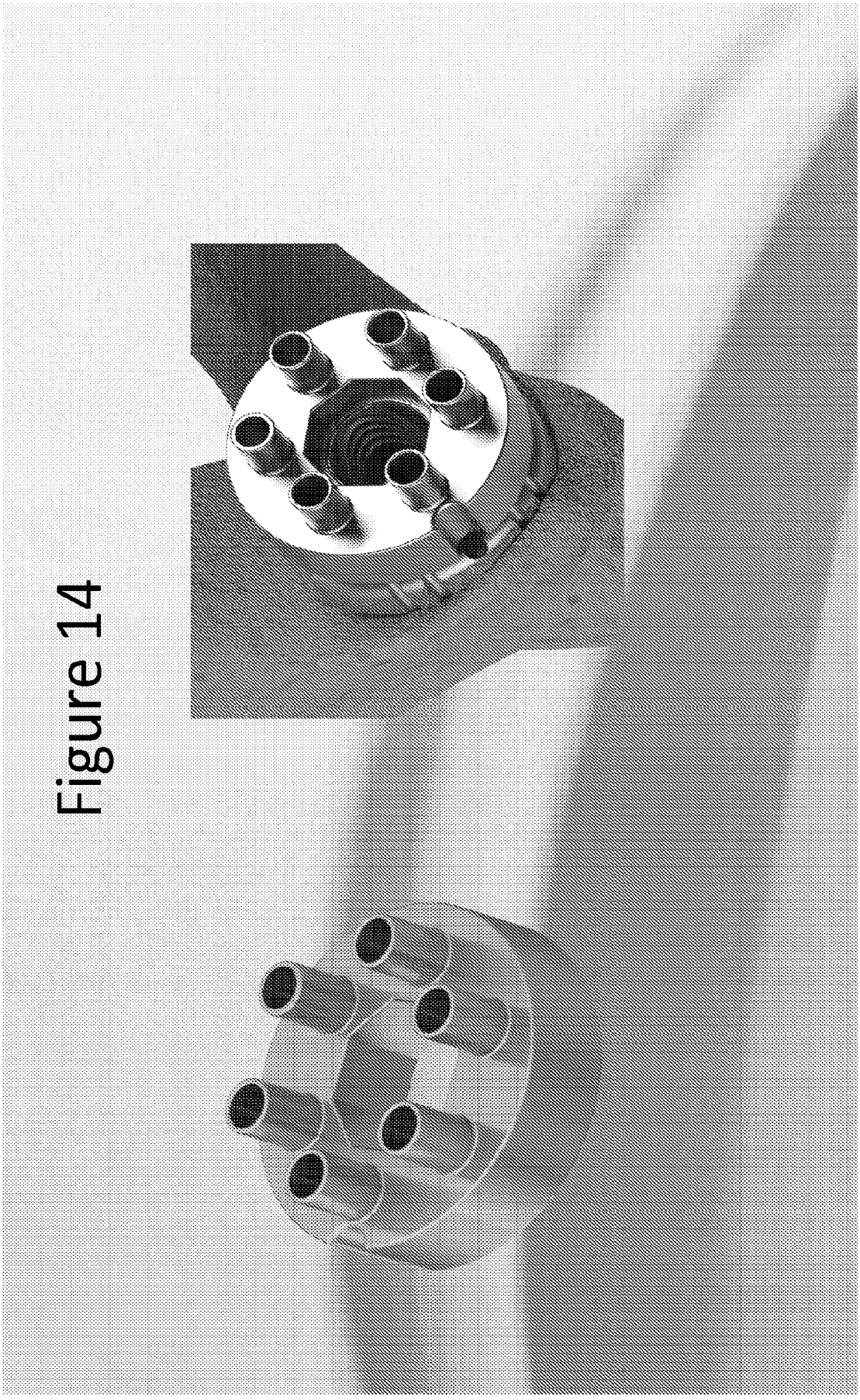


Figure 14

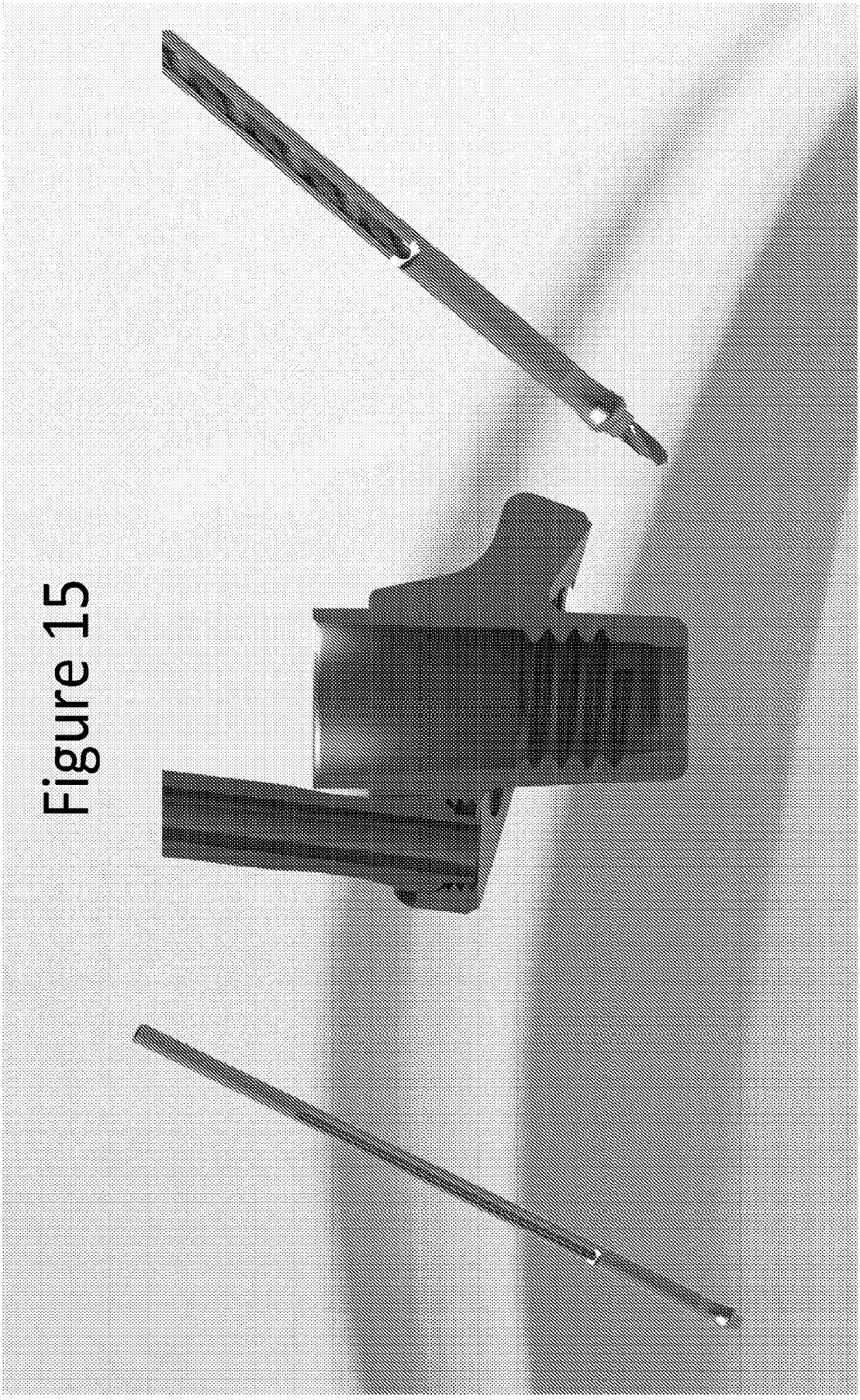
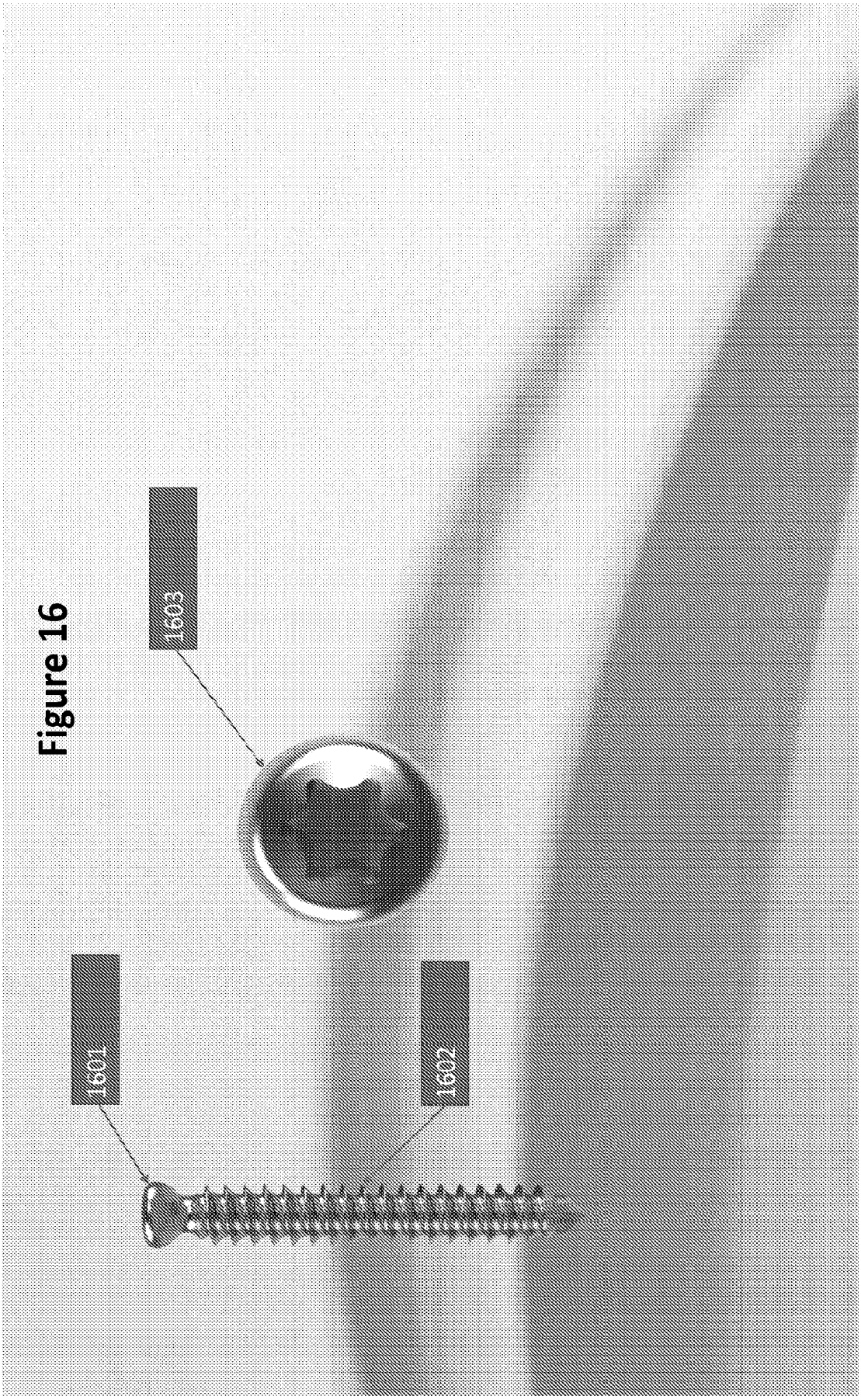


Figure 15

Figure 16



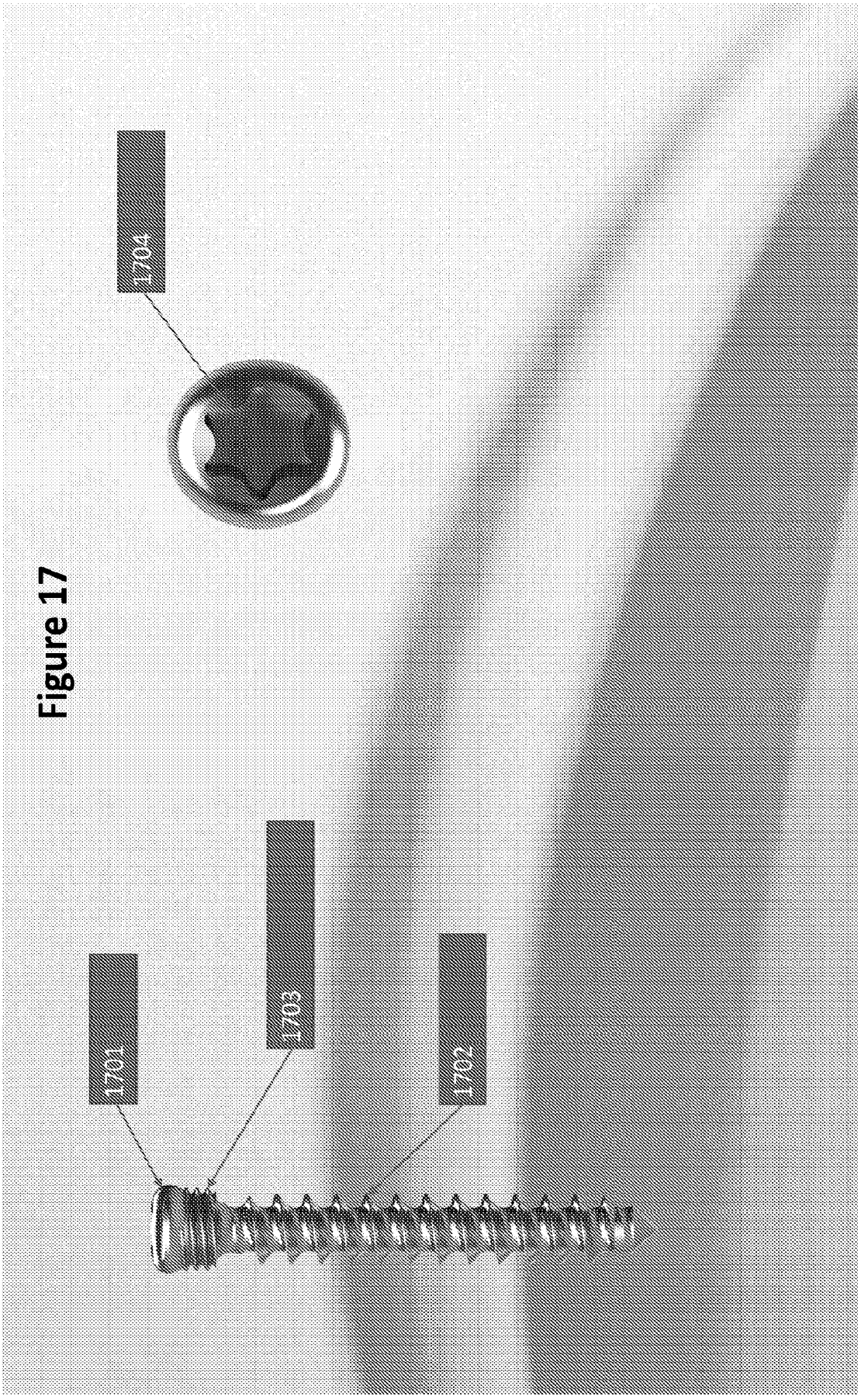
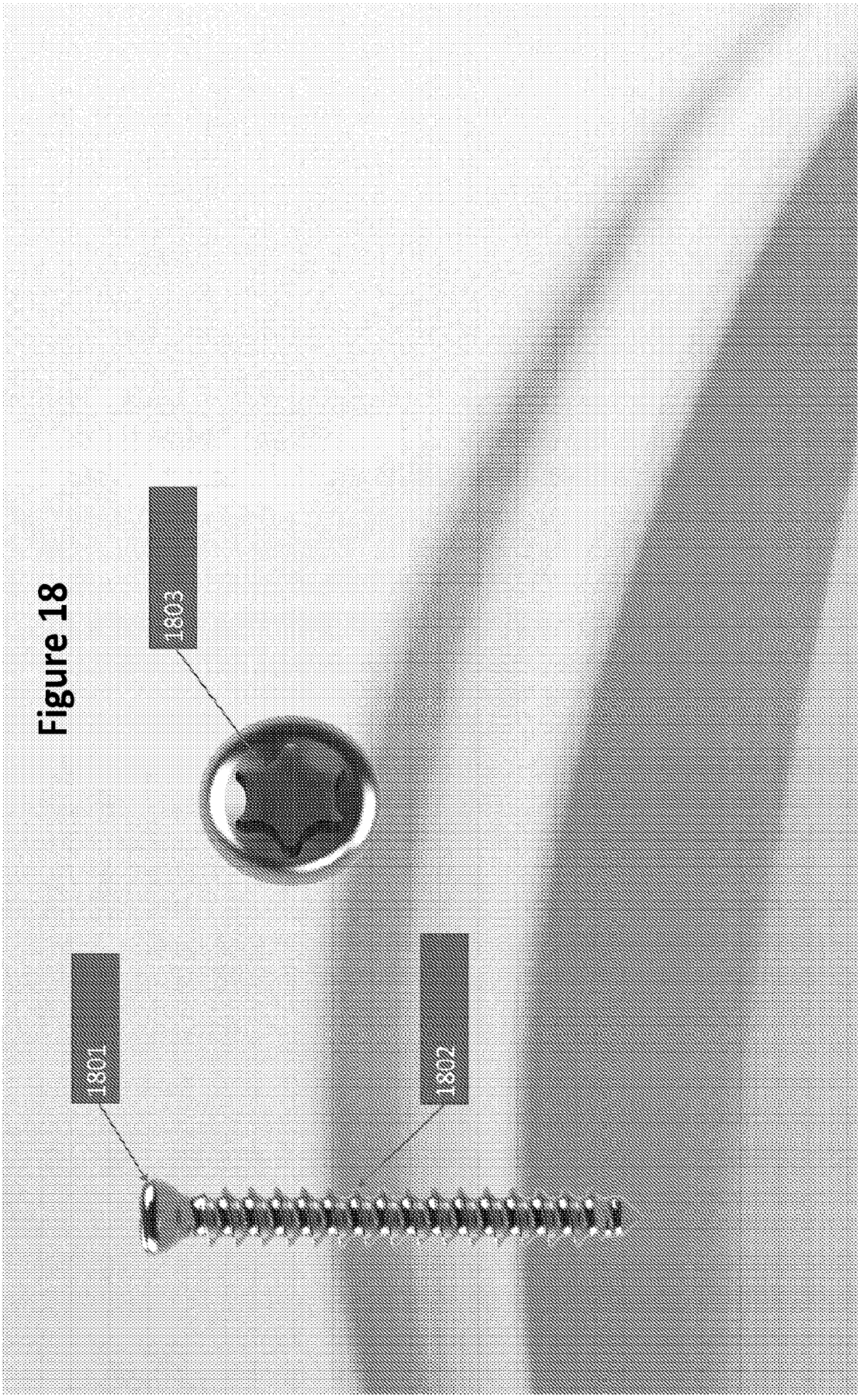


Figure 17

Figure 18



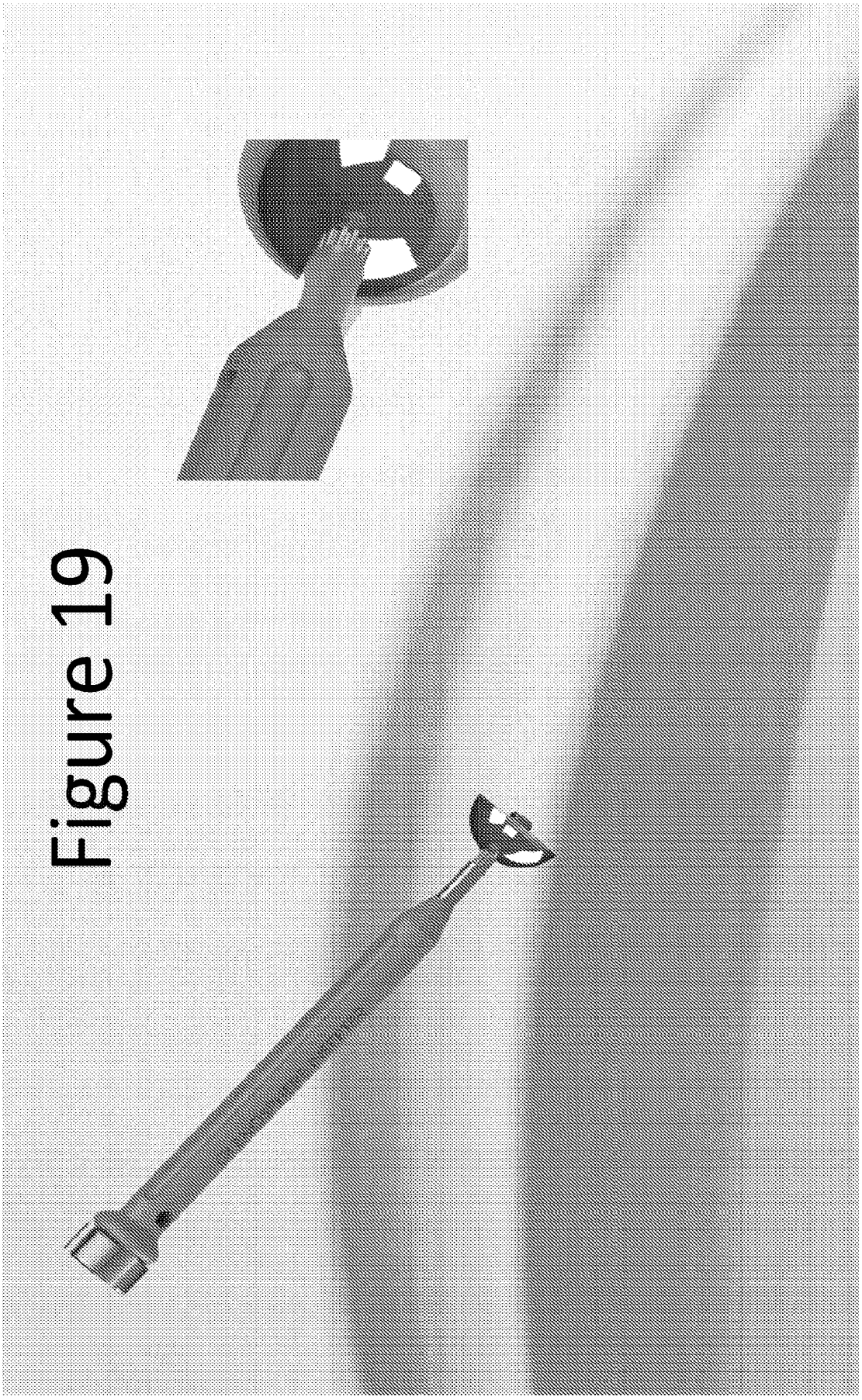


Figure 19

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
17/435,333	08/31/2021		240	SHOLD.013NP	16	1

CONFIRMATION NO. 1067

FILING RECEIPT

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IRVINE, CA 92614

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Date Mailed: 02/11/2022

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Inventor(s)

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Robert J. Ball, Holland, MI;
Jason Slone, Silver Lake, IN;

Applicant(s)

SHOULDER INNOVATIONS, INC., Holland, MI;

Power of Attorney: The patent practitioners associated with Customer Number 20995

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/US2020/022094 03/11/2020
which claims benefit of 62/816,708 03/11/2019

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

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The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 17/435,333**

Projected Publication Date: 05/19/2022

Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****
Title

TOTAL REVERSE SHOULDER SYSTEMS AND METHODS

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 17/435,333

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	160		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	70		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	400		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	16 minus 20 =	*	x 50 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*	x 240 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	630		TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET

Substitute for Form PTO-1360
(For use with Form PTO/SB/06)

Application Number	Filing Date
17435333	

Applicant(s) Donald Running

* May be used for additional claims or amendments

CLAIMS	AS FILED		AFTER FIRST AMENDMENT		AFTER SECOND AMENDMENT	
	Indep	Depend	Indep	Depend	Indep	Depend
1	1					
2		1				
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Total Indep	1		0		0	
Total Depend	15	↵	0	↵	0	↵
Total Claims	16		0		0	

CLAIMS	*		*		*	
	Indep	Depend	Indep	Depend	Indep	Depend
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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

U.S. APPLICATION NO.	FIRST NAMED INVENTOR	ATTY. DOCKET NO.
17/435,333	Donald E. Running	SHOLD.013NP

20995
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

INTERNATIONAL APPLICATION NO.	
PCT/US2020/022094	
I.A. FILING DATE	PRIORITY DATE
03/11/2020	03/11/2019

CONFIRMATION NO. 1067
371 FORMALITIES LETTER

OC000000131749286

Date Mailed: 02/11/2022

Notification of Insufficiency Under 37 CFR 1.492 and/or 1.495 (DO/EO/US)

The following items have been submitted by the applicant or the International Bureau to the United States Patent and Trademark Office as a Designated / Elected Office (37 CFR 1.495).

- Indication of Small Entity Status
- Priority Document
- Copy of the International Application filed on 08/31/2021
- Copy of the International Search Report filed on 08/31/2021
- U.S. Basic National Fees filed on 08/31/2021
- Authorize Access to Search Results filed on 08/31/2021
- Priority Documents filed on 08/31/2021
- Power of Attorney filed on 08/31/2021
- Authorization to Permit Access filed on 08/31/2021
- Application Data Sheet (37 CFR 1.76) filed on 08/31/2021

The following items **MUST** be furnished within the period set forth below:

SUMMARY OF FEES DUE:

Total additional fees required for this application is $**470** for a Small Entity:

- The application search fee has not been paid. Applicant must submit $**70** to complete the search fee. Note a surcharge will be required if submitted later than commencement of the national stage (37 CFR 1.492(h)).
- The application examination fee has not been paid. Applicant must submit $**400** to complete the examination fee for a small entity in compliance with 37 CFR 1.27. Note a surcharge will be required if submitted later than commencement of the national stage (37 CFR 1.492(h)) and the basic national fee was not paid before July 1, 2005.

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.495(c).

- Properly executed inventor's oath or declaration for the following inventor(s) has not been submitted: **Donald E. Running**, **Robert J. Ball**, and **Jason Slone**

ALL OF THE ITEMS SET FORTH ABOVE MUST BE SUBMITTED WITHIN TWO (2) MONTHS FROM THE DATE OF THIS NOTICE. FAILURE TO PROPERLY RESPOND WILL RESULT IN ABANDONMENT.

The time period set above may be extended by filing a petition and fee for extension of time under the provisions of 37 CFR 1.136(a).

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

VONDA M WALLACE

Telephone: (571) 272-3734

Catalyst v. Shoulder Innovations
PGR2025-00001

Exhibit 2003
Page 176

RESPONSE TO NOTICE OF INSUFFICIENCY

First Inventor: Running, Donald E.	**Conf. No.:** 1067
App. No.: 17/435333	**Filed:** August 31, 2021
	Art Unit:
Title: TOTAL REVERSE SHOULDER SYSTEMS AND METHODS	

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

The above-captioned application was filed lacking at least one item that would advance the application to examination. Enclosed in compliance with 37 CFR 1.53(f) are the following:

The present application qualifies for small entity status under 37 CFR § 1.27.

(X) Fees will be paid electronically. Any extension of time will be requested by payment of the appropriate extension fee.

The Commissioner is hereby authorized to charge any additional fees which may be required, now or in the future, or credit any overpayment, to Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: May 11, 2022

By: /Andrew I. Kimmel/
Andrew I. Kimmel
Registration No. 58,855
Registered Practitioner
(949) 760-0404

55599769

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/435,333	**05/11/2022 07:38:29 PM ET**	**SHOLD.013NP**

Title of Invention

TOTAL REVERSE SHOULDER SYSTEMS AND METHODS

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	-
CONFIRMATION #	1067	FILED BY	Debbie Munson
PATENT CENTER #	60664414	FILING DATE	08/31/2021
CUSTOMER #	20995	FIRST NAMED INVENTOR	Donald E. Running
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Andrew Kimmel

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
SHOLD-013NP_RESPONSETONOTICEOFINSUFFICIENCY.pdf	1	Applicant Response to Pre-Exam Formalities Notice	17 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
SHOLD-013NP_RESPONSETONOTICEOFINSUFFICIENCY.pdf	693D70A38F14DE62AD57C1ACE61EE670D66B5DE32DC410D09EF32950F2E7FCA5F23DBB18FABB33B406EBF02684E42A6D8317A6D83973D87248AED98715A725AB

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized

by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/435,333	05/11/2022 07:38:29 PM ET	SHOLD.013NP

Title of Invention

TOTAL REVERSE SHOULDER SYSTEMS AND METHODS

Application Information

APPLICATION TYPE	Utility - U.S. National Stage under 35 USC 371	PATENT #	-
CONFIRMATION #	1067	FILED BY	Debbie Munson
PATENT CENTER #	60664414	AUTHORIZED BY	Andrew Kimmel
CUSTOMER #	20995	FILING DATE	08/31/2021
INTL. APPLICATION #	-	INTL. FILING DATE	-
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Donald E. Running

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 2598	E20225AJ39394102	Jennifer Neat

PRE-AUTHORIZED ACCOUNT	PRE-AUTHORIZED CATEGORY
111410	37 CFR 1.17 (Patent application and reexamination processing fees); 37 CFR 1.492 (National application filing, search, and examination fees)

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
2633	NATIONAL STAGE EXAMINATION FEE - ALL OTHER SITUATIONS	400.00	1	400.00
2251	EXTENSION FOR RESPONSE WITHIN FIRST MONTH	110.00	1	110.00
2641	NATIONAL STAGE SEARCH FEE - U.S. WAS THE ISA	70.00	1	70.00
			TOTAL AMOUNT:	$580.00

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized

by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/435,333	08/31/2021	Donald E. Running	SHOLD.013NP

CONFIRMATION NO. 1067

PUBLICATION NOTICE

20995
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

OC00000133951777

Title:TOTAL REVERSE SHOULDER SYSTEMS AND METHODS

Publication No.US-2022-0151795-A1
Publication Date:05/19/2022

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
17/435,333	08/31/2021	3774	710	SHOLD.013NP	16	1

CONFIRMATION NO. 1067

UPDATED FILING RECEIPT

20995
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

OC000000134247124

Date Mailed: 06/03/2022

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Donald E. Running, Missoula, MT;
Robert J. Ball, Holland, MI;
Jason Slone, Silver Lake, IN;

Applicant(s)

SHOULDER INNOVATIONS, INC., Holland, MI;

Power of Attorney: The patent practitioners associated with Customer Number 20995

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/US2020/022094 03/11/2020
which claims benefit of 62/816,708 03/11/2019

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 02/09/2022

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 17/435,333**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

TOTAL REVERSE SHOULDER SYSTEMS AND METHODS

Preliminary Class

623

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 17/435,333

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	160		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	70		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	400		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	16 minus 20 =	*	x 50 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*	x 240 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	630		TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

U.S. APPLICATION NO.	FIRST NAMED INVENTOR	ATTY. DOCKET NO.
17/435,333	Donald E. Running	SHOLD.013NP

20995
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

INTERNATIONAL APPLICATION NO.	
PCT/US2020/022094	
I.A. FILING DATE	PRIORITY DATE
03/11/2020	03/11/2019

CONFIRMATION NO. 1067
371 ACCEPTANCE LETTER

OC000000134247125

Date Mailed: 06/03/2022

NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office, in its capacity as a Designated / Elected Office (37 CFR 1.495), has ACCEPTED the above identified international application for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above. A Filing Receipt will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE "FILING DATE or 371(c) DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 (c)(1) and (c)(2) REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN BELOW.** The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363)

08/31/2021
DATE OF RECEIPT OF 35 U.S.C.
371(c)(1) and (c)(2) REQUIREMENTS

The following items have been received:

- Indication of Small Entity Status
- Copy of the International Application filed on 08/31/2021
- Copy of the International Search Report filed on 08/31/2021
- U.S. Basic National Fees filed on 08/31/2021
- Authorize Access to Search Results filed on 08/31/2021
- Priority Documents filed on 08/31/2021
- Power of Attorney filed on 08/31/2021
- Authorization to Permit Access filed on 08/31/2021
- Application Data Sheet (37 CFR 1.76) filed on 08/31/2021

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.495(c).

- Properly executed inventor's oath or declaration for the following inventor(s) has not been submitted: **Donald E. Running**, **Robert J. Ball**, and **Jason Slone**

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

VONDA M WALLACE

Telephone: (571) 272-3734

Catalyst v. Shoulder Innovations
PGR2025-00001

Exhibit 2003
Page 189

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT7804158

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
DONALD E. RUNNING	01/27/2023
ROBERT J. BALL	01/17/2023
JASON SLONE	01/17/2023

RECEIVING PARTY DATA

Name:	SHOULDER INNOVATIONS, INC.
Street Address:	13827 PORT SHELDON ST.
City:	HOLLAND
State/Country:	MICHIGAN
Postal Code:	49424

PROPERTY NUMBERS Total: 1

Property Type	Number
Application Number:	17435333

CORRESPONDENCE DATA

Fax Number: (949)760-9502

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Phone: 949-760-0404
Email: efiling@knobbe.com
Correspondent Name: KNOBBE, MARTENS, OLSON & BEAR LLP
Address Line 1: 2040 MAIN STREET
Address Line 2: 14TH FLOOR
Address Line 4: IRVINE, CALIFORNIA 92614

ATTORNEY DOCKET NUMBER:	SHOLD.013NP
NAME OF SUBMITTER:	ANDREW KIMMEL
SIGNATURE:	/Andrew Kimmel/
DATE SIGNED:	02/17/2023
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 4
source=2021-01-02 Combined Assignment Declaration - SHOLD.013NP -Rob-Jason#page1.tif
source=2021-01-02 Combined Assignment Declaration - SHOLD.013NP -Rob-Jason#page2.tif

source=2021-01-02 Combined Assignment Declaration - SHOLD.013NP -Rob-Jason#page3.tif
source=2021-01-02 Combined Assignment Declaration - SHOLD.013NP -Rob-Jason#page4.tif

COMBINED DECLARATION & ASSIGNMENT (37 CFR 1.63(e))

Application Data Sheet filed previously or concurrently

Docket No.: SHOLD.013NP

Title: TOTAL REVERSE SHOULDER SYSTEMS AND METHODS

Inventors: Donald E. Running, Robert J. Ball, and Jason Slone

Declaration

This Declaration is directed to U.S. Application No. **17/435,333**, filed **August 31, 2021** and incorporating any amendments made thereto prior to the signature date of this Declaration.

As a named inventor, I declare that:

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 USC 1001 by fine or imprisonment of not more than five (5) years, or both.

I have reviewed and understand the contents of the above-identified application, including the claims, as amended by any amendment.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

Assignment from Inventors

WHEREAS, **above-identified Inventors** (individuals, hereinafter "ASSIGNOR") invented certain new and useful improvements, technology, inventions, developments, ideas, ornamental designs, or discoveries related to **TOTAL REVERSE SHOULDER SYSTEMS AND METHODS** (collectively hereinafter referred to as the "Work") for which an application for Letters Patent in the United States (identified above) has been filed or prepared for filing with the United States Patent and Trademark Office (hereinafter the "Application"), and ASSIGNOR desires to assign or confirm assignment of the Work and the Application to the below identified Assignee.

AND WHEREAS, **Shoulder Innovations, Inc.,** with its principal place of business at **13827 Port Sheldon St., Holland, MI 49424** (hereinafter the "ASSIGNEE"), desires to acquire or confirm ownership of the entire right, title, and interest in and to the Application and the Work.

NOW, THEREFORE, for good and valuable consideration of which receipt is hereby acknowledged, ASSIGNOR hereby acknowledges that ASSIGNOR has sold, assigned, transferred, and set over, and by these presents does hereby sell, assign, transfer, and set over, unto said ASSIGNEE, **its** successors, legal representatives, and assigns, the entire right, title, and interest throughout the world in and to the Application and the Work, including: all provisional and international applications relating to the Work and the Application (including but not limited to U.S. Provisional Application No. **62/816,708**, filed **March 11, 2019** and **International Application No. PCT/US2020/022094** filed **March 11, 2020**); all nonprovisional applications claiming priority to aforementioned provisional, international application and/or the Application, including, all divisions, continuations, continuations-in-part, and reissues, and all Letters Patent of the United States which may be granted thereon and all reissues and extensions thereof; and all rights of priority under International Conventions and any related Letters Patent which may hereafter be granted or filed in any country or countries foreign to the United States, all extensions, renewals, and reissues thereof.

ASSIGNOR hereby authorizes and requests the Commissioner for Patents of the United States, and any Official of any country or countries foreign to the United States, whose duty it is to issue patents on applications as aforesaid, to issue all related Letters Patent to the ASSIGNEE, **its** successors, legal representatives, and assigns.

AND ASSIGNOR DOES HEREBY acknowledge and agree that the assigned scope of the Application and the Work includes any currently recited claims, all embodiments, and all claims supported by the Application; Assignor agrees not to contest or disparage claim scope thus supported (including in any later-filed continuing patent applications) for any claims deemed patentable by any government patent office. Assignor also agrees not to challenge the validity, including as a defense to patent infringement, of any issued patent claims resulting from or based on the Work, regardless of the scope of any such claims.

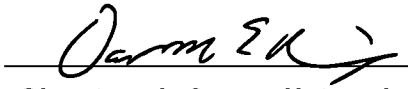
AND ASSIGNOR DOES HEREBY sell, assign, transfer, and convey to ASSIGNEE, **its** successors, legal representatives, and assigns all claims for damages and all remedies arising out of any violation of the rights assigned hereby that may have accrued prior to the date of assignment to ASSIGNEE, or may accrue hereafter, including, but not limited to, the right to sue for, collect, and retain damages for past infringements of said Letters Patent before or after issuance.

AND ASSIGNOR DOES HEREBY covenant and agree that ASSIGNOR will: communicate to said ASSIGNEE, **its** successors, legal representatives, and assigns any facts known to ASSIGNOR respecting the Work; testify in any legal proceeding; assist in the preparation of any other Patent Property relating to the Application and the Work or any improvements made thereto; sign/execute all lawful papers; authorize the filing of, execute, and make all rightful oaths and/or declarations in connection with the Application and the Work including any improvements made thereto, any patent applications filed therefrom, and any continuing application filed from any of the aforementioned applications; and generally do everything possible to aid the ASSIGNEE, **its** successors, legal representatives, and assigns, to obtain and enforce proper patent protection for the Work in all countries.

AND ASSIGNOR DOES HEREBY agree that if any term or provision of this agreement becomes invalid or unenforceable, the remainder shall survive unaffected.

Legal Name of Inventor: Donald E. Running

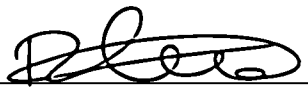
IN TESTIMONY WHEREOF, I hereunto set my hand and seal this 27th day of January, 20 23.

Signature: 

Signature before a Notary is desirable but not required. *When signed in presence of a Notary, please attach the appropriate notarial documentation.*

Legal Name of Inventor: Robert J. Ball

IN TESTIMONY WHEREOF, I hereunto set my hand and seal this 17th day of Jan, 20 23.

Signature: 

Signature before a Notary is desirable but not required. *When signed in presence of a Notary, please attach the appropriate notarial documentation.*

COMBINED DECLARATION & ASSIGNMENT (37 CFR 1.63(e))

Application Data Sheet filed previously or concurrently

Docket No.: SHOLD.013NP

Title: TOTAL REVERSE SHOULDER SYSTEMS AND METHODS

Inventors: Donald E. Running, Robert J. Ball, and Jason Slone

---

Legal Name of Inventor: Jason Slone

IN TESTIMONY WHEREOF, I hereunto set my hand and seal this 17th day of January, 2023.

Signature: William J. Slone

Signature before a Notary is desirable but not required. *When signed in presence of a Notary, please attach the appropriate notarial documentation.*

56891112

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/435,333	08/31/2021	Donald E. Running	SHOLD.013NP	1067

20995 7590 05/30/2024

Knobbe, Martens, Olson & Bear, LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

EXAMINER
SCHILLINGER, ANN M

ART UNIT	PAPER NUMBER
3774	

NOTIFICATION DATE	DELIVERY MODE
05/30/2024	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Atty.AdminCoordinator@knobbe.com
efiling@knobbe.com

Office Action Summary	Application No. 17/435,333	Applicant(s) Running et al.	
	Examiner ANN SCHILLINGER	Art Unit 3774	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 2 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 8/31/2021.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-16 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☐ Claim(s) _____ is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☑ Claim(s) 1-16 are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Election/Restriction

REQUIREMENT FOR UNITY OF INVENTION

As provided in 37 CFR 1.475(a), a national stage application shall relate to one invention only or to a group of inventions so linked as to form a single general inventive concept ("requirement of unity of invention"). Where a group of inventions is claimed in a national stage application, the requirement of unity of invention shall be fulfilled only when there is a technical relationship among those inventions involving one or more of the same or corresponding special technical features. The expression "special technical features" shall mean those technical features that define a contribution which each of the claimed inventions, considered as a whole, makes over the prior art.

The determination whether a group of inventions is so linked as to form a single general inventive concept shall be made without regard to whether the inventions are claimed in separate claims or as alternatives within a single claim. See 37 CFR 1.475(e).

When Claims Are Directed to Multiple Categories of Inventions:

As provided in 37 CFR 1.475 (b), a national stage application containing claims to different categories of invention will be considered to have unity of invention if the claims are drawn only to one of the following combinations of categories:

(1) A product and a process specially adapted for the manufacture of said product; or

(2) A product and a process of use of said product; or

(3) A product, a process specially adapted for the manufacture of the said product, and a use of the said product; or

(4) A process and an apparatus or means specifically designed for carrying out the said process; or

(5) A product, a process specially adapted for the manufacture of the said product, and an apparatus or means specifically designed for carrying out the said process.

Otherwise, unity of invention might not be present. See 37 CFR 1.475 (c).

This application contains claims directed to more than one species of the generic invention. These species are deemed to lack unity of invention because they are not so linked as to form a single general inventive concept under PCT Rule 13.1.

The species are as follows:

Species A: Fig. 2; Species B: Fig. 3; Species C: Fig. 4; Species D: Fig. 5; Species E: Fig. 7; and Species F: Fig. 8.

Applicant is required, in reply to this action, to elect a single species to which the claims shall be restricted if no generic claim is finally held to be allowable. The reply must also identify the claims readable on the elected species, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered non-responsive unless accompanied by an election.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise require all the limitations of an allowed generic claim.

The groups of inventions listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack unity of invention because even

though the inventions of these groups require the technical feature of angled glenoid baseplates, this technical feature is not a special technical feature as it does not make a contribution over the prior art in view of Gargac et al. (US Pub. No. 2018/0078377).

Applicant is reminded that upon the cancelation of claims to a non-elected invention, the inventorship must be corrected in compliance with 37 CFR 1.48(a) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. A request to correct inventorship under 37 CFR 1.48(a) must be accompanied by an application data sheet in accordance with 37 CFR 1.76 that identifies each inventor by his or her legal name and by the processing fee required under 37 CFR 1.17(i).

The examiner has required restriction between product or apparatus claims and process claims. Where applicant elects claims directed to the product/apparatus, and all product/apparatus claims are subsequently found allowable, withdrawn process claims that include all the limitations of the allowable product/apparatus claims should be considered for rejoinder. All claims directed to a nonelected process invention must include all the limitations of an allowable product/apparatus claim for that process invention to be rejoined.

In the event of rejoinder, the requirement for restriction between the product/apparatus claims and the rejoined process claims will be withdrawn, and the rejoined process claims will be fully examined for patentability in accordance with 37 CFR 1.104. Thus, to be allowable, the rejoined claims must meet all criteria for patentability including the requirements of 35 U.S.C. 101, 102, 103 and 112. Until all claims to the elected product/apparatus are found allowable, an otherwise proper restriction requirement between product/apparatus claims and process claims may be maintained. Withdrawn process claims that are not commensurate in scope with an allowable product/apparatus claim will not be rejoined. See MPEP § 821.04. Additionally, in

order for rejoinder to occur, applicant is advised that the process claims should be amended during prosecution to require the limitations of the product/apparatus claims. **Failure to do so may result in no rejoinder.** Further, note that the prohibition against double patenting rejections of 35 U.S.C. 121 does not apply where the restriction requirement is withdrawn by the examiner before the patent issues. See MPEP § 804.01.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANN SCHILLINGER whose telephone number is (571)272-6652. The examiner can normally be reached Monday-Friday 9 a.m.-5 p.m. EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jerrah Edwards can be reached on (408)918-7557. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ANN SCHILLINGER/
Primary Examiner, Art Unit 3774