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(54) **MULTI-COMPONENT IMPLANT ASSEMBLY WITH DUAL ARTICULATING AND/OR ROTATING SURFACES**

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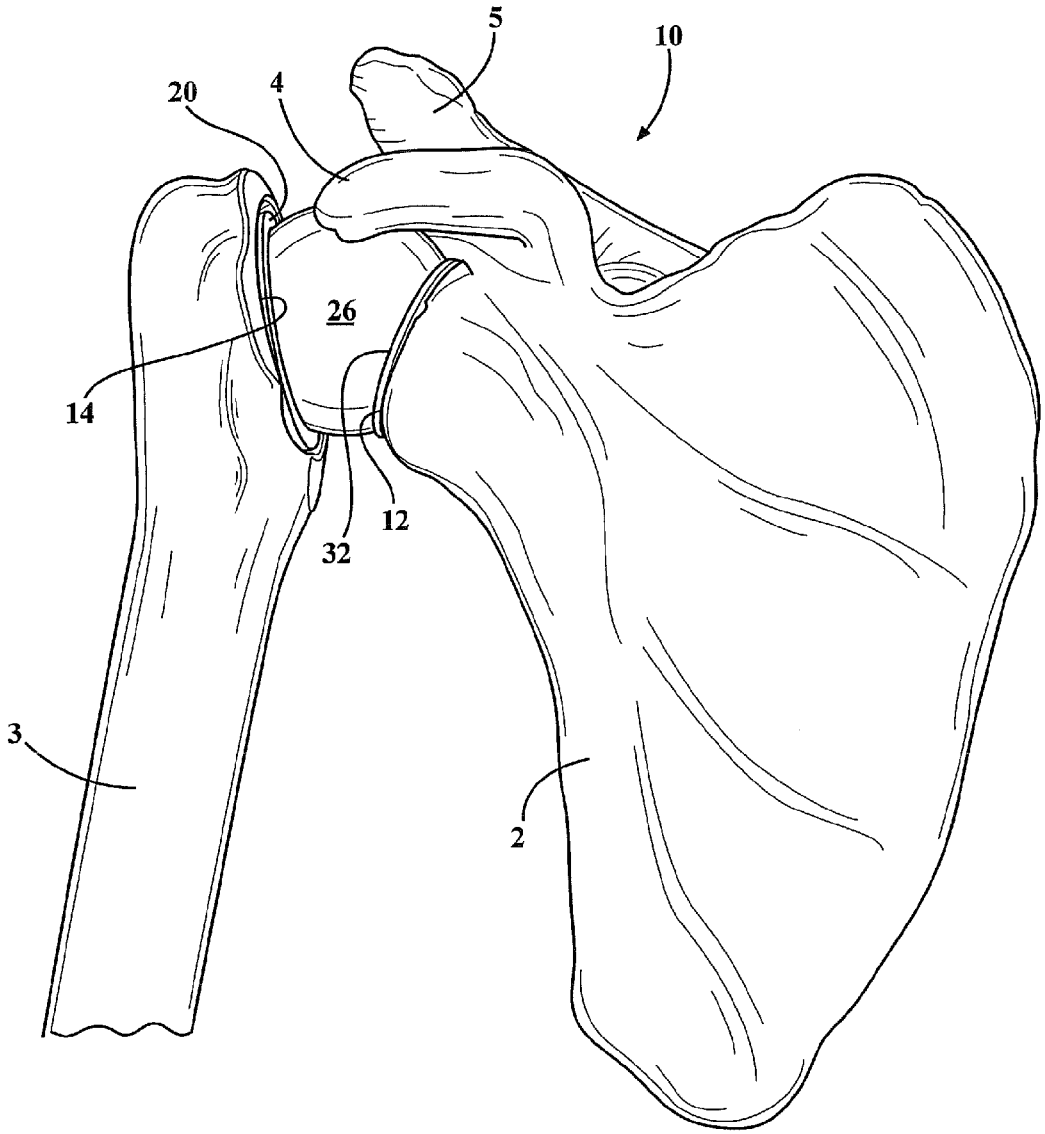
(57) **ABSTRACT**

An implant assembly for re-establishing a glenohumeral joint between a scapula and humerus. A first receiver is adapted to being mounted to a reconditioned glenoid cavity defined in the scapula, with a second receiver adapted to being mounted to a reconditioned humeral head associated with the humerus. A three dimensional and at least partially spherical shaped element is interposed between the first and second receivers for establishing at least one of articulating and rotating support at respective and spaced apart seating profiles.



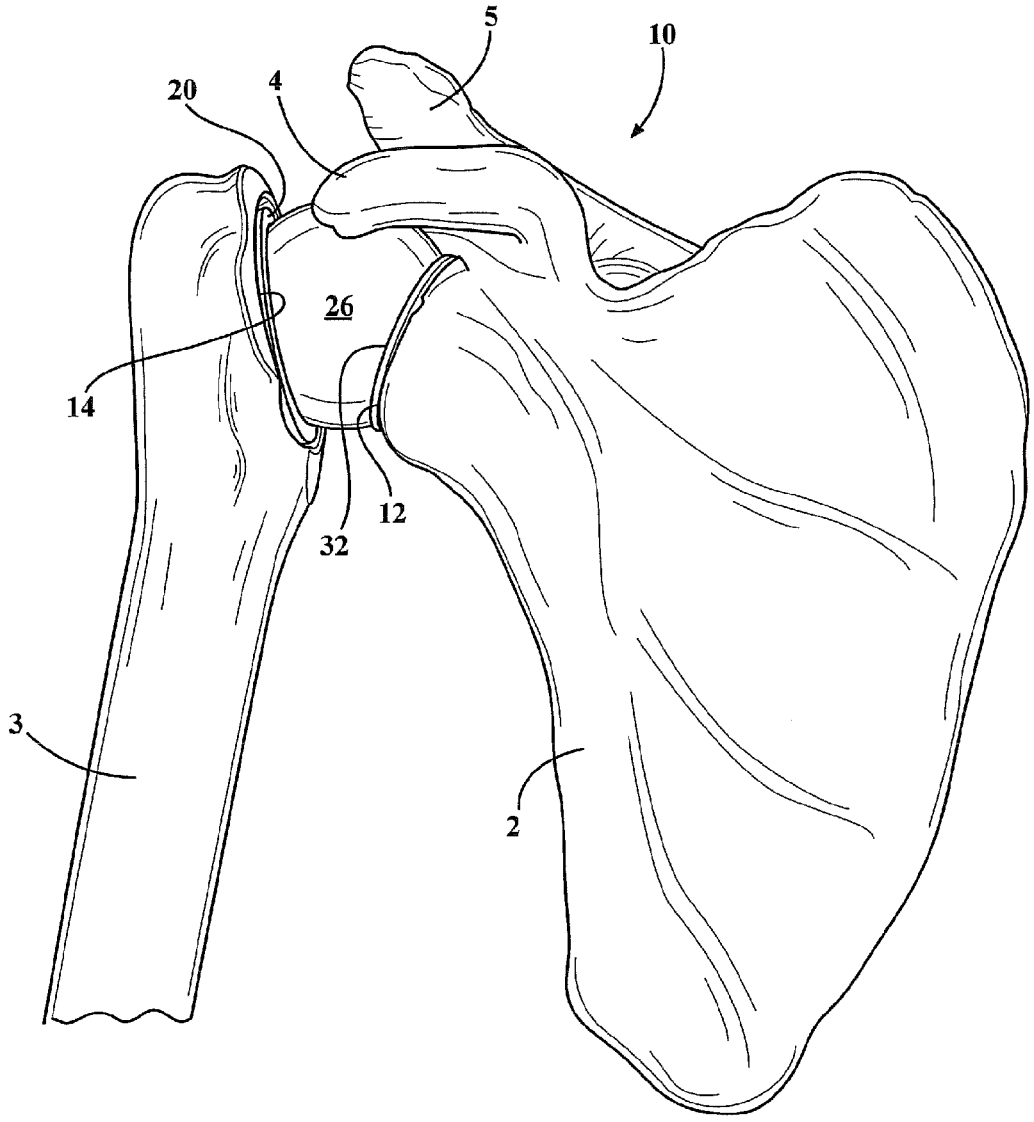


FIG. 1

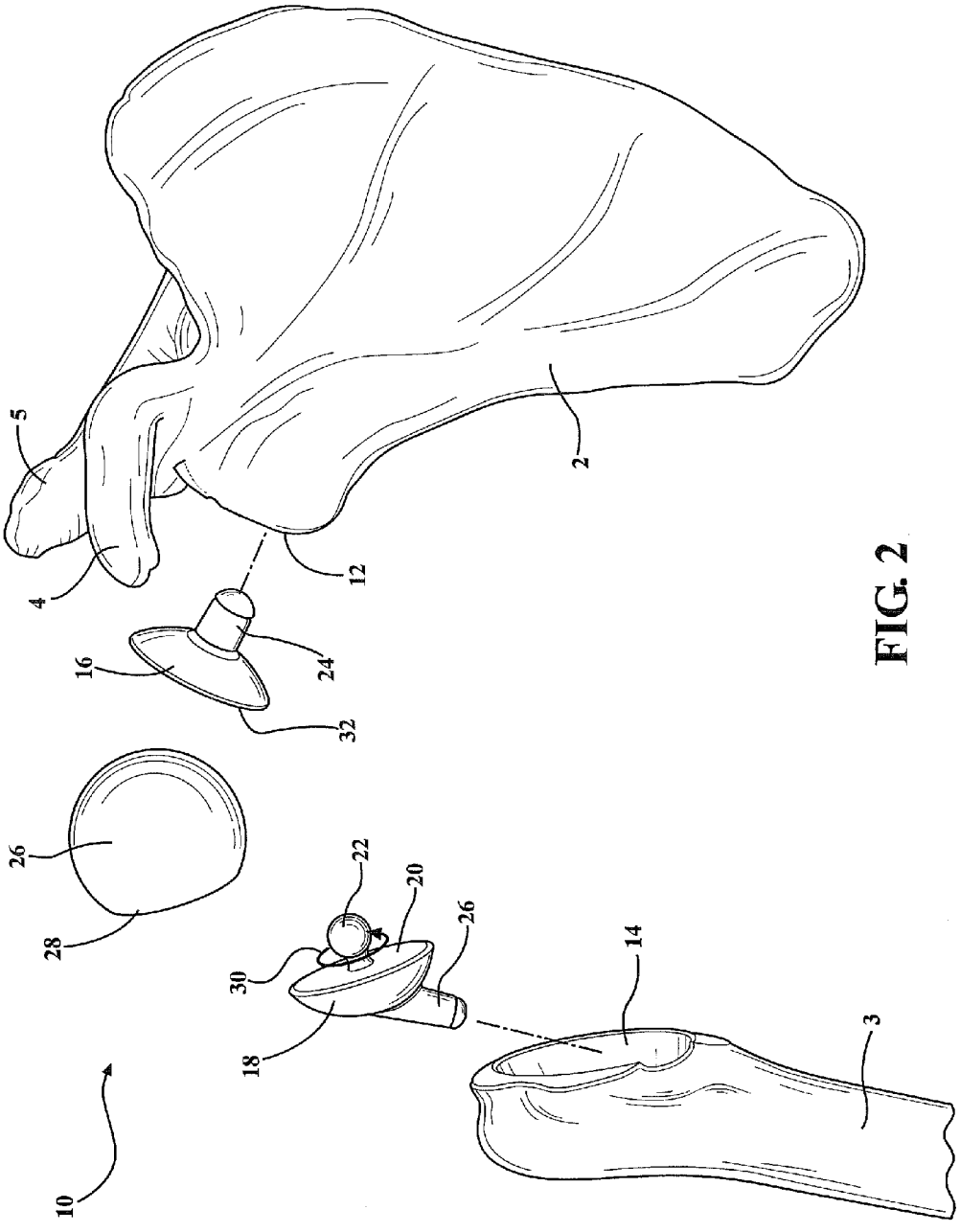


FIG. 2

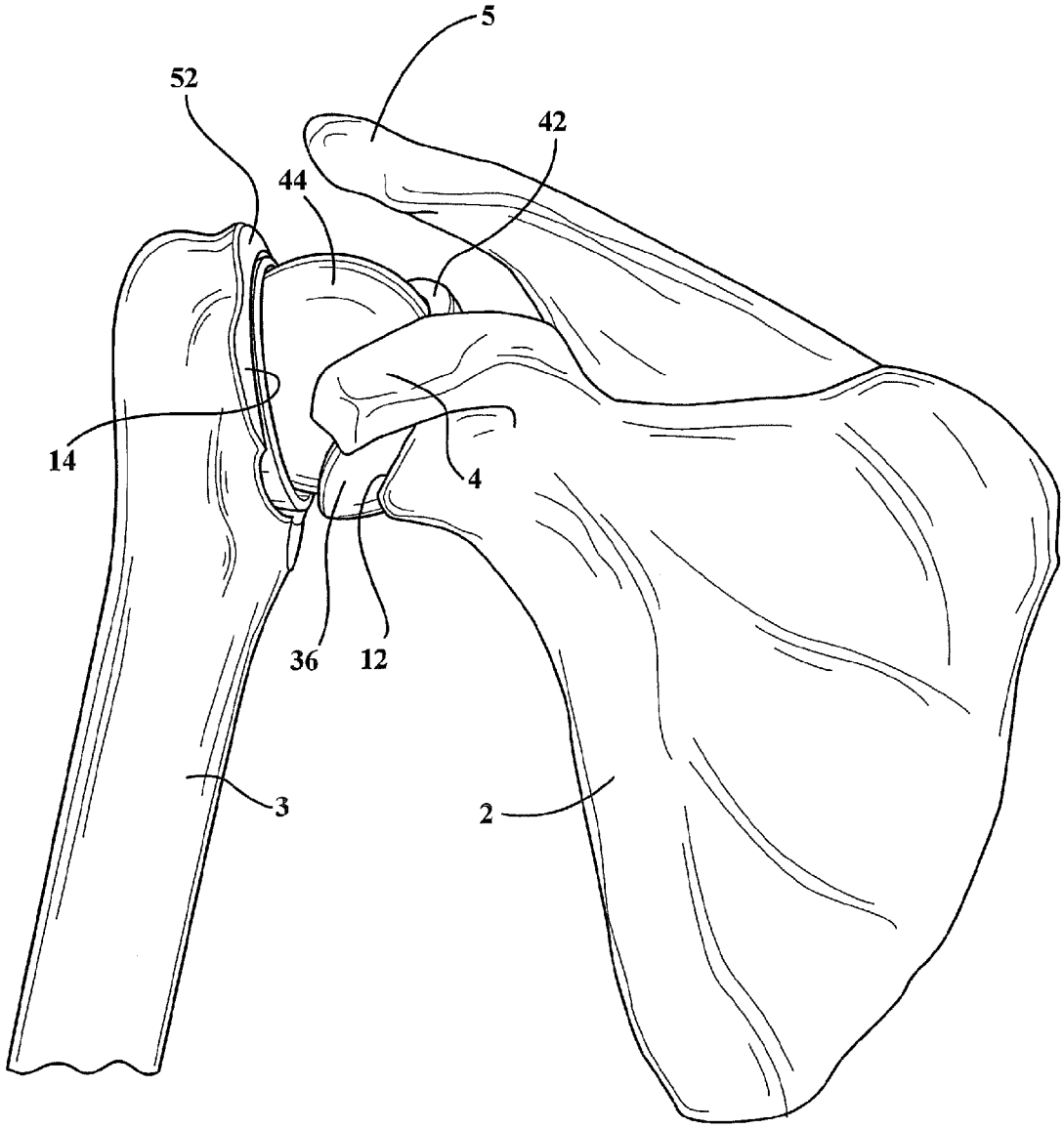
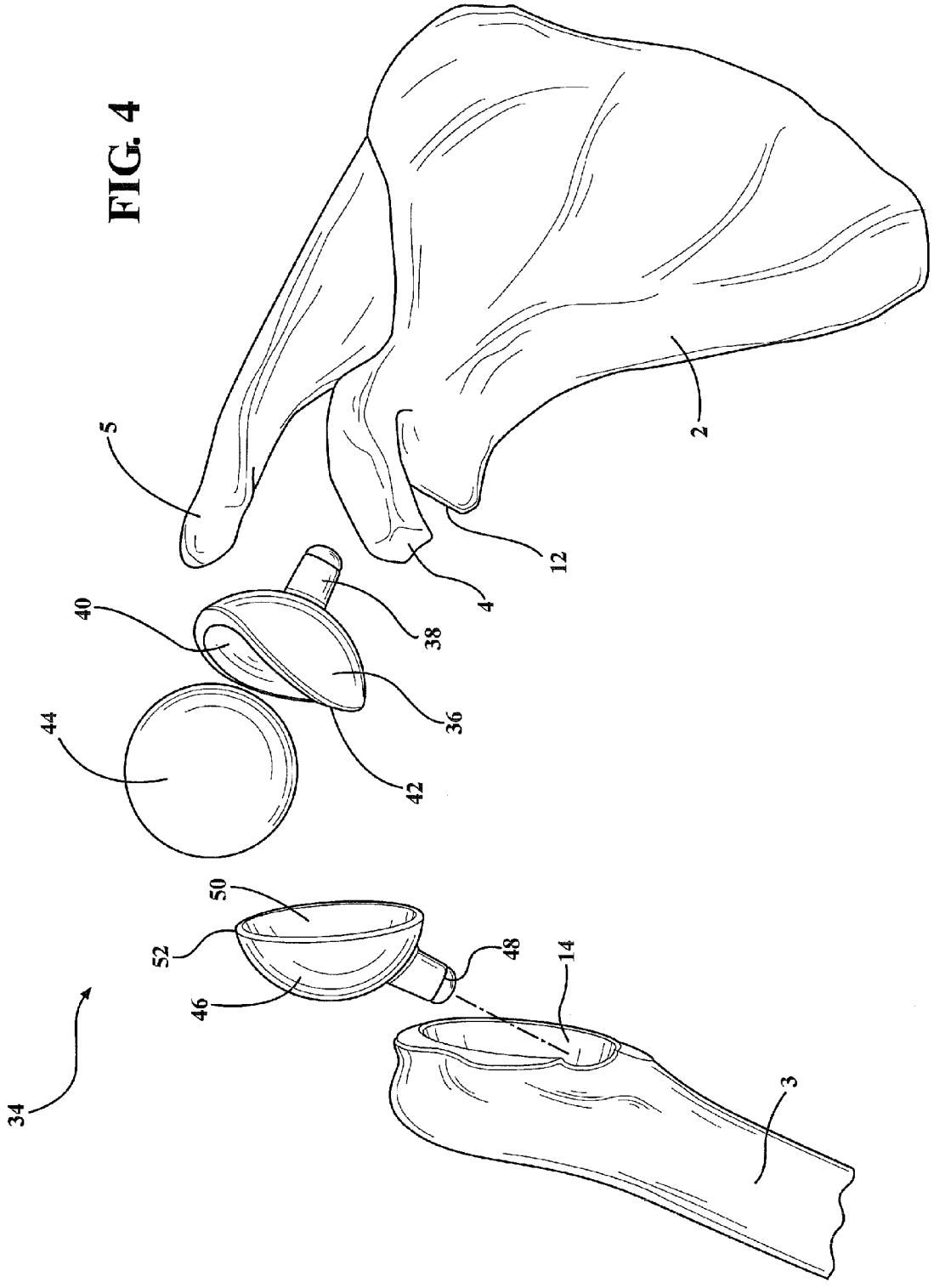


FIG. 3

FIG. 4



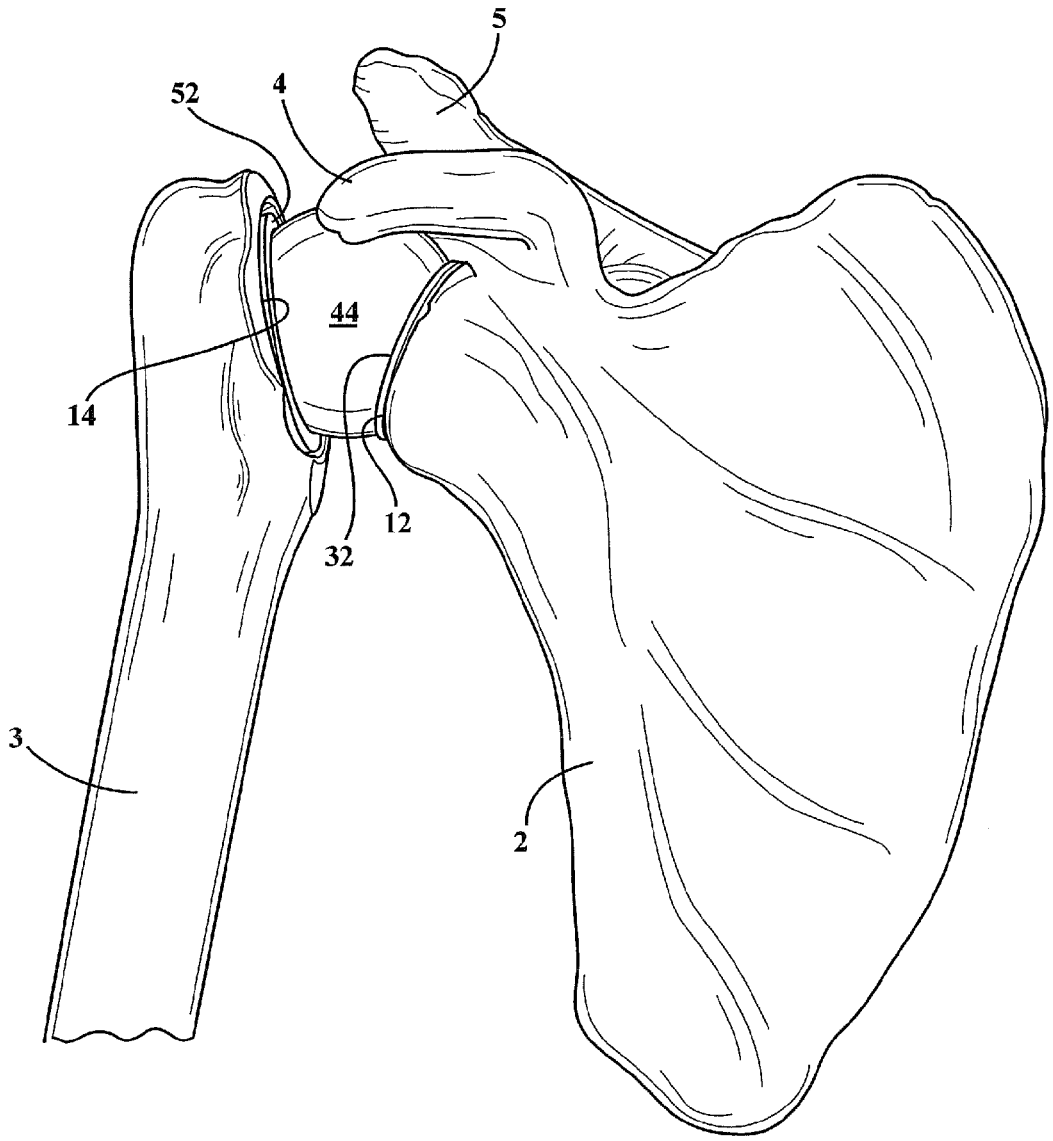


FIG. 5

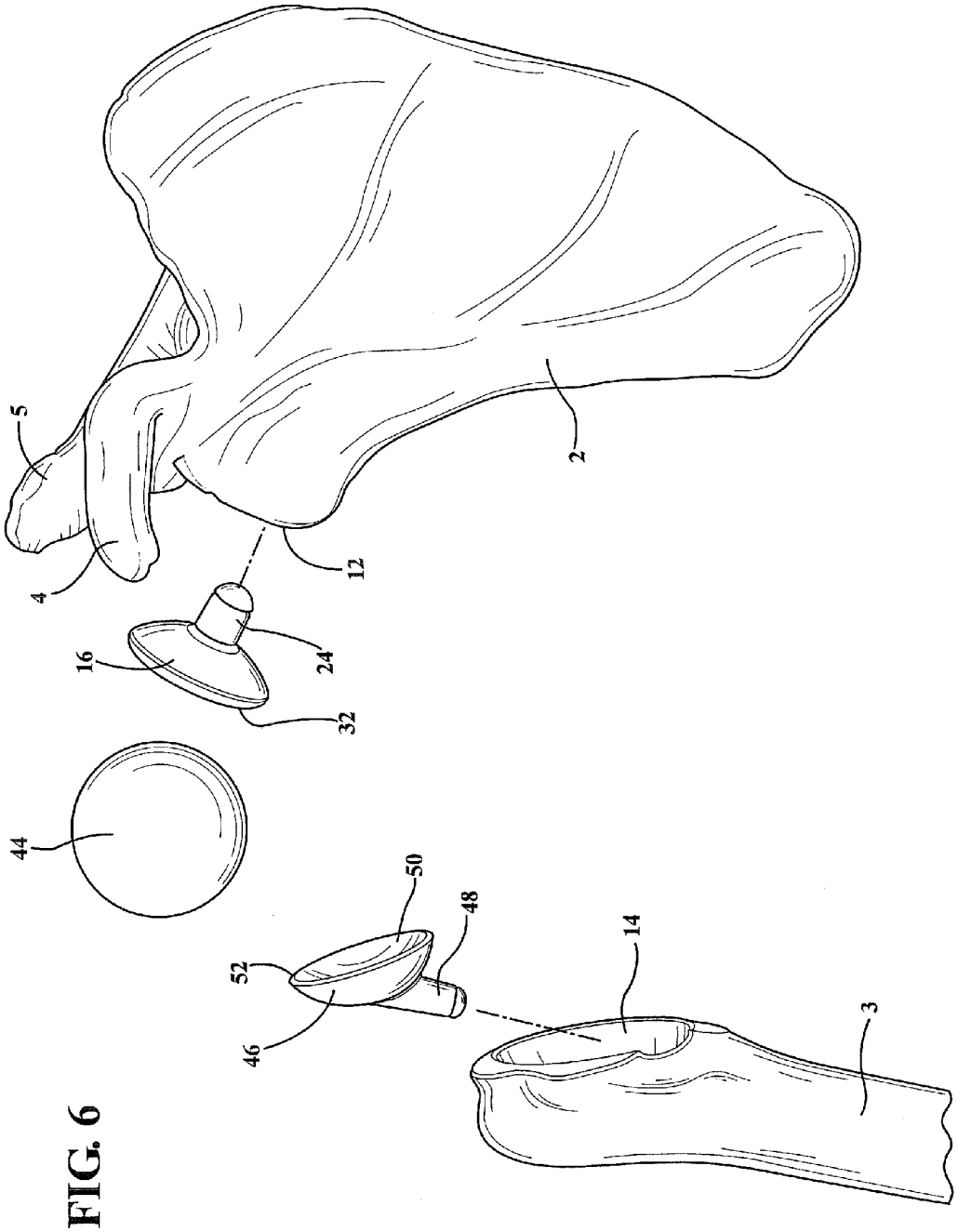


FIG. 6

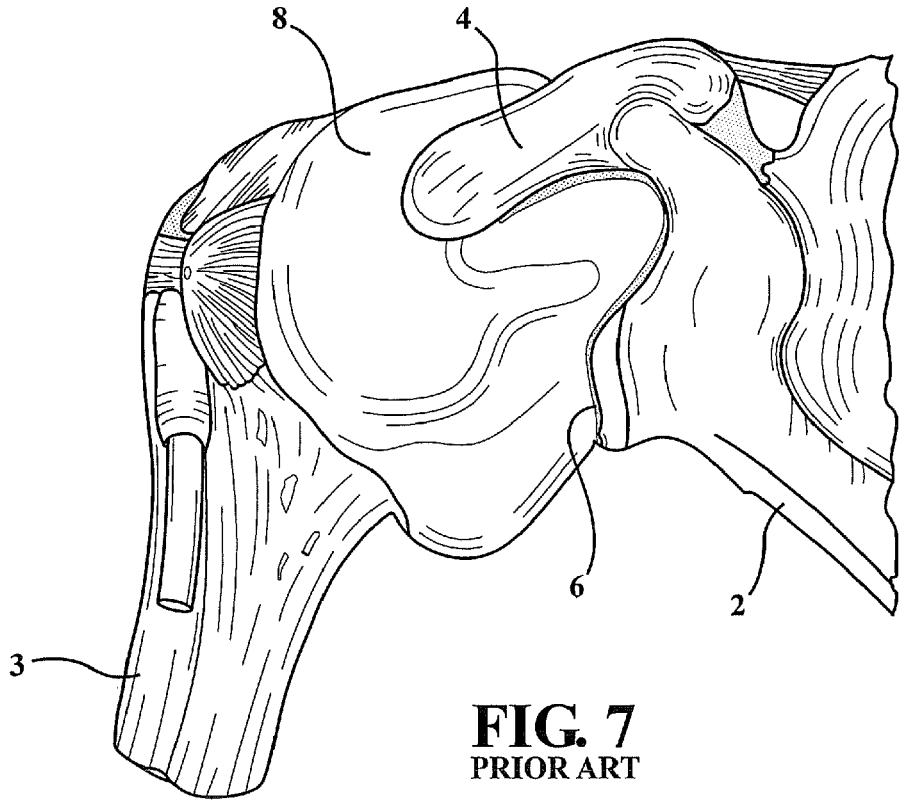


FIG. 7
PRIOR ART

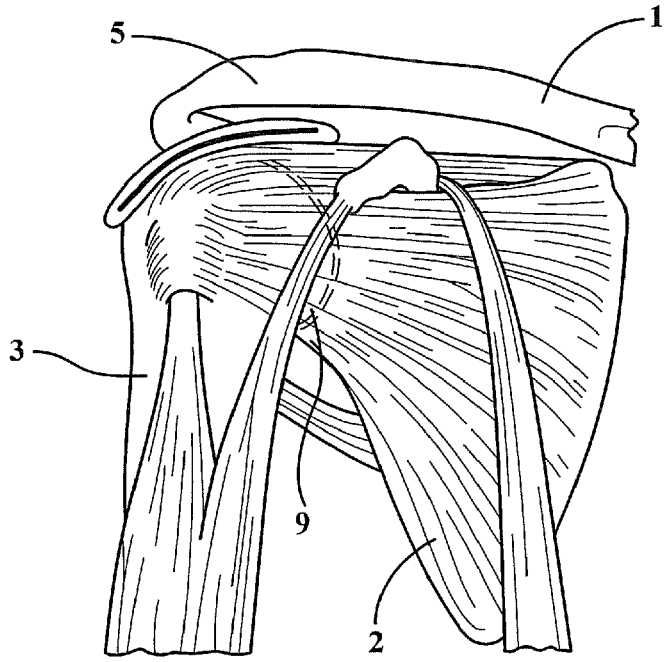


FIG. 9
PRIOR ART

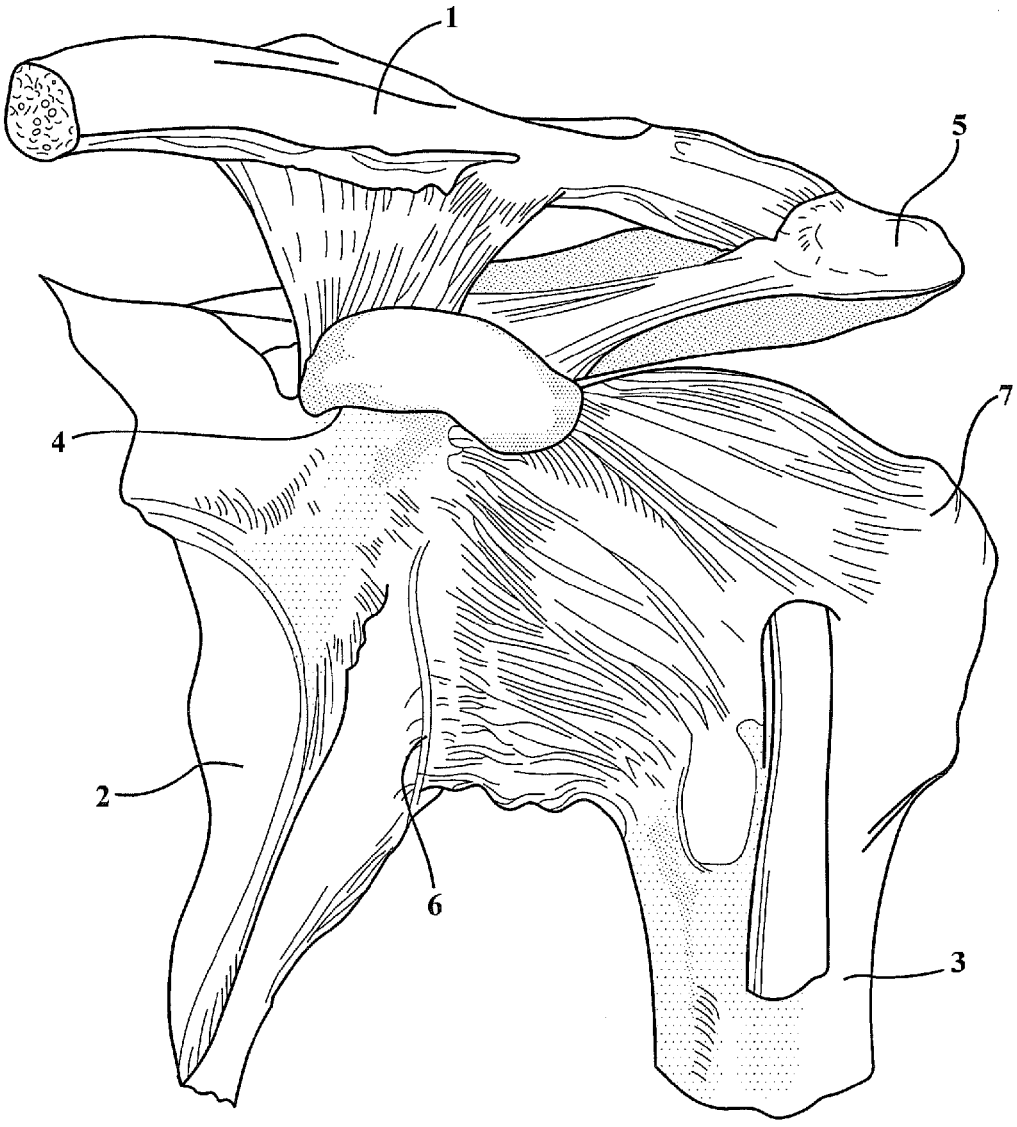


FIG. 8
PRIOR ART

MULTI-COMPONENT IMPLANT ASSEMBLY WITH DUAL ARTICULATING AND/OR ROTATING SURFACES

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the priority of U.S. Ser. No. 61/526,404 and U.S. Ser. No. 61/526,388, both filed Aug. 23, 2011.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention is directed to a shoulder implant assembly and, more specifically, to a multi-component implant assembly incorporating a pair of modified and inwardly recessed receivers mounted to first and second shoulder joint defining bones. An intermediated positioned and spherical (or substantially spherical with flattened base) shaped and intermediate defining component establishes dual and spaced apart universal and rotating and/or articulating surfaces with the spatially mounted first and second receivers, thereby providing evenly distributed wear profiles for increased useful life of the implant, as well as relieving associated ligament tension.

[0004] 2. Description of the Background Art

[0005] The prior art discloses various types of artificial implants, such as replacing damaged natural joint constructions including those for the shoulder. Examples of these include each of the modular humeral head resurfacing system of Winslow et al., US 2006/0009852 and US 2005/0107882, each of which incorporates a two piece humeral component for use in joint arthroplasty which is adapted to be implanted into a joint and engaged by a likewise implanted socket component.

SUMMARY OF THE PRESENT INVENTION

[0006] The present invention discloses an implant assembly for re-establishing a glenohumeral joint between a scapula and humerus. A first receiver is adapted to being mounted to a reconditioned glenoid cavity defined in the scapula, with a second receiver adapted to being mounted to a reconditioned humeral head associated with the humerus. A three dimensional and at least partially spherical shaped element is interposed between the first and second receivers for establishing at least one of articulating and rotating support at respective and spaced apart seating profiles.

[0007] Additional features include the first receiver exhibiting a first concave profile seating a first spherical shaped portion of the interposed three dimensional component for establishing a first universal articulating support. A bulbous projection extends from a planar annular profile associated with the second receiver for resistively fitting within a generally opposite facing and mating undercut profile defined a flattened profile defined in the three dimensional component amd for providing, in combination with the first articulating support, a second rotational support.

[0008] The first receiver exhibits a first concave recess defined in an exposed face for seating in articulating fashion a first portion of an interposed spherical component. The second receiver exhibits a second concave recess defined in an exposed face for seating in like articulating fashion a second portion of the spherical element.

[0009] The first receiver has an enlarged concave profile with a tapered extending rim for establishing enhanced shouldering support of an increased seating portion of the spherical component. Each of the first and second receiver components and interposed spherical component may also be constructed of an alternating material including at least one of a polymer, polymer composite, metal, metal composite or polymer/metal admixture.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Reference will now be made to the attached drawings, when read in combination with the following detailed description, wherein like reference numerals refer to like parts throughout the several views, and in which:

[0011] FIG. **1** is an assembled view of a first shoulder implant assembly;

[0012] FIG. **2** is an exploded view of the multi-component implant arrangement of FIG. **1** for reconditioned re-engagement of a patient's scapula and upper humerus bones and better depicting the respective mounted first and second uniquely configured receiver components, along with an intermediate and universally inter-supported and substantially spherical shaped component exhibiting a flattened profile opposing the humeral head mounted receiver with projecting bulb seating portion and in order to provide rotating support in combination with universal articulating support separately established between the intermediate component and the opposite scapula bone mounted receiver;

[0013] FIG. **3** is an assembled view of a modified shoulder implant assembly;

[0014] FIG. **4** is an exploded view of the multi-component arrangement of FIG. **3**, similar to the previous depiction of FIG. **2**, and better illustrating the modified nature of shoulder implant assembly in which a modified/enlarged and tapered concavity profile is formed in the scapula bone mounted receiver component, combined with a redesign of the second humeral head mounted receiver, and with the inter-supported element exhibiting a complete spherical shape;

[0015] FIG. **5** is an assembled view of a yet further modified shoulder implant assembly; and

[0016] FIG. **6** is an exploded view of the arrangement of FIG. **5** and better depicting the arrangement of a scapula mounted first receiver such as depicted in FIGS. **1-2**, combined with a second receiver configured as shown in FIGS. **3-4**, and in combination with a fully spherical shaped intermediate component for providing universal articulating support along each of two individual locations established between the humerus mounting receiver and intermediate component, and separately an opposite end profile of the intermediate component and the other receiver mounted in the scapula; and

[0017] FIGS. **7-9** depict a series of supporting Prior Art illustrations of a human anatomical shoulder joint, and for which the multi-component assembly provides an in situ and reconditioned implantation option.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] As will be described in additional detail with reference to the succeeding variants, the present invention discloses a multi-component shoulder implant assembly for pro-

viding an in-situ and reconditioned installation option which is an improvement over other conventional joint implant installations.

[0019] Prior to describing in detail the configurations of the various embodiments of multi-component shoulder implants, respectively depicted in FIGS. **1-2**, **3-4** and **5-6**, a Prior Art depiction of an anatomically correct human shoulder is shown in FIGS. **7-9** and which includes three bones consisting of the clavicle (collarbone) **1**, the scapula (shoulder blade) **2**, and the humerus (upper arm bone) **3**, as well as associated muscles, ligaments and tendons (see in particular FIGS. **8** and **9**). The articulations between the bones of the shoulder collectively make up the shoulder joints where the humerus **3** attaches to the scapula **2**.

[0020] An abbreviated and incomplete description of the scapula further includes, at strategic locations a coracoid process **4** and spine connected acromion **5**, in the proximity of which is configured the glenoid cavity **6**. The humerus **3** terminates, in relevant part, at an upper end located humeral head **7** (FIG. **8**) which generally seats via an interposed bursa **8** (FIG. **7**).

[0021] The three joints of the shoulder further include each of the glenohumeral, acromioclavicular and sternoclavicular joints. The glenohumeral joint, see as identified at **9** in FIG. **9**, is the main joint of the shoulder and the generic term "shoulder joint" usually refers to this ball and socket joint that allows the arm to rotate in a circular fashion or to hinge out and up away from the body.

[0022] As is best depicted in the prior art view of FIG. **8**, associated types of joint cartilage include articular cartilage located on the ends of the bones and which allows the bones to glide and move on each other and labrum cartilage located in the shoulder. In combination, the shoulder as constructed exhibits sufficient mobile for undertaking a wide range of actions of the arms and hands as well as being sufficiently stable as to allow for actions such as lifting, pushing and pulling. This compromise between mobility and stability results in a large number of shoulder problems not faced by other joints such as the hip.

[0023] With reference now to the embodiments of the invention set forth in FIGS. **1-6**, and for purposes of ease and clarity of illustration, a simplified depiction is shown of the glenohumeral joint established between the scapula **2** and humerus **3** and in which all ligaments, muscles and tendons are removed. In each instance, and prior to installation of the multi-component implant assembly (such as occurring after significant degradation of the natural glenohumeral joint or in other instances in which an accident or other traumatic incident has resulted in significant damage), an initial (in situ) surgical reconditioning procedure is employed of the opposing joint defining surfaces established by the humeral head **7** and the glenoid cavity **6**. This includes employing relevant surgical drilling and shaping instruments (also not shown) in order to prepare the joint defining locations of the bones for subsequently attaching selected components associated with the implant assembly and as will now be described.

[0024] The above stated, and referring initially to each of FIGS. **1** and **2**, a pair of assembled and exploded views, both generally at **10**, are depicted of a first variant of shoulder implant assembly for installation within reconditioned and opposing end locations of the patient's scapula **2** (represented by reconditioned profile **12**) and humerus (further represented by reconditioned profile **14**), and as is best shown in the exploded view of FIG. **2**. The implant assembly **10** includes, collectively, a first receiver shaped component **16** which is mounted within the reconditioned recess **12** of the scapula glenoid cavity.

[0025] A secondary and pseudo-receiver shaped component **18** likewise mounted within the reconditioned recess **14** of the upper humeral head. The secondary receiver **18** exhibits a planar and generally annular shaped surface profile **20** from which generally centrally projects a bulbous portion **22** which is interconnected to the planar surface profile **20** via a narrowed neck.

[0026] Each of the first receiver **16** and second receiver **18** further includes a uniquely configured stem portion, see at **24** and **26**, respectively, which seats within hidden configured recess configurations (not shown) established within the reconditioned innermost profile **12** of the scapula glenoid cavity and within the corresponding humeral head reconditioned profile **14**. In a typical surgical procedure, a medical bonding cement or other suitable fastener/adhesive (not shown) is employed for anchoring the receivers **16** and **18** to the respective bone locations **2** and **3**, it being further understood that the configuration of these elements is capable of being reversed (e.g. so that the receiver **16** is mounted to the humeral head and the receiver **18** reversed to mount to the scapula glenoid cavity).

[0027] An intermediate and universally inter-supported and substantially (also termed pseudo or partial) spherical shaped component is depicted at **26** exhibiting a flattened profile **28** opposing the humeral head mounted receiver **18** with projecting bulb seating portion **22**, the flattened profile **28** and bulbous portion **22** exhibited in a generally opposite facing direction relative to a spherical profile of the component **26** seating with the first receiver **16**. Although not clearly shown in FIG. **2**, a corresponding and bulbous enlarged undercut profile is formed in a hidden recess location of the flattened end profile **28** of the pseudo-spherical shaped component **26** of FIG. **2**, and into which is resistively installed (such as through a press-fit installation), the bulbous seating portion **22** in order to provide rotating support (see arrow **30**) between the humeral head receiver **18** and the flattened support profile **28** of the intermediate three dimensional component **26**. Separately, a further recess concave profile, largely hidden from view but generally designated at **32** in FIG. **2**, is formed in the outward facing perimeter of the scapula mounted first receiver **16** and, in combination with rotating support separately established between the pseudo-spherical intermediate component and the opposite scapula bone mounted receiver, establishes first rotating and second spaced and articulating surfaces within the joint assembly.

[0028] The first receiver **16**, second **18** and inter-disposed pseudo-spherical element **26** are each constructed of any suitable material including any type of plastic, metal or admixed composite. While not limited to any specific variant, the material selection for these components can alternate between the components, such as for example the first scapula mounted receiver **16** and second humeral head mounted receiver **18** being constructed of a first material (e.g. heavy duty, wear resistant and sanitary polymeric, polymeric composite, surgical steel/aluminum, other metal or metal composite, as well as plastic/metal admixture), and with the inter-disposed pseudo-spherical element **26** being constructed of a secondary/alternating material selected from such as the other of the identified materials.

[0029] Although not shown, the existing arrangement of ligaments, tendons and muscles provide the anchoring/seat-

ing support for retaining the articulating relationships established between the first and second uniquely configured receiver shaped elements **16** and **18** and interposed pseudo-spherical element **26**, it further being understood that these components are capable of being retrofit installed within the reconditioned bone ends of the patient without the necessity of the ligaments and tendons being severed of otherwise impacted, thereby enhancing the universal motion profile afforded by the design and likewise reducing recovery time for the patient. As previously described, the ability to segment a combination of rotational and universal/articulating motion of the glenohumeral joint into a pair of spaced apart profiles serves to both enhance artificial joint mobility as well as to more evenly distribute an associated wear profile of the joint, thereby increasing expected life of the assembly.

[0030] Referring now to FIGS. **3** and **4**, FIG. **4** a pair of assembled and exploded views are shown of a modified shoulder implant assembly, generally at **34**, in which a modified/enlarged and tapered concavity profile is formed in the scapula bone mounted receiver component, combined with a redesign of the second humeral head mounted receiver, and with the inter-supported element exhibiting a complete spherical shape. Specifically, redesigned first receiver **36** exhibits an enlarged configuration in comparison to that depicted at **16** in FIGS. **1-2**, with similar configured stem mounting portion **38**. Enlarged concavity profile **40** is further exhibited and round which extends a tapered perimeter rim **42**, such that an intermediate spherical element **44** is seated within the concave profile in the fashion as further depicted in FIG. **3**.

[0031] A correspondingly redesigned second humeral head mounted receiver **46** exhibits an extending and anchoring stem portion **48** (again generally matching the inner machine profile associated with the humeral head recess **14**). A further concave profile **50** is formed in an outwardly facing direction of the second receiver **46** and which is bound by a generally level and planar outer rim **52**.

[0032] Upon installation, the flared profile **42** of the first scapula mounted receiver **36** provides enhanced universal articulating and shouldering support with one seating side of the spherical intermediate element **44**, combined with the additional level of universal articulating and seating support established by the seating profile established by the second receiver element **46**. As best shown in FIG. **3**, the assembled arrangement is such that the outer tapered profile **42** of the first receiver **36** approaches the outer perimeter rim **52** of the second receiver **46** depending upon the angular orientation established between the humerus bone relative to the scapula, with the overall dimensioning of the seating/support surfaces being such that an optimization of seating support and articulating range of motion is maximized.

[0033] With reference finally to FIGS. **5** and **6**, successive assembled and exploded views are respectively shown depicting the arrangement of a scapula mounted first receiver **16**, such as depicted in FIGS. **1-2**, combined with a second receiver **46** configured as shown in FIGS. **3-4**, and in combination again with a fully spherical shaped intermediate component **44** for providing universal articulating support along each of two individual locations established between the humerus mounting receiver **46** and intermediate component **44**, and separately an opposite end profile of the intermediate component **44** and the other receiver **16** mounted in the scapula **2**. In this fashion, the assembled joint assembly depicted in FIG. **5**, differs marginally from that shown in FIG. **3** owing to the less significant degree of shouldering/seating support by the first receiver **16** (in comparison to the enhanced support depicted by the modified receiver **36** of FIG. **4** and which illustrates the tradeoff established between range of motion and support evidenced by these varying implant arrangements) depicted versus that associated with the second humeral head mounted receiver component **46**.

[0034] Having now described our invention, other and additional preferred embodiments will become evident to those skilled in the art to which it pertains, and without deviating from the scope of the appended claims.

We claim:

1. An implant assembly for re-establishing a glenohumeral joint between a scapula and humerus, comprising:

a first receiver adapted to being mounted to a reconditioned glenoid cavity defined in the scapula;

a second receiver adapted to being mounted to a reconditioned humeral head associated with the humerus; and

a three dimensional and at least partially spherical shaped element interposed between said first and second receivers for establishing at least one of articulating and rotating support at respective and spaced apart seating profiles.

2. The assembly as described in claim **1**, further comprising said first receiver exhibiting a first concave profile seating a first spherical shaped portion of said interposed three dimensional component for establishing a first universal articulating support, a bulbous projection extending from a planar annular profile associated with said second receiver resistively fitting within a generally opposite facing and mating undercut profile defined a flattened profile defined in said three dimensional component for providing, in combination with said first articulating support, a second rotational support.

3. The assembly as described in claim **1**, further comprising said first receiver exhibiting a first concave recess defined in an exposed face for seating in articulating fashion a first portion of an interposed spherical component, said second receiver exhibiting a second concave recess defined in an exposed face for seating in like articulating fashion a second portion of said spherical element.

4. The assembly as described in claim **3**, said first receiver further comprising an enlarged concave profile with a tapered extending rim for establishing enhanced shouldering support of an increased seating portion of said spherical component.

5. The assembly as described in claim **2**, each of said first and second receiver components and interposed spherical component being constructed of an alternating material including at least one of a polymer, polymer composite, metal, metal composite or polymer/metal admixture.

6. An implant assembly for re-establishing a glenohumeral joint between a scapula and humerus, comprising:

a first receiver adapted to being mounted to a reconditioned glenoid cavity defined in the scapula;

a second receiver adapted to being mounted to a reconditioned humeral head associated with the humerus;

a three dimensional and at least partially spherical shaped element interposed between said first and second receivers for establishing at least one of articulating and rotating support at respective and spaced apart seating profiles; and

said first receiver exhibiting a first concave profile seating a first spherical shaped portion of said interposed three dimensional component for establishing a first universal articulating support, a bulbous projection extending

from a planar annular profile associated with said second receiver resistively fitting within a generally opposite facing and mating undercut profile defined a flattened profile defined in said three dimensional component for providing, in combination with said first articulating support, a second rotational support.

7. The assembly as described in claim **6**, each of said first and second receiver components and interposed spherical component being constructed of an alternating material including at least one of a polymer, polymer composite, metal, metal composite or polymer/metal admixture.

8. An implant assembly for re-establishing a glenohumeral joint between a scapula and humerus, comprising:

a first receiver adapted to being mounted to a reconditioned glenoid cavity defined in the scapula;

a second receiver adapted to being mounted to a reconditioned humeral head associated with the humerus;

a three dimensional and at least partially spherical shaped element interposed between said first and second receivers for establishing at least one of articulating and rotating support at respective and spaced apart seating profiles; and

said first receiver exhibiting a first concave recess defined in an exposed face for seating in articulating fashion a first portion of an interposed spherical component, said second receiver exhibiting a second concave recess defined in an exposed face for seating in like articulating fashion a second portion of said spherical element.

9. The assembly as described in claim **8**, said first receiver further comprising an enlarged concave profile with a tapered extending rim for establishing enhanced shouldering support of an increased seating portion of said spherical component.

10. The assembly as described in claim **8**, each of said first and second receiver components and interposed spherical component being constructed of an alternating material including at least one of a polymer, polymer composite, metal, metal composite or polymer/metal admixture.

* * * * *