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Eash

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(54) **PATIENT-SPECIFIC GLENOID GUIDE WITH A REUSABLE GUIDE HOLDER**

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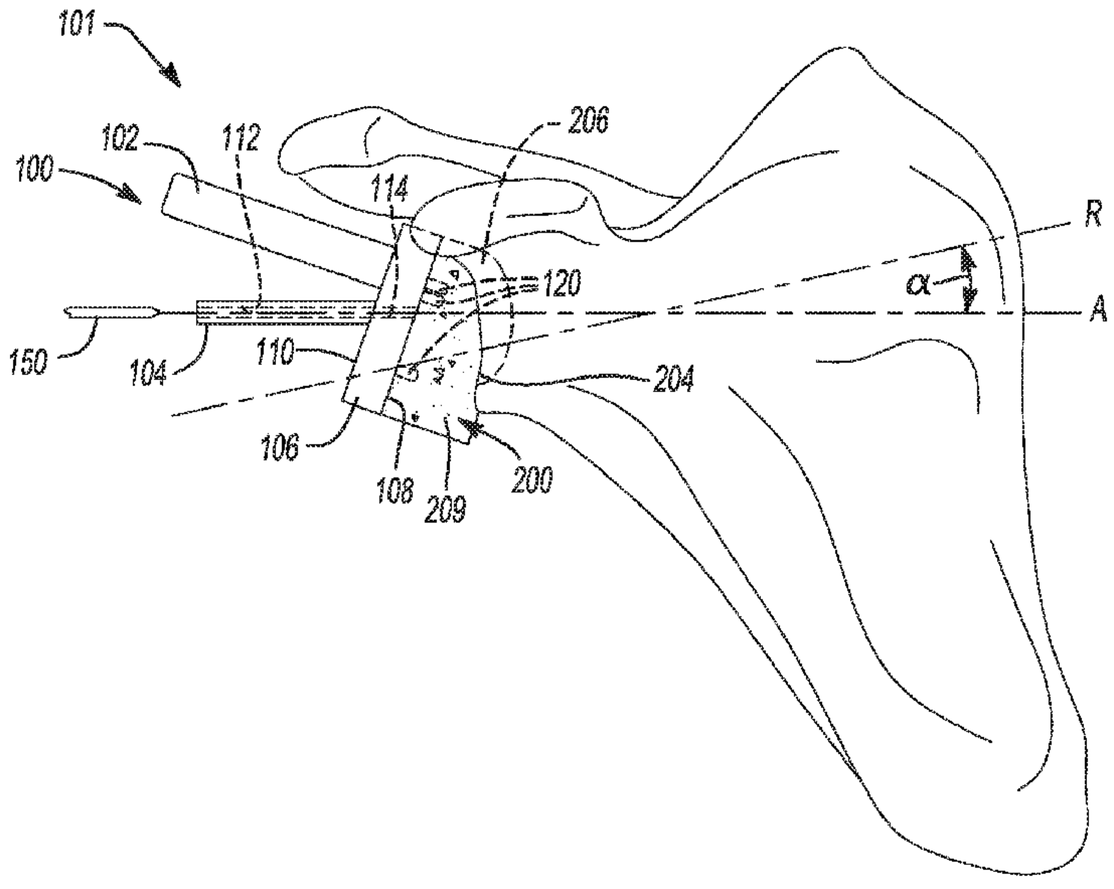
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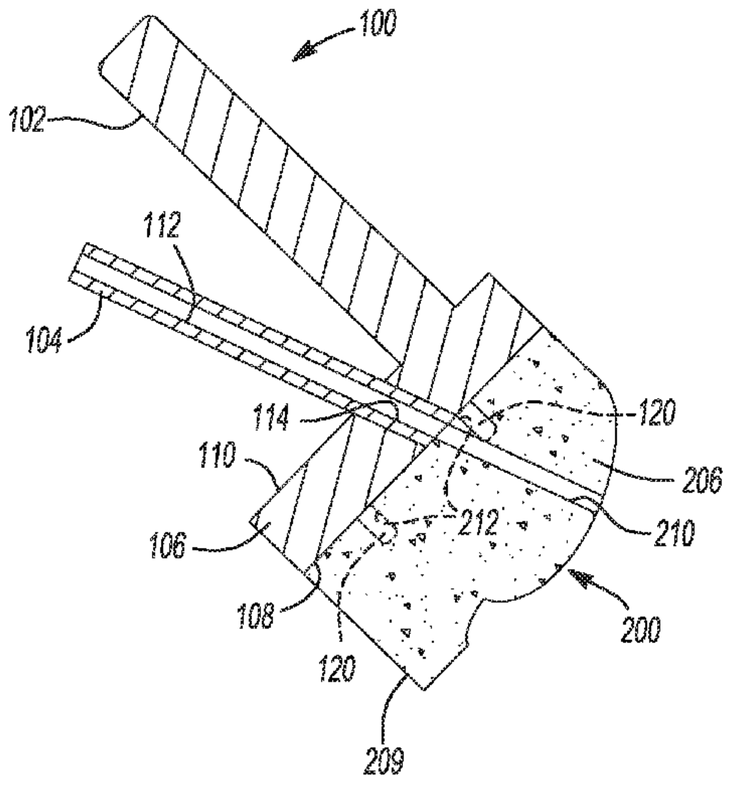
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(57) **ABSTRACT**

A glenoid device for preparing a shoulder joint of a patient includes a reusable guide holder having a body between an upper surface and a lower surface and a bore passing through the body of the guide holder. The glenoid device also includes a patient-specific glenoid guide having a body with an upper and lower surface. The lower surface of the patient-specific glenoid guide is configured as a negative surface of a glenoid face based on preoperative image scans of the shoulder joint of the patient. The upper face of the patient-specific glenoid guide is configured to be coupled and contact the lower face of the guide holder, such that the bore of the guide holder is aligned along a patient-specific bore through the body of the patient-specific glenoid guide and along a corresponding alignment axis of the patient-specific glenoid guide.

25 Claims, 4 Drawing Sheets





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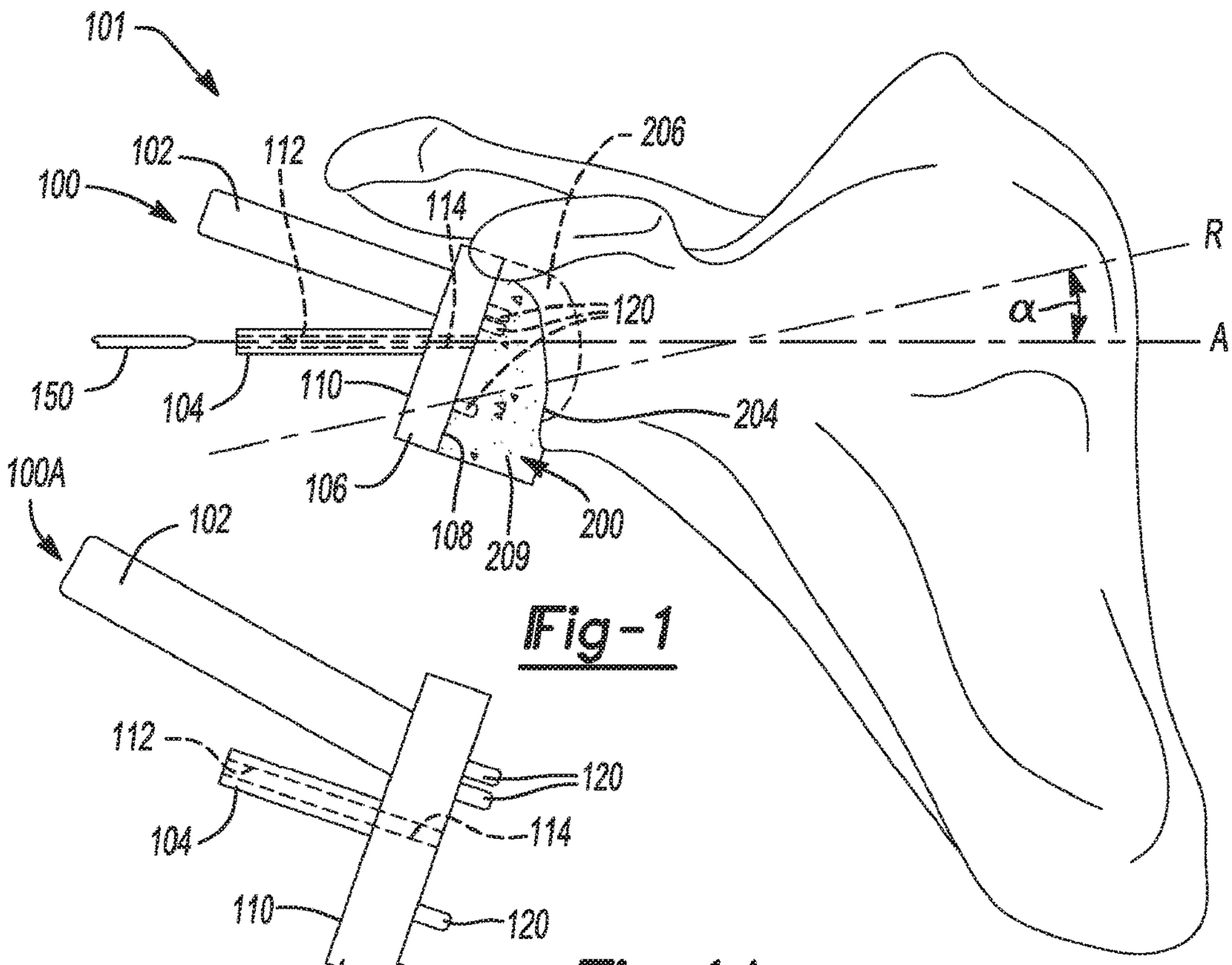


Fig-1

Fig-1A

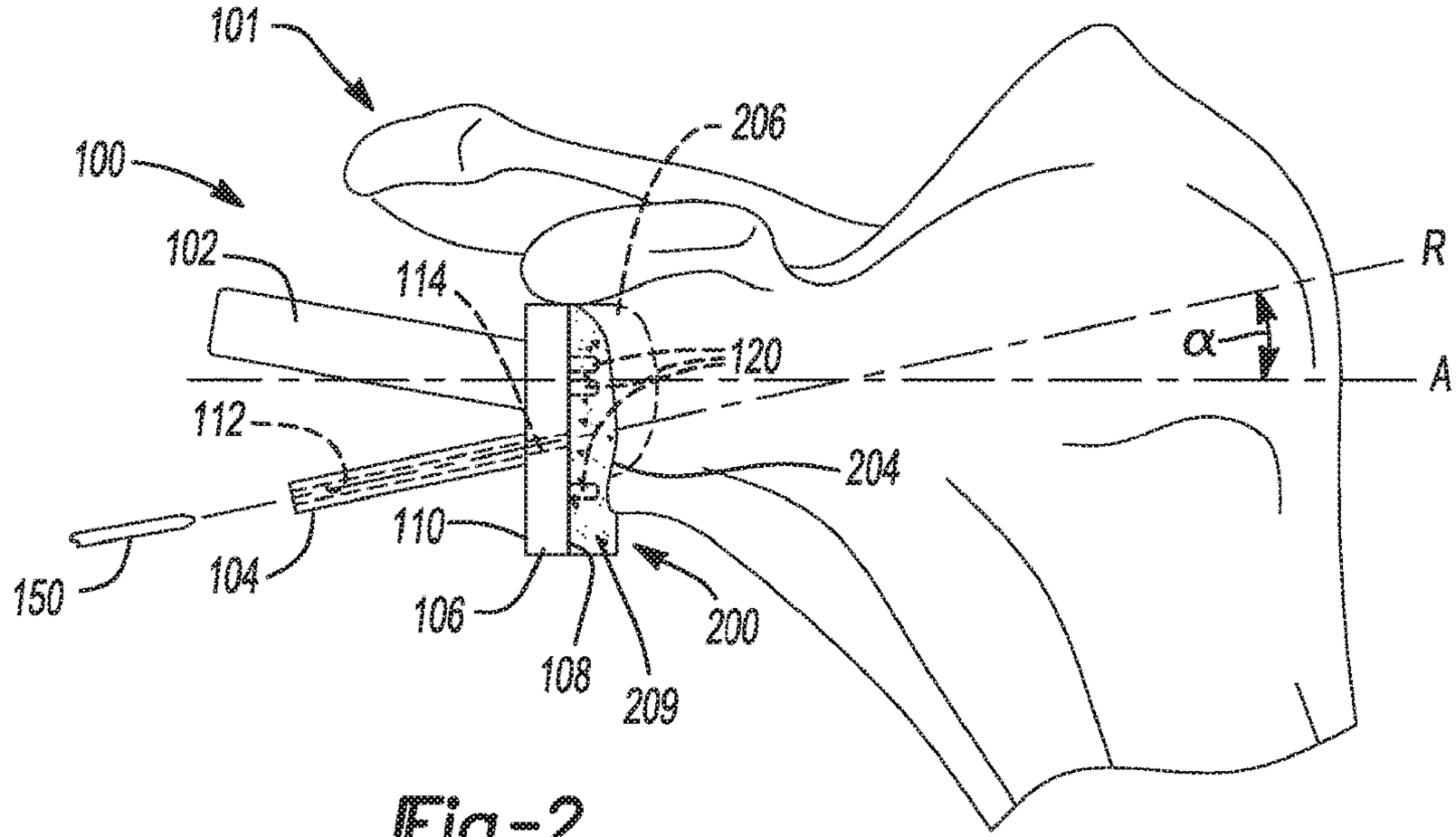


Fig-2

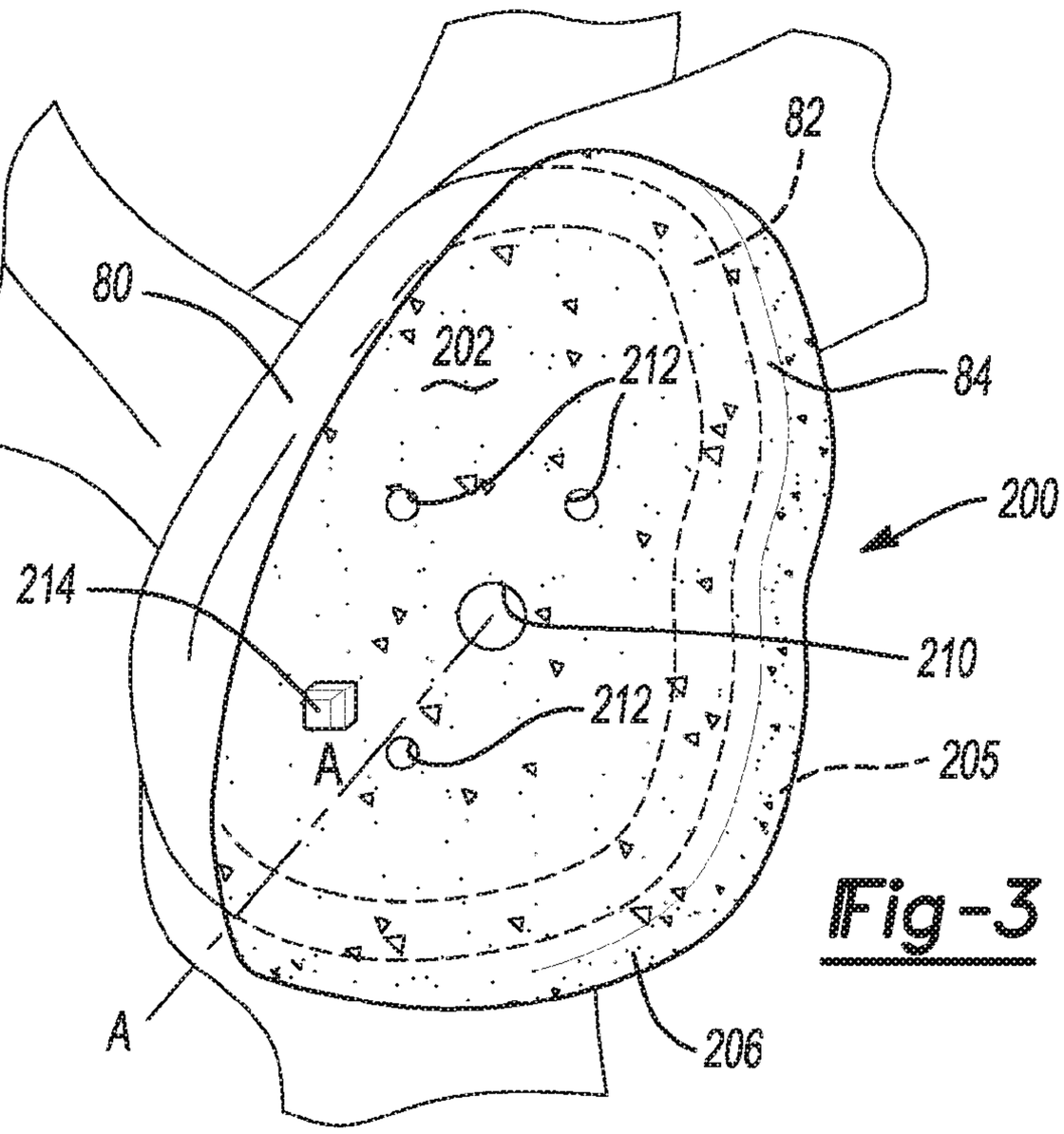

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Fig-3

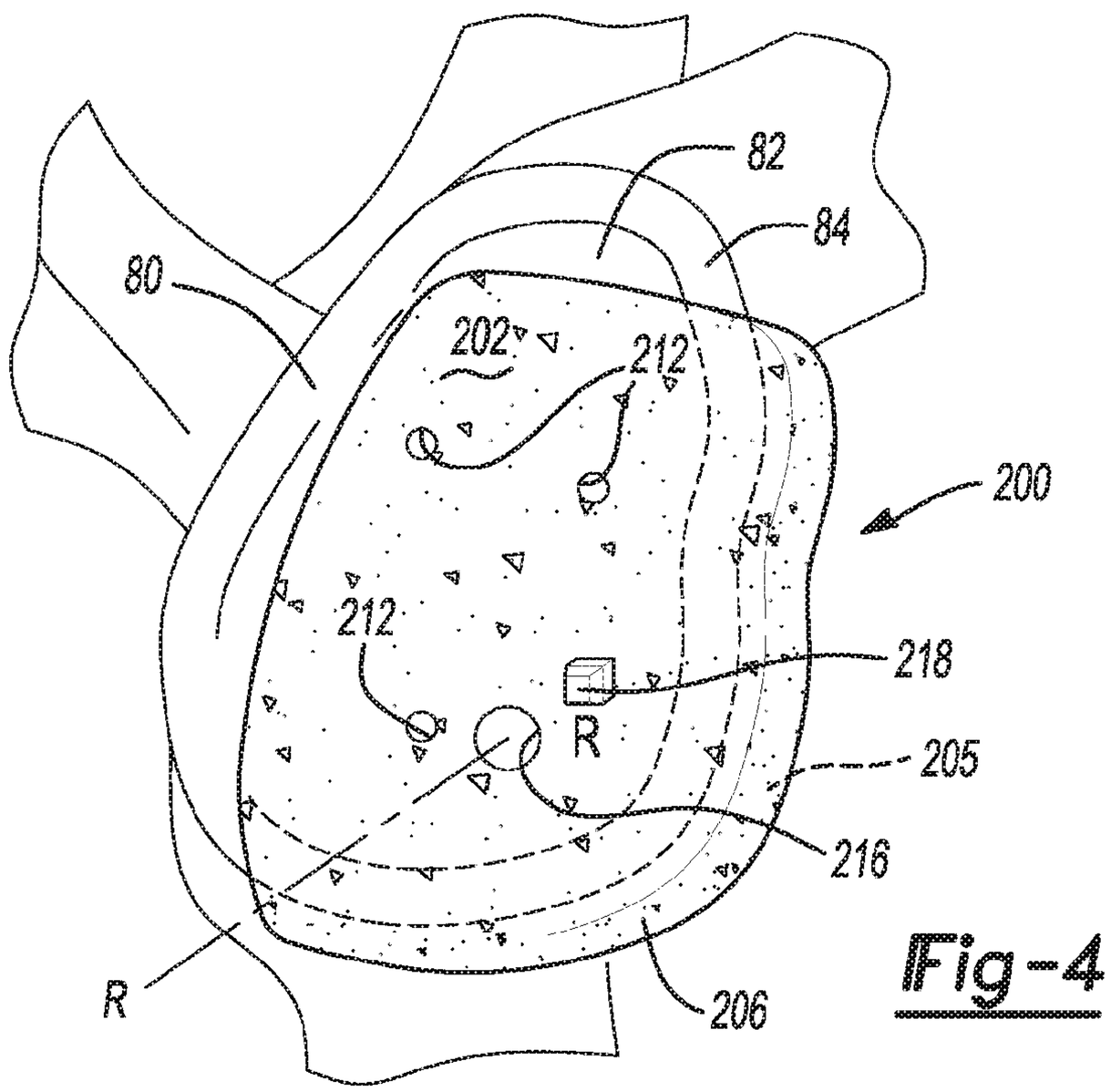

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Fig-4

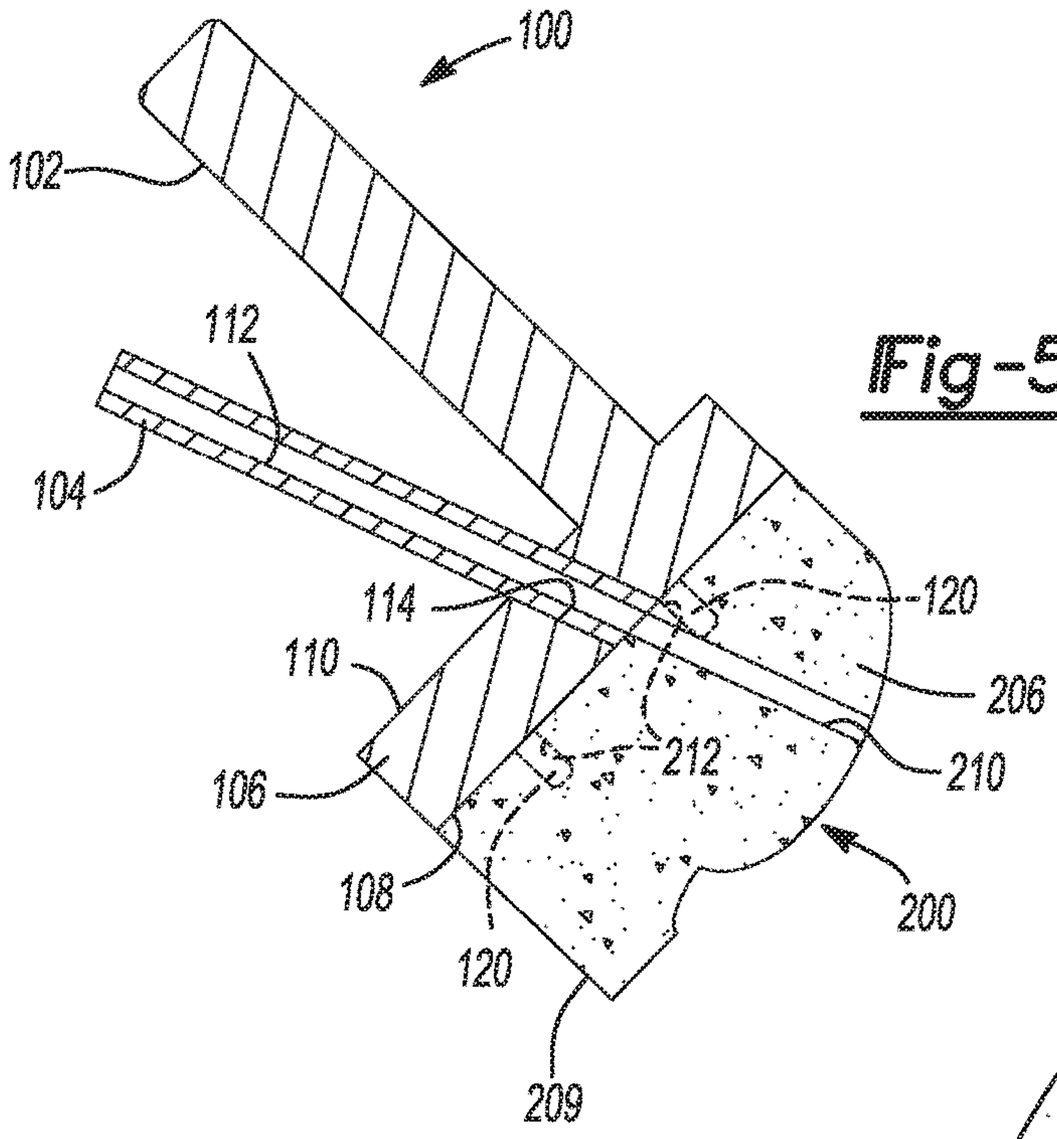


Fig-5

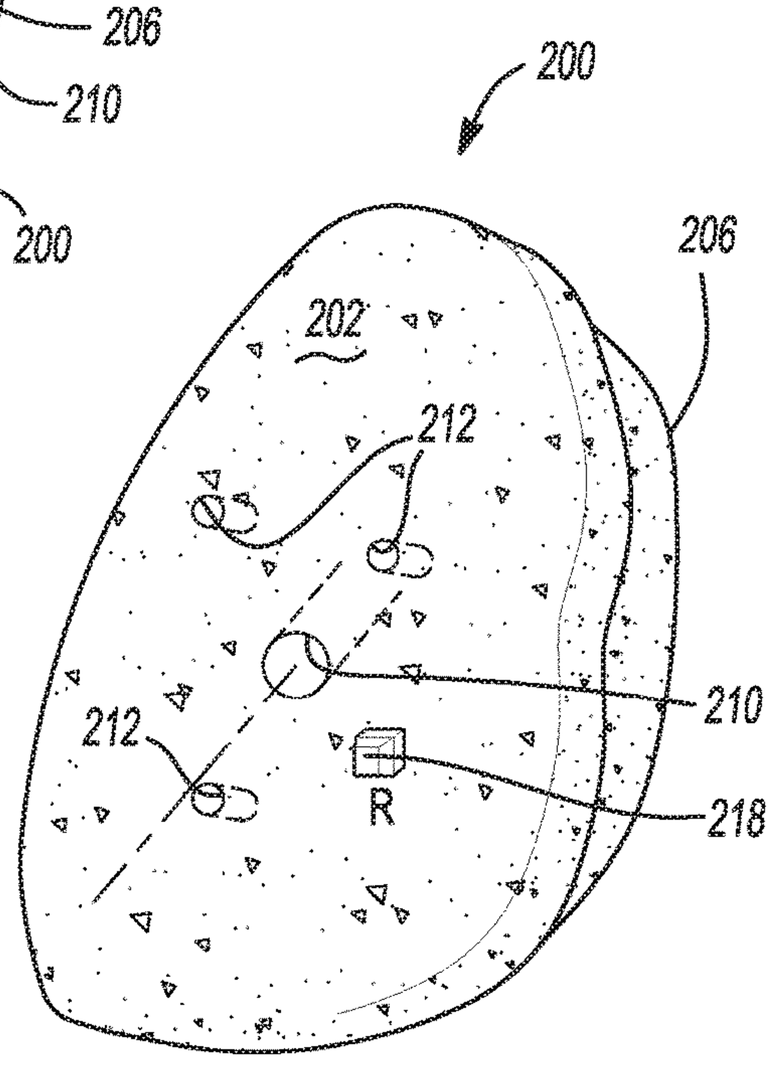


Fig-6

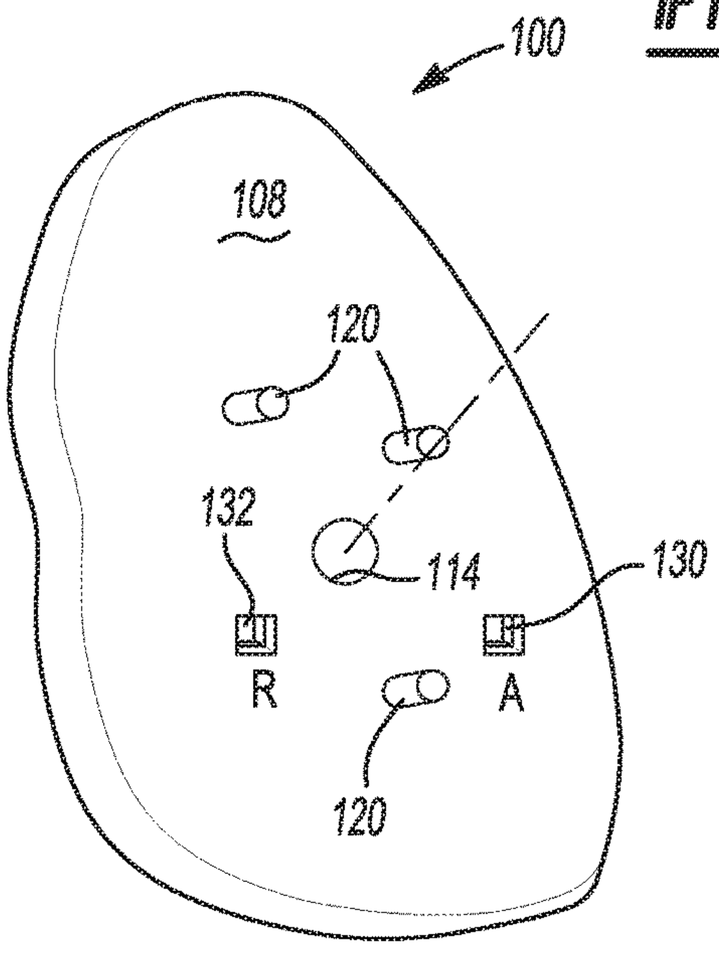


Fig-7

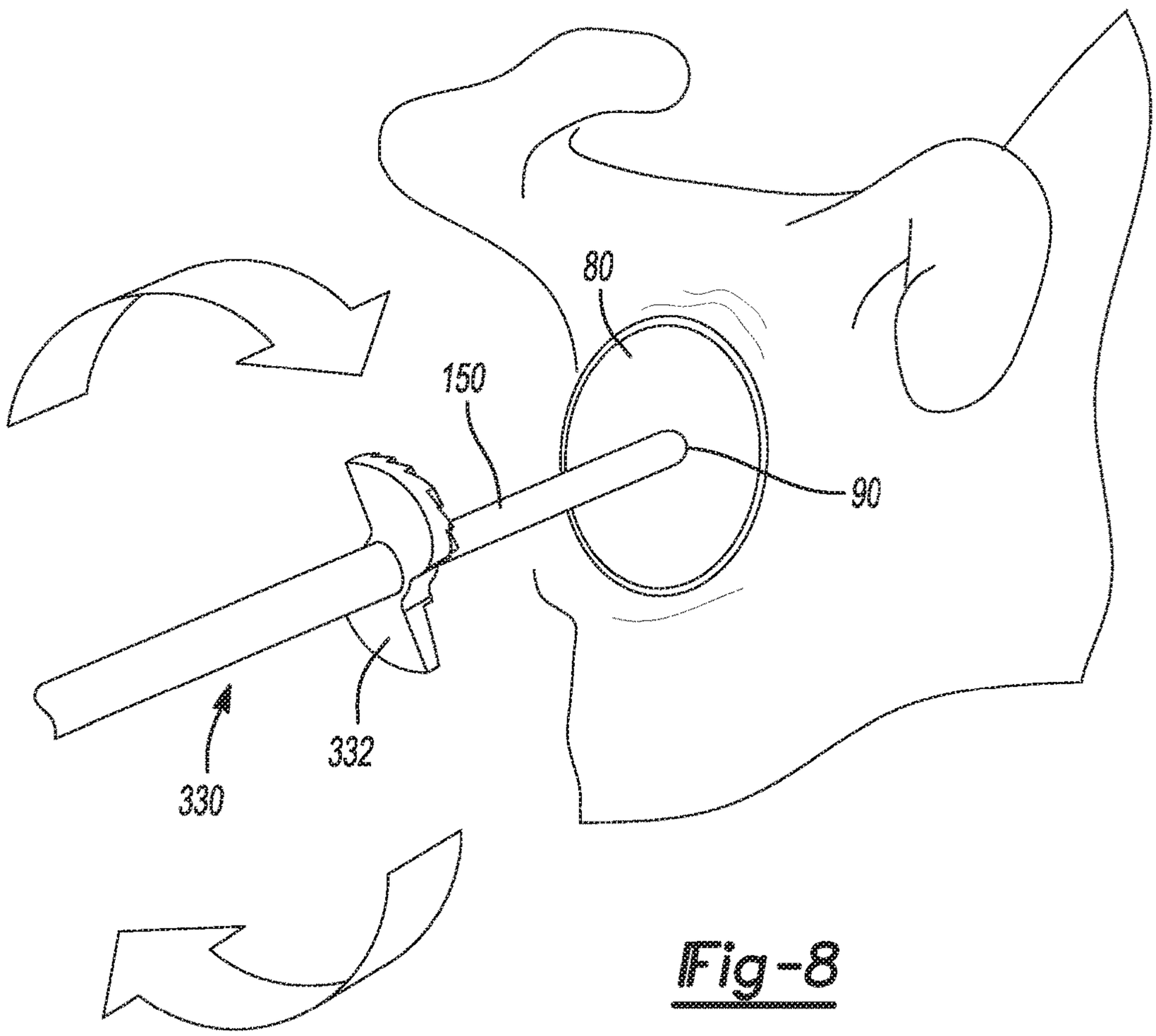


Fig-8

PATIENT-SPECIFIC GLENOID GUIDE WITH A REUSABLE GUIDE HOLDER

INTRODUCTION

In shoulder arthroplasty various guides and instruments are used to determine an alignment axis and guide an implant for anatomic or reverse shoulder arthroplasty. The present teachings provide various patient-specific and reusable guide instruments for use in shoulder arthroplasty.

SUMMARY

The present teachings provide a glenoid device that includes a non-custom guide holder and a patient-specific glenoid guide for anatomic and/or reverse shoulder arthroplasty.

The present teachings provide a glenoid device for preparing a shoulder joint of a patient includes a reusable guide holder having a body between an upper surface and a lower surface and a bore passing through the body of the guide holder. The glenoid device also includes a patient-specific glenoid guide having a body with an upper and lower surface. The lower surface of the patient-specific glenoid guide is configured as a negative surface of a glenoid face based on preoperative image scans of the shoulder joint of the patient. The upper face of the patient-specific glenoid guide is configured to be coupled and contact the lower face of the guide holder, such that the bore of the guide holder is aligned along a patient-specific bore through the body of the patient-specific glenoid guide and along a corresponding alignment axis of the patient-specific glenoid guide.

The present teachings also provide a method of preparing a shoulder joint of a patient for arthroplasty. The method includes attaching a reusable non-custom guide holder to a patient-specific glenoid guide. The patient-specific glenoid guide has a patient-specific lower surface configured to nestingly mate and conform to a corresponding surface of a glenoid face of the patient based on a three-dimensional image of a shoulder joint of the patient reconstructed preoperatively from image scans of the shoulder joint of the patient. The patient-specific lower surface is mated to the glenoid face. A guiding pin is passed through a bore of the guide holder and through a bore of the patient-specific glenoid guide along a patient-specific alignment orientation of the shoulder joint of the patient. The guiding pin is inserted into the glenoid face. The guide holder and the patient-specific glenoid guide are removed without removing the guiding pin. The guiding pin can be used to prepare the shoulder joint for arthroplasty.

Further areas of applicability of the present teachings will become apparent from the description provided hereinafter. It should be understood that the description and specific examples are intended for purposes of illustration only and are not intended to limit the scope of the present teachings.

BRIEF DESCRIPTION OF THE DRAWINGS

The present teachings will become more fully understood from the detailed description and the accompanying drawings.

FIG. **1** is an environmental view of a reusable holder and a patient-specific glenoid guide shown in use for anatomic shoulder arthroplasty according to the present teachings;

FIG. **1A** is a side view of an alternative reusable guide holder;

FIG. **2** is an environmental view of reusable holder and a patient-specific glenoid guide shown in use for reverse shoulder arthroplasty according to the present teachings;

FIG. **3** is perspective top environmental view of the patient-specific glenoid guide of FIG. **1**;

FIG. **4** is perspective top environmental view of the patient-specific glenoid guide of FIG. **2**;

FIG. **5** is a sectional view of the reusable guide holder and a patient-specific glenoid guide of FIG. **1**;

FIG. **6** is a perspective top view of the patient-specific glenoid guide of FIG. **5**;

FIG. **7** is a perspective bottom view of the reusable guide holder of FIG. **5**; and

FIG. **8** is an environmental view illustrating a guiding pin used during reaming in shoulder arthroplasty.

Corresponding reference numerals indicate corresponding parts throughout the several views of the drawings

DETAILED DESCRIPTION

The following description is merely exemplary in nature and is in no way intended to limit the present teachings, applications, or uses.

The present teachings generally provide a glenoid device that includes a reusable guide holder and a patient-specific alignment guide for use in shoulder joint replacement, shoulder resurfacing procedures and other procedures related to the shoulder joint or the various bones of the shoulder joint, including the glenoid face or cavity of the scapula, the humeral head and adjacent shoulder bones. The present teachings can be applied to anatomic shoulder replacement and reverse shoulder replacement. The reusable guide holder is not patient-specific. The patient-specific guide can be used either with conventional implant components or with patient-specific implant components and/or bone grafts that are prepared using computer-assisted image methods according to the present teachings. Computer modeling for obtaining three-dimensional images of the patient's anatomy using medical scans of the patient's anatomy (such as MRI, CT, ultrasound, X-rays, PET, etc.), any patient-specific prosthesis components and the patient-specific guides can be prepared using various commercially available CAD programs and/or software available, for example, by Object Research Systems or ORS, Montreal, Canada.

The patient-specific guide (and any associated patient-specific implants and bone grafts, when used) can be generally designed and manufactured based on computer modeling of the patient's 3-D anatomic image generated from medical image scans including, for example, X-rays, MRI, CT, PET, ultrasound or other medical scans. The patient-specific guide can have a three-dimensional engagement surface that is complementary and made to substantially mate and match in only one position (i.e., as a substantially negative or mirror or inverse surface) with a three-dimensional bone surface with or without associated soft tissues, which is reconstructed as a 3-D image via the aforementioned CAD or software. Very small irregularities need not be incorporated in the three-dimensional engagement surface. The patient-specific guide can include a custom-made guiding bore in an orientation selected to be aligned along the anatomic or reverse shoulder arthroplasty axis for the specific patient according to the preoperative surgical plan for the specific patient.

The three-dimensional geometry, shape and orientation of the various features of the patient-specific guide, as well as various patient-specific implants and bone grafts, if used, can be determined during the pre-operative planning stage of

the procedure in connection with the computer-assisted modeling of the patient's anatomy. During the pre-operative planning stage, patient-specific instruments, custom, semi-custom or non-custom implants and other non-custom tools, can be selected and the patient-specific components can be manufactured for a specific-patient with input from a surgeon or other professional associated with the surgical procedure.

In the following discussion, the terms "patient-specific", "custom-made" or "customized" are defined to apply to components, including tools such as alignment or drilling guides, implants, portions or combinations thereof, which include certain geometric features, including surfaces, curves, or other lines, and which are made to closely or nestingly conform and mate substantially as mirror-images or negatives or complementary surfaces of corresponding geometric features or anatomic landmarks of a patient's anatomy obtained or gathered during a pre-operative planning stage based on 3-D computer images of the corresponding anatomy reconstructed from image scans of the patient by computer imaging methods. Further, patient-specific guiding features, such as, guiding bores or other holes or openings that are included in patient-specific guides are defined as features that are made to have positions, orientations, dimensions, and axes specific to the particular patient's anatomy including various anatomic or reverse alignment axes based on the computer-assisted pre-operative plan associated with the patient.

The patient-specific guides can be configured to mate in alignment with natural anatomic landmarks by orienting and placing the corresponding alignment guide intra-operatively on top of the bone (with or without associated soft tissue at the discretion of the surgeon) to mate with corresponding landmarks. The anatomic landmarks function as passive fiducial identifiers or fiducial markers for positioning of the various alignment guides, drill guides or other patient-specific instruments.

The patient-specific guides can be made of any biocompatible material, including, polymer, ceramic, metal or combinations thereof. The patient-specific alignment guides can be disposable and can be combined or used with reusable and non patient-specific drilling, cutting, reaming and guiding components. The reusable guide holder can be made of metallic or polymeric materials that provide adequate rigidity for holding the patient-specific guide and guiding a drill. The reusable guide holder can be removable attached to an upper surface of the patient-specific guide such that an alignment pin or a drilling bit can be inserted through the guide holder and through the patient-specific guide along a patient-specific trajectory that corresponds to an anatomic or reverse alignment axis for the specific patient, as discussed below.

More specifically, the present teachings provide a reusable guide holder and a patient-specific glenoid guide that are used co-operatively for anatomic and reverse arthroplasty. The patient-specific glenoid guide of the present teachings can have a patient-specific engagement surface that references various portions of the shoulder joint and includes a patient-specific bore. The glenoid guide has a three-dimensional shape configured to align the guide holder to accurately position a guide wire or pin for later glenoid preparation and implantation procedures and for alignment purposes, including implant position control, implant version control, and implant inclination control for both anatomic and reverse arthroplasty.

In the following, when a portion of a glenoid guide is described as "referencing" a portion of the anatomy, it will be understood that the referencing portion of the glenoid guide is a patient-specific portion that mirrors or is a negative of the corresponding referenced anatomic portion.

In some embodiments, the glenoid guide can reference (substantially as a negative of) the face of the glenoid or glenoid cavity, avoiding the glenoid rim and any portion of the labrum. In other embodiments, the glenoid guide can reference (substantially as a negative of) the face of the glenoid and a portion of the glenoid rim. The glenoid guide can be designed to only remove a portion of the labrum (from 2-5 o'clock, for example) or the entire labrum. When the glenoid guide is designed to sit directly on bone rather than soft tissue, then the labrum is removed. In other embodiments, the glenoid guide can reference the labrum itself, such as when MRI scans are used to reconstruct details of the geometry of the soft tissue and the glenoid guide is designed references off soft tissue. In other embodiments, the glenoid guide can reference the glenoid face and a portion of the coracoid process or coracoid attachment or other bone surface that extends off the upper aspect of the glenoid.

A glenoid device **101** according to the present teachings is illustrated in use for anatomic shoulder arthroplasty of the glenoid of a scapula of a patient in FIG. **1** and for reverse shoulder arthroplasty in FIG. **2**. The glenoid device **101** includes a reusable guide holder **100** and a patient-specific glenoid guide **200**. The patient-specific glenoid guide **200** is constructed preoperatively, such as by milling a generic block, from medical image scans of the specific patient, as discussed above, and for the specific surgical procedure, anatomic or reverse shoulder arthroplasty.

Referring to FIGS. **3** and **4**, the patient-specific glenoid guide **200** has a three-dimensional patient-specific body **209** extending between an upper (or outer) surface **202** and a lower (or inner) or anatomy-engaging and patient-specific surface **204** that references (substantially as a negative or inverse or mirror) the glenoid face **80** and may include all or a portion of the labrum **82**, i.e., the peripheral cartilaginous structure that encircles and deepens the glenoid face **80**. Alternatively, the labrum **82** can be completely removed such that the patient-specific glenoid surface **204** references and mirrors only a portion of the bone surface of the glenoid cavity or glenoid face **80**. Optionally, the glenoid guide **200** can include a peripheral portion or peripheral lip **206** with a corresponding patient-specific peripheral surface **205** that engages a corresponding peripheral surface or glenoid rim **84** around the scapula of the patient.

The patient-specific glenoid guide **200** is configured to guide a guiding pin (such as the guiding pin **150** shown in FIGS. **1** and **2**) and provide an implant alignment orientation for anatomic or reverse shoulder arthroplasty according to the preoperatively surgical plan for the specific patient. In FIG. **3**, a patient-specific through bore **210** can extend from the upper surface **202** and through the patient-specific lower surface **204** of the glenoid guide **200** at a specific location and along an anatomic axis A that is determined and designed according to the pre-operative plan of the patient to define a patient-specific alignment axis and insertion point for a guiding pin **150** for anatomic shoulder arthroplasty. In FIG. **4**, a patient-specific through bore **216** can extend from the upper surface **202** and through the lower surface **204** of the glenoid guide **200** at a specific location and along a reverse axis R that is determined and designed according to the pre-operative plan of the patient to define a patient-specific alignment axis and insertion point for a guiding pin **150** for reverse shoulder arthroplasty.

For the same patient, the reverse alignment axis R can have an inferior tilt a relative to the anatomic alignment axis A, such as, for example, a ten-degree inferior tilt a. The patient-specific bore **210** of FIG. **3** and the patient-specific bore **216** of FIG. **4** are prepared preoperatively in alignment to the corresponding anatomic and reverse alignment axes of the specific patient. Further, the three-dimensional geometry of the body **209**, including variable depth and shape, is designed preoperatively such that the upper surface **202** of the patient-specific glenoid guide **200** can engage and guide the reusable guide holder **100** for anatomic or reverse shoulder arthroplasty alignment, as discussed below.

Referring to FIGS. **1** and **1**A, the reusable guide holder **100** or **100**A has a plate-like or substantially flat body **106** with upper and lower flat surfaces **110**, **108** that are substantially parallel to one another. The overall shape of the body **106** can be oval approximating the shape of a typical glenoid surface. A handle shaft **102** is fixedly attached to and extends outward and away from the upper surface **110** at a 90-degree angle (FIG. **1**) or other angle (FIG. **1**A) relative to the upper surface **110**. An elongated tubular guiding element **104** having an inner bore **112** is fixedly attached to and extends from the upper surface **110** at an angle relative to the upper surface **110**. The bore **112** is collinear to a bore **114** through the body **106** such that a guiding pin **150** can be passed through the guide holder **100** and through the patient-specific glenoid guide **200** along the anatomic axis A, as shown in FIG. **1**, or through the reverse axis R as shown in FIG. **2**.

In other embodiments, the handle shaft **102** and the guide element **104** can be removably coupled to the body **106** for compact and easy packaging during transportation. The removable coupling can be a snap-fit, screw in or other removable attachment. It is noted that whether removably or fixedly attached to the body **106**, the handle shaft **102** and the tubular guiding element **104** have fixed, non-custom orientations relative to the upper surface **110** of the body **106** of the guide holder **100**.

The guide holder **100** also includes a plurality of short extensions, pegs or pins **120** that extend from the lower surface **108** of the guide holder **100** and can be received in corresponding mating bores or holes **212** preoperatively prepared through the upper surface **202** of the patient-specific glenoid guide **200** by a snap-fit or taper-to-taper or other type of quick connection. Three pins **120** and three corresponding holes **212** are shown in FIGS. **6** and **7**. It is noted that location of pins **120** and holes **212** can be reversed, such that the pins extend from the glenoid guide **200** and the holes are formed in the guide holder **100**. When the lower surface **108** of the guide holder **100** is placed in contact with the upper surface **202** of the patient-specific glenoid guide **200** such that the pins **120** are received in holes **212**, the tubular guiding element **104** is oriented along the corresponding anatomic alignment axis A or reverse alignment axis R of the corresponding anatomic or reverse patient-specific glenoid guide **200** as shown in FIGS. **1** and **2**. This is accomplished by taking into account the fixed (constant and non-custom) angle of the tubular guiding element **104** relative to the lower surface **108** (or upper surface **110**, when these surfaces are substantially parallel) and preoperatively preparing the orientation of the upper surface **202** of the patient-specific glenoid guide **200** such that the anatomic axis A or reverse axis R that are patient-specific have the same orientation relative to the upper surface **202** as the non-custom and fixed orientation of the tubular guiding element **104** relative to the contacting lower surface **108**.

The guide holder **100** and the patient-specific glenoid guide **200** can include corresponding markings indicating whether the patient-specific glenoid guide **200** is prepared for anatomic or reverse shoulder arthroplasty, facilitating easy identification and to avoid confusion. The markings can provide visual and keyed identification through the guide holder **100**. The guide holder **100** can include two windows, anatomic window **130** and reverse window **132**, correspondingly marked as A or anatomic and R or reverse, as illustrated in FIG. **7**. The upper surface **202** of the patient-specific glenoid guide **200** includes one boss **214** or **218**, as illustrated in FIG. **6**. Boss **214** is positioned and configured to mate with the anatomic window **130** and boss **218** is configured to mate with the reverse window **132**. By observing which of the two windows, anatomic **130** or reverse **132** receives a boss from the patient-specific glenoid guide **200**, the surgeon can immediately verify that the patient-specific glenoid guide **200** is planned for anatomic or reverse shoulder arthroplasty.

Referring to FIGS. **1** and **2**, with the guide holder **100** coupled to the patient-specific guide **200** and the patient-specific guide **200** registered and seated in a unique position on the glenoid of the specific patient, a guidewire or guiding pin **150** can be inserted through the tubular element **104** of the guide holder **100** and through the patient-specific guide **200** into the glenoid face **80** of the patient along the anatomic A or reverse R alignment axis depending on the pre-planned surgical procedure. Alternatively, a drill bit can be inserted through the tubular element **104** and a hole **90** drilled into the glenoid through the tubular element **104** for the guiding pin **150**. The guide holder **100** and the patient-specific guide **200** can then be removed without removing the guiding pin **150**. The guiding pin **150** can be used to guide a cannulated reamer **330** to ream the glenoid **80**, as shown in FIG. **8**, and also used for guiding an implant component along the patient-specific alignment direction A or R, correspondingly, for anatomic or reverse shoulder arthroplasty.

Generally, the patient-specific glenoid guide **200** of the present teachings references landmarks on the glenoid to orient the glenoid guide **200** in a predetermined orientation according to a preoperative plan for the specific patient. Landmarks can include, for example, the glenoid face **80** with or without any portion of the labrum, the coracoid process (or portions thereof or coracoid attachment), the glenoid rim and/or other landmarks of the scapula. The patient-specific glenoid guide **200** can be used to correctly orient a guide wire or guiding pin **150** along a patient-specific orientation that will be used in later glenoid preparation procedures in combination with a non-custom reusable guide holder **100**, as discussed above. The patient-specific orientation can be designed and configured into the patient-specific glenoid guide **200** during the preoperative planning stage for the patient for implant positioning, implant version control, and implant inclination control.

As described above, the patient-specific glenoid guide **200** can fit around or on the exposed glenoid rim and surface substantially as a negative of the corresponding anatomy of the patient. Additionally, the glenoid guide **200** can match or correct defects and imperfections in the specific patient's glenoid. The overall, three-dimensional shape and size of the patient-specific guide **200** and the orientation of the upper surface **202** relative to the patient-specific anatomic alignment axis A or reverse alignment axis R are preoperatively designed such that the patient-specific guide **200** can be coupled to the reusable guide holder **100** and orient the

tubular element **104** of the guide holder **100** along the corresponding anatomic alignment axis A or reverse alignment axis R.

The guide holder **100** and the patient-specific glenoid guide **200** can be included in any anatomic or reverse arthroplasty kit with corresponding implants and other instruments.

The foregoing description of the embodiments has been provided for purposes of illustration and description. It is not intended to be exhaustive or to limit the disclosure. Individual elements or features of a particular embodiment are generally not limited to that particular embodiment, but, where applicable, are interchangeable and can be used in a selected embodiment, even if not specifically shown or described. The same may also be varied in many ways. Such variations are not to be regarded as a departure from the disclosure, and all such modifications are intended to be included within the scope of the disclosure.

Example embodiments are provided so that this disclosure will be thorough, and will fully convey the scope to those who are skilled in the art. Numerous specific details are set forth such as examples of specific components, devices, and methods, to provide a thorough understanding of embodiments of the present disclosure. It will be apparent to those skilled in the art that specific details need not be employed, that example embodiments may be embodied in many different forms and that neither should be construed to limit the scope of the disclosure. In some example embodiments, well-known processes, well-known device structures, and well-known technologies are not described in detail.

What is claimed is:

1. A glenoid device for preparing a shoulder joint of a patient comprising:

a reusable guide holder comprising a handle shaft, the handle shaft comprising an elongate projection defining a major axis extending along a largest dimension of the handle shaft, the elongate projection configured to extend perpendicularly away from the glenoid face of the shoulder joint when the glenoid device is engaged with a glenoid face of the shoulder joint; and

a patient-specific glenoid guide having a body releasably couplable to the reusable guide holder, the body defining a patient-specific surface configured to nestingly mate and conform to a corresponding portion of a surface of the glenoid face of the patient based on an image of the shoulder joint of the patient as reconstructed preoperatively from a medical image of the shoulder joint of the patient, wherein the handle shaft is releasably couplable to the patient-specific glenoid guide body on an opposite side of the body as the patient-specific surface; and

a tubular element releasably connected to the body on the opposite side of the body as the patient-specific surface, the tubular element defining a bore having a patient-specific orientation aligned along an anatomic or reverse alignment axis of the patient determined according to a pre-operative plan of the patient.

2. The glenoid device of claim **1**, wherein the alignment axis corresponds to the reverse anatomic axis of the shoulder joint that extends at an oblique angle to the anatomic alignment axis of the patient.

3. The glenoid device of claim **1**, wherein the reusable guide holder further comprises a resusable guide holder body connecting the tubular element and the handle shaft to the body.

4. The glenoid device of claim **1**, wherein the handle shaft is screwed into the patient-specific glenoid guide.

5. The glenoid device of claim **1**, wherein the tubular element is separable from the patient-specific glenoid guide.

6. The glenoid device of claim **1**, wherein the major axis of the handle shaft is offset from a major axis of the tubular element.

7. The glenoid device of claim **1**, wherein the patient-specific surface includes portions configured to mate with a plurality of anatomic landmarks on the glenoid.

8. The glenoid device of claim **7**, wherein the patient-specific surface is configured to mate with at least a portion of a rim of the glenoid.

9. The glenoid device of claim **8**, wherein the patient-specific glenoid guide includes a lip adjacent the patient-specific surface for engaging the rim.

10. The glenoid device of claim **7**, further comprising a non-tubular window extending into the body of the patient-specific glenoid guide separate from the handle shaft and the tubular element and between anatomic landmarks.

11. A glenoid device for preparing a shoulder joint of a patient comprising:

a patient-specific glenoid guide having a patient-specific surface configured to nestingly mate and conform to a corresponding surface of an anatomic landmark of a glenoid of a patient and a back surface spaced from the patient-specific surface on an opposite side of the patient-specific glenoid guide, the patient-specific surface shaped based on a three-dimensional model of a shoulder joint of the patient as reconstructed from preoperative imaging of the shoulder joint of the patient;

wherein the patient-specific glenoid guide defines a bore extending from the back surface to the patient-specific surface, the bore having a patient-specific orientation relative to the patient-specific surface so that the bore is aligned along an alignment axis of the shoulder joint of the patient determined according to a pre-operative plan of the patient according to an anatomic axis or a reverse axis for the patient; and

an elongate reusable tubular element releasably connectable to the back surface of the patient-specific glenoid guide at the bore, the elongate reusable tubular element being elongated in a direction extending away from the patient-specific surface, such that the elongate reusable tubular element is longer in the direction extending generally away from the patient-specific surface than in a direction extending generally parallel to the patient-specific surface.

12. The glenoid device of claim **11**, wherein the alignment axis corresponds to an anatomic or reverse axis of the shoulder joint.

13. The glenoid device of claim **11**, further comprising a handle shaft extending from the patient-specific glenoid guide.

14. The glenoid device of claim **13**, wherein the handle shaft can be screwed to and unscrewed from the patient-specific glenoid guide on a side of the patient-specific glenoid guide opposite the patient-specific surface.

15. The glenoid device of claim **14**, wherein a major axis of the handle shaft is offset from a major axis of the bore.

16. The glenoid device of claim **11**, wherein the patient-specific surface is configured to mate with at least a portion of a rim of the glenoid.

17. The glenoid device of claim **16**, wherein the patient-specific glenoid guide includes a lip for engaging the rim.

18. A glenoid device comprising:

a patient-specific glenoid guide having surfaces located around a periphery of the glenoid device for referenc-

ing a plurality of landmarks on a glenoid to orient the glenoid guide in a predetermined orientation according to a preoperative plan for a specific patient, wherein the plurality of landmarks are located along a rim of the glenoid;

a patient-specific alignment bore extending through a portion of the patient-specific glenoid guide central to the surfaces located around the periphery of the glenoid device configured to reference the plurality of landmarks that are located along the rim of the glenoid; and

a reusable tubular element having a central passage, the reusable tubular element separably connected to the patient-specific glenoid guide at the patient-specific alignment bore such that the central passage and the patient-specific alignment bore extend consecutively along an alignment axis that defines an axis for performing an anatomic shoulder arthroplasty or a reverse shoulder arthroplasty according to the preoperative plan for the specific patient.

19. The glenoid device of claim **18**, further comprising an axially extending handle device releasably coupled to the patient-specific glenoid guide axially offset from an axis of the tubular element.

20. The glenoid device of claim **18**, wherein the patient-specific glenoid guide further comprises:

a patient-specific inner surface configured to nestingly mate and conform to the plurality of landmarks on the glenoid; and

an upper surface opposite the patient-specific inner surface.

21. The glenoid device of claim **19**, wherein the handle device includes a handle shaft having a screw-type connection at a distal end thereof.

22. The glenoid device of claim **18**, wherein the patient-specific glenoid guide further comprises a lip for engaging the rim.

23. The glenoid device of claim **20**, wherein the patient-specific glenoid guide further comprises rectilinear windows extending into the patient-specific glenoid guide from the upper surface toward the patient-specific inner surface between landmarks of the plurality of landmarks.

24. The glenoid device of claim **20**, wherein the handle device includes a portion that is inserted into an orifice in the upper surface of the patient-specific glenoid guide opposite the patient-specific inner surface to couple the handle device to the patient-specific glenoid guide.

25. The glenoid device of claim **1**, wherein the handle shaft of the reusable guide holder is fabricated from a metallic material and the body of the patient-specific glenoid guide is fabricated from a polymeric material, the body being disposable.

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