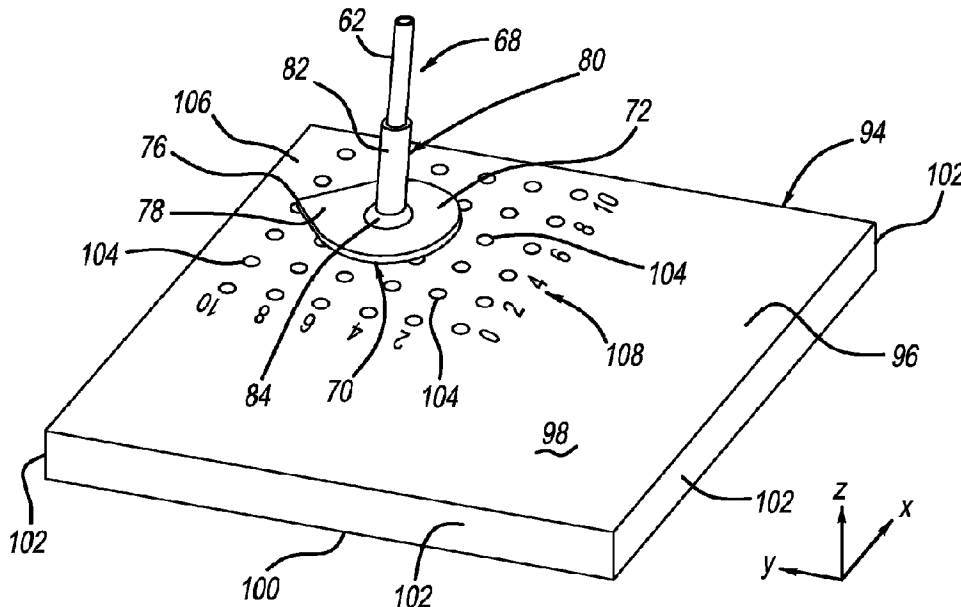




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(54) Title: ADJUSTABLE GLENOID PIN INSERTION GUIDE



(57) **Abrégé/Abstract:**

A system and method for aligning a guiding pin relative to a glenoid including a guiding pin insertion guide for orienting the guiding pin relative to the anatomic structure and an axis alignment device. The guiding pin insertion guide includes a base plate and a movable pin orientation device coupled to and extending from the base plate. The axis alignment device has a plurality of through holes that each define a different alignment axis. The guiding pin mates with one of the through holes to align the guiding pin at a patient-specific alignment axis, the guiding pin is then received within the guiding pin insertion guide when mated with the one of the through holes to align the guiding pin insertion guide along the patient-specific alignment axis relative to the base plate, and the guiding pin insertion guide is fixed to the base plate along the patient-specific alignment axis.

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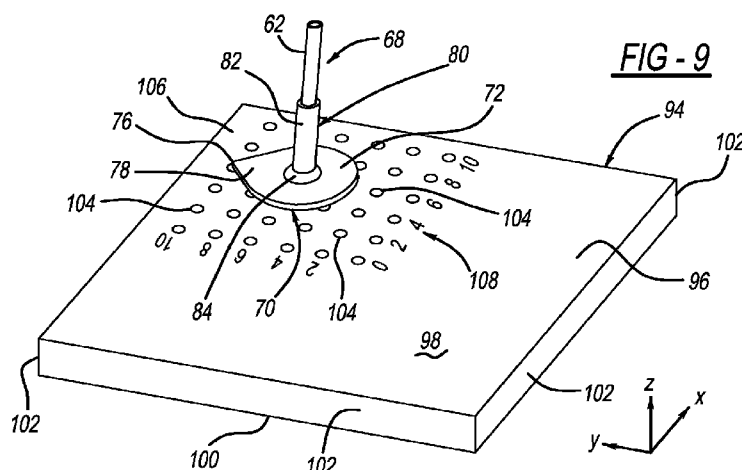
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(54) Title: ADJUSTABLE GLENOID PIN INSERTION GUIDE



(57) Abstract: A system and method for aligning a guiding pin relative to a glenoid including a guiding pin insertion guide for orienting the guiding pin relative to the anatomic structure and an axis alignment device. The guiding pin insertion guide includes a base plate and a movable pin orientation device coupled to and extending from the base plate. The axis alignment device has a plurality of through holes that each define a different alignment axis. The guiding pin mates with one of the through holes to align the guiding pin at a patient-specific alignment axis, the guiding pin is then received within the guiding pin insertion guide when mated with the one of the through holes to align the guiding pin insertion guide along the patient-specific alignment axis relative to the base plate, and the guiding pin insertion guide is fixed to the base plate along the patient-specific alignment axis.

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ADJUSTABLE GLENOID PIN INSERTION GUIDE

CLAIM OF PRIORITY

5 [0001] This application claims the benefit of U.S. Patent Application Serial No. 14/499,965, entitled, "ADJUSTABLE GLENOID PIN INSERTION GUIDE," filed on September 29, 2014, the benefit of priority of which is claimed hereby.

FIELD

[0002] The present disclosure relates to an adjustable glenoid pin insertion guide.

10

BACKGROUND

[0003] This section provides background information related to the present disclosure which is not necessarily prior art.

15 [0004] Performing an anatomic or reverse arthroplasty generally requires the placement of a guide pin or wire in a glenoid. Considerable surgical skill, however, is generally required to correctly expose the glenoid and remove the soft tissue surrounding the glenoid to accurately align the guide pin in the correct orientation on the glenoid before performing the anatomic or reverse arthroplasty. It is desirable, therefore, for an instrument or system that can accurately and quickly orient a guide pin relative to the glenoid before performing an anatomic or reverse
20 arthroplasty.

SUMMARY

[0005] This section provides a general summary of the disclosure, and is not a comprehensive disclosure of its full scope or all of its features.

25 [0006] In Example 1, a system for aligning a guiding pin relative to an anatomic structure may be provided. The system may include a guiding pin insertion guide that may be used to orient the guiding pin relative to the anatomic structure. The guiding pin insertion guide may include a base plate and a pin orientation device that may be coupled to and may extend from the base plate. The pin orientation device may be movable relative to the base plate. The system may
30 also include an axis alignment device. The axis alignment device may be a planar

member that may include a first surface and a second surface that may have a plurality of through holes that may extend between the first surface and the second surface. Each of the through holes may define a different alignment axis. One of the through holes may be configured to align the guiding pin at a patient-specific alignment axis. The guiding pin insertion guide may be configured to receive the guiding pin when the guiding pin is mated with one of the through holes to align the guiding pin insertion guide along the patient-specific alignment axis that may be relative to the base plate. The guiding pin insertion guide may be configured to be fixed to the base plate along the patient-specific alignment axis.

10 [0007] In Example 2, the axis alignment device of Example 1 may optionally include a coordinate system.

[0008] In Example 3, the one through-hole of any one of the preceding Examples may be configured to align the guiding pin with the patient-specific alignment axis that may be located at a patient-specific coordinate.

15 [0009] In Example 4, the base plate of any one of the preceding Examples may optionally include an alignment device for aligning the base plate with a location that may be visible on the anatomic structure. In addition, the alignment device may be configured to align the base plate relative to the axis alignment device.

20 [0010] In Example 5, the base plate of any one of the preceding Examples may be shaped to include an apex and the alignment device may be defined by the apex.

[0011] In Example 6, the pin orientation device of any one of the preceding Examples may be hollow.

25 [0012] In Example 7, the pin orientation device of any one of the preceding Examples may optionally include a bulbous portion that may movably mate with the base plate. The bulbous portion may allow the pin orientation device to articulate relative to the base plate and may lock into place.

[0013] In Example, 8, any one of the preceding Examples may optionally include a reaming device.

30

[0014] In Example 9, each of the guiding pin insertion guide and the alignment axis device of any one of the preceding Examples may be reusable.

[0015] In Example 10, the guiding pin insertion guide and the alignment axis device of any one of the preceding Examples may be formed from either
5 titanium or surgical steel.

[0016] In Example 11, the base plate of the guiding pin insertion guide of any one of the preceding Examples may include a surface that may define a patient-specific contour.

[0017] In Example 12, the guiding pin insertion guide of any one of the
10 preceding Examples may be configured to be fixed to the base plate along the patient-specific alignment axis.

[0018] In Example 13, the through holes of any one of the preceding Examples may be arranged in a coordinated array.

[0019] In Example 14, each through hole of any one of the preceding
15 Examples may define a different alignment axis by a predetermined angular amount.

[0020] In Example 15, the predetermined angular of amount of Example 14 may be defined by a coordinate system.

[0021] In Example 16, a system for aligning a guiding pin relative to a
glenoid may be provided. The system may include a guiding pin insertion guide
20 that may be used to orient the guiding pin relative to the glenoid. The guiding pin insertion guide may include a base plate that may have an upper surface and a glenoid-engaging surface. A pin orientation device may be coupled to and may extend from the upper surface of the base plate. The pin orientation device may be movable relative to the base plate. The system may further include an axis
25 alignment device. The axis alignment device may be a planar member that may include a first surface and a second surface that may have a plurality of through holes that may be arranged in a coordinated array that may extend between the first surface and the second surface. Each of the through holes may define a different alignment axis. One of the through holes may be configured to align the guiding pin
30 at a patient-specific alignment axis that may be defined by a patient-specific coordinate of the array. The guiding pin insertion guide may be configured to

- receive the guiding pin when the guiding pin is mated with the one through hole to align the guiding pin insertion guide along the patient-specific alignment axis relative to the base plate. The guiding pin insertion guide may be configured to be fixed to the base plate along the patient-specific alignment axis.
- 5 **[0022]** In Example 17, a method for aligning a guiding pin relative to a glenoid may be provided. The method may include determining a patient-specific alignment axis for the guiding pin relative to the glenoid. The method may also include providing an axis alignment device that may be defined by a planar member that may include a first surface and a second surface that may have a plurality of
- 10 through holes that may be arranged in a coordinated array that may extend between the first surface and the second surface. Each of the through holes may define a different alignment axis. The method may also include determining a coordinate location of one of the through holes that may define an alignment axis that may correspond to the patient-specific alignment axis. The method may also include
- 15 mating the guiding pin with the one through hole to orient the guiding pin along the patient-specific alignment axis. The method may also include placing a guiding pin insertion guide over the guiding pin. The guiding pin insertion guide may include a base plate that may have an upper surface and a glenoid-engaging surface, and a pin orientation device that may be coupled to and may extend from the upper surface of
- 20 the base plate. The pin orientation device may be movable relative to the base plate such that when the guiding pin insertion guide is placed over the guiding pin, the pin orientation device may be aligned along the patient-specific alignment axis. The method may also include fixing the pin orientation device aligned along the patient-specific alignment axis relative to the base plate. The method may also include
- 25 removing the guiding pin along with the guiding pin insertion device from the axis alignment device. The method may also include contacting the glenoid-engaging surface of the base plate with the glenoid. The method may also include securing the guiding pin to the glenoid along the patient-specific alignment axis.
- 30 **[0023]** In Example 18, Example 17 may optionally include aligning the base plate with a location visible on the glenoid.

[0024] In Example 19, the base plate of any one of Examples 17 or 18 may include an alignment device. The base plate may be shaped to include an apex, and the alignment device may be defined by the apex.

5 [0025] In Example 20, any one of Examples 17-19 may optionally include reaming the glenoid while utilizing the guiding pin.

[0026] In Example 21, any one of Examples 17-20 may optionally include sterilizing each of the guiding pin insertion guide and the alignment axis device such that each may be reusable.

10 [0027] In Example 22, the pin orientation device of any one of the Examples 17-21 may be hollow and may optionally include a bulbous portion that may movably mates with the base plate. The bulbous portion may allow the pin orientation device to articulate relative to the base plate and lock into place.

[0028] In Example 23, the guiding pin insertion guide and the alignment axis device of any one of the Examples 17-22 may be formed from either titanium
15 or surgical steel.

[0029] In Example 24, determining the coordinate location in any one of Examples 17-23 may include selecting the coordinate location from the coordinated array.

20 [0030] Further areas of applicability will become apparent from the description provided herein. The description and specific examples in this summary are intended for purposes of illustration only and are not intended to limit the scope of the present disclosure.

DRAWINGS

25 [0031] The drawings described herein are for illustrative purposes only of selected embodiments and not all possible implementations, and are not intended to limit the scope of the present disclosure.

[0032] FIG. 1 is an exploded view of a prior art implant for reverse shoulder arthroplasty;

[0033] FIG. 2 is an environmental view of the prior art implant of FIG. 1;

30 [0034] FIG. 3 is a perspective view of a prior art implant for anatomic shoulder arthroplasty;

- [0035] FIG. 4A is an environmental view illustrating a guiding pin used during reaming in reverse shoulder arthroplasty;
- [0036] FIG. 4B is an environmental view illustrating a guiding pin after reaming in reverse shoulder arthroplasty;
- 5 [0037] FIG. 5 is a perspective view of a guiding pin insertion guide according to a principle of the present disclosure;
- [0038] FIG. 6 is a side perspective view of the guiding pin insertion guide illustrated in FIG. 5;
- [0039] FIG. 7 is another perspective view of the guiding pin insertion guide
10 illustrated in FIG. 5;
- [0040] FIG. 8 is a top perspective view of the guiding pin insertion guide illustrated in FIG. 5;
- [0041] FIG. 9 is a perspective view of the guiding pin insertion guide relative to an axis alignment device according to a principle of the present
15 disclosure;
- [0042] FIG. 10 is a top perspective view of the guiding pin insertion guide relative to an axis alignment device illustrated in FIG. 9;
- [0043] FIG. 11 is a side perspective view of the guiding pin insertion guide relative to an axis alignment device illustrated in FIG. 9;
- 20 [0044] FIG. 12 is another side perspective view of the guiding pin insertion guide relative to an axis alignment device illustrated in FIG. 9;
- [0045] FIG. 13 is another side perspective view of the guiding pin insertion guide relative to an axis alignment device illustrated in FIG. 9;
- [0046] FIG. 14 is a perspective view of the guiding pin insertion guide
25 positioned relative to a glenoid according to a principle of the present disclosure;
and
- [0047] FIG. 15 is a side perspective view of the guiding pin insertion guide positioned relative to a glenoid of FIG. 14.
- [0048] Corresponding reference numerals indicate corresponding parts
30 throughout the several views of the drawings.

DETAILED DESCRIPTION

[0049] Example embodiments will now be described more fully with reference to the accompanying drawings.

[0050] The present teachings generally provide reusable surgical instruments that may be configured to be patient-specific. The surgical instruments
5 may include, for example, alignment guides, drill guides, and other tools 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
10 shoulder replacement. The instruments 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,
15 PET, etc.), the patient-specific prosthesis components and the patient-specific guides, templates and other instruments, can be prepared using various commercially available CAD programs and/or software available, for example, by Object Research Systems or ORS, Montreal, Canada.

[0051] The instruments, when patient-specific, and any associated patient-specific implants and bone grafts can be generally designed and manufactured based
20 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. Very small irregularities need not be incorporated in the three-dimensional engagement surface. The patient-specific instruments can include
25 custom-made guiding formations, such as, for example, guiding bores or cannulated guiding posts or cannulated guiding extensions or receptacles that can be used for supporting or guiding other instruments, such as drill guides, reamers, cutters, cutting guides and cutting blocks or for inserting guiding pins, K-wire, or other fasteners according to a surgeon-approved preoperative plan.

[0052] In various embodiments, the instruments of the present teachings can
30 also include one or more patient-specific tubular guides for receiving and guiding a

tool, such as a drill or pin or guide wire at corresponding patient-specific insertion points and orientations relative to a selected anatomic or reverse axis for the specific patient. The instruments can include guiding or orientation formations and features for guiding the implantation of patient-specific or off-the-shelf implants associated with the surgical procedure. The geometry, shape and orientation of the various features of the instruments, 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.

[0053] Referring to FIGS. 1-2, a prior art reverse shoulder implant 10 is illustrated. The reverse shoulder implant 10 includes a humeral stem 12, a humeral tray 14, a humeral bearing 16, a glenosphere 18 and a baseplate 20 having a plate portion 22 and a central boss 24. The humeral stem 12 is implanted in the humeral bone 26 and has a proximal end 28 coupled via a Morse taper connection to a male taper 30 extending from a plate 32 of the humeral tray 14. The glenosphere 18 can be modular and include a head 34 articulating with the bearing 16 and an offset double-taper component 36. The double-taper component 36 has a first tapered portion 38 coupled to a corresponding tapered opening 40 of the head 34 and a second tapered portion 42 coupled to the central boss 24 of the glenoid baseplate 20. A central screw 44 passes through the baseplate 20 into the glenoid face 46 of the patient's scapula. Peripheral screws 48 are used to lock the baseplate 20 in the glenoid face 46.

[0054] Referring to FIG. 3, a prior art anatomic shoulder implant 50 is illustrated. The anatomic shoulder implant 50 includes a humeral stem 52, a glenosphere 54 and a bearing 56 with peripheral pegs 58 and a removable or non-removable central peg 60.

[0055] FIG. 4A illustrates using a guiding pin 62 to guide reaming of the glenoid face 46 in reverse shoulder arthroplasty using a reaming device 64. FIG. 4B illustrates the guiding pin 62 through a hole 66 formed using reaming device 64 through the glenoid face 46. The guiding pin 62 is used to guide placement of the reverse implant 10 or the anatomic implant 50, discussed above. A hole (not shown) may be pre-drilled in glenoid face 46 before receiving guiding pin 62, or guiding pin 62 may be K-wire that is aligned relative to glenoid face 46 before insertion into glenoid face 46. Each of these processes will be described in more detail below.

[0056] Referring to Figures 5-8, an exemplary patient-specific guiding pin insertion guide 68 is illustrated. Patient-specific guiding pin insertion guide 68 is configured to guide the guiding pin 62 during insertion into glenoid 46, and provide an implant alignment orientation for reverse as well as anatomic shoulder arthroplasty at the surgeon's discretion. The guiding pin insertion guide 68 includes a base plate 70 having an upper (or outer) planar surface 72 and a lower (or inner) planar or anatomy-engaging surface 74 that references the glenoid face 46. Although lower surface 74 is illustrated as being planar, it should be understood that it is not out of the scope of the present disclosure that lower surface 74 be patient-specific such that lower surface 74 is three-dimensionally contoured to correspond to the patient-specific contours of glenoid 46 such that lower surface 74 rests in only one position on glenoid 46. In other words, lower surface 74 may be contoured such that lower surface 74 is a negative surface of glenoid 46. As illustrated, the labrum can be completely removed such that the lower surface 74 references and mirrors only the bone surface of the glenoid cavity or glenoid face 46.

[0057] Base plate 70 may be tear-drop shaped such that an apex 76 of base plate 70 defines an alignment device 78. Alignment device 78 can be used to align base plate 70 in the proper orientation relative to glenoid face 46 by pointing the apex 76 at an anatomical reference point of the glenoid 46. For example, alignment device 78 can be used to orient base plate 70 such that apex 76 points at a visual landmark such as the superior apex of the glenoid 46. Base plate 70 may be formed from materials such as titanium, surgical steel, and polymeric materials such as polyethylene. Moreover, it will be appreciated that base plate 70 may be any shape

desired so long as an alignment device 78 is defined that can point at a visual landmark of the patient's anatomy such as the superior apex of the glenoid 46.

[0058] A pin orientation device or guide tube 80 is coupled to and extends outward from base plate 70. Pin orientation device 80 includes a cylindrical guide 82 having a proximal end 84 and a distal end 86. Proximal end 84 defines a bulbous portion 88 that mates with base plate 70. In this regard, base plate 70 includes an aperture 90 that is shaped to receive bulbous portion 88, and allow pin orientation device 80 to be movable or articulate relative to base plate 70 in a manner similar to a joystick. Bulbous portion 88 may be unitary with cylindrical guide 82, or may be manufactured separately and bonded to cylindrical guide 82 by welding, brazing, or the like. Regardless, cylindrical guide 82 and bulbous portion are preferably formed from the same materials as base plate 70. Namely, materials such as titanium, surgical steel, and polymeric materials such as polyethylene. Cylindrical guide 82 is hollow and defines an elongate channel 92 for receipt of guiding pin 62.

[0059] To allow bulbous portion 88 to articulate relative to base plate 70, base plate 70 includes a slit 89 formed therein that extends from an end portion 91 to aperture 90 such that opposing ends 93 and 95 of base plate 70 face each other. In addition, ears 97 extend from opposing ends 93 and 95, respectively, with each ear 97 including an aperture 99 for receipt of a set screw 71. Thus, when bulbous portion 88 is to be fixed relative to base plate 70, screw 71 may be engaged with apertures 99 to draw opposing ends 93 and 95 tightly together to clamp bulbous portion 88 at the desired orientation.

[0060] As discussed above, pin orientation device 80 is movable relative to base plate 70. This allows guiding pin 62 to be oriented in any desired axial direction relative to glenoid 46 before insertion into glenoid 46. Preferably, the desired axial directions (*i.e.*, for anatomic and reverse arthroplasty) are determined and designed according to pre-operative plans for the patient to define patient-specific anatomic alignment axes and insertion points for guiding pin 62. To assist in orienting pin orientation device 80 relative to base plate 70 at the correct axial direction for either anatomic or reverse arthroplasty, the present disclosure provides an axis alignment device 94.

[0061] As best shown in Figures 9-13, axis alignment device 94 is a planar member 96. Planar member 96 includes a first surface 98, a second surface 100, and a plurality of side surfaces 102 connecting first and second surfaces 98 and 100. Planar member 96 also includes a plurality of through holes 104 that pass through
5 planar member 96 from first surface 98 to second surface 100 at different angles. Moreover, although through holes 104 are only illustrated as being positioned in a single quadrant 106 of planar member 96, it should be understood that the entirety of planar member 96 may be provided with through holes 104, with each through hole 104 defining a different axial angle through planar member 96. It should be
10 understood base plate 70 is not illustrated as including ears 97 in Figures 9-13 for ease of illustration only.

[0062] Axis alignment device 94 can include a coordinate system 108. Coordinate system 108 assists in organizing the axial angle of each through hole 104. In the illustrated embodiment, the coordinate system 108 includes the
15 coordinates 0, 2, 4, 6, 8, and 10 in each of the x- and y-directions. At the through hole 104 that corresponds to coordinates (0,0 - with the first zero corresponding to the x-axis and the second zero corresponding to the y-axis), the axial angle may be ninety degrees such that pin orientation device 80 will extend normal to base plate 70 when aligned using this through hole 104. At the through hole 104 that
20 corresponds to coordinates (0,2), the axial angle of through hole 104 may be tilted by two degrees in the y-direction. In another example, at the through hole 104 that corresponds to coordinates (4, 6), the through hole 104 will define an angle that has first been tilted four degrees in the x-direction from the position normal, and then titled four degrees in the y-direction.

[0063] The remaining quadrants 106 may include through holes (not shown) that define angles that are titled in the negative x- and y-directions relative first surface 98. In this manner, the axis alignment device 94 provides for a full range of axial angles relative first surface 98 for proper orientation of pin orientation device relative to base plate 70. Although the coordinate system 108 described above
25 corresponds to changes in the axial alignment of two degree increments in each of the x- and y-directions, it should be understood that any incremental change (*e.g.*,
30

increments less than one degree, one degree, two degrees, three degrees, etc.) can be defined by coordinate system 108. Moreover, although numbers are used to identify various coordinates, it should be understood that letters, symbols, or any combination of letters, symbols, and numbers may also be used. For example, the x-axis may use numbers while the y-axis uses letters to identify each through hole 104.

[0064] As noted above, the preferable axial angle at which pin orientation device 80 is to be oriented relative to base 70 can be determined preoperatively such that the preferable axial angle is patient-specific. This specific axial angle can then be assigned the proper coordinates on axis alignment device 94 that provides an orientation for guiding pin 62 that is as close as possible to the patient-specific orientation. Alternatively, a plurality of axis alignment devices 94 may be provided with different angular increments, and the proper angular increment selected to best match the patient-specific orientation.

[0065] Once the glenoid face 46 has been prepared for insertion of guiding pin 62, the surgeon may place the axis alignment device 94 flat on a table. The guiding pin 62 (*e.g.*, a Steinmann pin, guide pin, or K-wire) can then be inserted into the through hole 104 at the predetermined coordinates. The guiding pin insertion guide 68 including base plate 70 and pin orientation device 80 may then be placed over the guiding pin 62 resting in the predetermined through hole 104 such that lower surface 74 of base plate 70 rests flat against first surface 98 of axis alignment device 94. With base plate 70 resting against first surface 98, apex 76 should always point in the positive y-direction, and be aligned with the through hole 104 in the same column as the selected coordinate through hole 104. Because pin orientation device 80 is movable relative to base plate 70, this process will orient pin orientation device 80 at the proper axial angle relative to base plate 70. Pin orientation device 80 may then be fixed relative to base plate 70 using set screw 71 as described above such that the proper axial angle between pin orientation device 80 and base plate 70 is maintained. Then, guiding pin insertion guide 68 may be removed from guiding pin 62 and transferred to the patient.

[0066] Once guiding pin insertion guide 68 is transferred to the patient, base plate 70 is placed on the glenoid face 46, preferably as close to the center of the glenoid face 46 as possible. In this regard, it has been determined that surgeons are capable of accurately determining the center of the glenoid face 46. To ensure proper alignment of base plate 70 on the glenoid face 46, apex 76 of alignment device 78 is pointed at the visible landmark of the patient's anatomy such as the superior apex of the glenoid 46. Then, with pin orientation device 80 already correctly axially aligned relative to base plate 70 due to coordination with axis alignment device 94, the guiding pin 62 may be inserted through elongate channel 92 of pin orientation device 80 and inserted into the glenoid face 46 at the correct axial orientation for either anatomic or reverse arthroplasty (*e.g.*, if guiding pin 62 is a K-wire). The guiding pin insertion guide 68 may then be removed from the guiding pin 62, leaving the guiding pin 62 inserted into the glenoid face 46. Alternatively, a drill may be placed through the aligned pin orientation device 80 to pre-drill a hole (not shown) along the desired patient-specific axis that will subsequently receive guiding pin 62. Regardless, after proper placement of guiding pin 62, the surgeon may then proceed with either the selected anatomic or reverse arthroplasty procedure.

[0067] It should be understood that the pre-operative plan for the patient may include coordinates for each of an anatomic or reverse arthroplasty. In this manner, once the glenoid 46 has been prepared for surgery, the surgeon can determine intra-operatively the correct procedure to perform. Moreover, it should be understood that the coordinates determined pre-operatively can be changed intra-operatively. That is, if the surgeon determines that the axial angle at which the guiding pin 62 is to be inserted into the glenoid 46 will be insufficient, the surgeon may select a different axial angle for the guiding pin 62 by selecting one of the plurality of through holes 104 having a different axial angle than the through hole 104 that was pre-selected pre-operatively. For example, if the surgeon determines intra-operatively that the designed axial angle should be shifted by two degrees in the x-direction, the surgeon may select that through hole 104 on axis alignment device 94 when orienting pin orientation device 80 relative to base plate 70.

Alternatively, the surgeon may select another axis alignment device 94 with less angular differences between each of the coordinate through holes 104.

[0068] Lastly, it should be understood that guiding pin insertion guide 68 and axis alignment device 94 may be reusable. Specifically, each of guiding pin
5 insertion guide 68 and axis alignment device 94 may be formed from materials such as titanium or surgical steel that allows these devices to be sterilized and re-used. As noted above, however, it should be understood that lower surface 74 of base plate 70 may include a patient-specific surface, if desired.

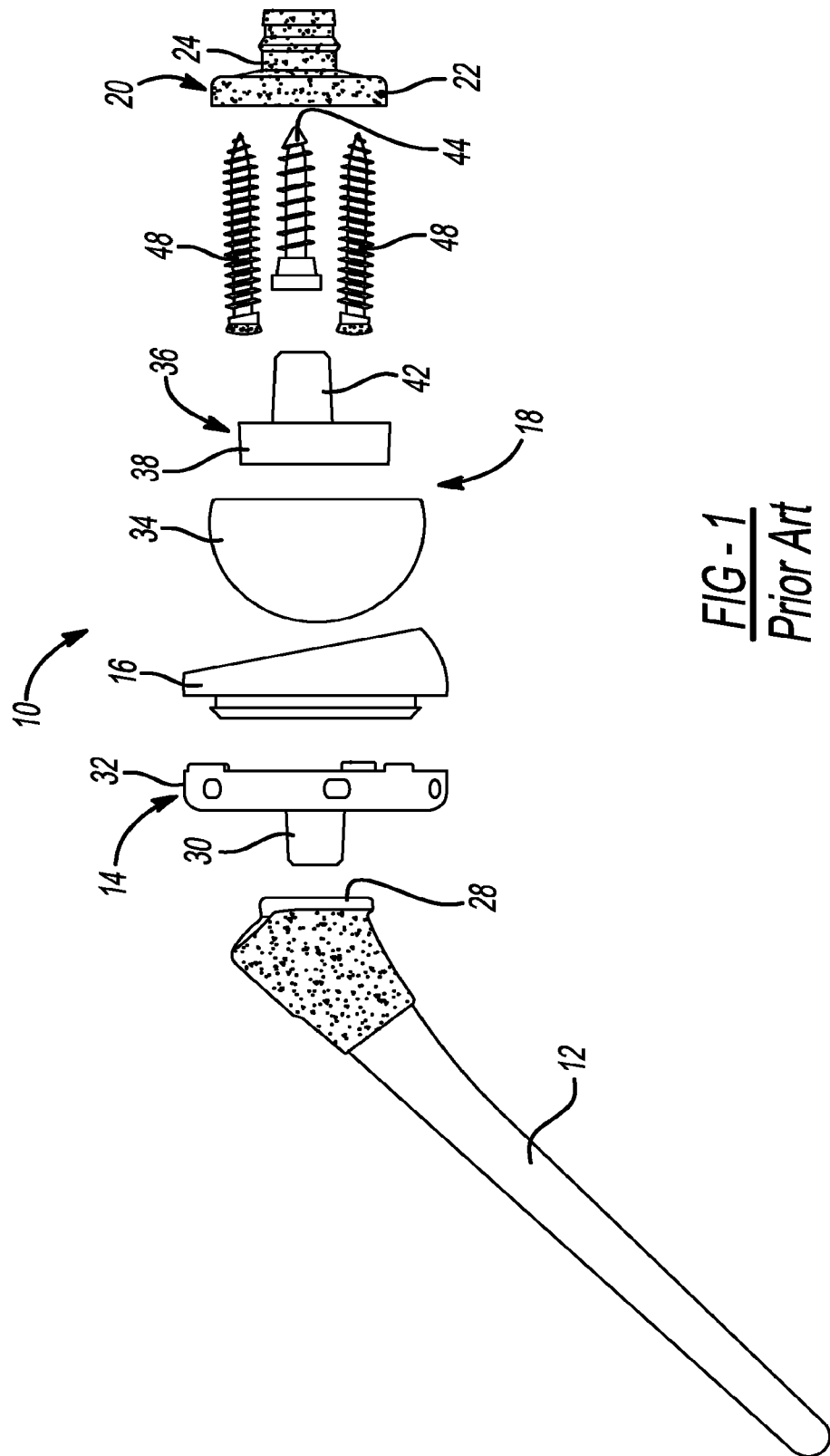
[0069] The foregoing description of the embodiments has been provided for
10 purposes of illustration and description. It is not intended to be exhaustive or to limit the disclosure. Individual elements or features of a particular embodiment are generally not limited to that particular embodiment, but, 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
15 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.

What is claimed is:

1. A system for aligning a guiding pin relative to an anatomic structure, comprising:
guiding pin insertion guide for orienting the guiding pin relative to the anatomic structure, the guiding pin insertion guide including a base plate and a pin orientation device coupled to and extending from the base plate, the pin orientation device being movable relative to the base plate; and
an axis alignment device, the axis alignment device including a first surface and a second surface having a plurality of through holes extending between the first surface and the second surface, each of the through holes defining a different alignment axis, wherein one of the through holes is configured to align the guiding pin at an orientation that is substantially aligned with a patient-specific alignment axis, the guiding pin insertion guide is configured to receive the guiding pin when the guiding pin is mated with one of the through holes to align the guiding pin insertion guide along the patient-specific alignment axis relative to the base plate, and the guiding pin insertion guide is configured to be fixed to the base plate along the patient-specific alignment axis.
2. The system of claim 1, wherein the through holes are arranged in an array.
3. The system of claim 2, wherein the axis alignment device includes a coordinate system.
4. The system of claim 3, wherein the one through-hole defining the patient-specific alignment axis is located at a patient-specific coordinate.
5. The system of claim 3, wherein each through hole defines a different alignment axis by a predetermined angular amount.
6. The system of claim 5, wherein the predetermined angular amount is defined by the coordinate system.

7. The system of claim 1, wherein the base plate includes an alignment device for aligning the base plate with a location visible on the anatomic structure, and for aligning the base plate relative to the axis alignment device.
8. The system of claim 7, wherein the base plate is shaped to include an apex, and the alignment device is defined by the apex.
9. The system of claim 1, wherein the pin orientation device is hollow, and includes a bulbous portion that movably mates with the base plate.
10. The system of claim 9, wherein the bulbous portion allows the pin orientation device to articulate relative to the base plate and lock into place.
11. The system of claim 1, further comprising a reaming device.
12. A system for aligning a guiding pin relative to a glenoid, comprising:
 - a guiding pin insertion guide for orienting the guiding pin relative to the glenoid, the guiding pin insertion guide including a base plate having an upper surface and a glenoid-engaging surface, and a pin orientation device coupled to and extending from the upper surface of the base plate, the pin orientation device being movable relative to the base plate; and
 - at least one axis alignment device, the axis alignment device including a first surface and a second surface having a plurality of through holes arranged in a coordinated array extending between the first surface and the second surface, each of the through holes defining a different alignment axis, wherein one of the through holes is configured to align the guiding pin at an orientation that is at least proximate a patient-specific alignment axis defined by a patient-specific coordinate of the array, the guiding pin insertion guide is configured to receive the guiding pin when the guiding pin is mated with the one through hole to align the guiding pin insertion guide along the patient-specific alignment axis relative to the base plate, and the guiding pin insertion guide is configured to be fixed to the base plate along the patient-specific alignment axis.

13. The system of claim 12, wherein each through hole defines a different alignment axis by a predetermined angular amount.
14. The system of claim 13, wherein the predetermined angular amount is defined by the coordinate system.
15. The system of claim 12, wherein the base plate includes an alignment device for aligning the base plate with a location visible on the glenoid, and for aligning the base plate relative to the axis alignment device.
16. The system of claim 15, wherein the base plate is shaped to include an apex, and the alignment device is defined by the apex.
17. The system of claim 12, wherein the pin orientation device is hollow, and includes a bulbous portion that movably mates with the base plate.
18. The system of claim 17, wherein the bulbous portion allows the pin orientation device to articulate relative to the base plate and lock into place.
19. The system of claim 12, wherein each of the guiding pin insertion guide and the alignment axis device are reusable.
20. The system of claim 19, wherein the guiding pin insertion guide and the alignment axis device are formed from either titanium or surgical steel.
21. The system of claim 12, further comprising a reaming device.



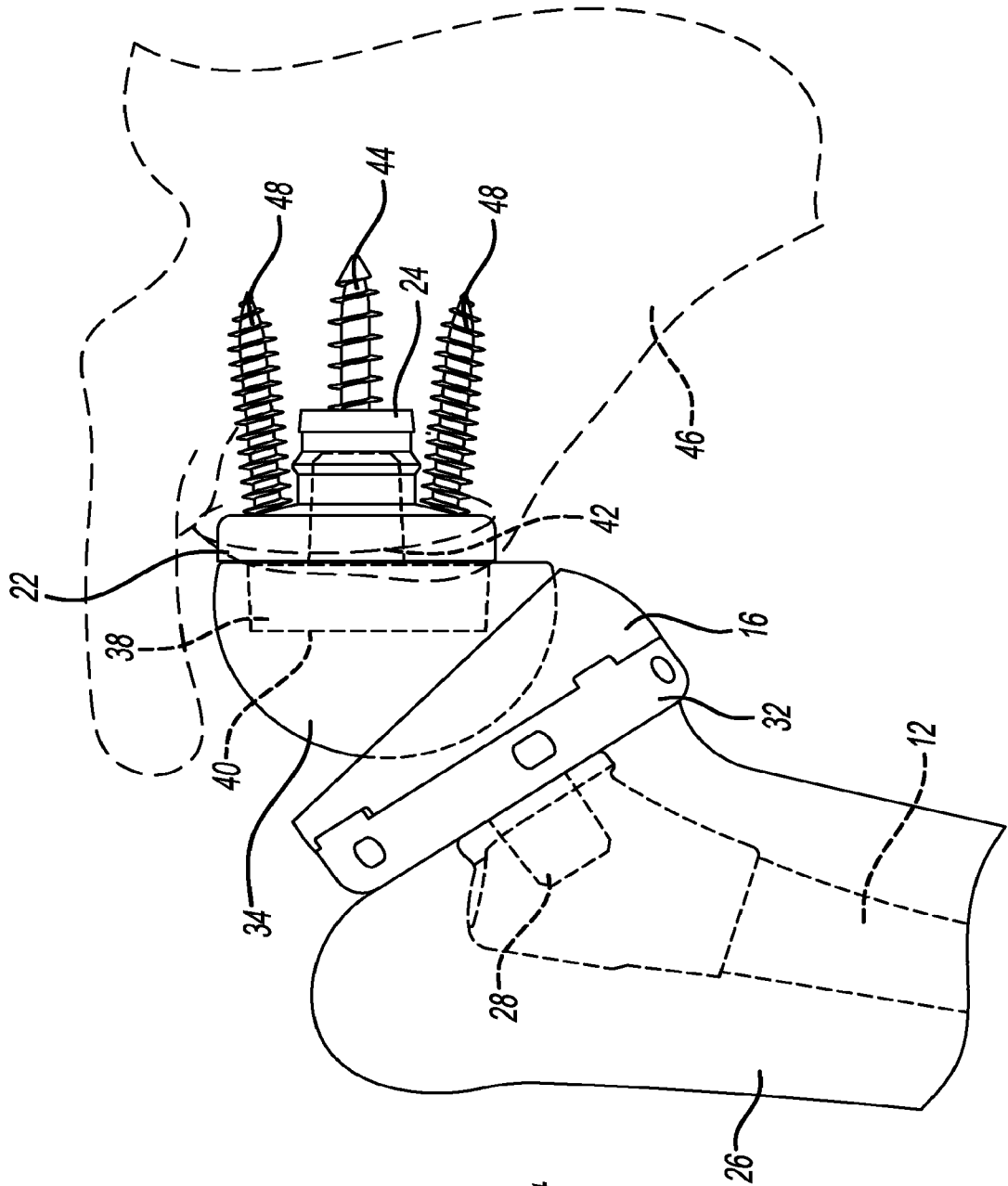
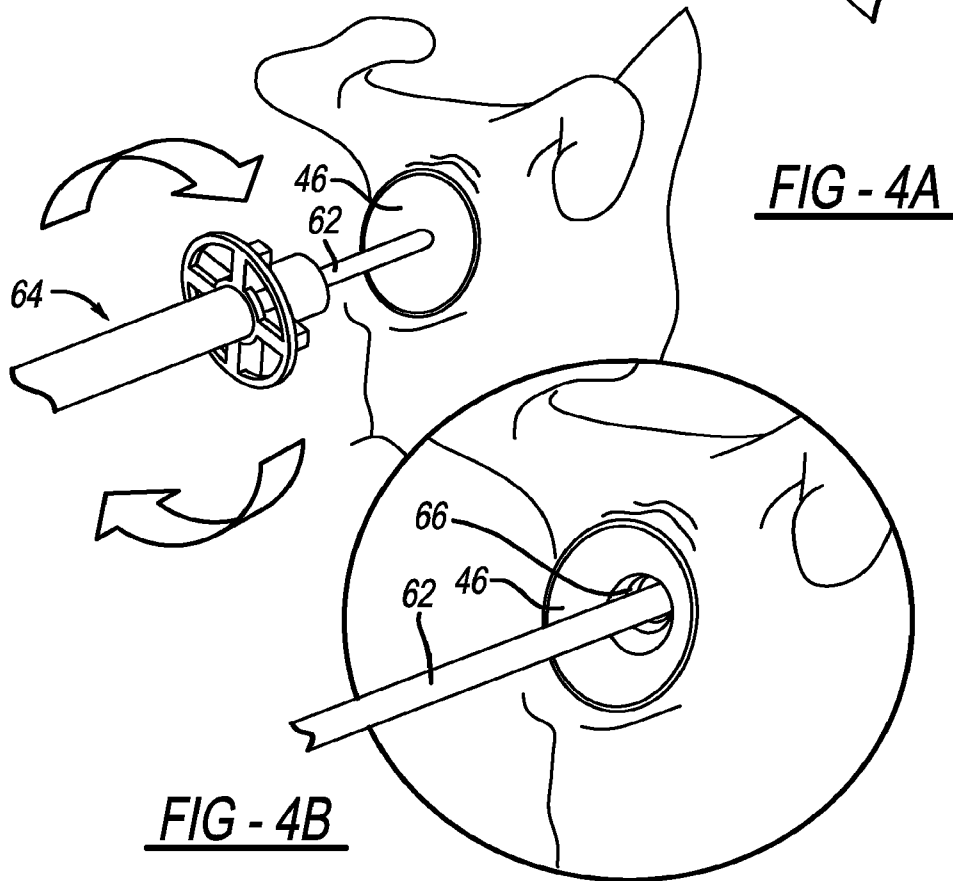
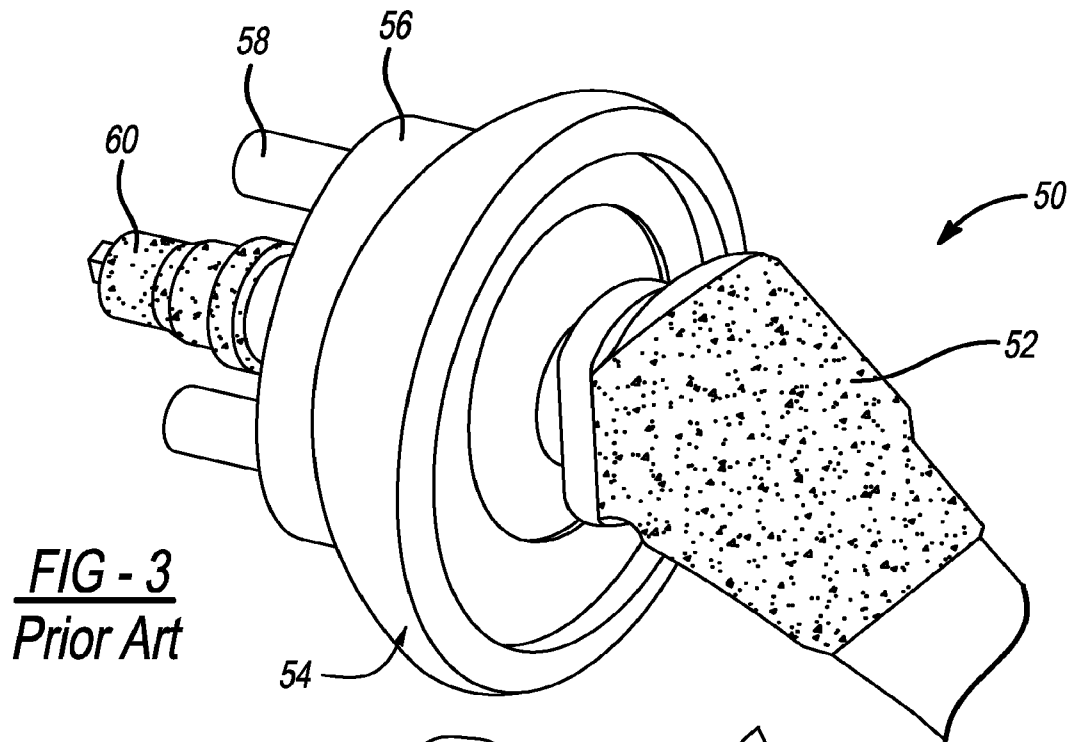
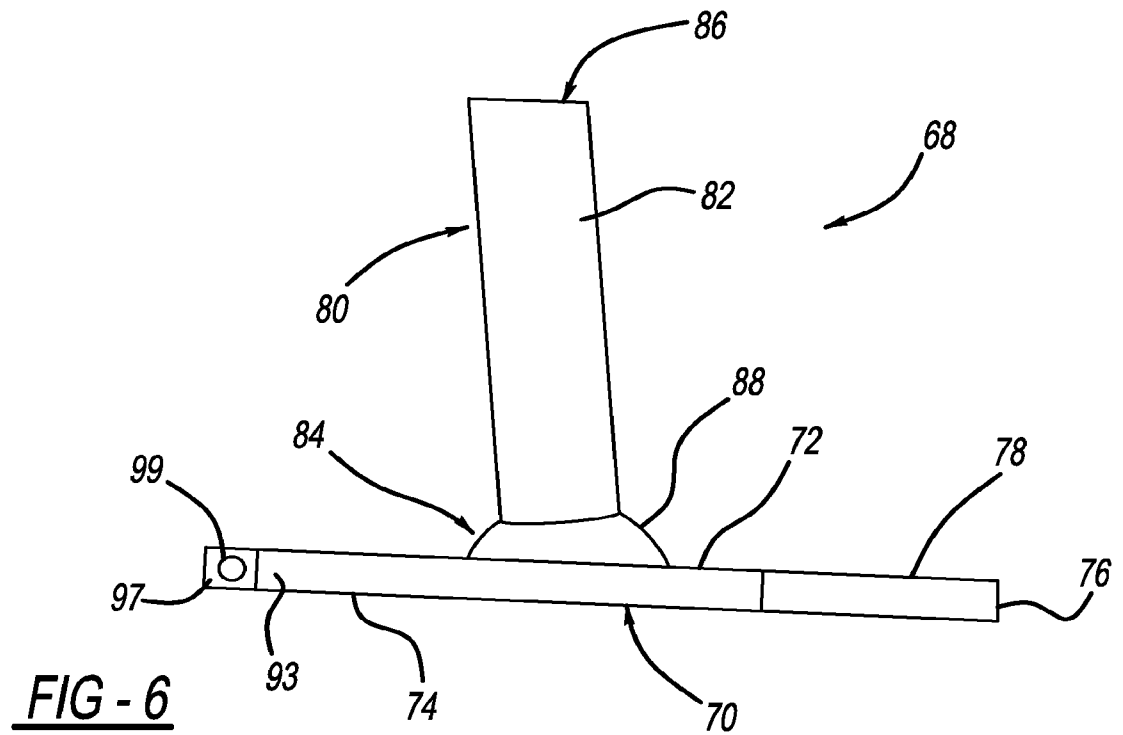
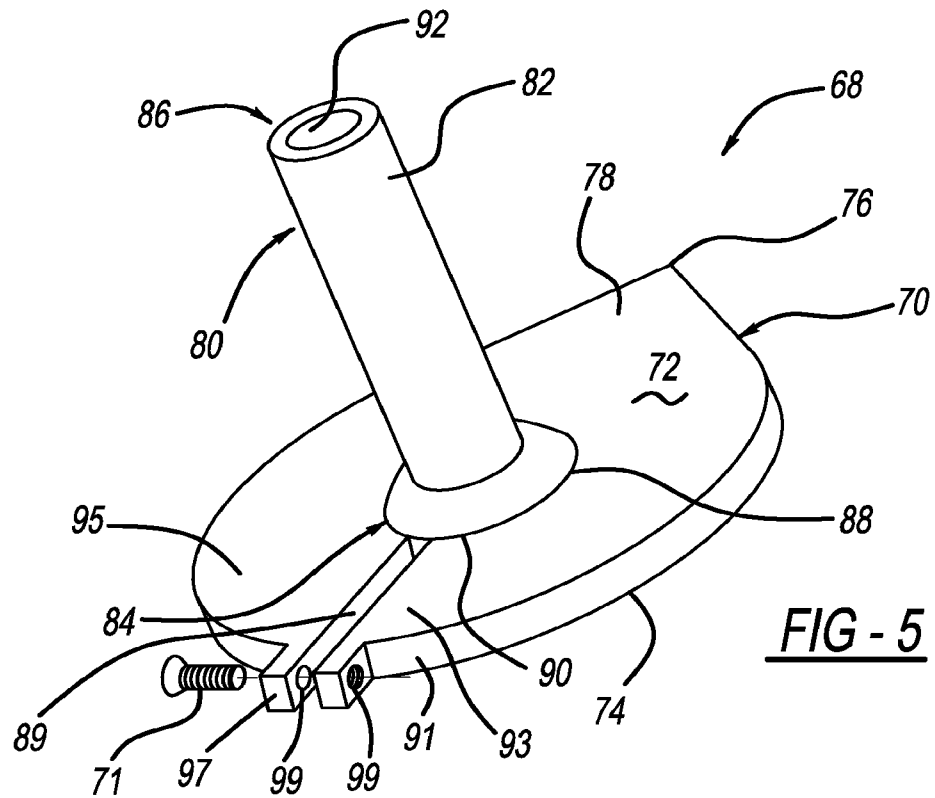
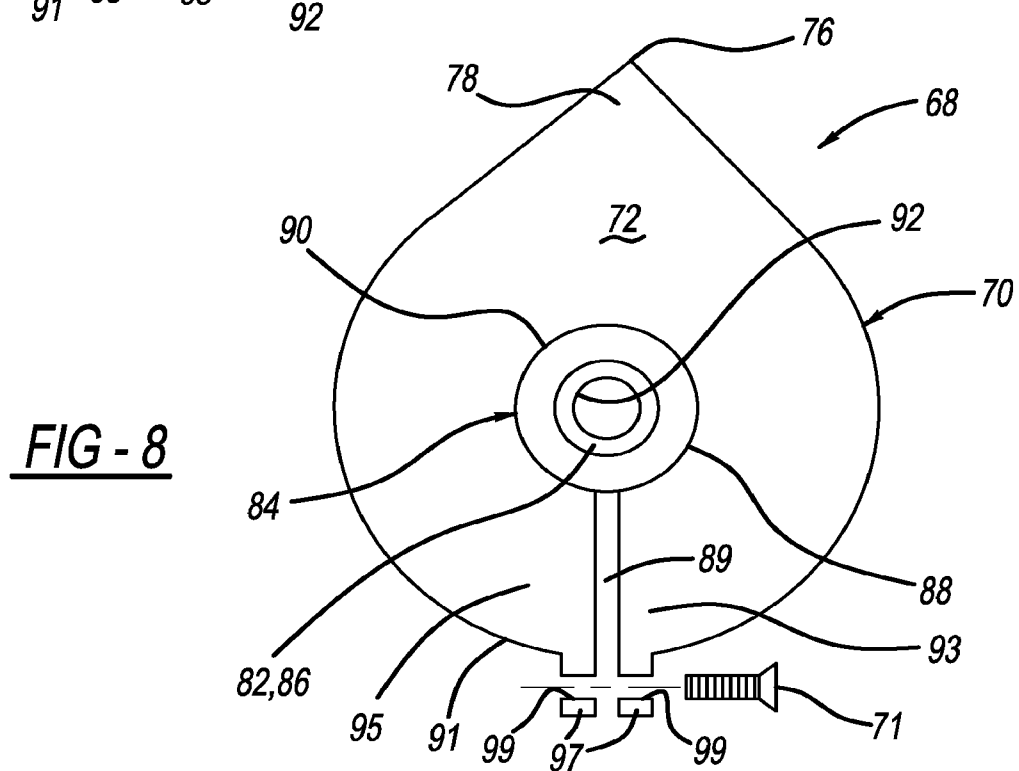
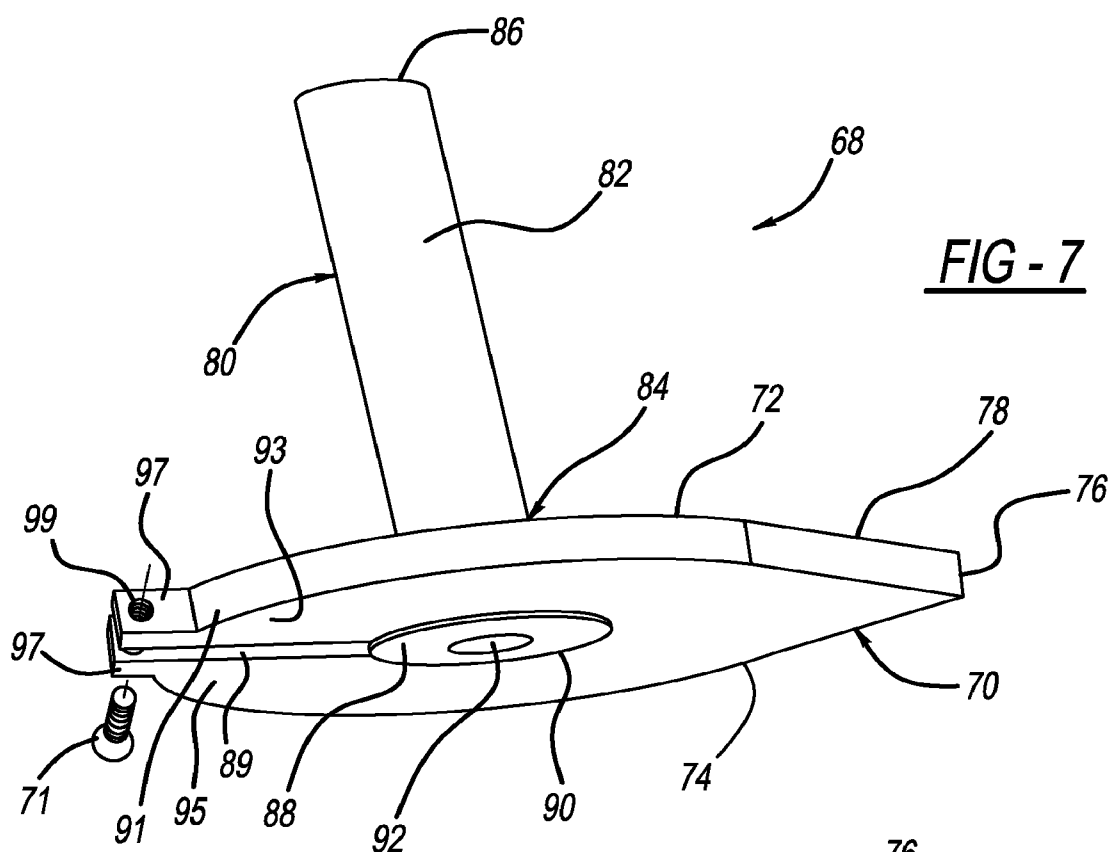
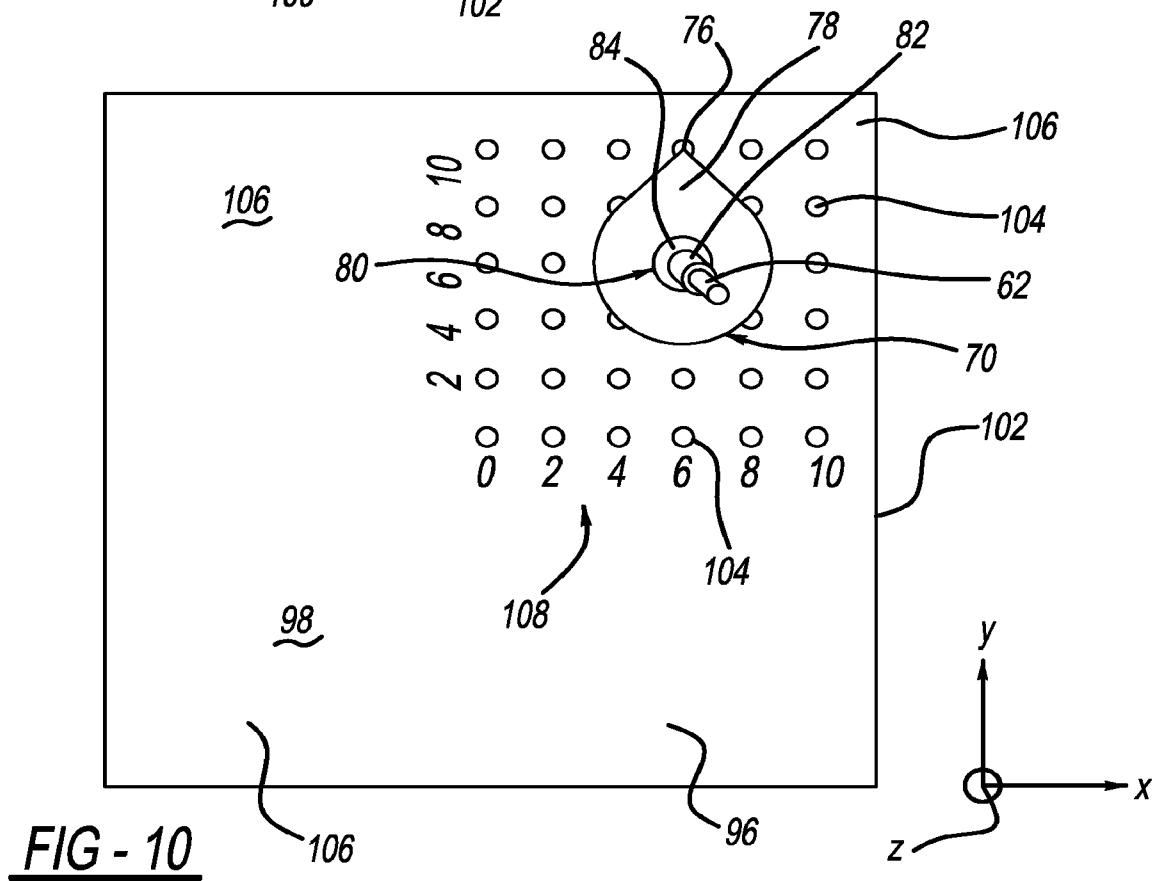
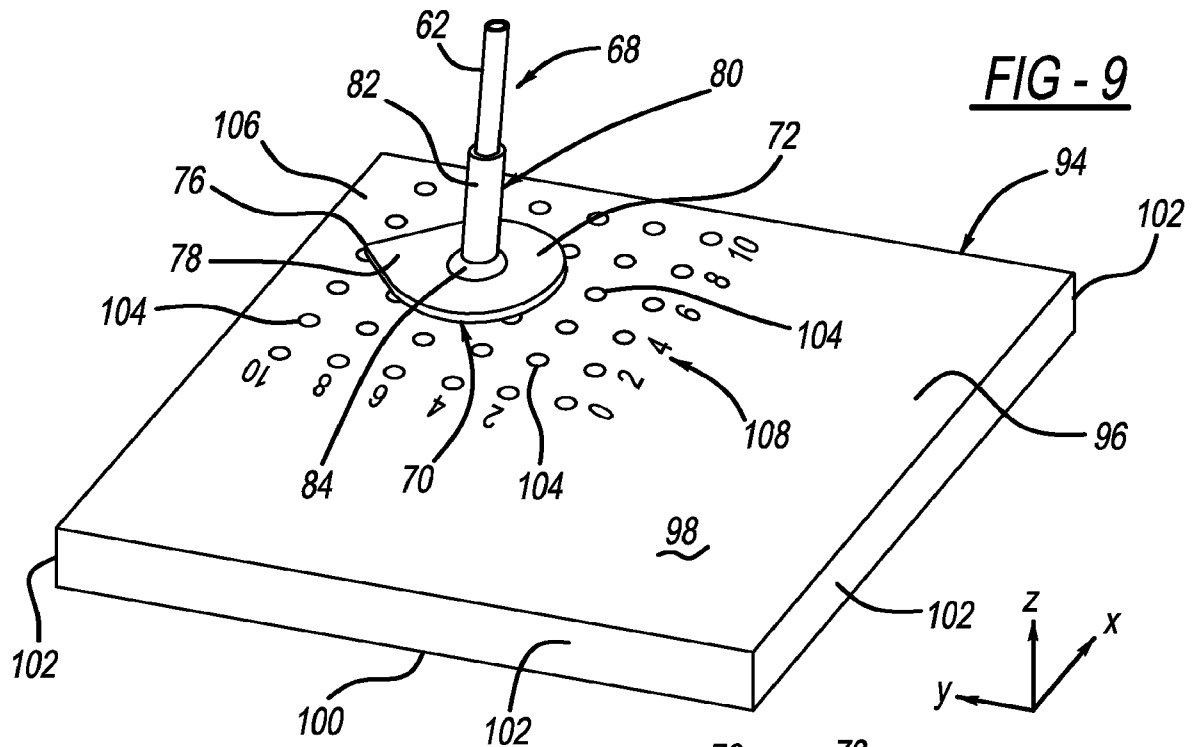


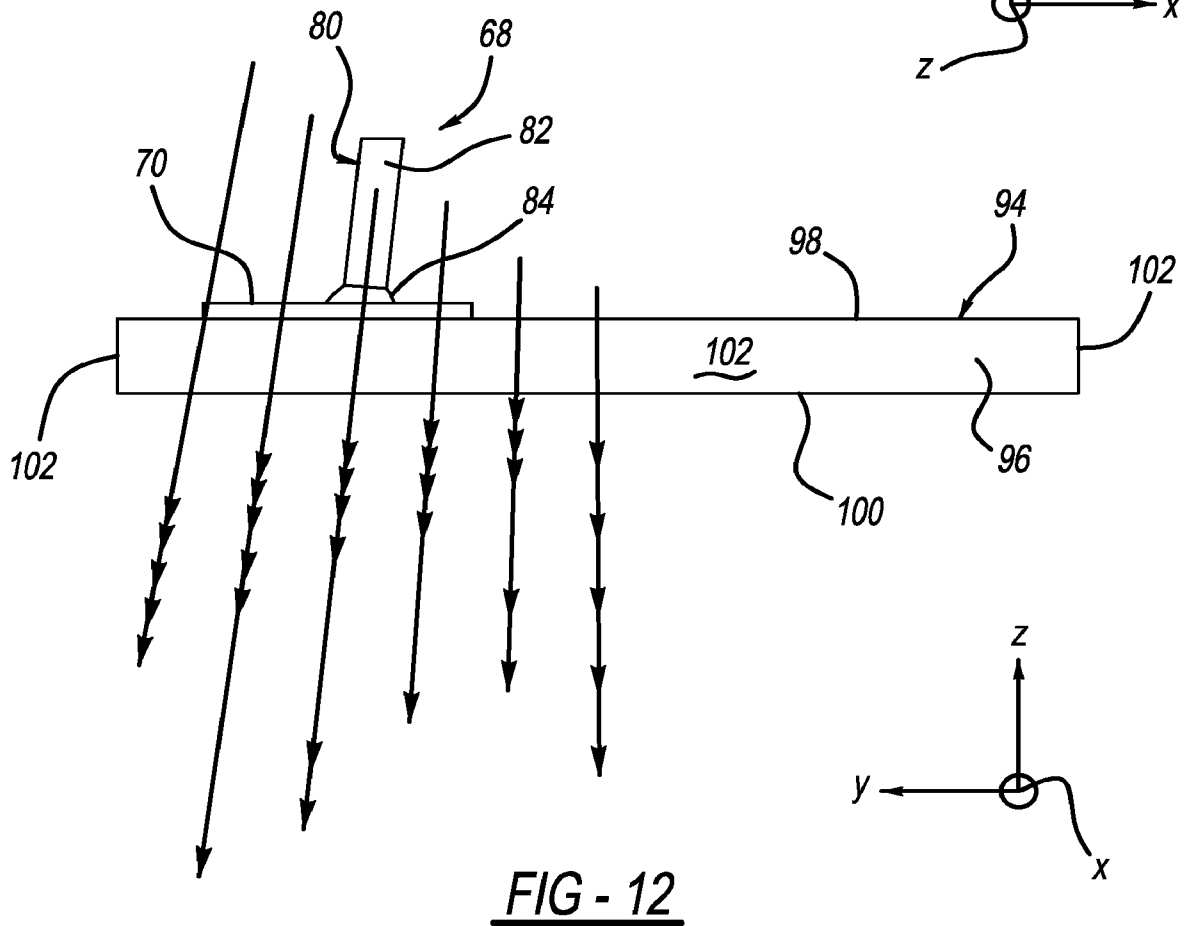
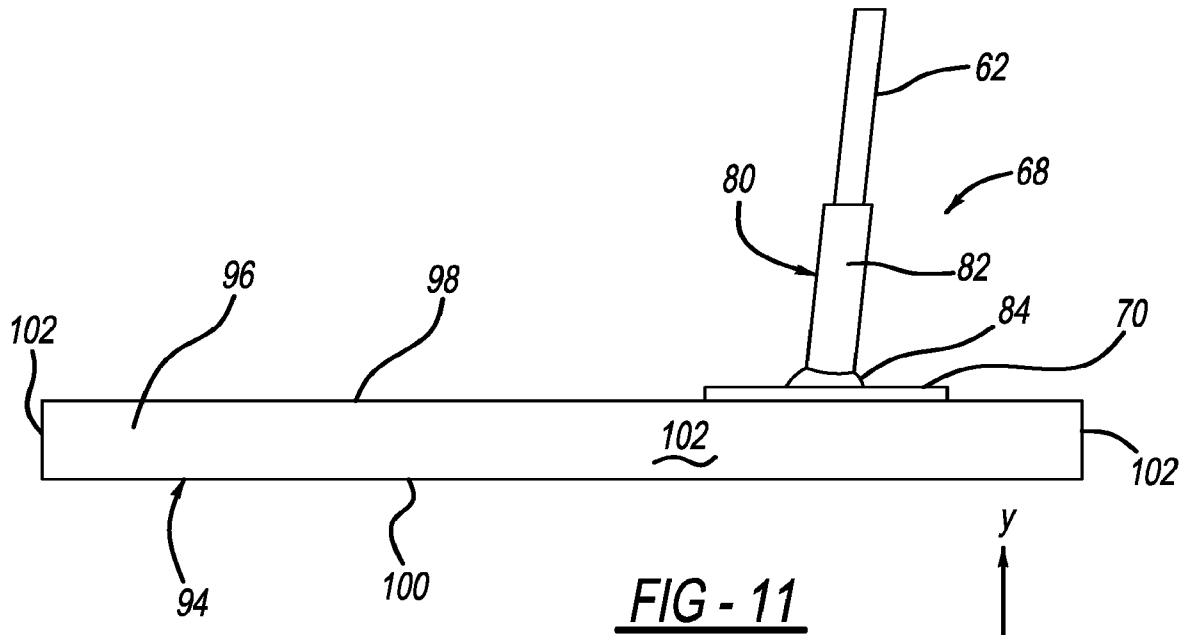
FIG-2
Prior Art

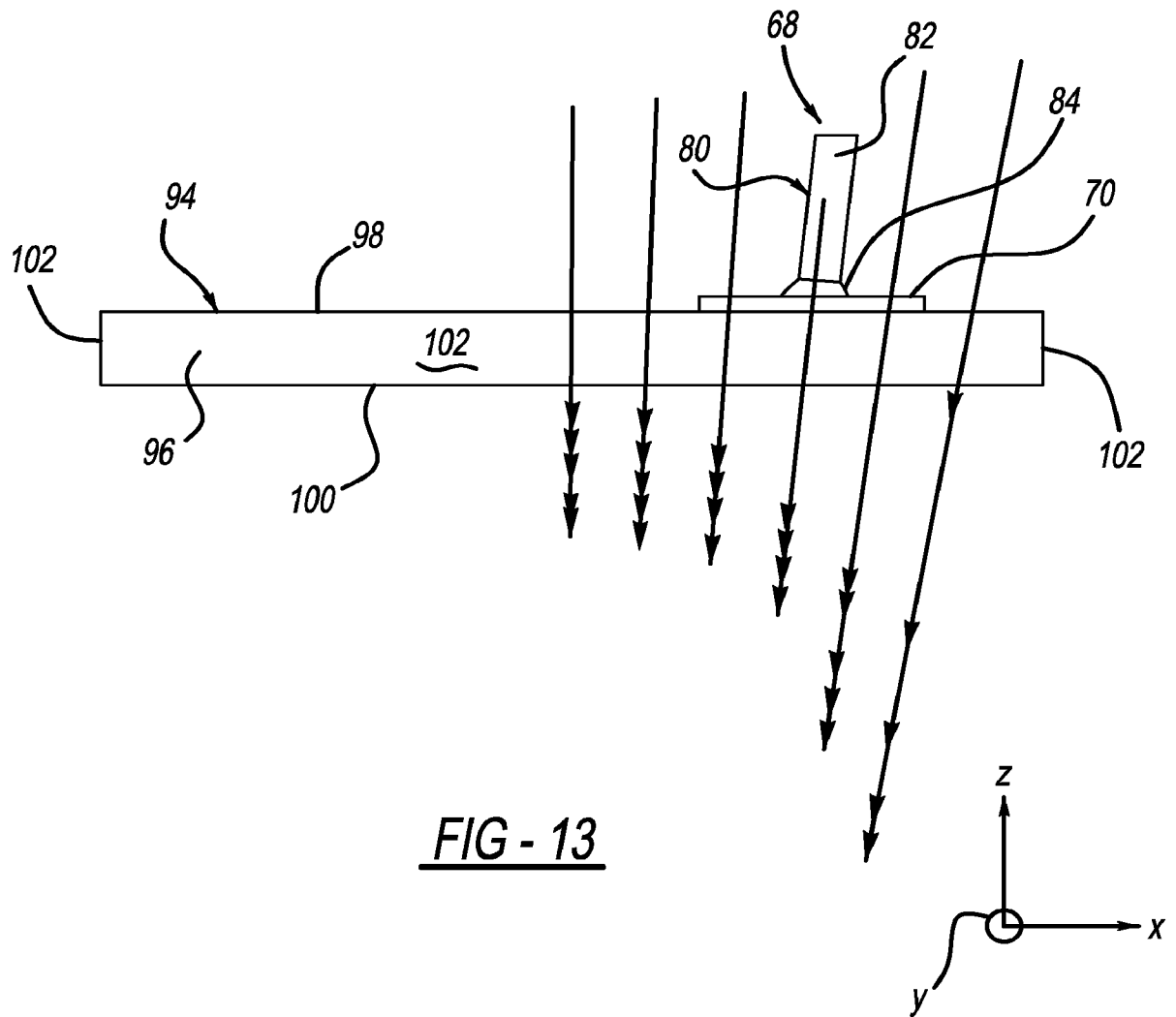












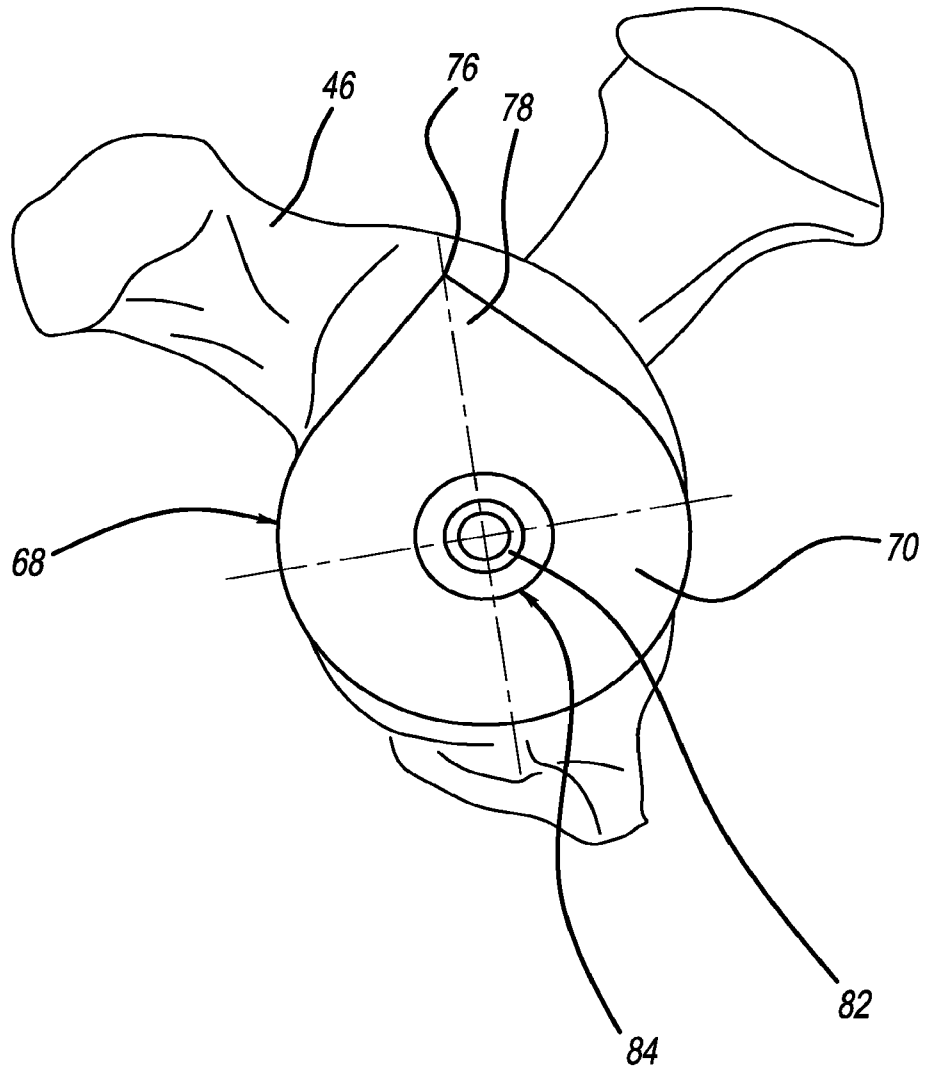


FIG - 14

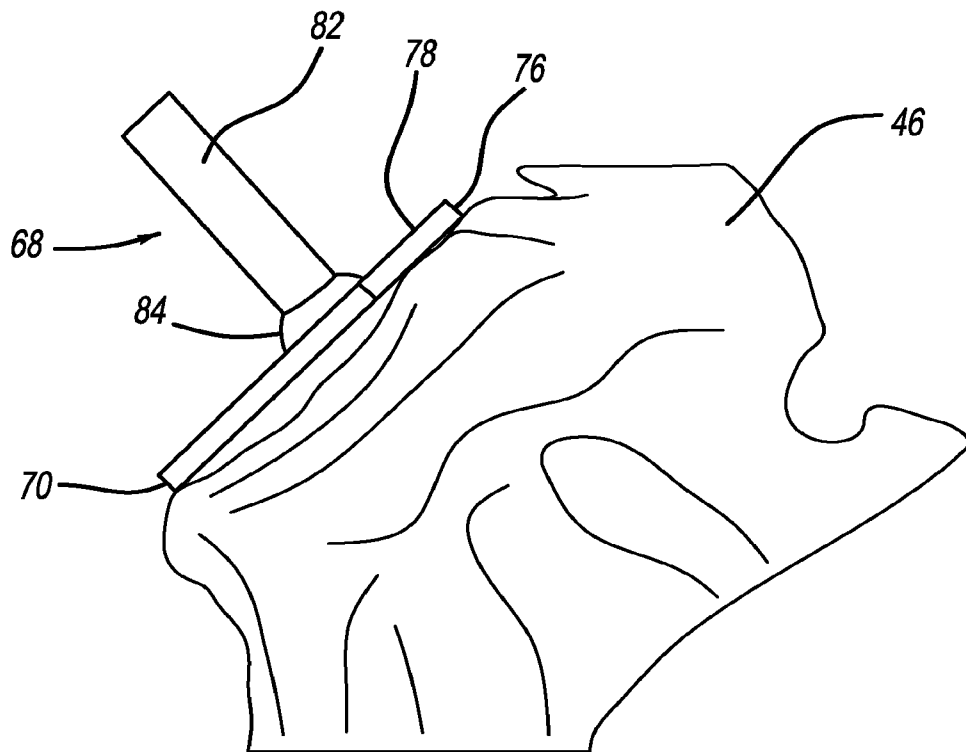


FIG - 15

