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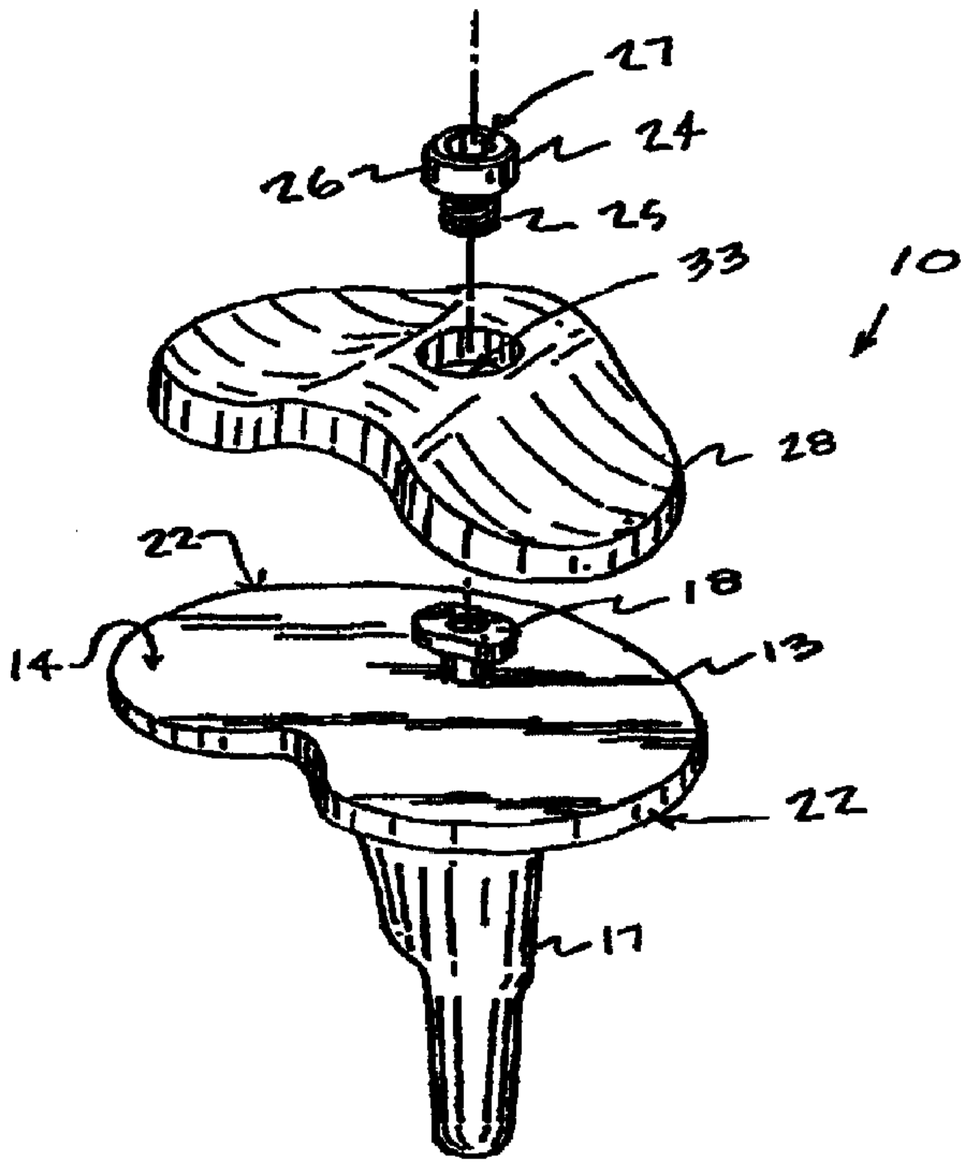
(54) **PROTHESE DE GENOU A SUPPORT MOBILE**
(54) **MOBILE BEARING KNEE PROSTHESIS**



(57) Une prothèse de genou à support mobile permet à un chirurgien de transformer un élément d'insertion de support mobile comportant des surfaces articulaires supportées par une plaque ou un plateau tibial provenant d'une prothèse à rotation et à translation en une prothèse qui ne peut que tourner. Cette transformation s'effectue au moyen d'un dispositif de fixation ou d'un élément de blocage qui par une ouverture formée dans l'élément d'insertion se connecte à la plaque tibiale. Cette prothèse peut être utilisée en tant qu'élément d'une chirurgie totale du genou lorsque le chirurgien choisit d'utiliser une prothèse comportant une surface articulaire mobile.

(57) A mobile bearing knee prosthesis enables a surgeon to convert a mobile bearing insert having articular surfaces, supported by a tibial base plate or tray from a rotating and translating prosthesis to one that rotates only. This conversion is accomplished with a fastener or locking member that connects through an opening in the insert to the tibial base plate. This prosthesis can be used as part of a total knee surgery when the surgeon chooses to use a prosthesis that incorporates a movable articular surface.

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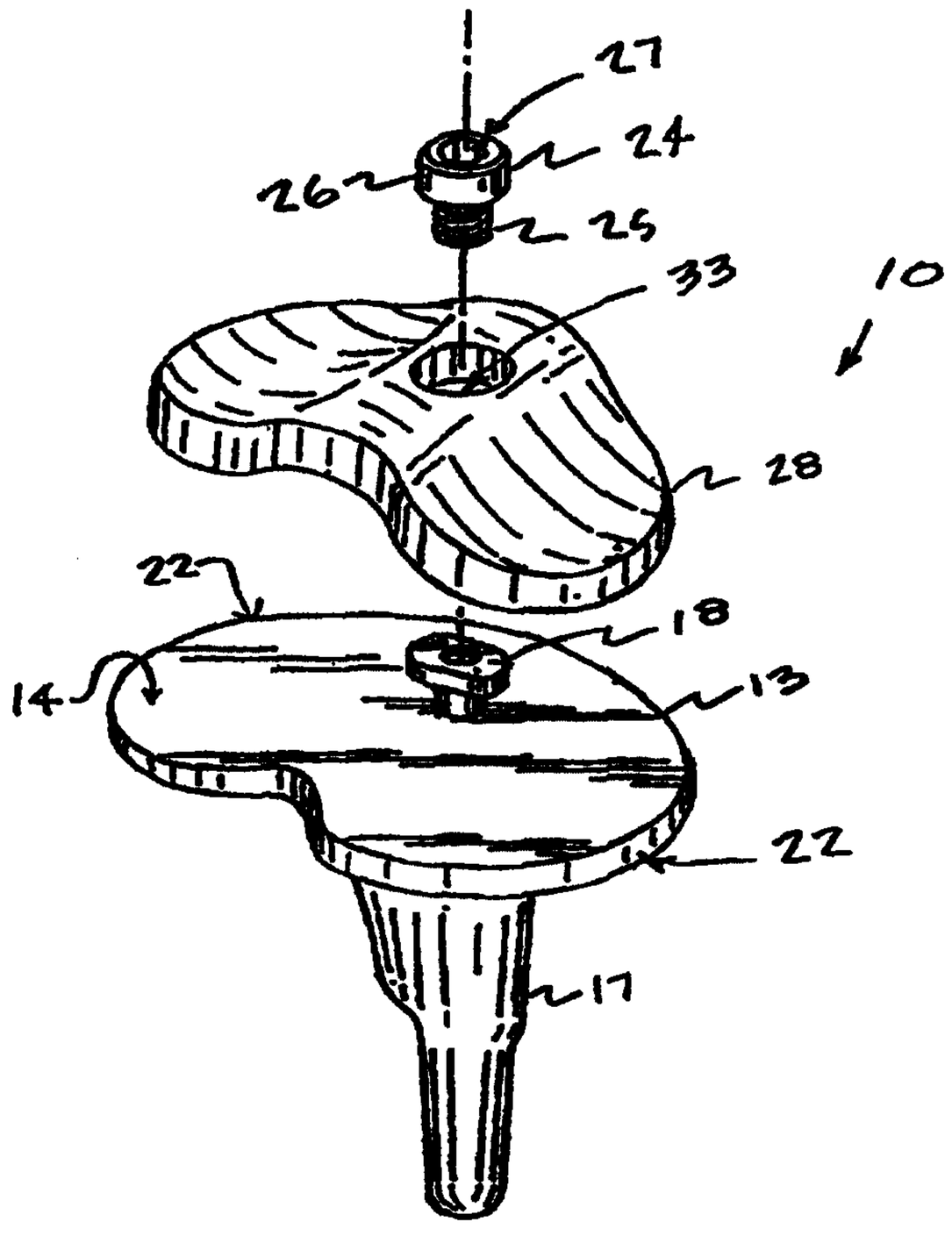
(54) **Title:** MOBILE BEARING KNEE PROSTHESIS

(57) **Abstract**

A mobile bearing knee prosthesis enables a surgeon to convert a mobile bearing insert having articular surfaces, supported by a tibial base plate or tray from a rotating and translating prosthesis to one that rotates only. This conversion is accomplished with a fastener or locking member that connects through an opening in the insert to the tibial base plate. This prosthesis can be used as part of a total knee surgery when the surgeon chooses to use a prosthesis that incorporates a movable articular surface.



MOBILE BEARING KNEE PROSTHESIS

The present invention relates to orthopaedic prosthetic devices, and more particularly to an improved rotating platform, mobile knee prosthesis that incorporates anterior stabilization along with the ability to constrain the movement of the articular surface from rotation and translation, to rotation only.

Previous rotating platform designs have incorporated rotating only or rotation and translation through the use of different prosthesis. An example of a prosthesis that rotates and translates is shown in British publication 2219942, entitled "Knee prosthesis", and in the German document DE-A-4308563.

The present invention has as an object a tibial base plate and mating articular insert with specially configured stabilization posts. The invention enables for the surgeon to convert a mobile bearing articular surface from a fixed to a rotating only or translating only. The prosthesis can also provide both rotation and translation simultaneously.

These conversions are accomplished with special locking members or plugs that connect to the tibial base special plate. The plugs can be secured to the base plate with a taper lock or a thread connection for example.

A post on the proximal tibial base plate can be positioned with an offset with respect to an oval hole in the articular insert to provide anterior stabilzation in the total knee prosthesis.

The prosthesis of the present invention will be used as part of a total knee surgery when the surgeon chooses to use a prosthesis that incorporates a particular, selected relative motion between tibial tray and tibial insert.

BRIEF DESCRIPTION OF THE SEVERAL VIEW OF THE DRAWINGS

For a further understanding of the nature, objects, and advantages of the present invention, reference should be had to the following

AMENDED SHEET

detailed description, read in conjunction with the following drawings, read in conjunction with the following drawings, wherein like reference numerals denote like elements and wherein:

Figure 1 is a perspective, exploded view of the preferred embodiment of the apparatus of the present invention;

Figure 2 is a partial sectional of the preferred embodiment of the apparatus of the present invention illustrating the locking member portion thereof;

Figure 3 is a top, fragmentary view of the preferred embodiment of the apparatus of the present invention illustrating the locking member portion thereof;

Figure 4 is a partial, elevational view of the preferred embodiment of the apparatus of the present invention illustrating the locking member portion thereof;

Figure 5 is a rear, elevational and exploded view of the preferred embodiment of the apparatus of the present invention illustrating the articular polymeric insert and tray portions thereof;

Figure 6 is a sectional, elevational view of the preferred embodiment of the apparatus of the present invention shown with the locking member removed;

Figure 7 is another sectional, elevational view of the preferred embodiment of the apparatus of the present invention illustrating the locking member in operating position when only rotational movement is desired;

Figure 8 is a partial top view of the preferred embodiment of the apparatus of the present invention showing the polymeric insert;

Figure 9 is a partial, bottom view of the preferred embodiment of the apparatus of the present invention showing the polymeric insert;

Figure 10 is a partial rear view of the preferred embodiment of the apparatus of the present invention showing the polymeric insert;

Figure 11 is a partial sectional view of the preferred embodiment of the apparatus of the present invention taken along lines 11-11 of Figure 8;

Figure 12 is a sectional view of the preferred embodiment of the apparatus of the present invention taken along lines 12-12 of Figure 8;

Figure 13 is a partial top view of the preferred embodiment of the apparatus of the present invention illustrating the tray;

Figure 14 is a sectional view of the preferred embodiment of the apparatus of the present invention taken along lines 14-14 of Figure 13;

Figure 15 is a top view of the preferred embodiment of the apparatus of the present invention illustrating the insert and tray portions thereof in operating position without the locking member;

Figure 16 is a top side view of the preferred embodiment of the apparatus of the present invention illustrating the insert, tray and locking member portions thereof in operating position;

Figure 17 is a top view of the preferred embodiment of the apparatus of the present invention illustrating rotation of the insert relative to the tray;

Figures 18-21 are fragmentary perspective views of an alternate embodiment of the apparatus of the present invention illustrating constructions for the post portion and illustrating the connection between the post and the tray;

Figures 22-25 are schematic plan views of alternate constructions of the tibial insert to be used respectively with the post constructions of Figures 18-21;

Figure 26 is a top view of the second alternate embodiment of the apparatus of the present invention illustrating the tray portion thereof;

Figure 27 is an elevational view of the second alternate embodiment of the apparatus of the present invention illustrating the tray portion thereof;

Figure 28 is a bottom view of the second alternate embodiment of the apparatus of the present invention illustrating the tray portion thereof;

Figure 29 is a plan view of the second embodiment of the apparatus of the present invention illustrating the polymeric insert portion thereof;

Figure 30 is a frontal elevational view of the second alternate embodiment of the apparatus of the present invention illustrating the plastic insert portion thereof;

Figure 31 is a bottom view of the plastic insert portion of the second alternate embodiment of the apparatus of the present invention;

Figure 32 is a fragmentary view of the second alternate embodiment illustrating the locking plug member portion thereof;

Figure 33 is a sectional view taken along lines 33-33 of Figure 32;

Figure 34 is a sectional view taken along lines 34-34 of Figure 26

Figure 35 is a sectional view taken along lines 35-35 of Figure 29;

Figure 36 is a sectional view taken along lines 36-36 of Figure 29;

Figure 37 is an elevational view of the second alternate embodiment of the apparatus of the present invention illustrating the cap and set screw separated from the insert and tray portions thereof;

Figure 38 is a partial sectional elevational view of the second alternate embodiment of the apparatus of the present invention illustrating the mobile insert moving with respect to the tray;

Figure 39 is a perspective exploded view of a third alternate embodiment of the apparatus of the present invention;

Figure 40 is a partial top view of the third alternate embodiment of the apparatus of the present invention illustrating the insert portion thereof;

Figure 41 is a side view of the insert portion of the third alternate embodiment of the apparatus of the present invention;

Figure 42 is a perspective view of the insert portion of the third alternate embodiment of the apparatus of the present invention;

Figure 43 is a posterior view of the insert portion of the third alternate embodiment of the apparatus of the present invention;

Figure 44 is a bottom view of the tray portion of the third alternate embodiment of the apparatus of the present invention;

Figure 45 is a side view of the tray portion of the third alternate embodiment of the apparatus of the present invention;

Figure 46 is a perspective view of the tray portion of the third alternate embodiment of the apparatus of the present invention;

Figure 47 is a posterior view of the tray portion of the third alternate embodiment of the apparatus of the present invention;

Figures 48-49 are fragmentary views of the third alternate embodiment of the apparatus of the present invention illustrating one of the plug portions thereof;

Figures 50-51 are side and top views of a second plug portion that is used with the third alternate embodiment of the apparatus of the present invention;

Figure 52 is a perspective, exploded view of an alternative embodiment of the apparatus of the present invention;

Figure 53 is a sectional, elevational view of the alternative embodiment shown in Figure 52, shown with the locking member removed;

Figure 54 is another sectional, elevational view of the alternative embodiment shown in Figure 52, illustrating the locking member in operating position when only rotational movement is desired;

Figure 55 is a partial top view of the alternative embodiment of the apparatus shown in Figure 52 illustrating the tray; and

Figure 56 is a sectional view of the alternative embodiment of the apparatus shown in Figure 52 taken along lines 56-56 of Figure 55.

DETAILED DESCRIPTION OF THE INVENTION

Figures 1-7 show generally the preferred embodiment of the apparatus of the present invention designated generally by the numeral 10 in Figures 1, 6, and 7.

Mobile bearing knee prosthesis 10 is placed upon a patient's surgically cut proximal tibia 11 at a surgically cut proximal surface 12 that is preferably flat. This enables a tray 13 to be mounted to the proximal tibia 11 at surface 12 as shown in Figures 6 and 7. Tray 13 has a flat proximal surface 14 and a generally flat distal surface 15 that mates with and faces the surgically prepared surface 12 as shown in Figures 6-7. The tray 13 can provide a plurality of spikes 16 and a stem 17 for enhancing implantation to the patient's proximal tibia 11.

The proximal surface 14 of tray 13 provides a post 18 having an internally threaded socket 19.

Post 18 is comprised of a generally cylindrically-shaped smaller diameter section 20 and an enlarged flange 21 that mounts to the top of cylindrically-shaped section 20 as shown in Figures 5 and 13-14. Tray 13 has a periphery 22. A recess 23 is provided in between the proximal surface 14 of tray 13 and flange 21.

A locking member 24 forms a removable connection with the socket 19. Locking member 24 has an externally cylindrical section 25 that provides threads that correspond to the threads of internally socket 19 so that the locking member 24 can be threaded into the socket 19 as shown in Figure 7. Locking member 24 includes an enlarged cylindrically-shaped head 26 having a tool receptive socket 27 such as a hexagonal socket for example.

A polymeric insert 28 provides a vertical channel 33 that can be placed in communication with post 18 as shown in Figures 6 and 7. Insert 28 provides a preferably flat distal surface 29 that communicates with the flat proximal surface 14 of tray 13. A pair of spaced apart concavities 30, 31 are provided for defining articulation surfaces that cooperate with correspondingly shaped

articulating surface on a patient's femur or femoral implant. The insert 28 has a periphery 32 that generally corresponds in shape to the periphery 22 of tray 13.

Vertical channel 33 is comprised of a number of sections that are specially shaped to interact with the post 18 and locking member 24. Vertical channel 33 thus includes a proximal, cylindrically-shaped section 34, an oval shaped slot 35, and a distal opening 36. The distal opening 36 includes a generally oval section 37 and a somewhat half oval section 38. Flat surfaces 39, 40 are positioned at the top of and at the bottom of the oval shaped slot 35 as best seen in Figures 8-11. The cylindrically-shaped head 26 of locking member 24 closely fits the cylindrically-shaped section 36.

In order to assemble insert 28 to tray 13, the distal surface of 29 of insert 28 is placed next to and generally parallel to the proximal surface 14 of tray 13. Post 18 is aligned with vertical channel 33 of insert 28. During assembly of insert 28 to tray 13, the post 18 is shaped to enter the oval opening portion 37 of distal opening 36. Once the distal surface 29 of insert 28 meets proximal surface 14 of tray 13, flange 21 aligns with oval shaped slot 35 of vertical channel 33. After such assembly, insert 28 is held in position by post 18. This retention of insert 28 by post 18 occurs when flange 21 engages flat surface 40 to prevent separation if any rotation (see arrow 41 of Figure 17) at all occurs between insert 28 and tray 13. If no rotation has occurred between insert 28 and tray 13 (see Figure 15), the oval shaped circular section 37 is sized to allow post 18 to be inserted into or withdrawn from channel 33.

In Figure 15, the apparatus 10 is shown in an assembled position wherein the fastener 24 has been removed so that the insert 28 can move in a translation and rotation and rotation fashion relative to tray 13. In Figure 16, the fastener 24 has been threadably attached to the internally threaded socket 19 and is in operating position. In Figure 17, the insert 28 can rotate relative to the tray 13 through an angle 41.

However, because of the attachment of fastener 24, only rotation and not translation is permitted in Figure 17. Thus, in Figure 17, the apparatus 10 of the present invention provides a mating mechanism between the post 18 and the fastener 24 and the insert 28 that defines a constraining mechanism so that the insert 28 may be constrained for rotation only relative to the tray 13.

In Figures 18-21 and 22-25, there is seen various alternate constructions of the post that can be used instead of post 18 when the selected post is fitted to the tibial tray 13. In Figures 22-25, an alternate construction of the insert 28 is shown with an illustration of the various types of relative motion between the insert and the tibial tray that can be selectively provided to a surgeon.

In Figure 18-21, four different constructions of the post are provided. In Figure 18, a post 42 has a cylindrical outer surface 43 and a circular top 44. Post 42 has a rectangular base 45 with a generally flat undersurface and a plurality of four inclined surfaces 46 which provides a means of attaching the post to the tray or the post may be permanently attached to the tray. The rectangular base 45 fits tray 13A socket 47 at its inclined surfaces 48 with a taper lock type connection for example. Other types of connections could be used to join post 42 to tray 13A at socket 47.

In Figure 19, post 49 includes a plurality of four vertical side walls 50 and a plurality of four inclined surfaces 51. A rectangular flat top 52 is provided opposite a generally flat undersurface of post 49. The inclined surfaces 51 of post 49 fit similarly configured inclined surfaces 48 of socket 47 in tray 13A.

In Figure 20, post 53 is generally rectangularly shaped providing a pair of opposed flat larger vertical side walls 54 and a pair of opposed flat smaller end walls 55 with a flat top 56. Post 53 has a base 57 that includes four inclined surfaces 58. The inclined surfaces 58 form a taper lock connection with four

similarly configured inclined surfaces 48 of socket 47 of tray 13A.

In Figure 21, post 59 has a hexagonal shape providing a hexagonally shaped flat top 60. Hexagonal post 59 also has a plurality of vertical side walls 61 and a rectangular base 62. The base 62 has inclined surfaces 63 that form a taper lock connection with inclined surfaces 48 of tray socket 47 of tray 13A.

In Figure 22, insert 28A provides a square opening 64 that exactly fits peg 49. In Figure 22, there is no relative motion between insert 28A and tray 13A. In Figure 23, rotational motion only is indicated by arrow 65 between insert 28A and tray 13A when peg 42 is used.

In Figure 24, the rectangular peg 53 enables only translational movement between the insert 28A and tray 13A as indicated by arrow 66. In Figure 25, the hexagonal peg 59 enables both rotational motion as indicated by arrow 65 and translational motion as indicated by arrow 66 between insert 28A and tray 13A.

An alternate embodiment of mobile bearing knee apparatus 110 is shown generally in Figure 37. In Figure 37, the prosthesis 110 is shown positioned upon a patient's proximal tibia 111, specifically upon a flat surgically cut proximal surface 112 as shown.

In Figures 26-28, tibial tray 113 is shown, which can be of metallic construction such as titanium alloy, for example. Tray 113 has a flat proximal surface 114 and a flat distal surface 115. A plurality of spikes 116 on surface 115 can be used to enhance fixation of tibial tray 113 to the patient's proximal tibial 111. A stem 117 can also be used to facilitate attachment of prosthesis 110 to the patient's tibia 111 at the tibial intramedullary canal.

The flat proximal surface 114 of tray 113 has a round post 118 with a hollow bore or socket 119. The post 118 is spaced inwardly from the periphery 120 of tray 113 as shown in Figures 26 and 27. The post 118 is preferably positioned with an offset with respect to oval

slot 126 in the articular insert to provide anterior stabilization in the total knee prosthesis.

Figures 29-31 show the insert 121 portion of the present invention, typically a polymeric plastic insert that fits tray 113. Insert 121 has a flat distal surface 122 and a proximal surface 123 that includes curved portions. These curved portions are in the form of concavities 124, 125 receive shaped surfaces of a femoral prosthesis after total knee joint replacement surgery is completed. The flat distal surface 122 of insert 121 has an anterior to posterior extending generally oval shaped slot 126 as shown in Figure 31.

The slot 126 receives post 118 during use, enabling the insert 121 to slide in an anterior to posterior direction relative to tray 113.

The present invention provides a rotating platform, mobile knee prosthesis 110 that incorporates anterior stabilization along with the ability to selectively constrain the movement of the articular surface from rotation and translation to rotation only. This is accomplished by using an opening 136 in insert 121 that communicates with slot 126 as shown in Figures 29-31 and 35-38. The opening includes a frustoconical portion 137 that corresponds in shape to a similar frustoconically-shaped enlarged annular surface 134 of locking plug member 127. The locking plug member 127 is shown more particularly in Figures 32, 33, and 37.

Locking plug member 127 includes a lower frustoconical surface 128. The frustoconical outer surface 128 of locking member 127 below annular reference line 138 is sized and shaped to fit and form a taper lock connection with surface 139 of frustoconical socket 119 of post 118. Above annular reference line 138, the enlarged annular shoulder has a frustoconical shape as shown in Figure 32 that corresponds generally to the size and shape of frustoconical portion 137 of opening 136 as shown in Figure 36.

When the locking member 127 is first placed through opening 136 of insert 121 and then into frustoconical

socket 119 of post 118, a locking connection is formed between the frustoconical outer surface 128 of locking member 127 and the frustoconical surface 139 of post 118. This connection can be a taper lock type connection.

Locking screw 131 can be used to engage a correspondingly sized and shaped internally threaded opening 132 of tray 113 if desired. The locking screw 131 can include a head 140 that is enlarged so that the head 140 is retained by annular shoulder 133 of locking member 137 as shown in Figures 33 and 37.

In Figure 38, arrows 141 indicate sliding movement of insert 121 relative to tray 113 as occurs when locking plug member 127 is removed. In such a situation, the insert 121 is free to slide with respect to tray 113. The distal surface 122 of insert 121 slides upon the flat proximal surface 114 of tray 113. Post 118 slides relative to slot 126.

When locking member 127 is inserted through opening 136 and into socket 119 of post 118, sliding movement is prevented. The enlarged annular shoulder 134 of locking member 127 engages the frustoconical portion 137 of opening 136 disallowing a sliding action of insert 121 relative to tray 113. However, the enlarged annular shoulder 134 of locking member 127 is slightly spaced from frustoconical portion 137 of opening 136, so that rotational movement of insert 121 relative to tray 113 is permitted. The second alternate embodiment of the present invention provides a rotating platform, mobile knee prosthesis 110 that incorporates anterior stabilization along with the ability to constrain movement of the articular surface from rotation and translation to rotation only.

Figures 39 and 40-51 show a third alternate embodiment of the apparatus of the present invention designated generally by the numeral 142 in Figure 39. Mobile bearing knee prosthesis 142 includes a tray 143 that can be attached to a patient's surgically cut proximal tibia using a stem 146 for example that occupies the patient's intramedullary canal. The tray 143 has a

proximal surface 144 that receives an insert 159 and a distal surface 145 that registers upon the proximal tibia after the tibia has been surgically prepared to conform to the underside or distal surface 145 of tray 143.

The proximal 144 surface of tray 143 provides a frustoconically-shaped socket 147 that can receive either of two selected plugs 148 or 154 (or any of the plug embodiments shown in Figures 18-21). The first plug 148 is designed to provide rotational movement only between insert 159 and tray 143. The plug 148 has a frustoconical surface 149, cylindrical surface 150, beveled annular surface 151, and a pair of opposed generally parallel flat end surfaces 152, 153.

The second plug 154 is designed to provide both anterior to posterior translational movement between the insert 159 and tray 153 as well as rotational movement between the insert 159 and tray 153. The plug 154 has a frustoconical surface 155, a reduced diameter cylindrical surface 156, and flat end surfaces 157, 158.

During use, a surgeon selects either of the plugs 148 or 154. The frustoconical surfaces 149 or 155 form a tight taper lock fit with a correspondingly shaped frustoconical socket 147 that communicates with the proximal 144 surface of tray 143. Once the selected plug 148 or 154 has been inserted into frustoconical socket 147, the insert 159 is placed on the selected plug 148 or 154. The shape of the plug 148 or 154 that is selected determines whether or not the insert 159 can achieve only rotational movement relative to tray 143 or both rotational and anterior to posterior translational movement.

In the case of the plug 148, only rotational movement between the insert 159 and the tray 143 can be attained. The plug 148 is shorter and thus only communicates with the cylindrically-shaped opening 164 on the bottom or distal surface 162 of insert 159. Plug 148 once inserted in socket 147 only enables a rotational movement of the insert 159 on the tray 143. The cylindrical surface 150 of plug 148 corresponds in size

and shape to the circular opening 164 to accomplish a relatively close fit between cylindrical surface 150 of plug 148 and cylindrical opening 164 on insert 159.

When both rotational and translational anterior to posterior movement are desired, the surgeon selects the plug 154. The plug 154 is placed in socket 147 so that frustoconical surface 155 forms a taper lock fit with a correspondingly sized and shaped socket 147 of tray 143. The smaller cylindrically-shaped portion 156 of plug 154 is taller in a proximal to distal direction than the cylindrically-shaped portion 150 of plug 148. The portion 156 fits elongated slot 163 so that the insert 159 can translate in an anterior to posterior direction as the reduced diameter cylindrical portion 156 travels anterior to posterior in the direction of arrow 165 in Figure 44. Because the slot 163 is at least as wide as the diameter of cylindrical portion 156, rotational movement is also available between insert 159 and tray 143. Insert 159 also provides proximal concavities 160, 161 for receiving a femoral component of a knee implant.

Figures 52-56 disclose an alternative embodiment of this invention identified as prosthesis 210, comprising a tibial tray 213, a polymeric insert 28, and a locking member 24. In this embodiment, insert 28 and locking member 24 are the same as described above, but flange 221 is generally D-shaped, having a periphery extending laterally in the medial, lateral, and anterior directions from the outer surface of cylindrical section 220, thereby creating recess 223 on the medial, lateral and anterior sides of section 220. As evidenced by the following description, the assembly of prosthesis 210 is essentially identical to that of prosthesis 10 except for the shape of flange 221.

Locking member 24 forms a removable connection with the socket 219. Locking member 24 has an externally cylindrical section 25 that provides threads that correspond to the threads of internally socket 219 so that the locking member 24 can be threaded into the socket 219 as shown in Figure 54.

In order to assemble insert 28 to tray 213, the distal surface of 29 of insert 28 is placed next to and generally parallel to the proximal surface 214 of tray 213. Post 218 is aligned with vertical channel 233 of insert 28. During assembly of insert 28 to tray 213, the post 218 is oriented to enter the oval opening portion 37 of distal opening 36. Once the distal surface 29 of insert 28 meets proximal surface 214 of tray 213, flange 221 aligns with oval shaped slot 35 of vertical channel 33. After such assembly, insert 28 is held in position by post 218. This retention of insert 228 by post 218 occurs when flange 221 engages flat surface 40 to prevent separation if any rotation at all occurs between insert 28 and tray 213. If no rotation has occurred between insert 28 and tray 213, the oval shaped circular section 37 is sized to allow post 218 to be inserted into or withdrawn from channel 33.

PARTS LIST

The following is a list of suitable parts and materials for the various elements of the preferred embodiment of the present invention.

Part Number	Description
10	mobile bearing knee prosthesis
11	tibia
12	surgically cut proximal surface
13	tray
13A	tray
14	flat proximal surface
15	flat distal surface
16	spike
17	stem
18	post
19	internally threaded socket
20	cylindrically-shaped section
21	flange
22	periphery
23	recess

24	fastener
25	externally threaded section
26	head
27	tool receptive socket
28	insert
29	flat distal surface
30	concavity
31	concavity
32	periphery
33	vertical channel
34	proximal, cylindrically-shaped section
35	oval shaped slot
36	distal opening
37	oval section
38	half oval section
39	flat surface
40	flat surface
41	arrow/angle
42	post
43	cylindrical surface
44	circular top
45	rectangular base
46	inclined side wall
47	tray socket
48	inclined surface
49	post
50	vertical side wall
51	inclined surface
52	flat top
53	post
54	vertical side wall
55	vertical end wall
56	flat top
57	rectangular base
58	inclined surface
59	post
60	flat top

61	vertical side wall
62	rectangular base
63	inclined surface
64	insert opening
65	arrow
66	arrow
110	mobile bearing knee prosthesis
111	tibia
112	surgically cut proximal surface
113	tray
114	flat proximal surface
114A	opening
115	flat distal surface
116	spike
117	stem
118	post
119	socket
120	periphery of tray
121	insert
122	flat distal surface
123	proximal surface
124	concavity
125	concavity
126	slot
127	locking plug member
128	frustoconical outer surface
129	socket
130	threaded bore
131	locking screw
132	internally threaded opening
133	annular shoulder
134	enlarged annular shoulder
135	periphery of insert
136	opening
137	frustoconical portion
138	annular reference line
139	frustoconical surface
140	enlarged head

141	arrows
142	mobile bearing knee prosthesis
143	tray
144	proximal surface
145	distal surface
146	stem
147	frustoconical socket
148	plug
149	frustoconical surface
150	cylindrical surface
151	beveled annular surface
152	flat end surface
153	flat end surface
154	plug
155	frustoconical surface
156	reduced diameter cylindrical surface
157	flat end surface
158	flat end surface
159	insert
160	proximal concavity
161	proximal concavity
162	flat distal surface
163	elongated slot
164	cylindrical opening
165	arrow
210	mobile bearing knee prosthesis
213	tray
214	flat proximal surface
215	flat distal surface
216	spike
217	stem
218	post
219	internally threaded socket
220	cylindrically-shaped section
221	flange
222	periphery
223	recess

The foregoing embodiments are presented by way of example only; the scope of the present invention is to be limited only by the following claims.

CLAIMS

1. A knee prosthesis (10) apparatus comprising:

a) a tibial component that includes a tibial tray portion (13) adapted to be surgically implanted on a patient's transversely cut proximal tibia (11);

b) a femoral component that engage the tibial component;

c) a tibial insert (28) having a surface that fits against and articulates with the proximal surface of the tray (13);

d) a constraining mechanism that can selectively join the insert (28) to the tibial tray (13);

e) a slot (36) in the tibial insert (28); whereby

f) the constraining mechanism is shaped to slot (36) at least partially into the slot (36) in the tibial insert (28) enabling the tibial insert (28) to move on the tibial tray portion (13) in a number of different possible relative motions between the tibial insert (28) and tibial tray (13)including anterior to posterior translation and rotation, rotation only, translation only, or no relative motion, depending on the shape of the constraining mechanism and/or the shape of the slot in the tibial insert (28);

g) wherein all or part of the constraining means is separable from the tray and characterised by wherein selective removal of all or part of the constraining mechanism determines which of the said possible relative motions will take place.

2. The knee prosthesis (10) of claim 1 wherein the surface of the tibial insert (28) that fits against the tibial tray (13) has one or more concavities for articulating with the femoral component.

3. The knee prosthesis (10) of claim 3 wherein there are two concavities that define the articulation surface.

4. The knee prosthesis (10) of claim 1 wherein the constraining mechanism includes a post (42) extending up from the proximal surface of the tibial tray (13).

5. The knee prosthesis (10) of claim 4 wherein the constraining mechanism includes a locking plug member (127) that fits a socket on the post (42).

6. The knee prosthesis (10) of claim 1 wherein the removable constraining mechanism includes a post (42) extending up from the proximal surface of the tibial tray (13), a slot (36) on the distal surface of the tibial insert (28), an opening on the proximal surface on the tibial insert (28) that communicates with the slot (36) and a locking plug member (127) that can access the post (42) from the proximal surface of the tibial insert (28) via the opening.

7. The knee prosthesis (10) of claim 6 wherein the removable constraining includes a socket on the post (42) that receives the locking plug member (127) when the locking plug member (127) is attached to the post (42) for further defining movement between the tibial insert (28) and tibial tray (13).

8. The knee prosthesis (10) of claim 6 wherein the opening is defined an annular surface that fits closely to the locking plug member (127) when the locking plug member (127) is connected to the post (42).

9. The knee prosthesis (10) of claim 1 wherein the removable constraining mechanism includes an opening that extends from the proximal to the distal surface of the tibial insert (28) and a variety of connectable portions which are selectively attachable to or

separable from the tibial tray (13), and wherein the geometry of the various connectable portions relative to the opening enables a user to determine which of the relative motions will take place.

10. The knee prosthesis (10) of claim 4 wherein the slot (36) in the tibial insert (28) fits about the post (42), the slot (42) enabling both anterior to posterior, and vice versa, translation of the tibial insert (28) relative to the tibial tray (13).

11. The knee prosthesis (10) of claim 4 wherein the slot (36) in the tibial insert (28) fits about the post (42), the slot (42) enabling rotational translation of the tibial insert (28) relative to the tibial tray (13).

12. The knee prosthesis (10) of claim 4 wherein the slot (36) in the tibial insert (28) fits about the post (42), the slot (42) enabling rotational translation of the tibial insert (28) relative to the tibial tray (13), and both anterior to posterior translation, and vice versa, translation of the tibial insert (28) relative to the tibial tray (13).

13. The knee prosthesis (10) of claim 10, 11 or 12 wherein the slot (36) extends through the tibial insert (28), communicating with both the proximal and distal surfaces of the tibial insert (28).

14. The knee prosthesis (10) of claim 10, 11 or 12 wherein the slot (36) has an elongated section that communicates with the distal surfaces of the tibial insert (28).

15. The knee prosthesis (10) of claim 10, 11 or 12 wherein the slot (36) has a generally cylindrically-shaped section that communicates with the proximal surfaces of the tibial insert (28).

16. The knee prosthesis (10) of claim 13 wherein the slot (36) has a larger transverse cross section at the distal surfaces of the tibial insert (28) and a smaller transverse cross section at the proximal surfaces of the tibial insert (28).

17. The knee prosthesis (10) of claim 1 wherein there is a generally vertical channel (33) at the central portion of the tibial insert (28), the opening including an elongated slot (35) portion that extends a partial distance through the tibial insert (28), beginning at the distal surfaces of the tibial insert (28) and terminating at a position intermediate the proximal and distal surfaces of the tibial insert (28), the slot (36) extending generally along an anterior to posterior line;

a) the slot (36) registering upon and sliding with respect to the post (42) of the tibial tray (13); and

b) a locking plug member (127) for selectively locking the tibial insert (28) and tibial tray (13) together with a rotational connection, the locking plug member (127) extending through the tibial insert (28) to connect with the post (42) on the tibial tray (13).

c) means for providing selected relative motion between the tibial insert (28) and tibial tray (13) by respectively connecting or disconnecting the locking plug member (127), wherein the tibial insert (28) is rotatable relative to the tibial tray (13) when the locking plug member (127) connects to the post (42).

18. The knee prosthesis (10) of claim 17 wherein the post has a socket (110) that receives the locking plug member (127).

19. The knee prosthesis (10) of claim 17 wherein the slot (36) extends through the tibial insert (28), communicating with both the proximal and distal surfaces of the tibial insert (28).

20. The knee prosthesis of claim 19 wherein the slot (36) has a larger transverse cross section at the distal surface of the tibial insert (28) and a small transverse cross section at the proximal surface of the tibial insert (28).

21. The knee prosthesis (10) of claim 19 wherein the channel (33) extends completely through the tibial insert (28) and the locking plug member (127) extends through the tibial insert (28) at the proximal surface of the tibial insert (28) to connect with the post (42).

22. The knee prosthesis (10) of claim 21 wherein the channel (33) closely conforms to the locking plug member (127) at the proximal surface of the tibial insert (28).

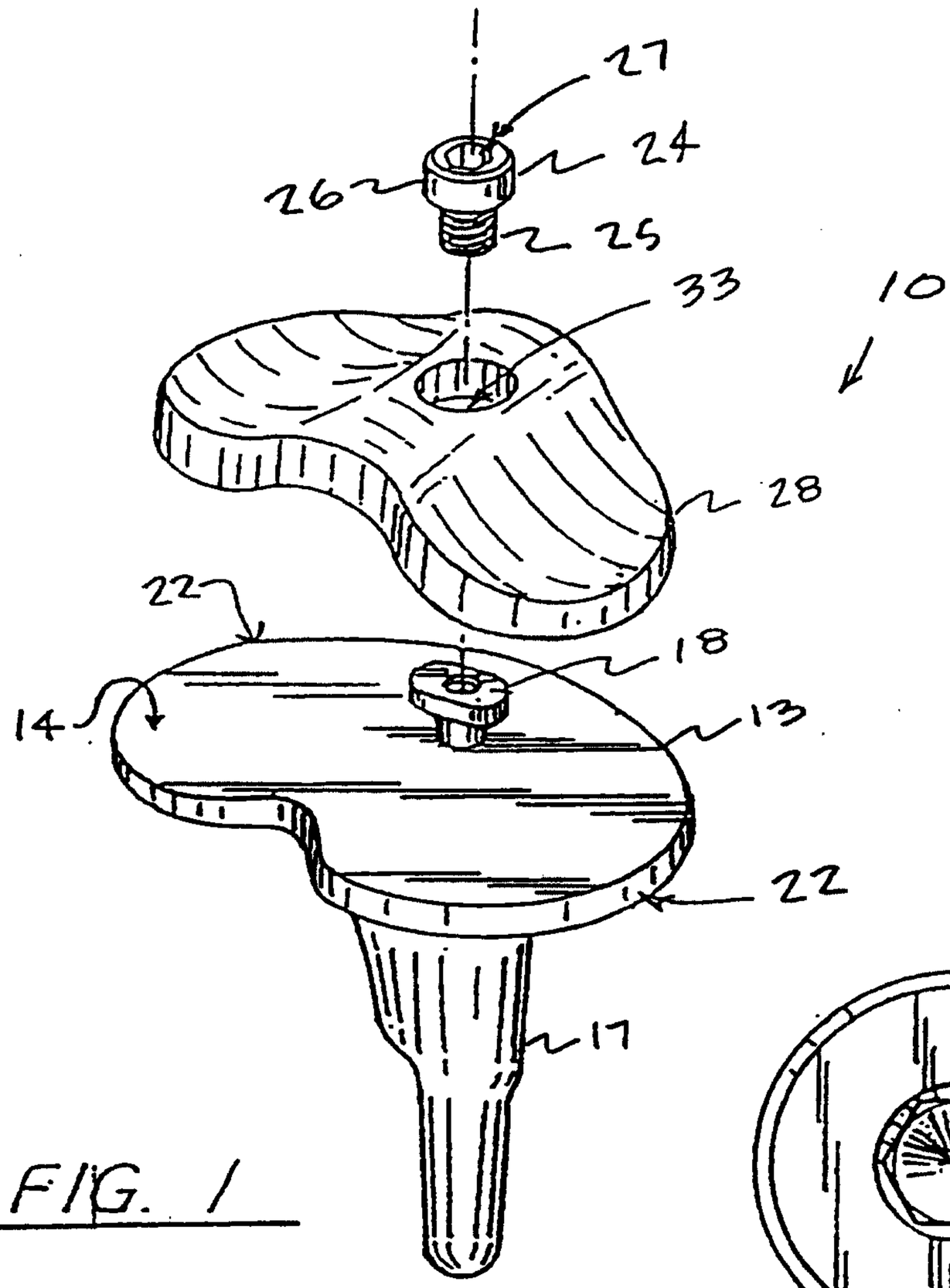


FIG. 1

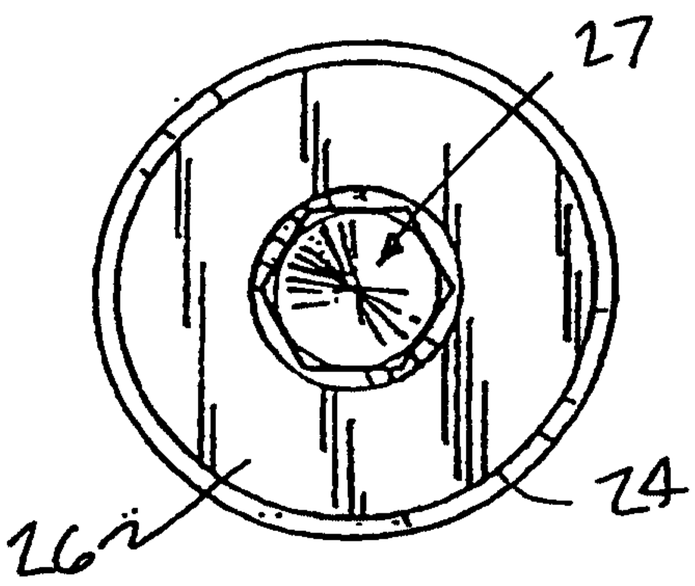


FIG. 3

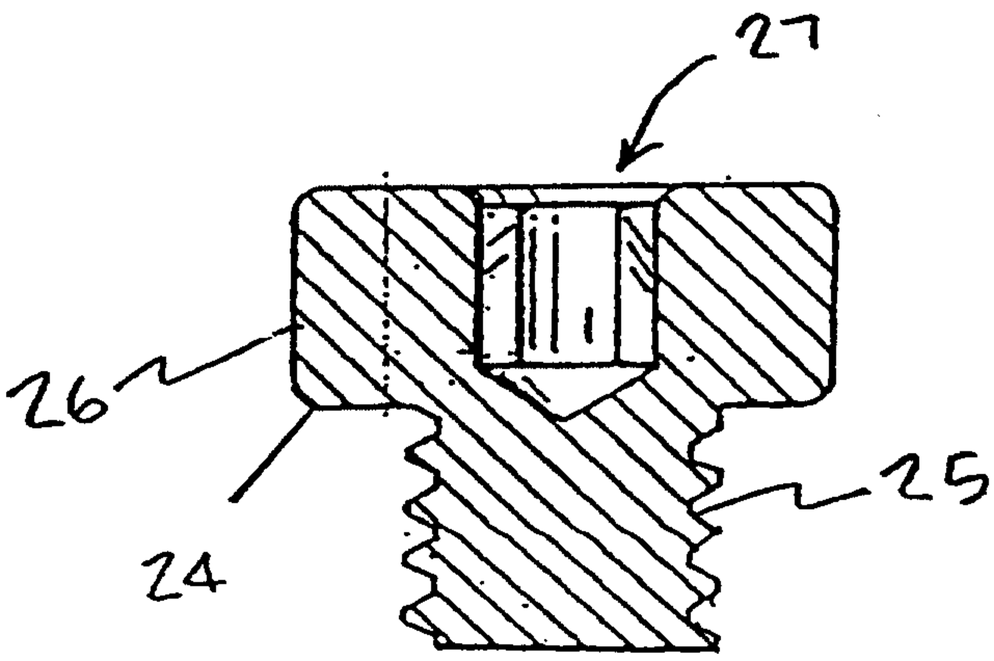


FIG. 2

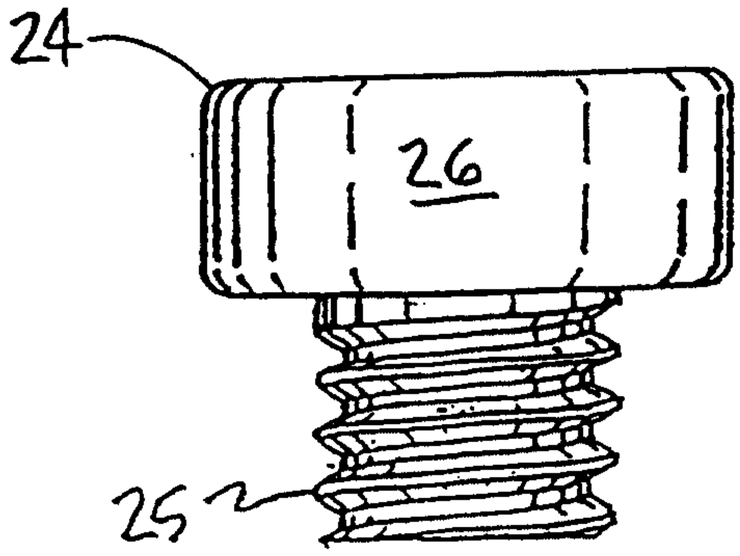
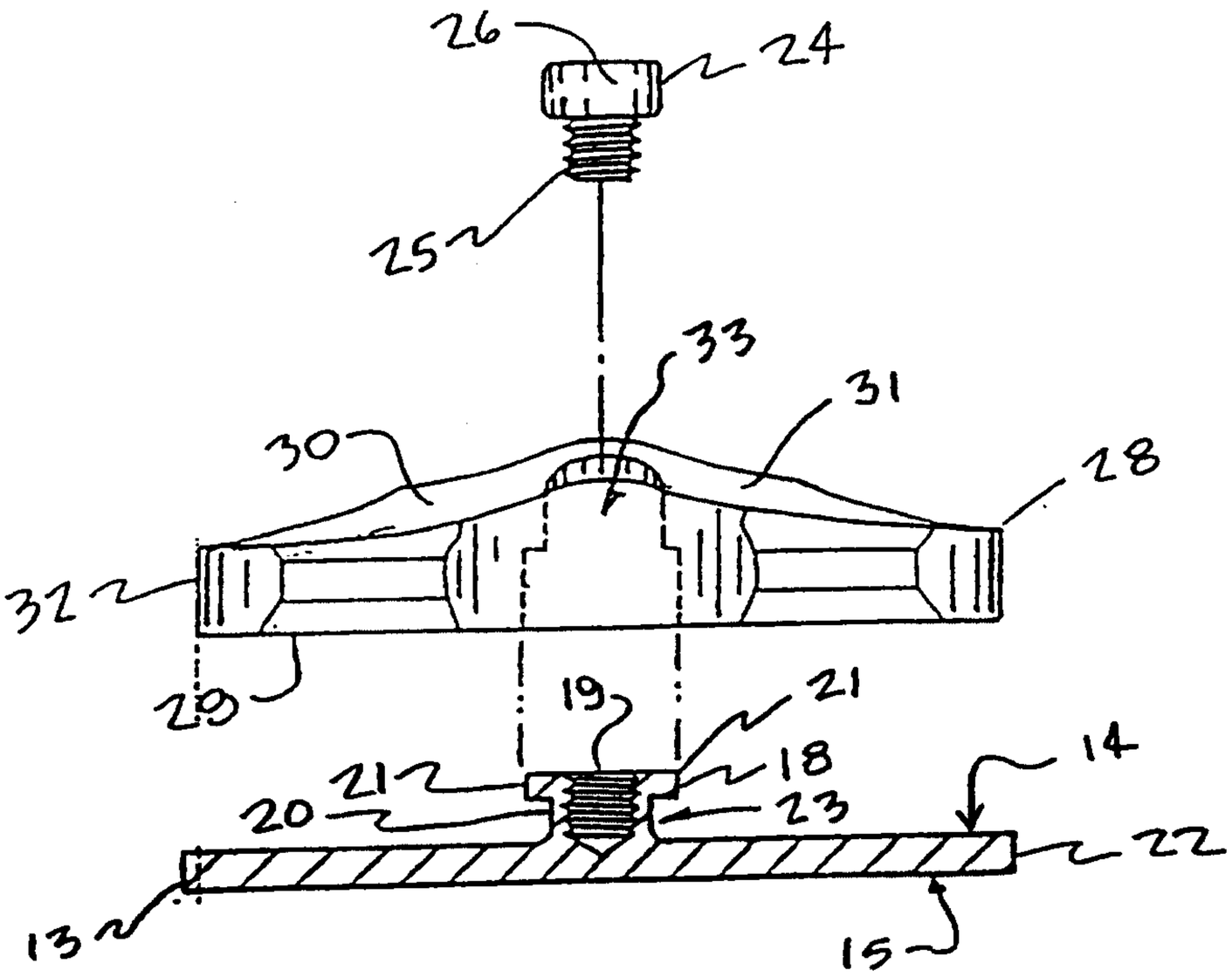


FIG. 4



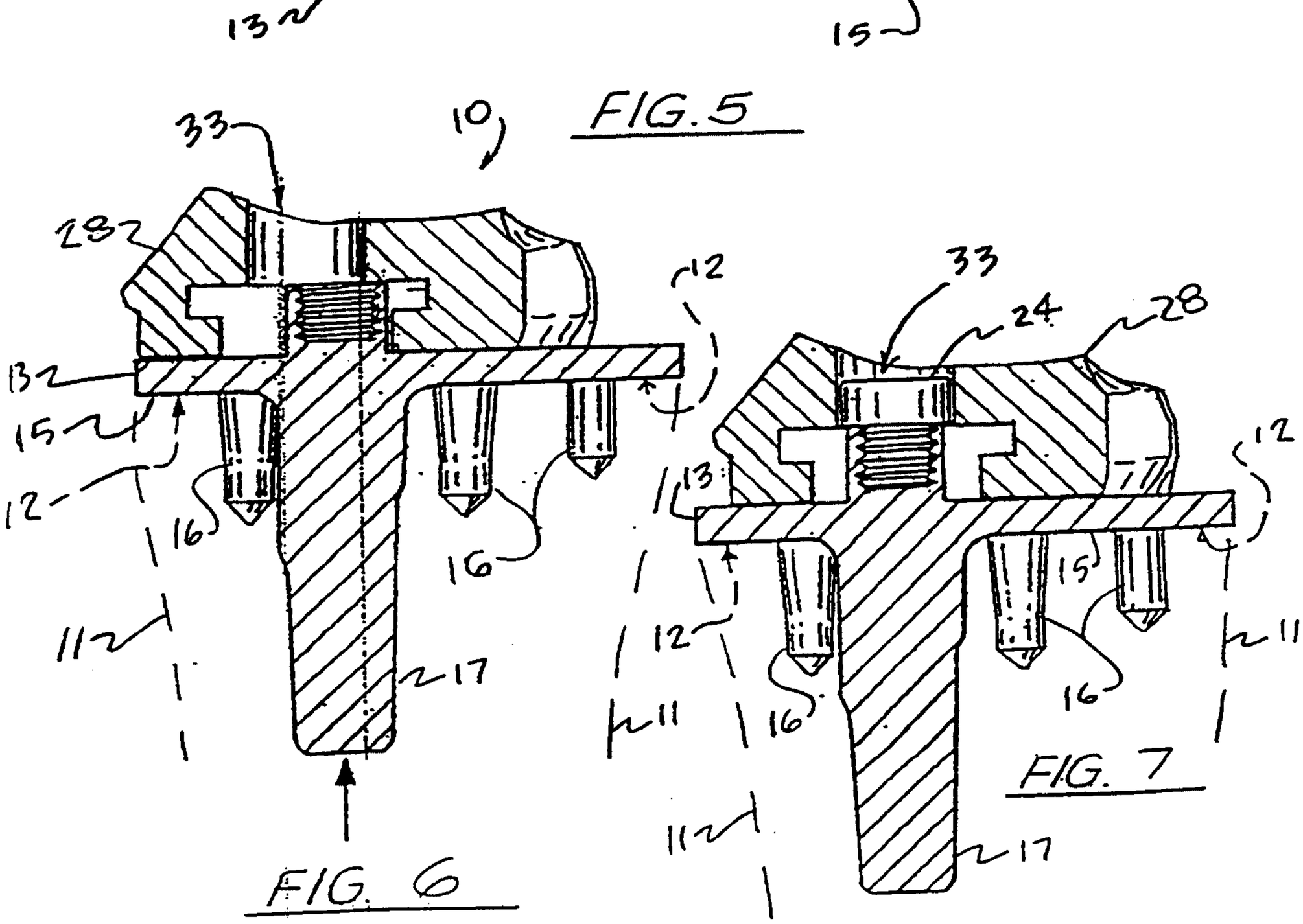


FIG. 5

FIG. 6

FIG. 7

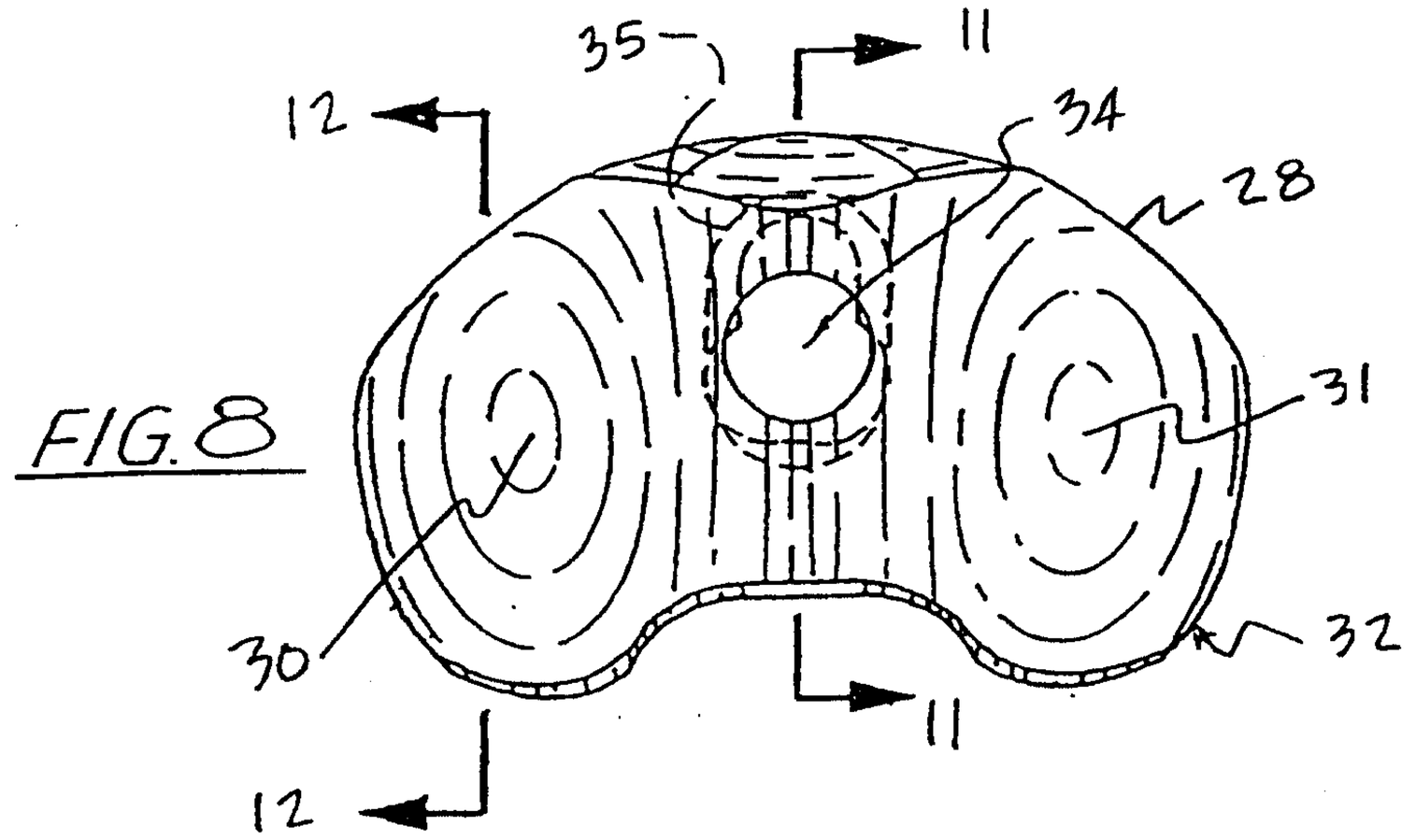


FIG. 8

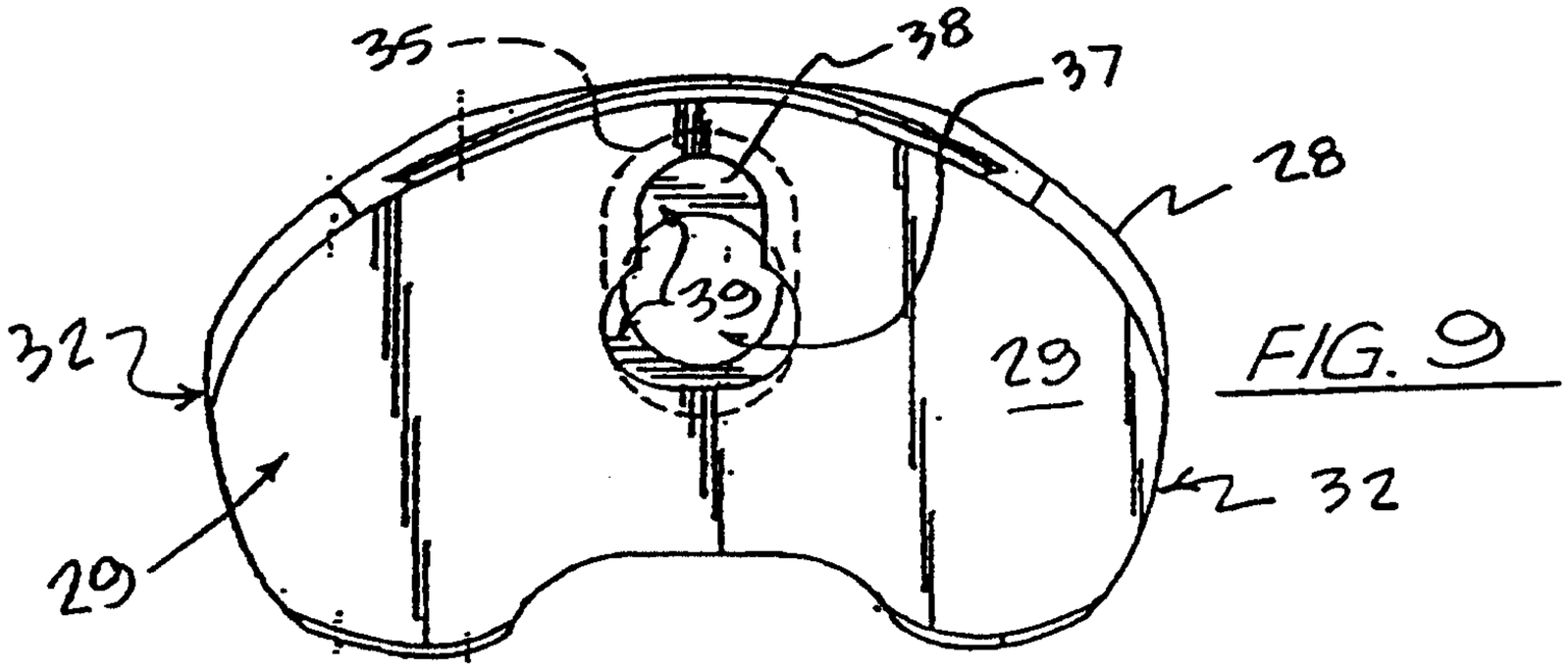


FIG. 9

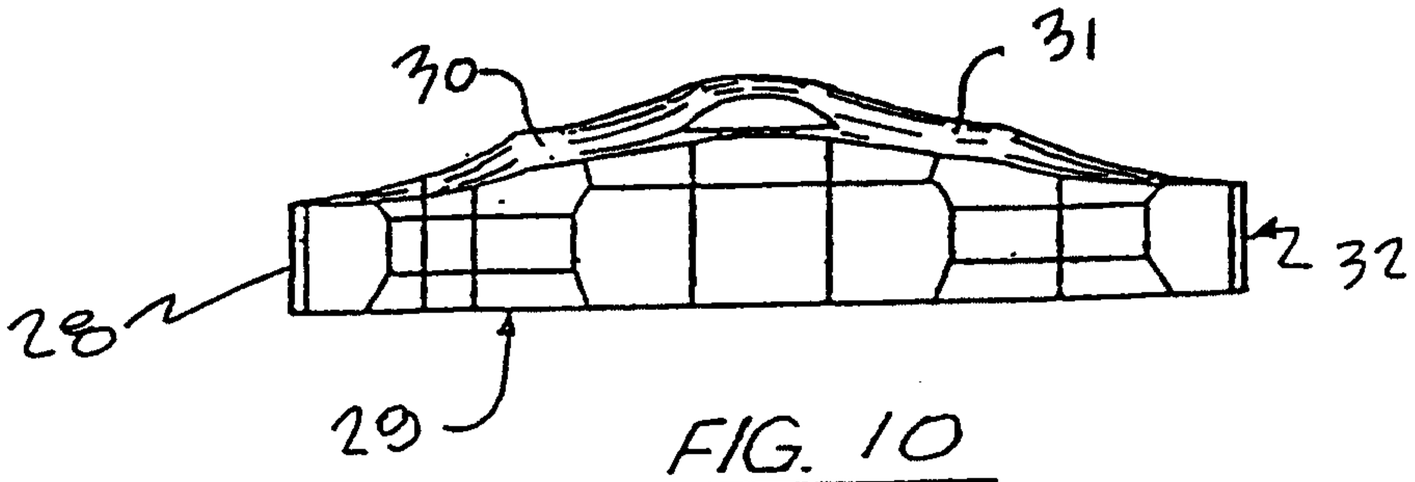


FIG. 10

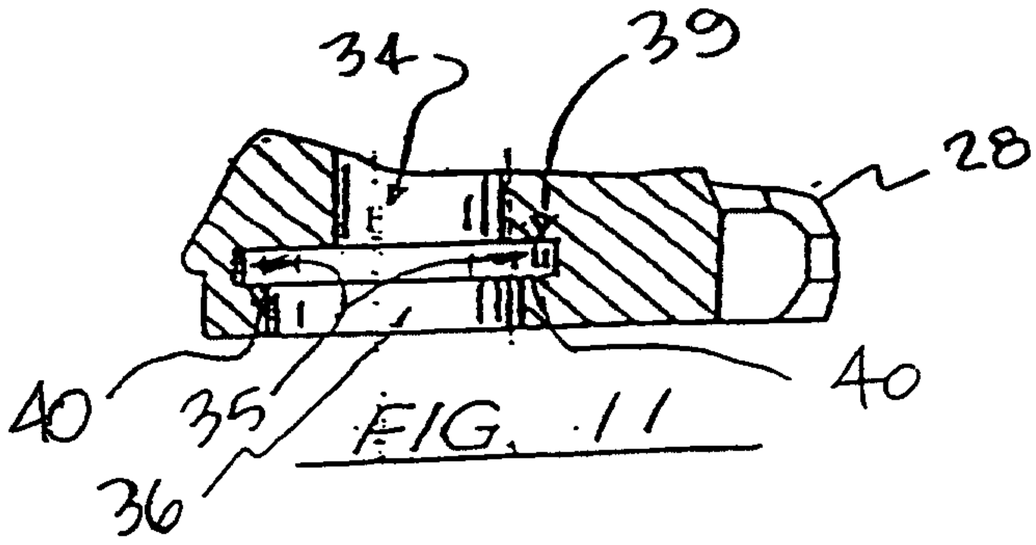


FIG. 11

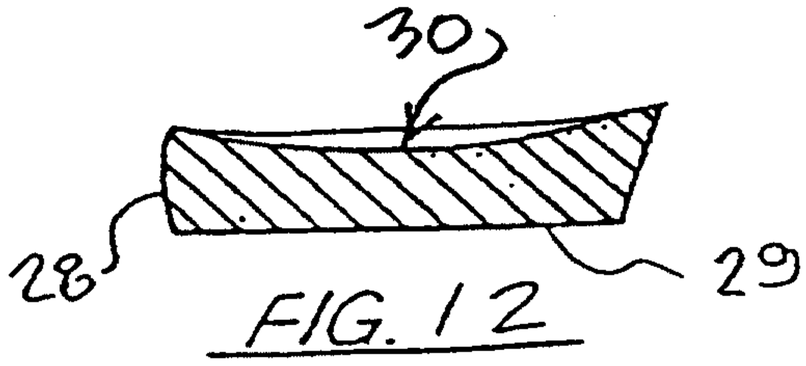


FIG. 12

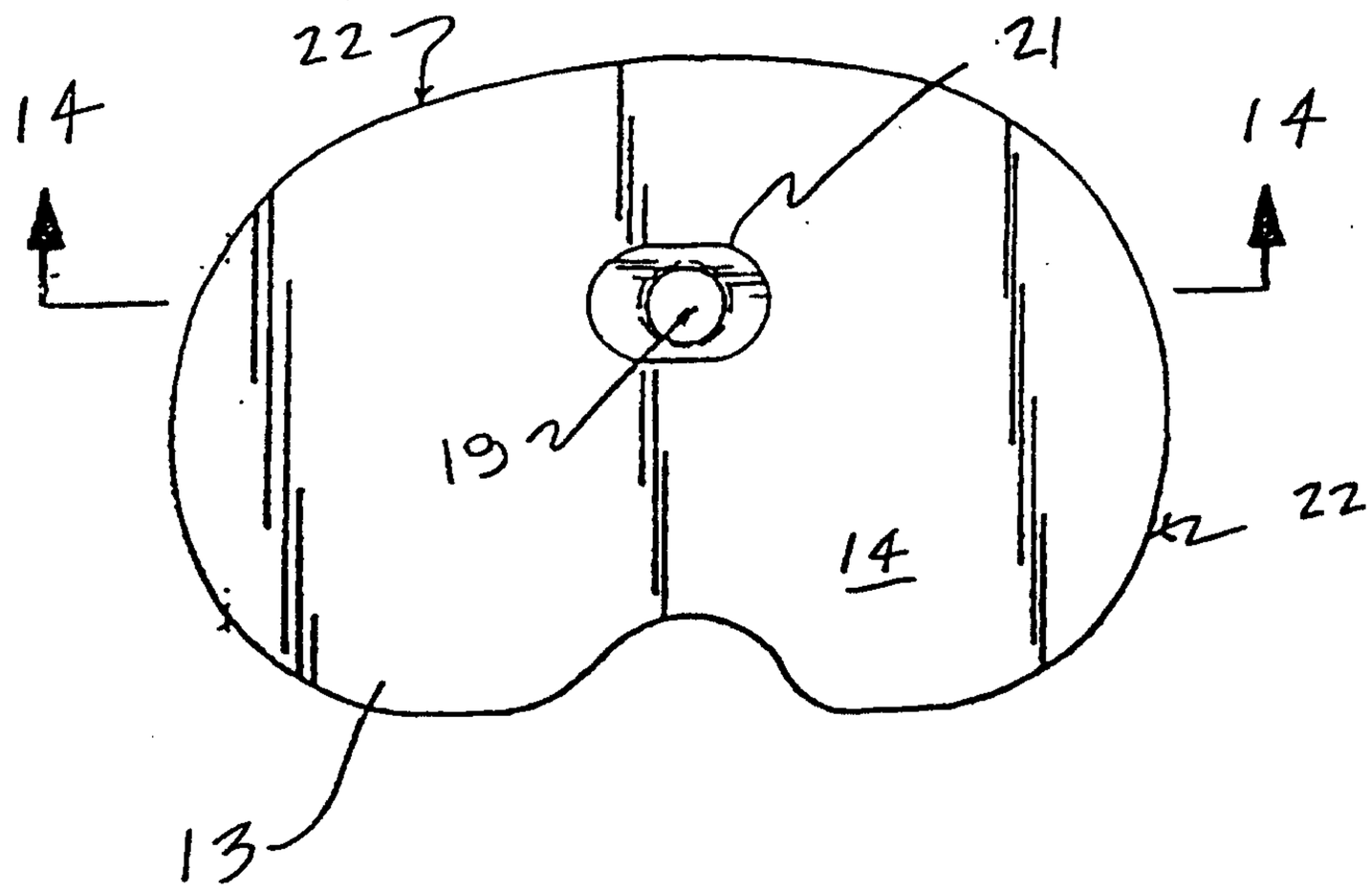


FIG. 13

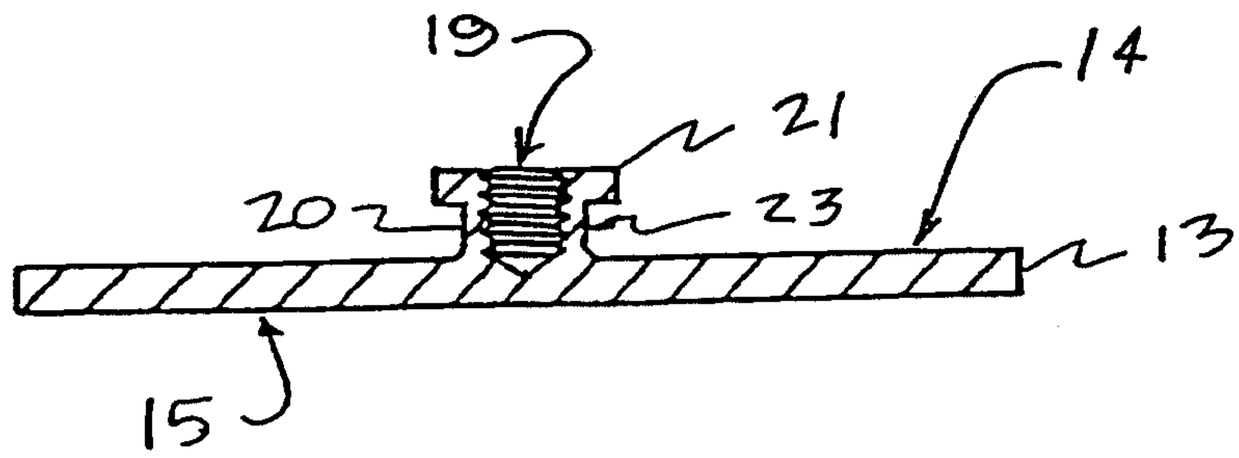


FIG. 14

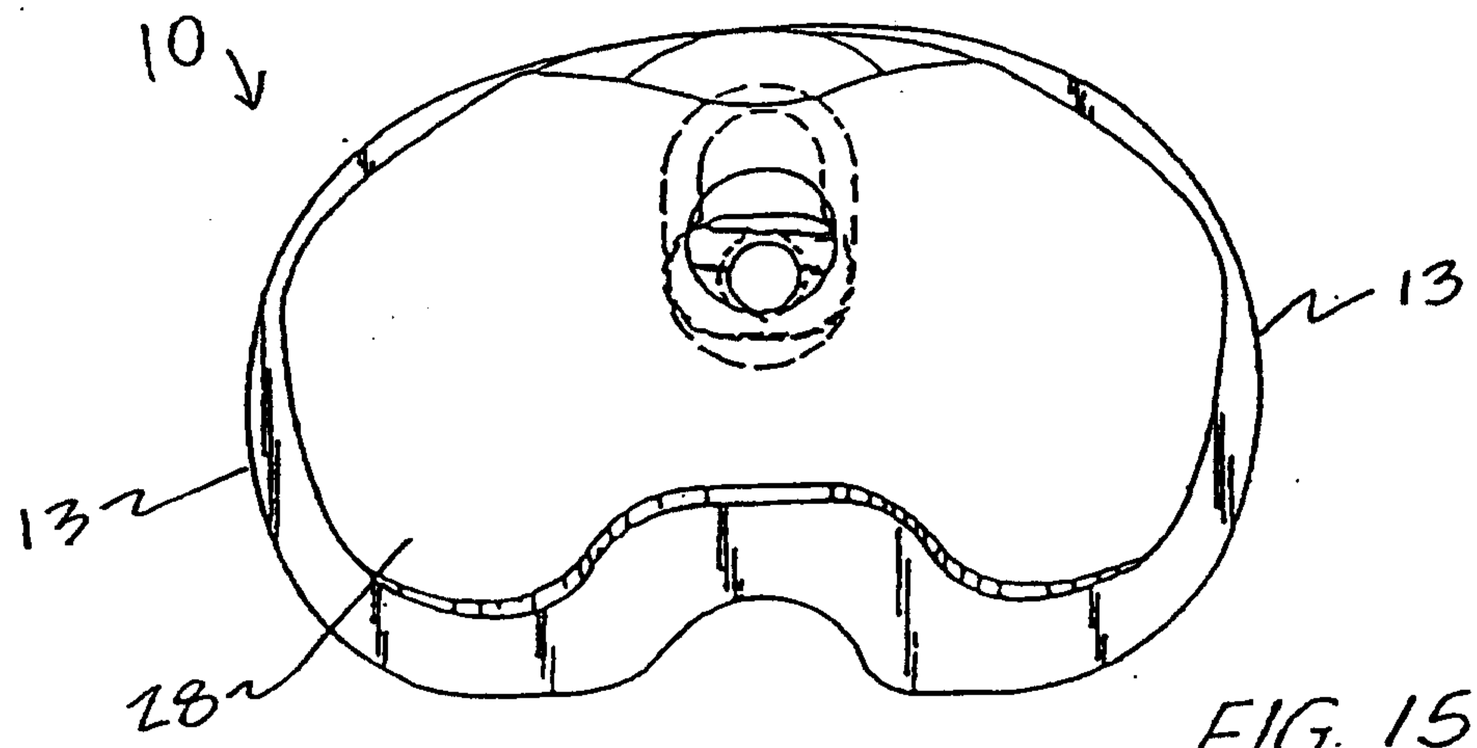


FIG. 15

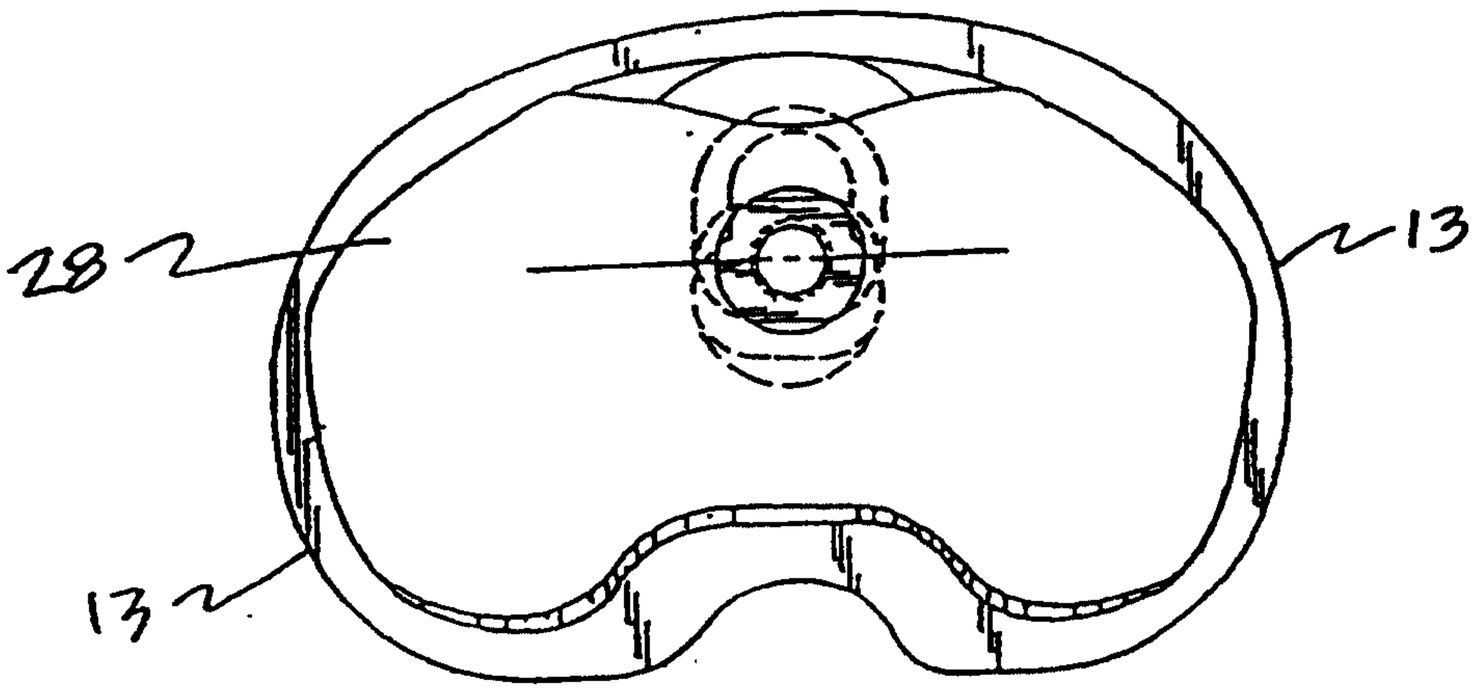


FIG. 16

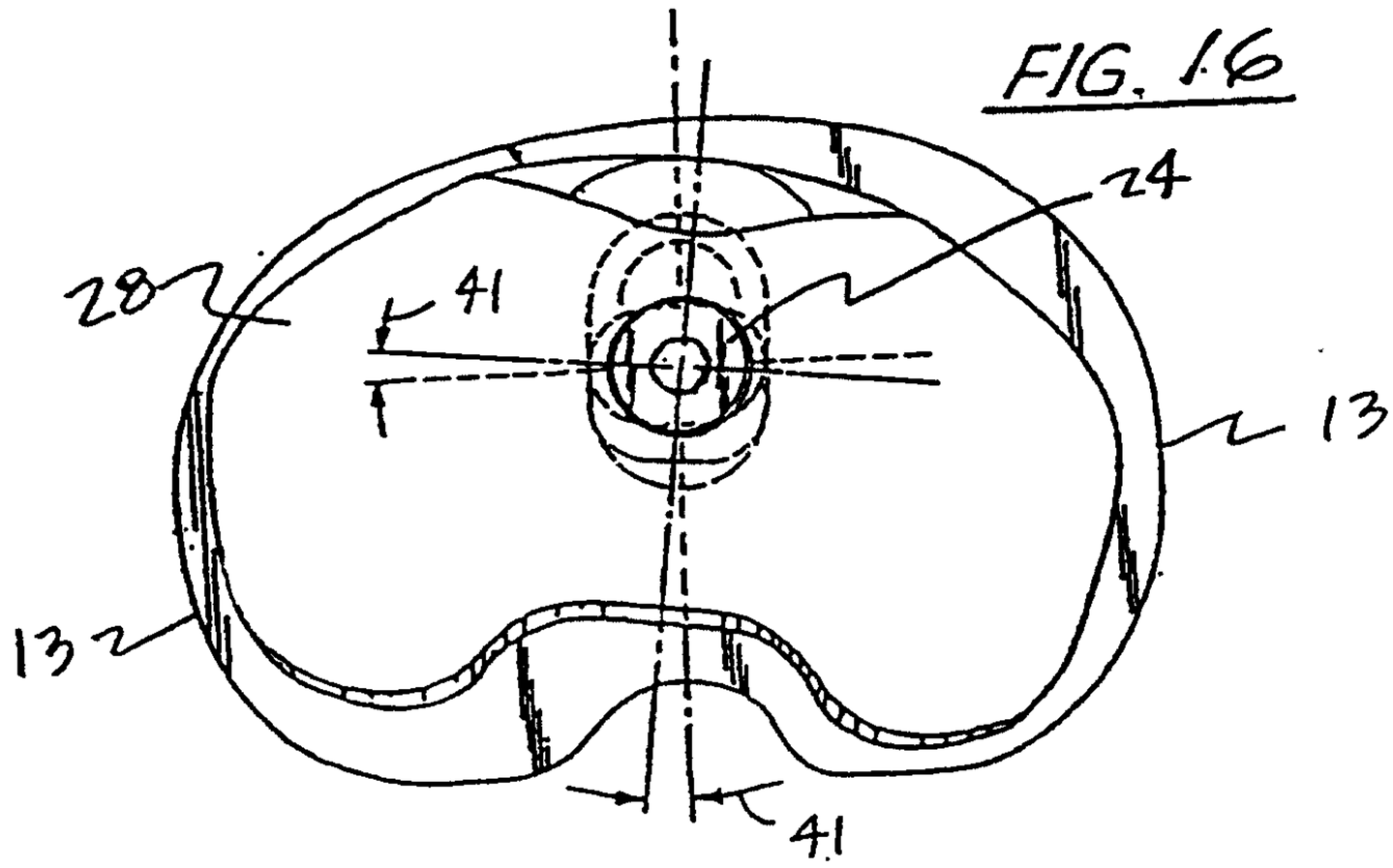


FIG. 17

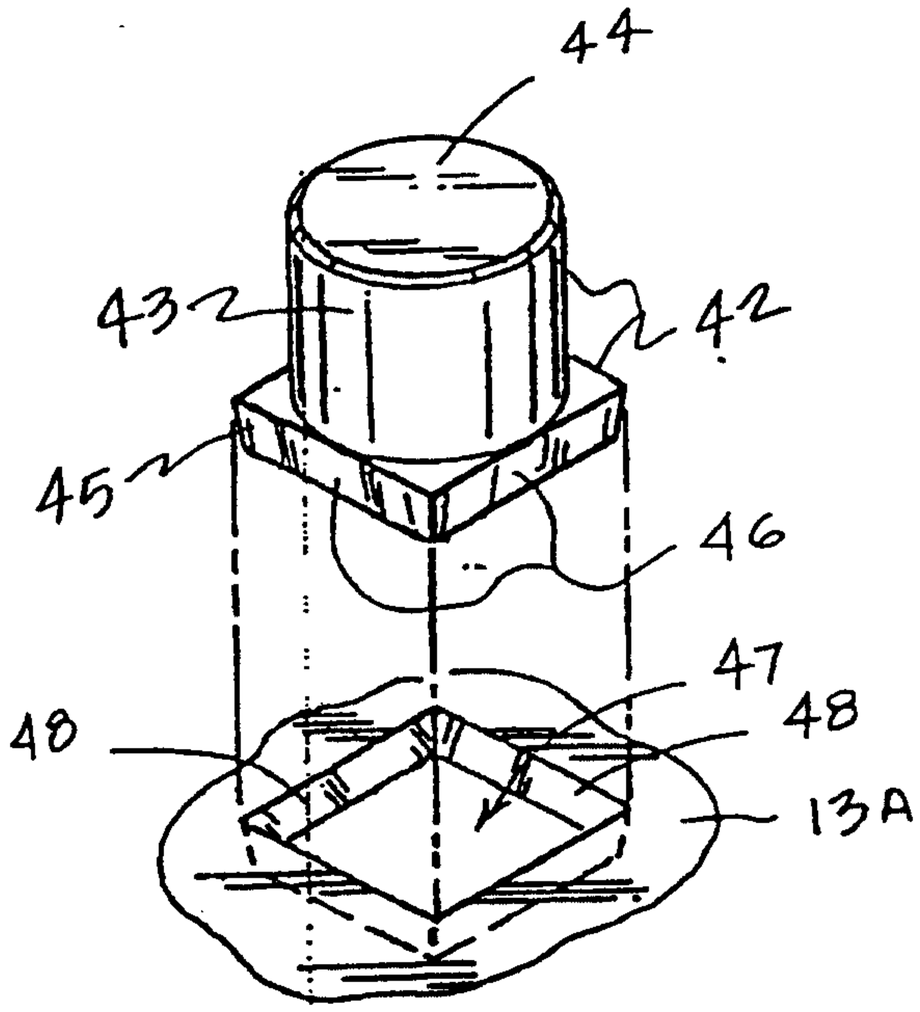


FIG. 18

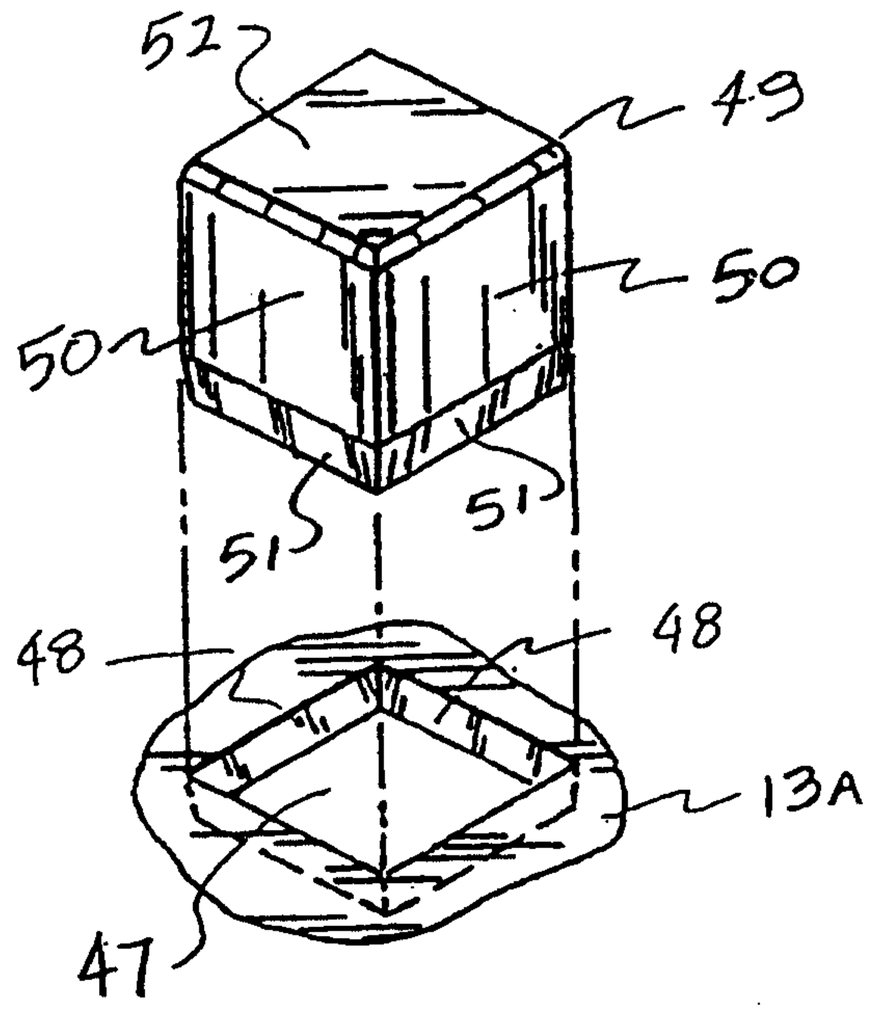


FIG. 19

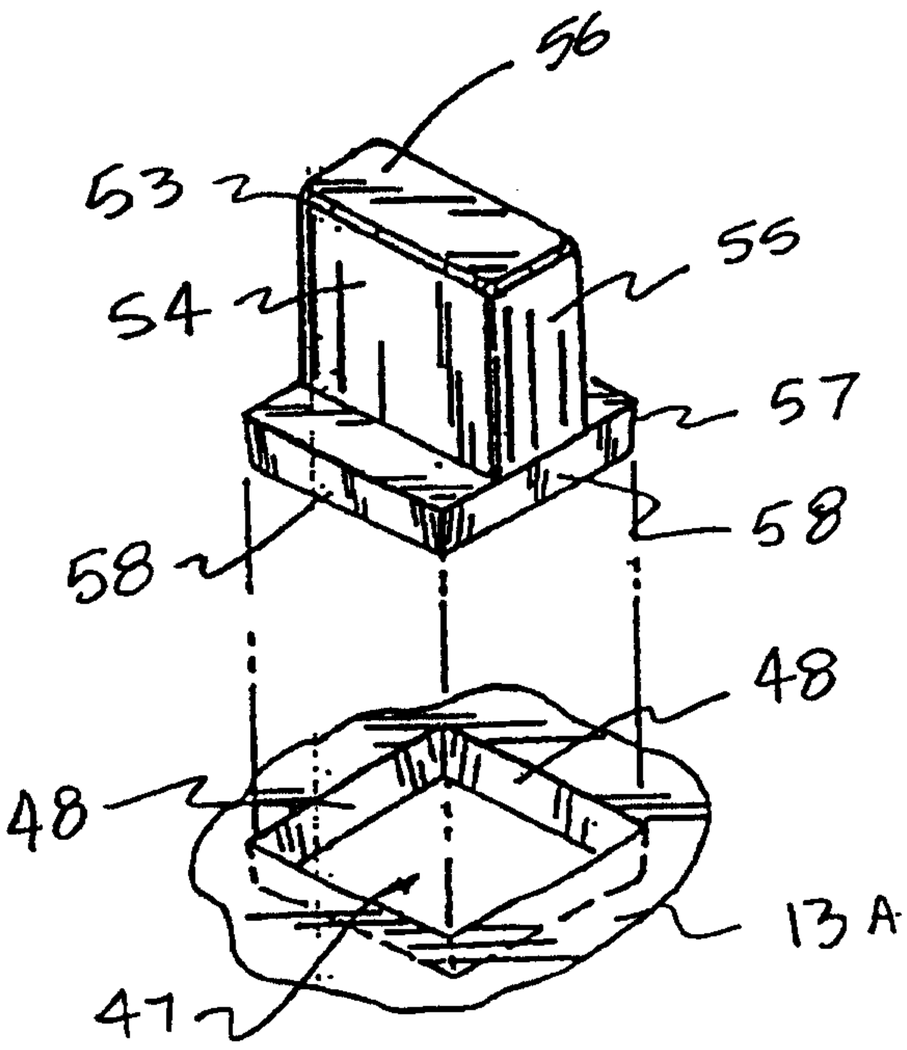


FIG. 20

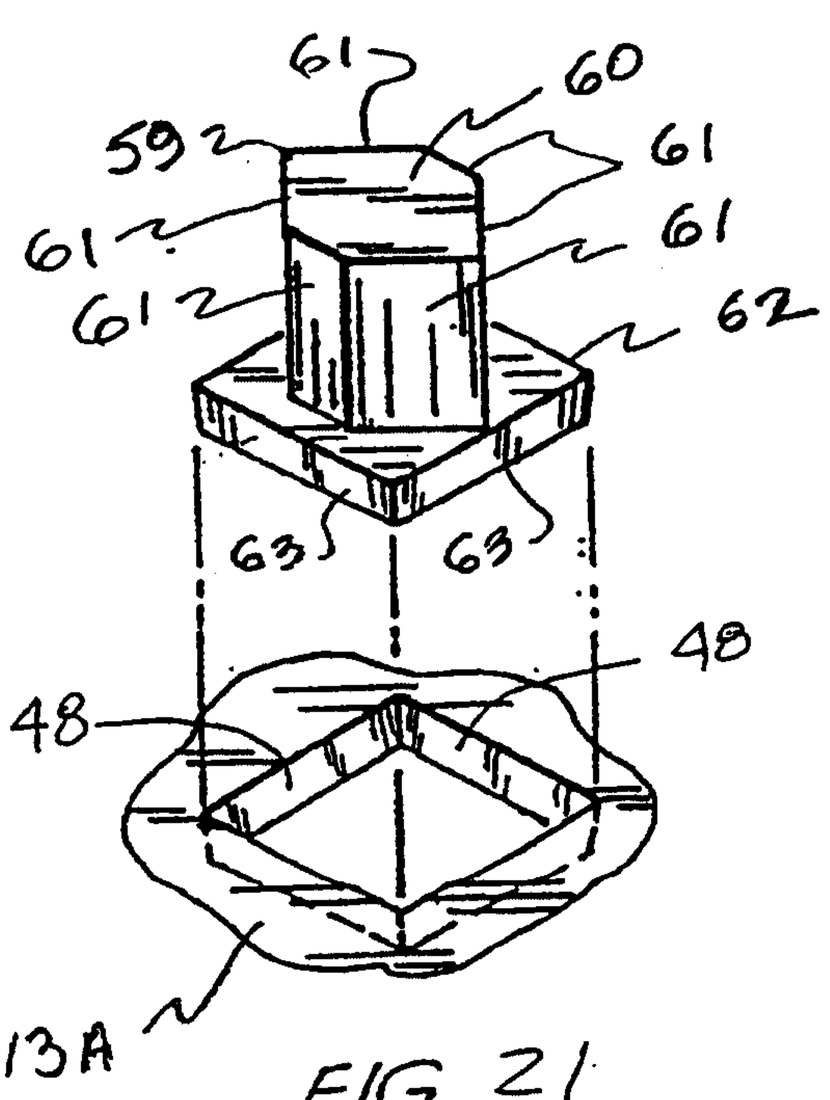


FIG. 21

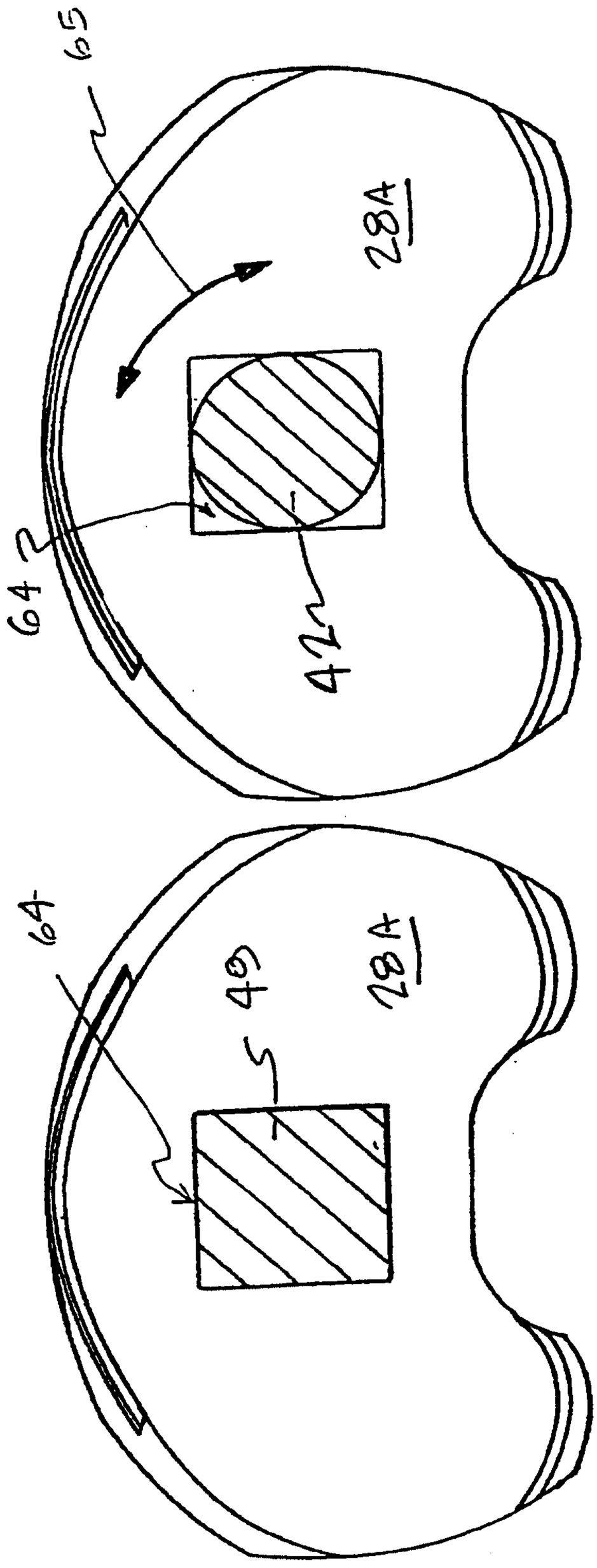


FIG. 23

FIG. 22

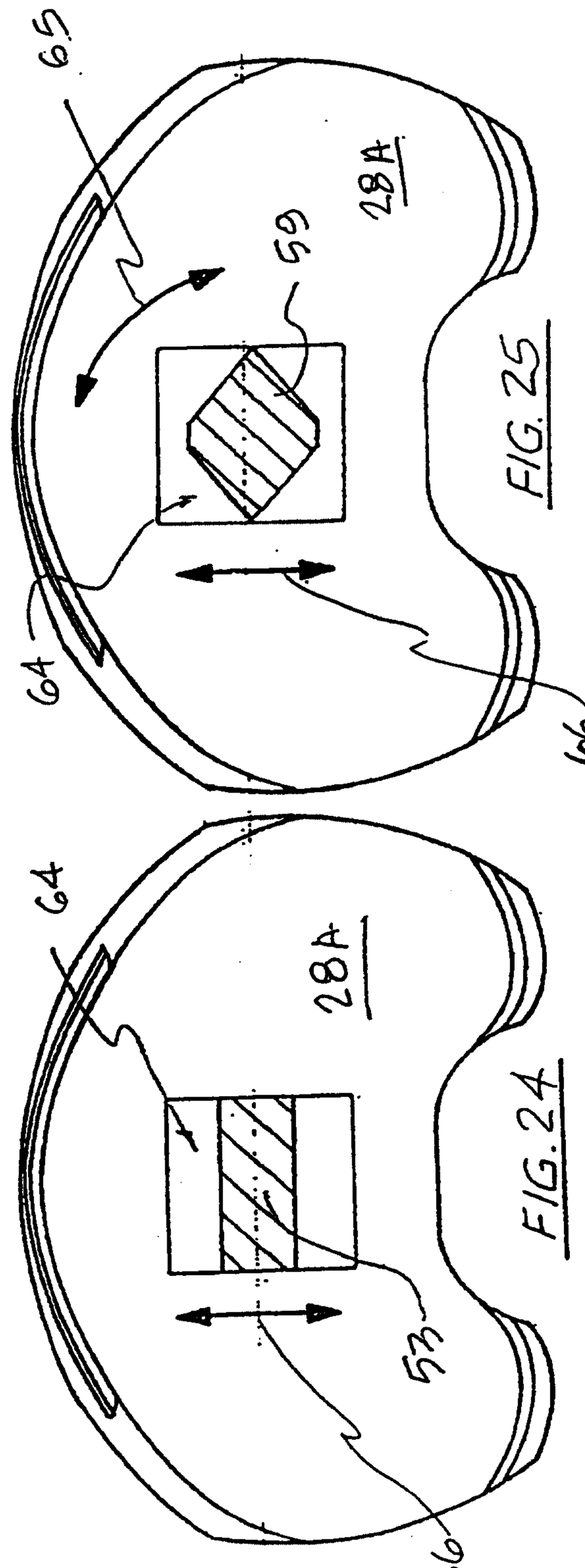


FIG. 25

FIG. 24

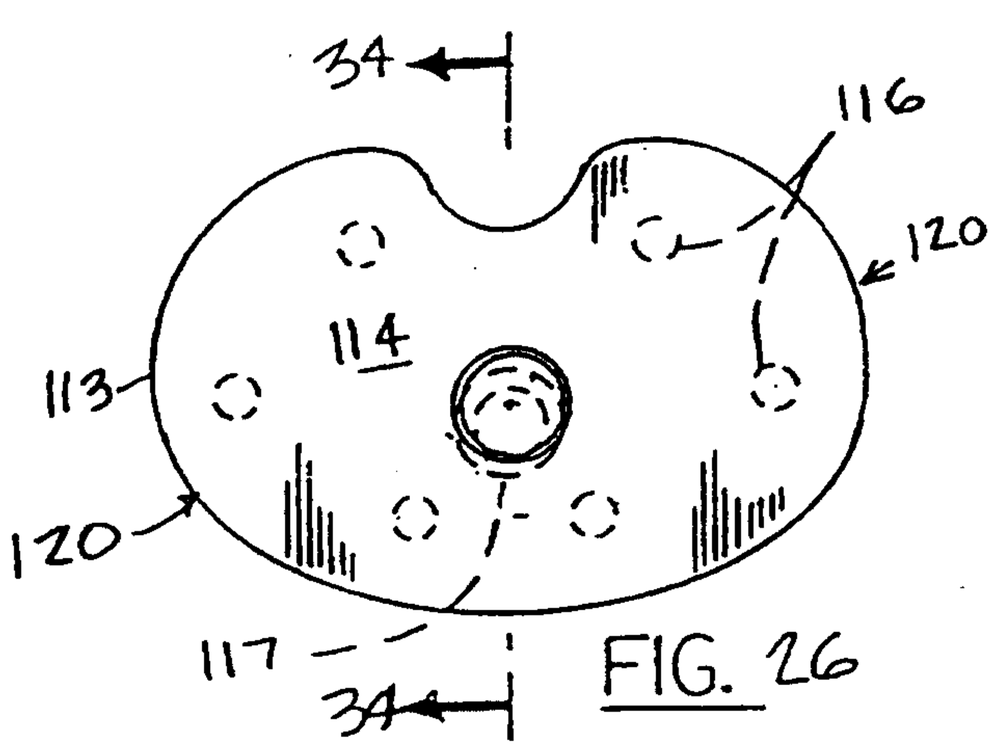


FIG. 26

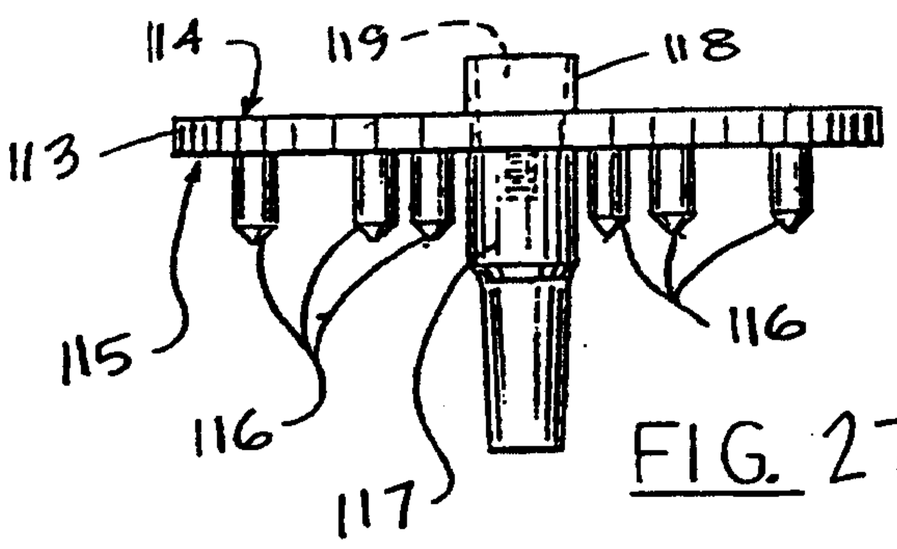


FIG. 27

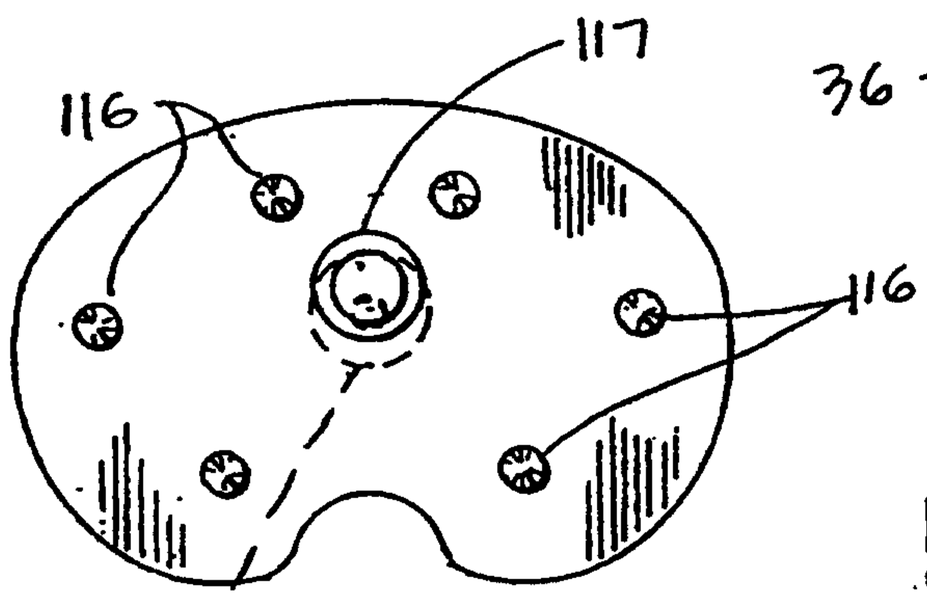


FIG. 28

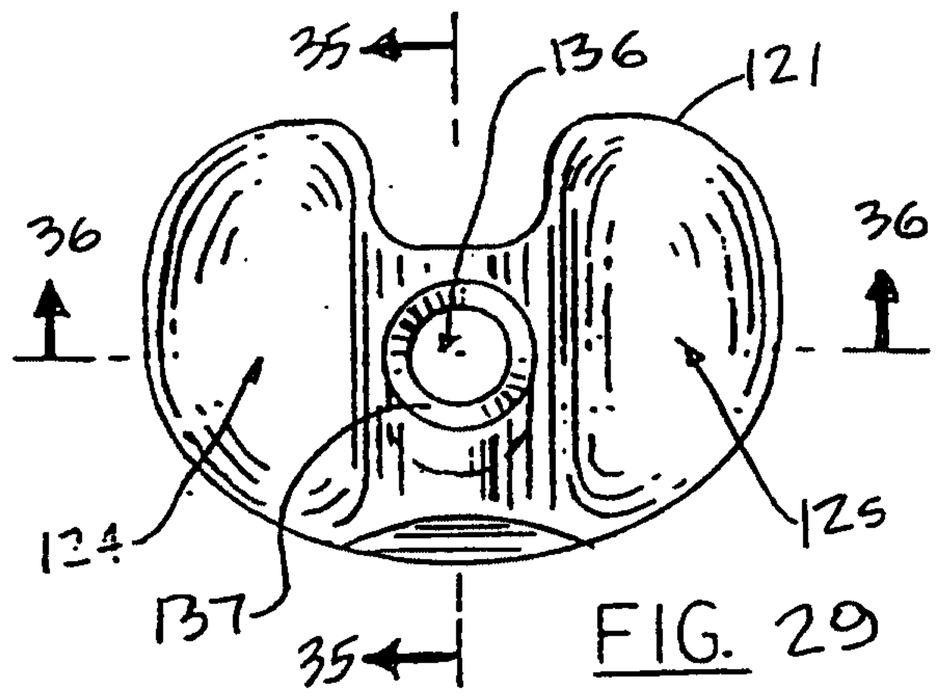


FIG. 29

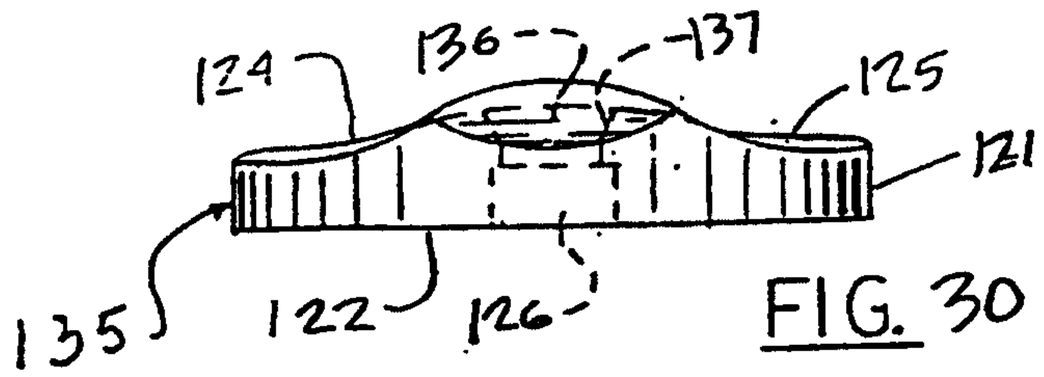


FIG. 30

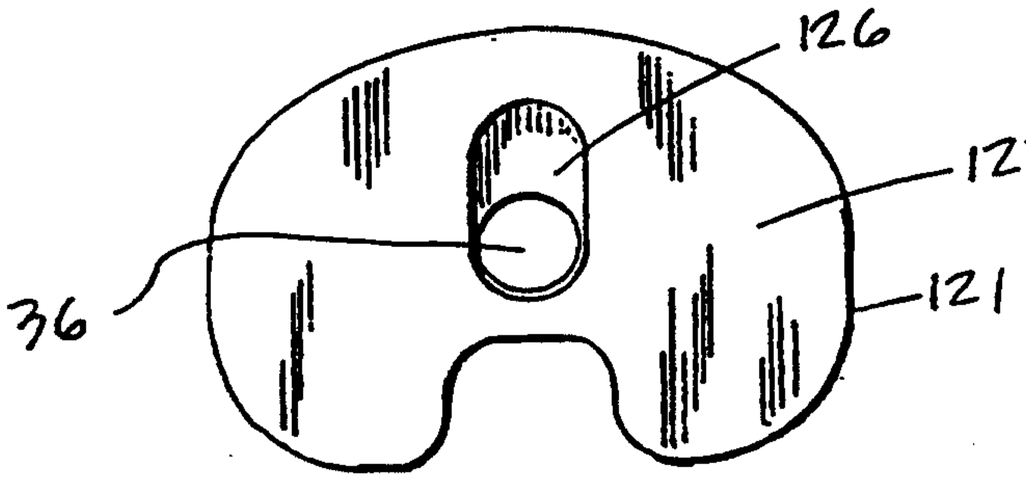


FIG. 31

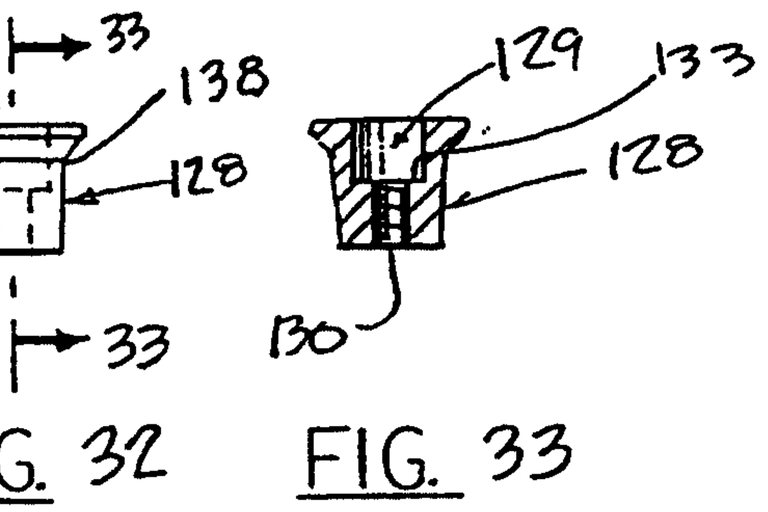


FIG. 32 FIG. 33

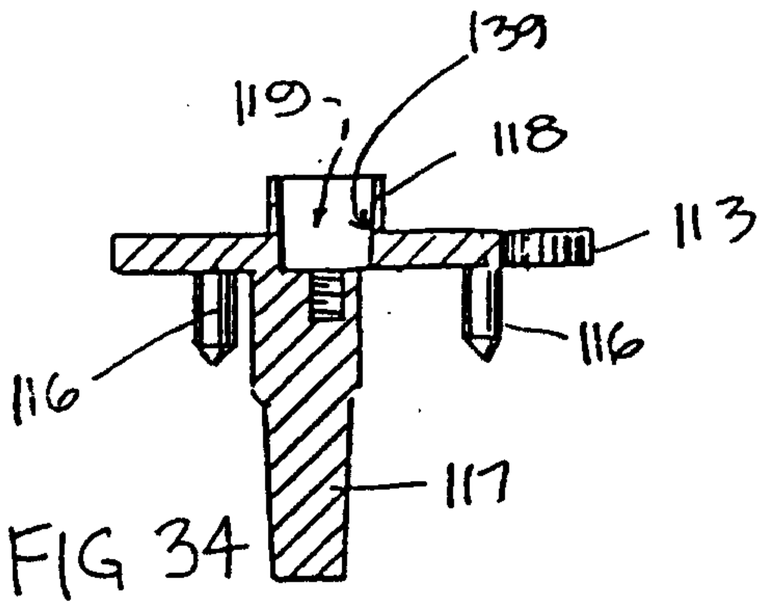


FIG 34

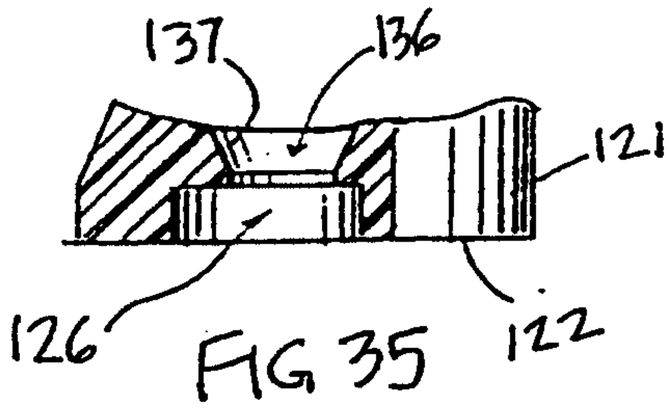


FIG 35

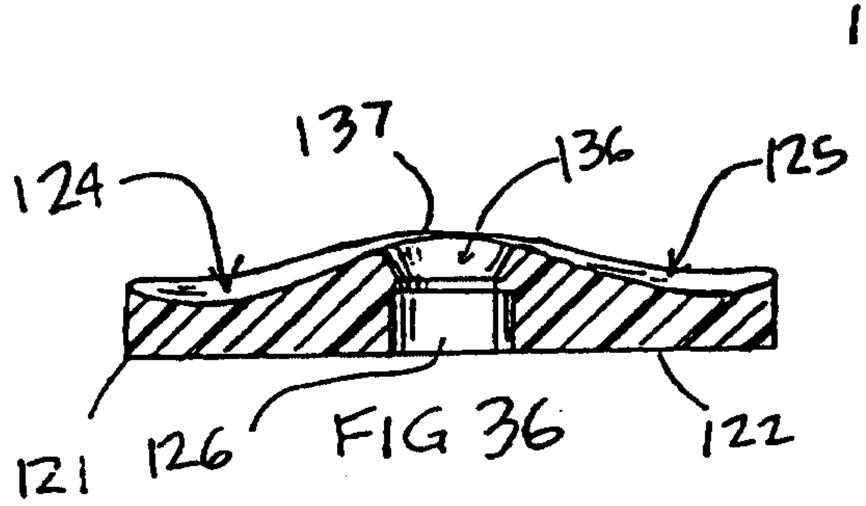


FIG 36

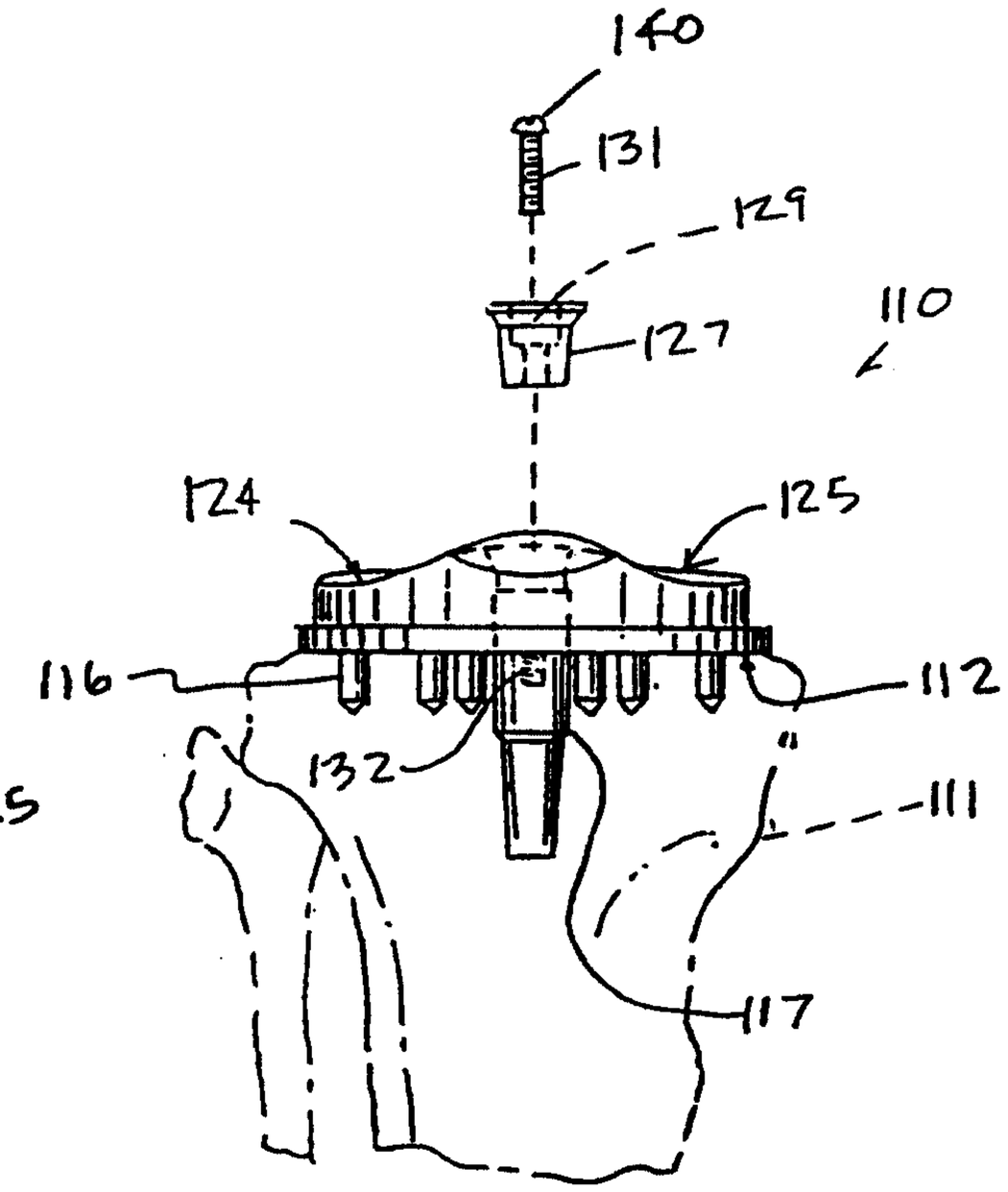


FIG 37

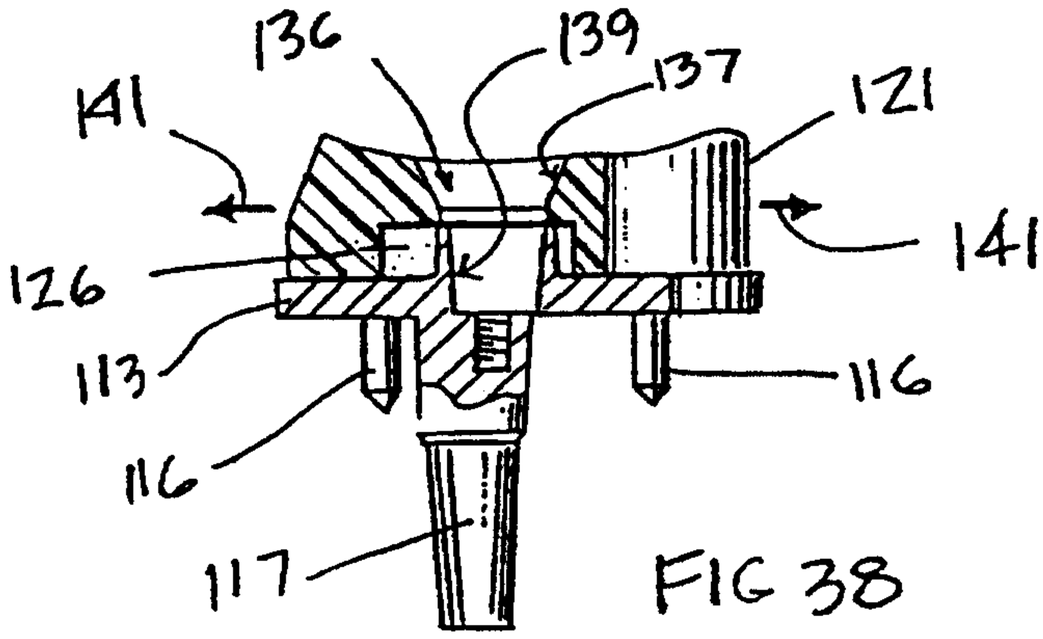


FIG 38

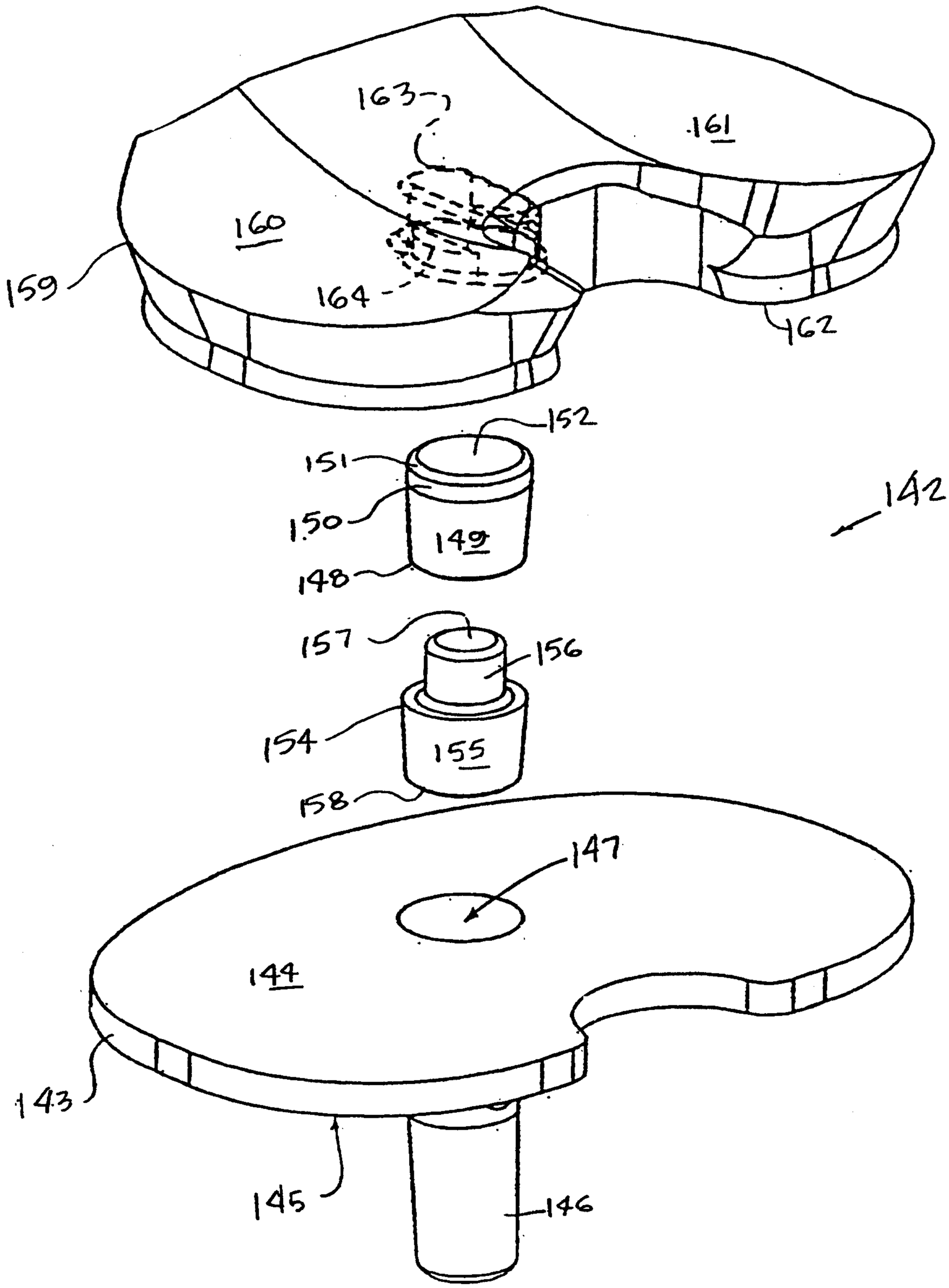

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FIG 39

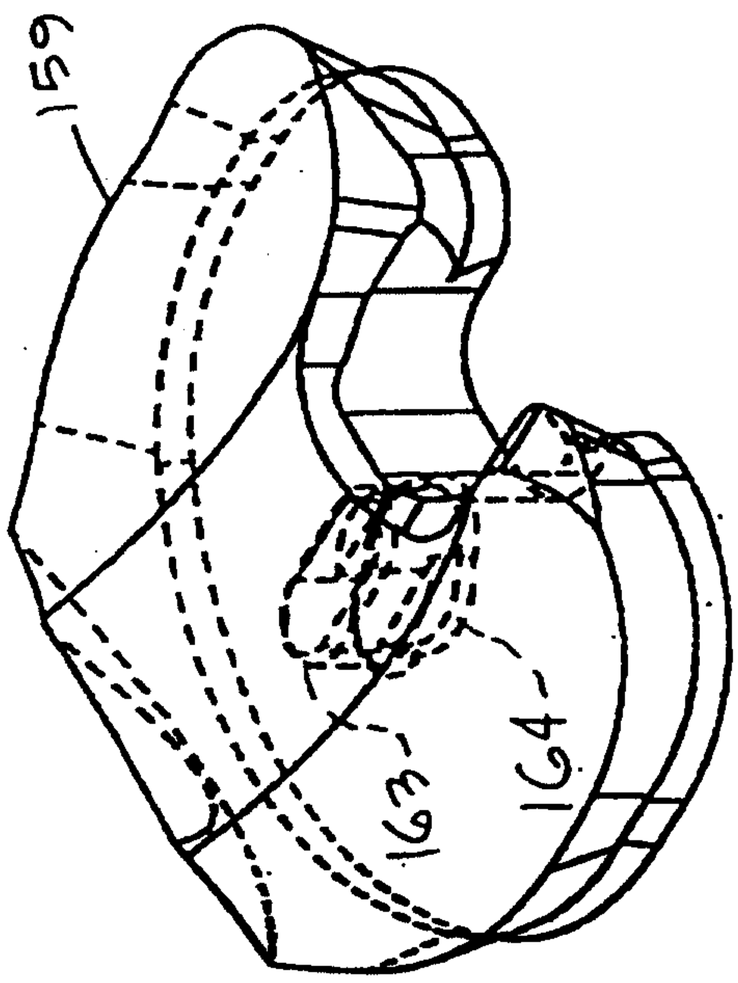

FIG 42

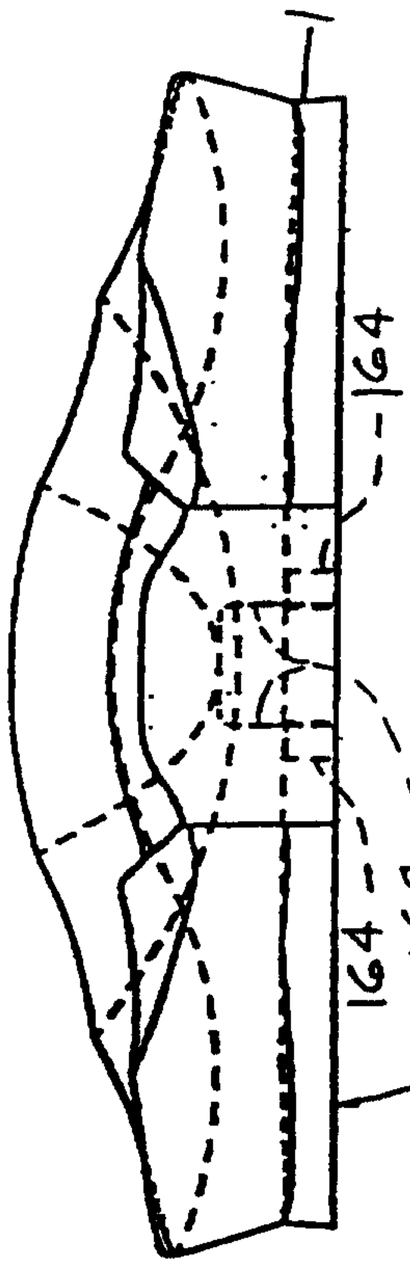

FIG 43

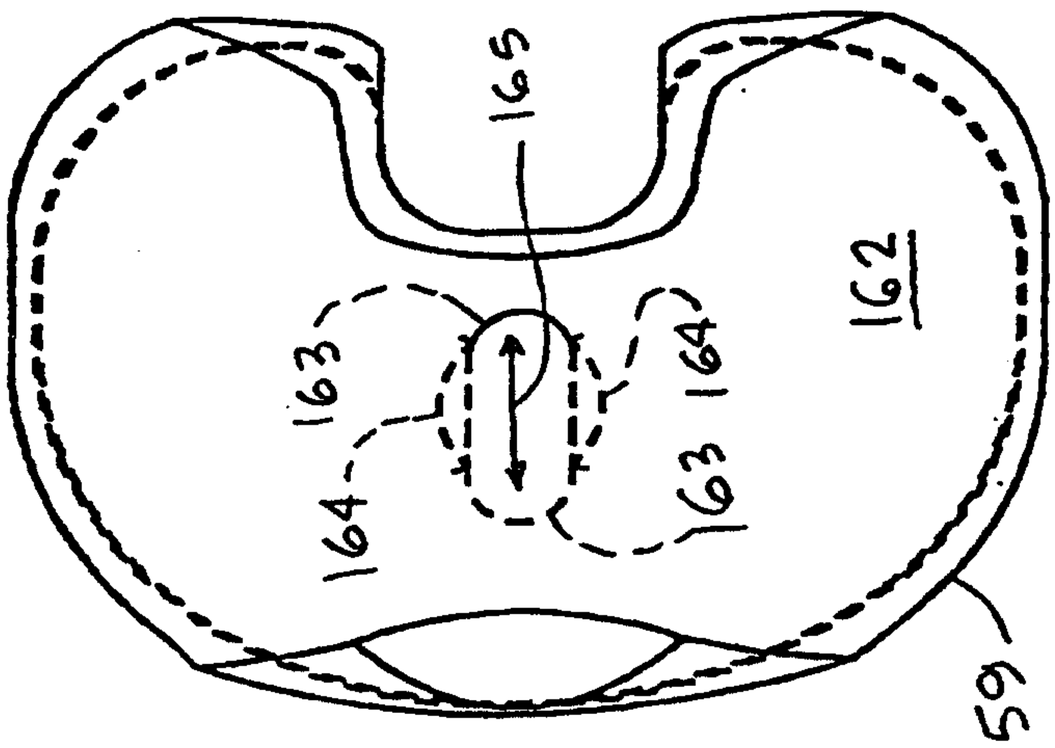

FIG 40

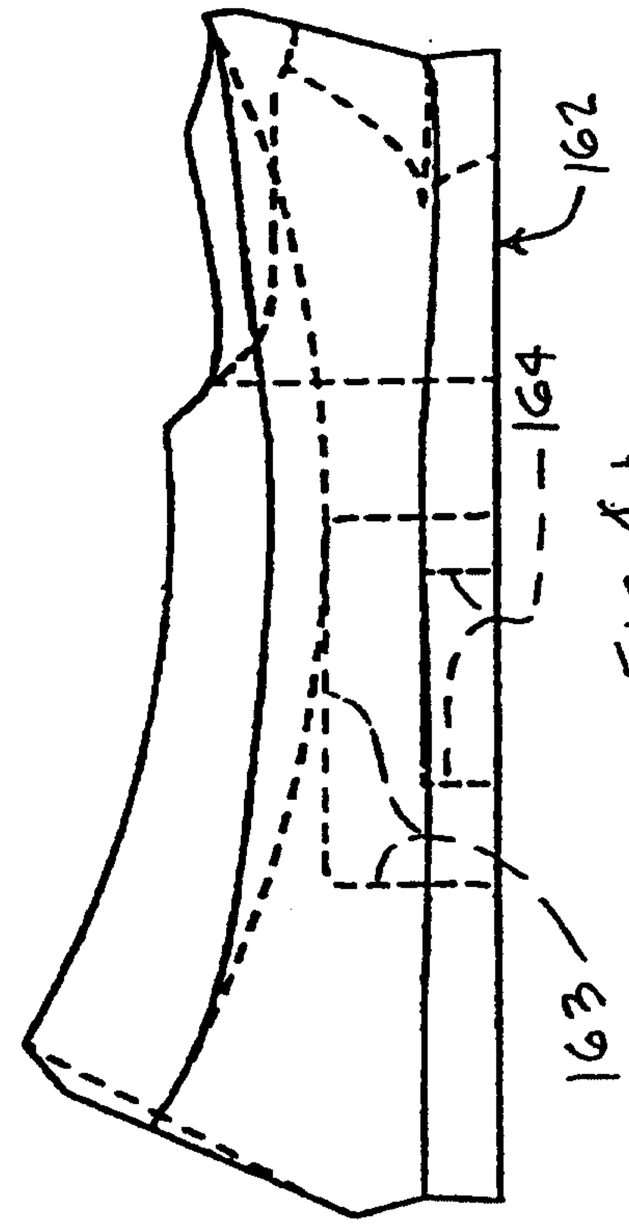

FIG 41

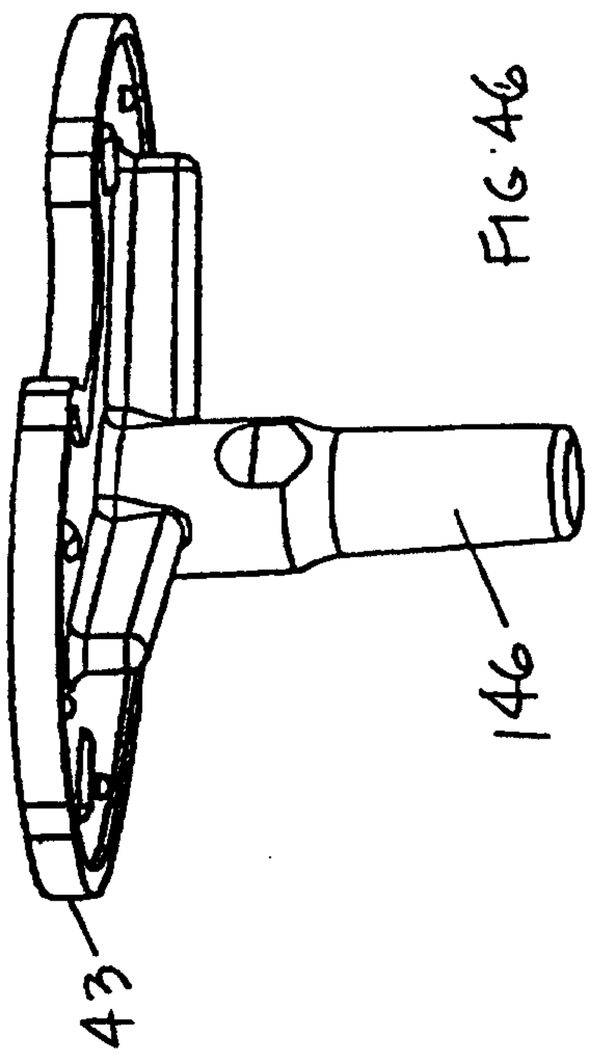

FIG 46

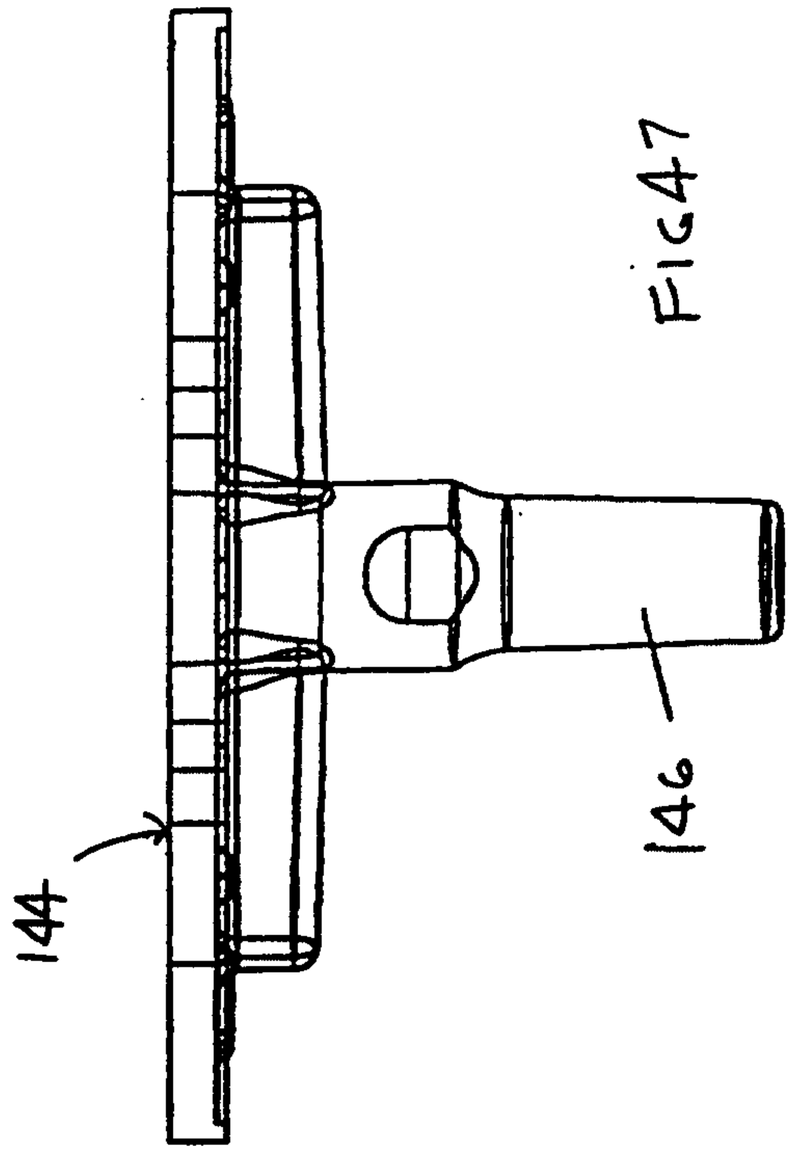

FIG 47

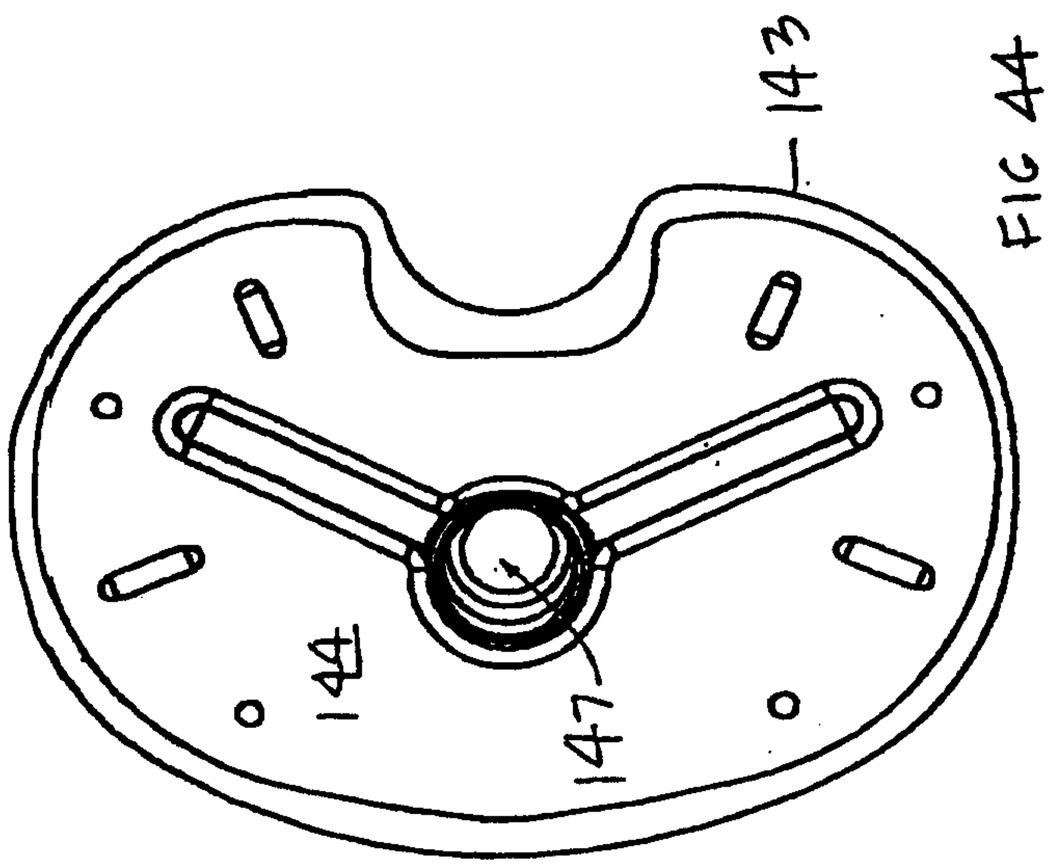

FIG 44

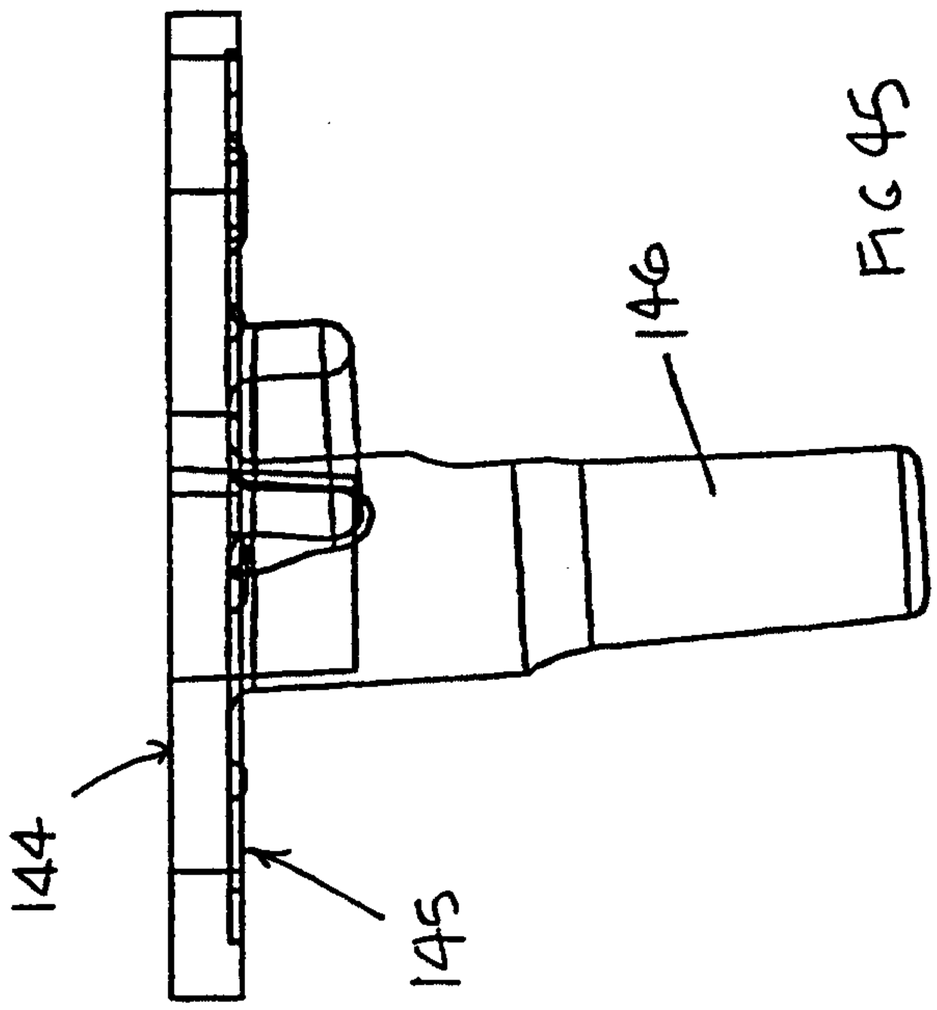

FIG 45

FIG 50 FIG 51

FIG 48 FIG 49

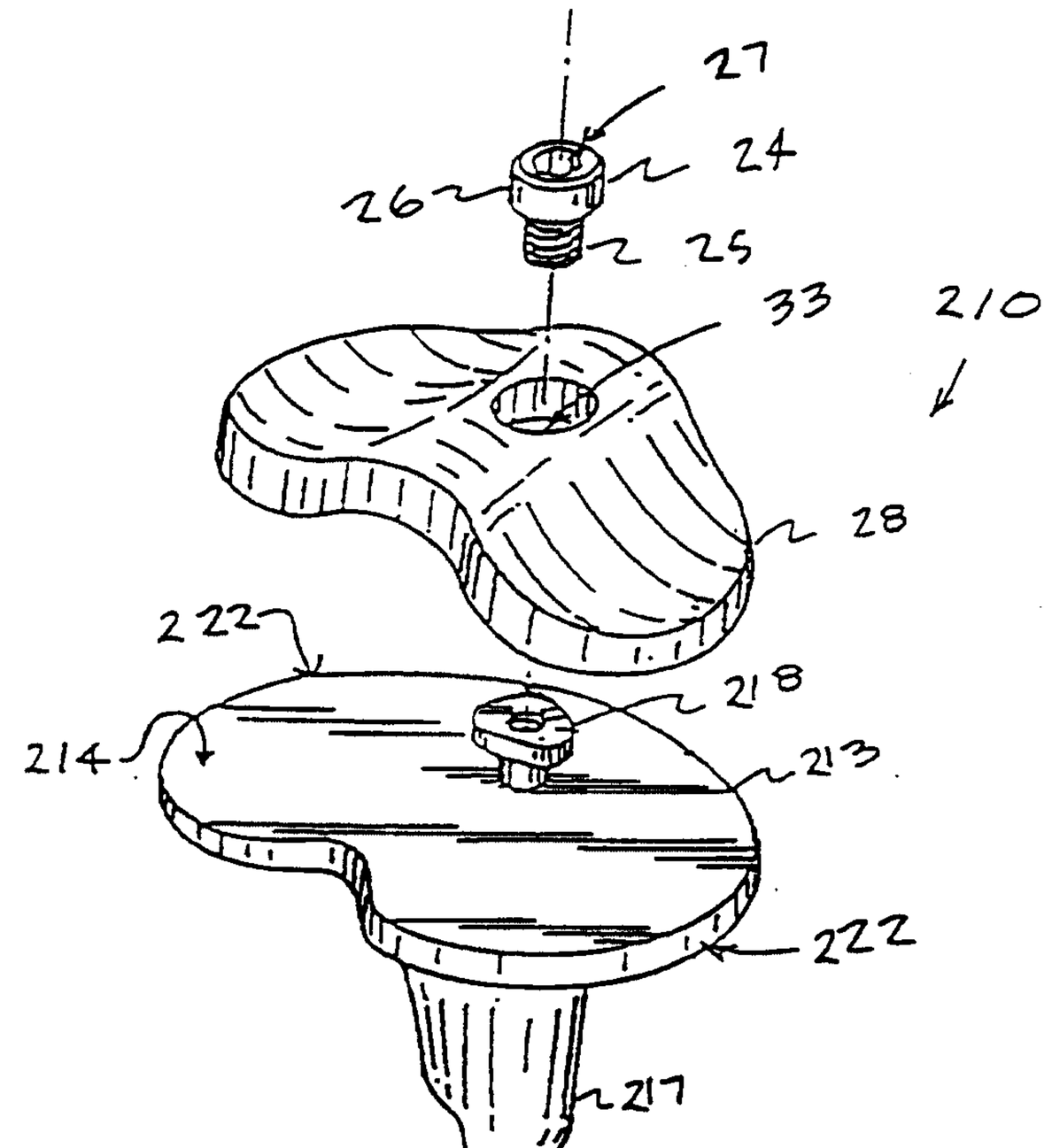

FIG. 52

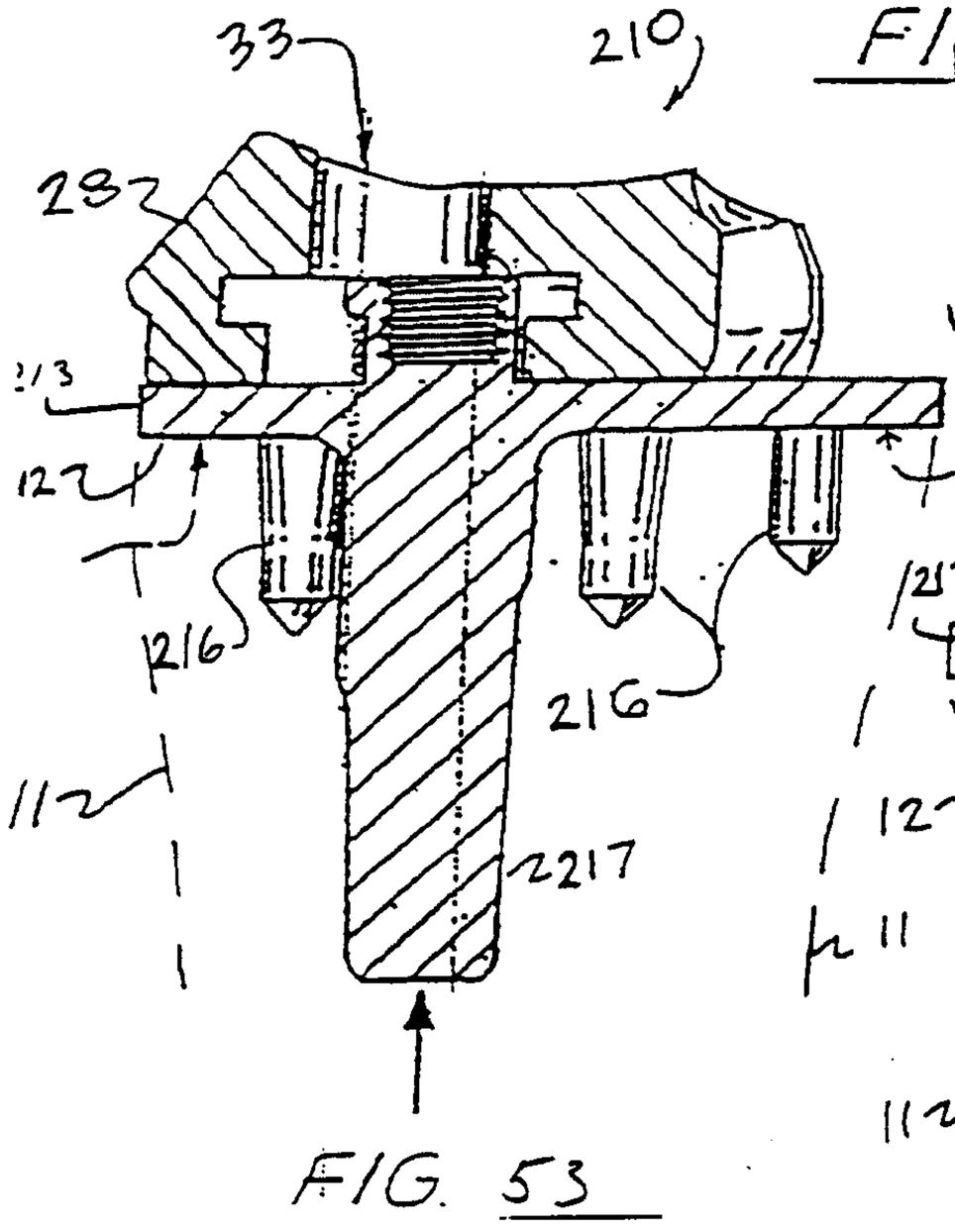

FIG. 53

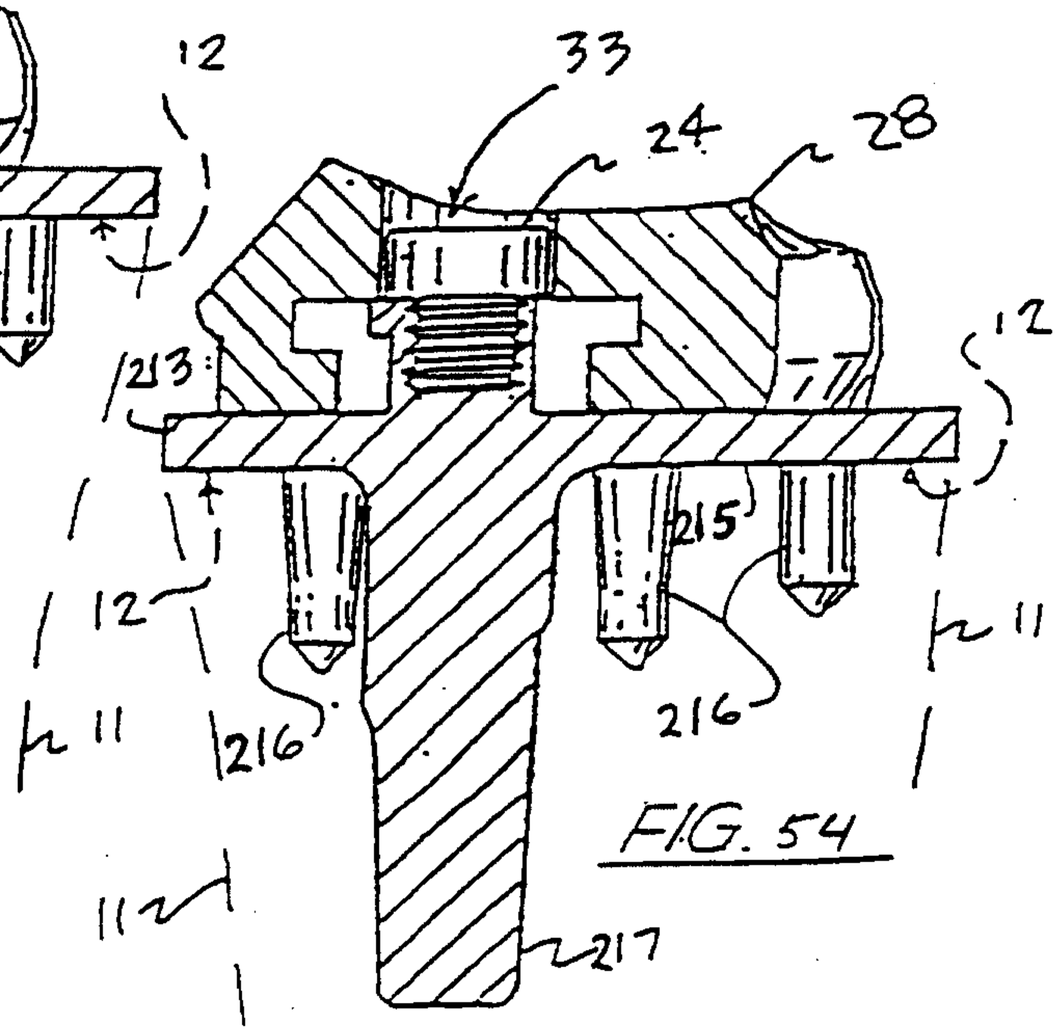

FIG. 54

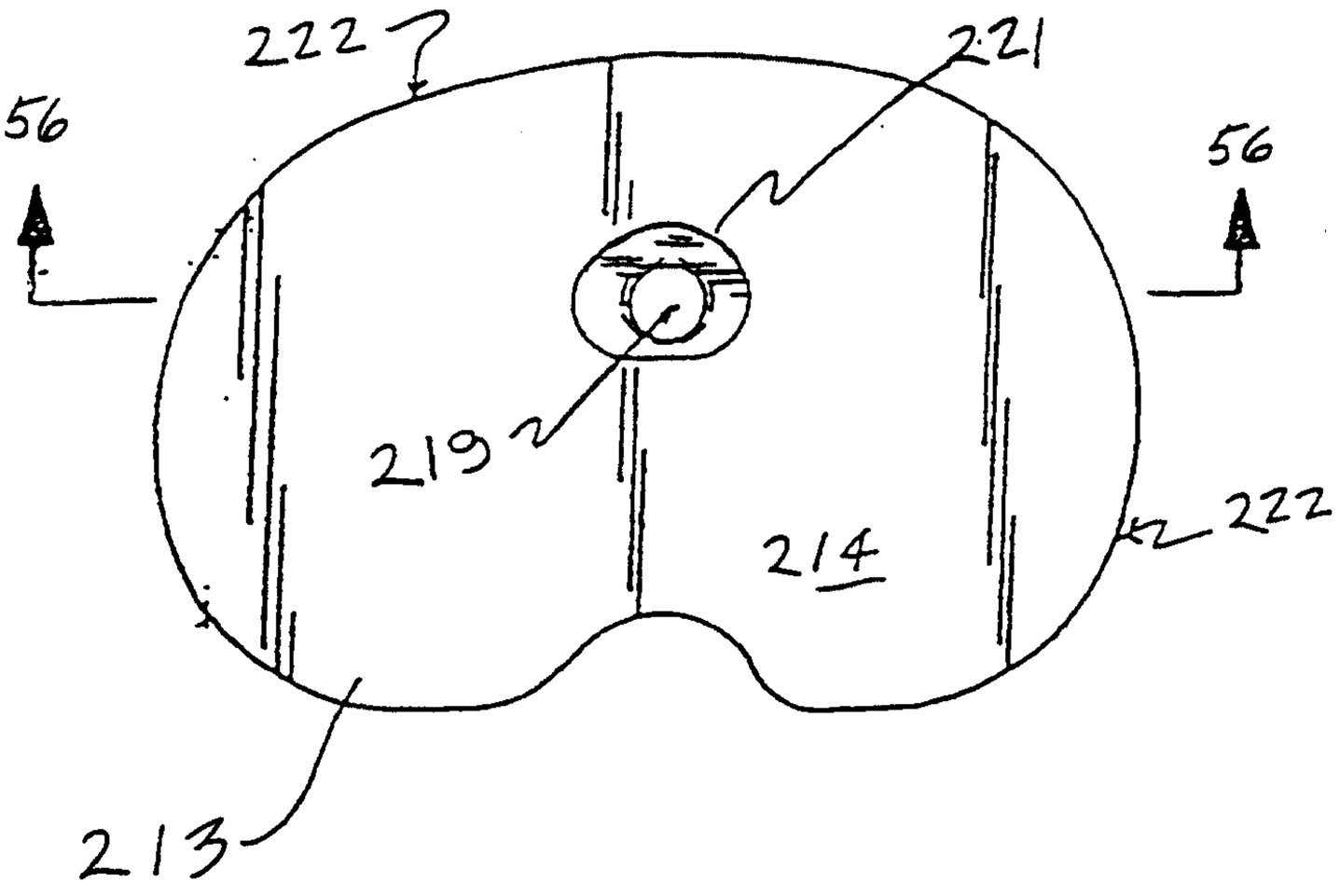

FIG. 55

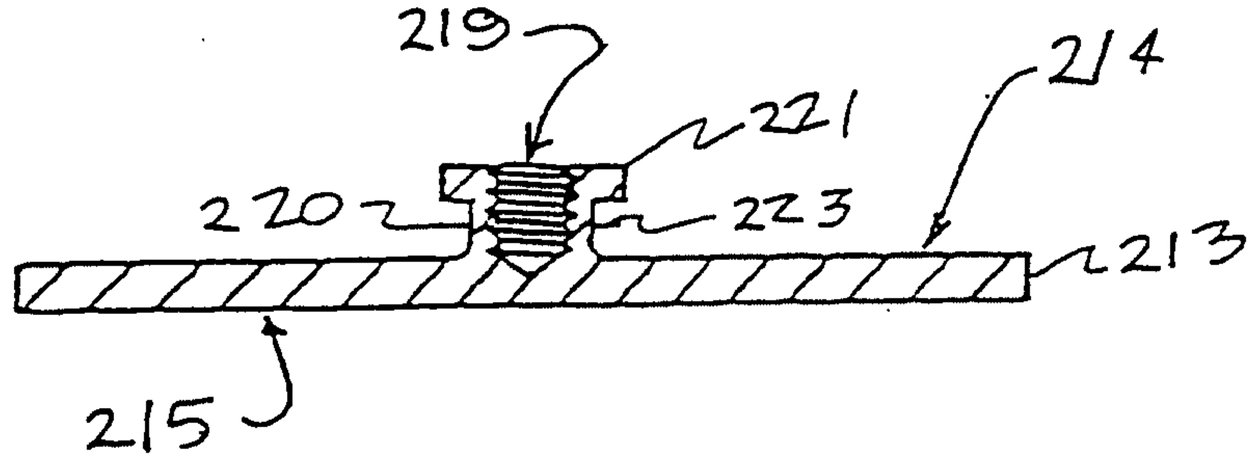

FIG. 56