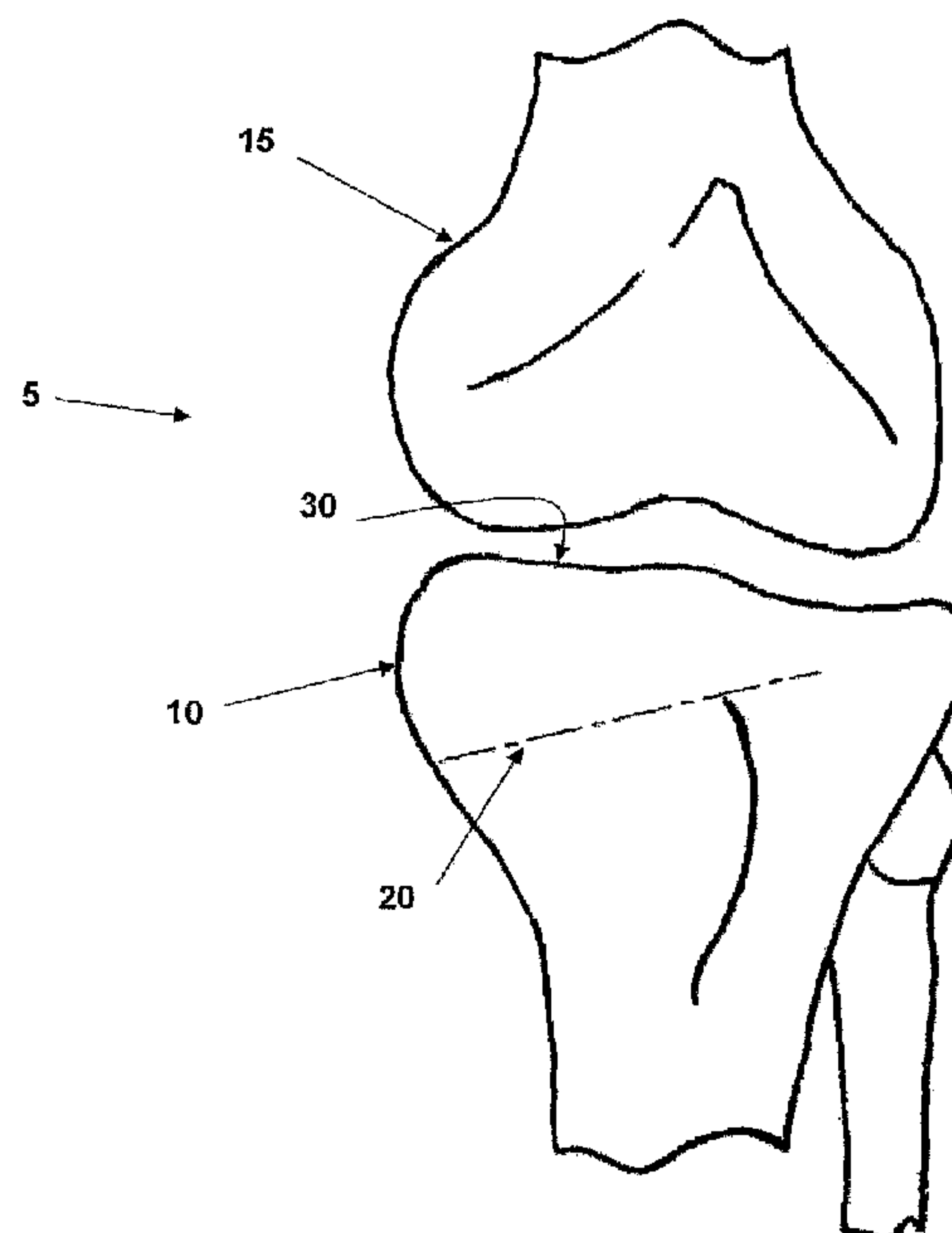




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In one form of the present invention, there is provided an osteotomy implant for supporting an open wedge osteotomy, the osteotomy implant comprising: a first graft containment arm for disposition along one side of the open wedge osteotomy; a second graft containment arm for disposition along a second, opposite side of the open wedge osteotomy/ and a base component for disposition along the mouth of the open wedge osteotomy, the base component being configured to selectively connect the first graft containment arm and the second graft containment arm to one another so as to form a generally wedge-shaped structure, wherein the base component constitutes the thicker end of the wedge. In another form of the present invention, there is provided a method for conducting an open wedge osteotomy, comprising: forming a wedge-like opening in the bone; positioning a first graft containment arm along one side of the wedge-like opening, and positioning a second graft containment arm along a second, opposite side of the wedge-like opening/ and positioning a base component along the mouth of the wedge-like opening, the base component being selectively connected to the first graft containment arm and the second graft containment arm so as to form a generally wedge-shaped structure, wherein the base component constitutes the thicker end of the wedge.

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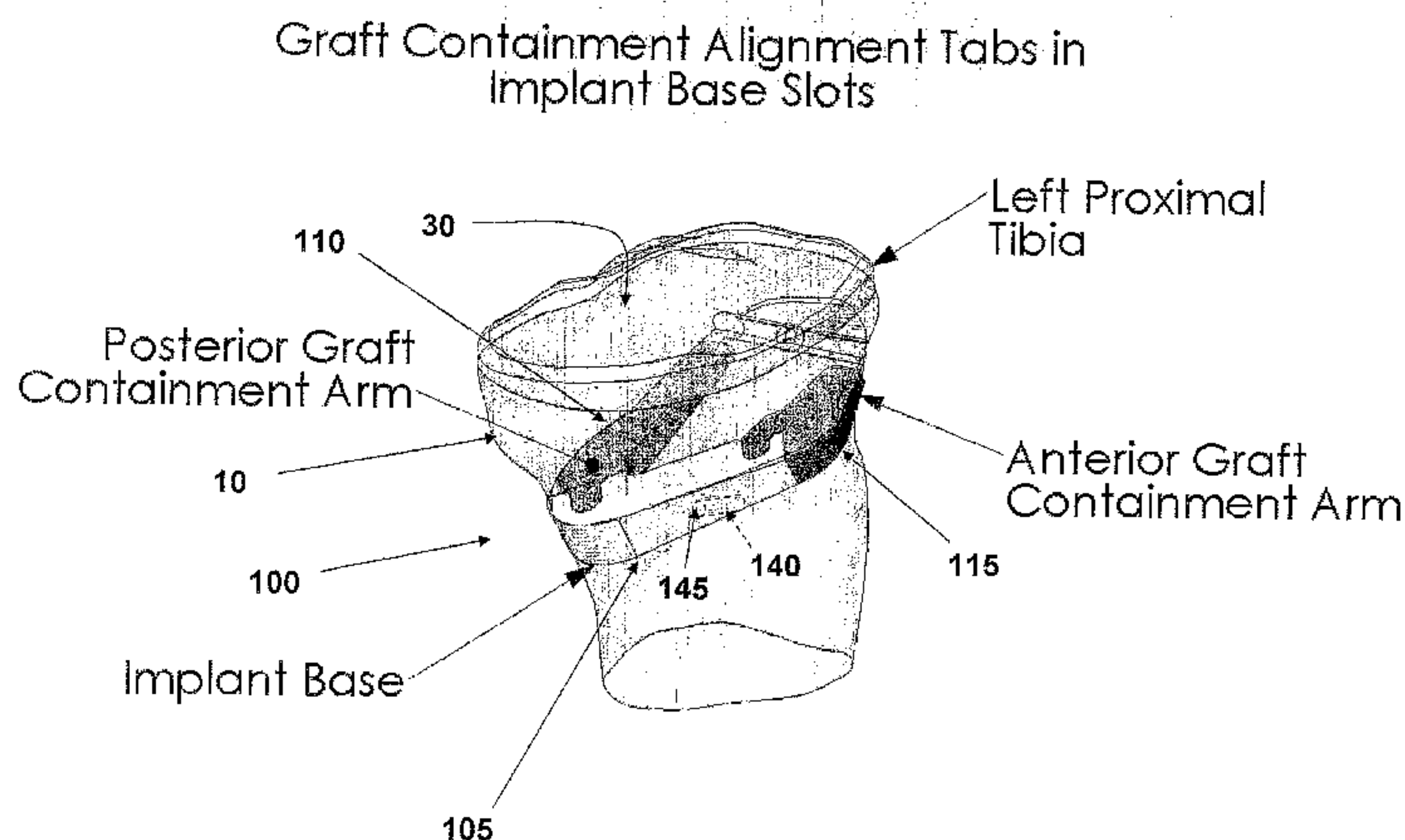
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(54) Title: MULTI-PART IMPLANT FOR OPEN WEDGE KNEE OSTEOTOMIES



(57) **Abstract:** In one form of the present invention, there is provided an osteotomy implant for supporting an open wedge osteotomy, the osteotomy implant comprising: a first graft containment arm for disposition along one side of the open wedge osteotomy; a second graft containment arm for disposition along a second, opposite side of the open wedge osteotomy/ and a base component for disposition along the mouth of the open wedge osteotomy, the base component being configured to selectively connect the first graft containment arm and the second graft containment arm to one another so as to form a generally wedge-shaped structure, wherein the base component constitutes the thicker end of the wedge. In another form of the present invention, there is provided a method for conducting an open wedge osteotomy, comprising: forming a wedge-like opening in the bone; positioning a first graft containment arm along one side of the wedge-like opening, and positioning a second graft containment arm along a second, opposite side of the wedge-like opening/ and positioning a base component along the mouth of the wedge-like opening, the base component being selectively connected to the first graft containment arm and the second graft containment arm so as to form a generally wedge-shaped structure, wherein the base component constitutes the thicker end of the wedge.

WO 2006/086666 A2

MULTI-PART IMPLANT FOR OPEN WEDGE KNEE OSTEOTOMIES

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Field Of The Invention

This invention relates to surgical methods and apparatus in general, and more particularly to surgical methods and apparatus for performing open wedge
5 osteotomies of the knee.

Background Of The Invention

Osteotomies of the knee are an important technique for treating knee osteoarthritis. In essence, knee
10 osteotomies adjust the geometry of the knee joint so as to transfer weight bearing load from arthritic portions of the joint to the relatively unaffected portions of the joint.

Most knee osteotomies are designed to modify the
15 geometry of the upper tibia, so as to adjust the manner in which the tibia engages the femur and hence the locations at which the load is transferred across the joint.

There are essentially two ways in which to adjust
20 the orientation of the tibia: (i) the closed wedge technique; and (ii) the open wedge technique.

With the closed wedge technique, a wedge of bone is removed from the tibia, and the portions on either side of the resulting gap are brought together, whereby to reorient the tibial plateau and hence adjust the manner in which the tibia engages the femur.

With the open wedge technique, a cut is made into the tibia, the portions on either side of the cut are moved apart so as to form a wedge-like opening in the bone, and then the bone is secured in this position (e.g., by screwing metal plates to the bone or by inserting a wedge-shaped implant into the opening in the bone), whereby to reorient the tibial plateau and hence adjust the manner in which the tibia engages the femur.

While both closed wedge osteotomies and open wedge osteotomies provide substantial benefits to the patient, they are procedurally challenging to the surgeon. Furthermore, with respect to open wedge osteotomies, the wedge-shaped implants currently used are relatively large and awkward to position, and do not lend themselves to minimally invasive procedures, among other things.

The present invention is directed to open wedge osteotomies, and to wedge-shaped implants for positioning in the osteotomy opening.

5 Summary Of The Invention

The present invention comprises a novel method and apparatus for effecting an open wedge osteotomy. More particularly, the present invention comprises the provision and use of a novel multi-part implant for use
10 in an open wedge osteotomy.

In one form of the present invention, there is provided an osteotomy implant for supporting an open wedge osteotomy, the osteotomy implant comprising:

15 a first graft containment arm for disposition along one side of the open wedge osteotomy;

a second graft containment arm for disposition along a second, opposite side of the open wedge osteotomy; and

20 a base component for disposition along the mouth of the open wedge osteotomy, the base component being configured to selectively connect the first graft containment arm and the second graft containment arm to

one another so as to form a generally wedge-shaped structure, wherein the base component constitutes the thicker end of the wedge.

In another form of the present invention, there is provided a method for conducting an open wedge osteotomy, comprising:

forming a wedge-like opening in the bone;

positioning a first graft containment arm along one side of the wedge-like opening, and positioning a second graft containment arm along a second, opposite side of the wedge-like opening; and

positioning a base component along the mouth of the wedge-like opening, the base component being selectively connected to the first graft containment arm and the second graft containment arm so as to form a generally wedge-shaped structure, wherein the base component constitutes the thicker end of the wedge.

Brief Description Of The Drawings

These and other objects and features of the present invention will be more fully disclosed or rendered obvious by the following detailed description

of the preferred embodiments of the invention, which is to be considered together with the accompanying drawings wherein like numbers refer to like parts, and further wherein:

5 Figs. 1 and 2 are schematic views showing the formation of the wedge-like opening in the tibia for an open wedge osteotomy;

10 Figs. 3-10 are schematic views showing various multi-part implants with tab and slot interface construction;

Figs. 11-18 are schematic views showing various multi-part implants with wedge and groove interface construction;

15 Figs. 19-26 are schematic views showing various multi-part implants with ball and socket interface construction; and

Figs. 27-34 are schematic views showing various multi-part implants with flat-to-flat interface construction.

20

Detailed Description Of The Preferred EmbodimentsForming The Wedge-Like Opening In The Tibia

Looking first at Figs. 1 and 2, there is shown a
5 knee joint 5 upon which an open wedge osteotomy is to
be performed. Knee joint 5 generally comprises a tibia
10 and a femur 15. In accordance with the present
invention, the open wedge osteotomy is effected by
first making a cut 20 (Fig. 1) into the upper tibia,
and then moving apart the portions of the bone on
either side of cut 20 so as to form a wedge-like
opening 25 (Fig. 2) in the bone, with the wedge-like
opening 25 being configured such that the tibial
plateau 30 is given the desired orientation relative to
15 femur 15. Cut 20 and wedge-like opening 25 may be
formed in a variety of ways well known in the art. In
one preferred form of the invention, cut 20 and
wedge-like opening 25 are formed using an antero-medial
approach, preferably with a minimally invasive
20 technique.

In accordance with the present invention, once the
desired wedge-like opening 25 has been formed in tibia

10 and tibial plateau 30 given its desired orientation,
a novel multi-part implant is positioned in wedge-like
opening 25 so as to maintain the reconfigured geometry
of the tibia while weight bearing load is applied and
5 healing occurs.

The Novel Multi-Part Implant In General

In accordance with the present invention, the
novel implant comprises a multi-part construction
10 having a generally wedge-shaped configuration
substantially corresponding to the geometry of the
wedge-shaped opening 25. The various components of the
multi-part implant are intended to be assembled
together, preferably in-situ, so as to form the
15 complete wedge-shaped implant. The multi-part
construction of the implant is significant and provides
numerous advantages over prior art implants.

First, the multi-part construction permits
patient-specific sizing of the implant with reduced
20 inventory requirements. In addition, if desired, the
implant can be trimmed on-site, in the operating room,

to even more precisely approximate the geometry of wedge-shaped opening 25.

Second, the multi-part construction of the new implant permits the various component parts to be separately introduced into wedge-shaped opening 25, with the parts thereafter being connected together so as to form the complete implant. Since each of the component parts is relatively small, they are easy to manipulate and, as such, can be more precisely placed in position.

Third, the multi-part approach facilitates use of the implant with minimally invasive procedures.

Multi-Part Implant With Tab And Slot

Interface Construction

Looking next at Figs. 3 and 4, in one preferred form of the invention, there is provided a novel implant 100 which generally comprises a base 105, a first graft containment arm 110 and a second graft containment arm 115. Base 105, first graft containment arm 110 and second graft containment arm 115 are intended to be attached together, preferably in-situ,

so as to collectively form a generally wedge-shaped structure, with base 105 constituting the thicker end of the wedge. In the case where wedge-shaped opening 25 is formed using an antero-medial approach (e.g.,
5 such as that shown in Fig. 3), so that implant 100 is positioned using an antero-medial approach, first graft containment arm 110 is disposed in the posterior position, second graft containment arm 115 is disposed in the anterior position, and base 105 is disposed in
10 the antero-medial position, with base 105 extending between and connecting together posterior graft containment arm 110 and anterior graft containment arm 115. In this setting, posterior graft containment arm 110 and anterior graft containment arm 115 are
15 preferably disposed substantially parallel to one another, intersecting the antero-medial base 105 at non-right angles (see Fig. 3), or as otherwise appropriate for the anatomy. Furthermore, in this setting, posterior graft containment arm 110 is longer
20 than anterior graft containment arm 115.

In this form of the invention, base 105, first graft containment arm 110 and second graft containment

arm 115 are attached together using a tab and slot interface construction, with the first graft containment arm 110 having a first male (tab) member 120 which is received by a first female (slot) recess 125 formed in base 105, and with the second graft containment arm 115 having a second male (tab) member 130 which is received by a second female (slot) recess 135 formed in base 105. If desired, first male member 120 may form a friction fit in first female recess 125, and/or second male member 130 may form a friction fit in second female recess 135.

If desired, the various components of wedge-shaped implant 100 may be provided with barbs, ridges, projections, roughening, etc., as generally indicated at B (shown in Fig. 4 but omitted from Fig. 3 for the sake of clarity), so as to enhance engagement between the implant components and the bone.

In use, the wedge-shaped implant 100 is positioned in wedge-like opening 25 in tibia 10 so as to stabilize the tibia with the desired geometry while healing occurs. To this end, an appropriately sized base 105, an appropriately sized first graft containment arm 110

and an appropriately sized second graft containment arm 115 are selected from a library of parts, preferably provided to the surgeon in kit form. If desired, the selected parts can be further sized to a desired dimension, e.g., by cutting. In the setting of an antero-medial approach, deployment of implant 100 may be effected by first appropriately positioning posterior graft containment arm 110 and anterior graft containment arm 115 in wedge-like opening 25, and then connecting them together with base 105. As this occurs, posterior graft containment arm 110, anterior graft containment arm 115 and base 105 form a generally U-shaped perimeter which can contain bone paste, bone cement, other bone graft materials or the like within the interior of wedge-like opening 25, whereby to facilitate healing. One or more bone screws 140, installed through openings 145, can be used to screw base 105 to the tibia.

If desired, the first graft containment arm and the second graft containment arm may be joined together by a bridge so as to form a single unit. More particularly, and looking now at Figs. 5 and 6, there

is shown a novel implant 100A which comprises a base 105A, a first graft containment arm 110A, a second graft containment arm 115A, and a bridge 150A connecting together first graft containment arm 110A and second graft containment arm 115A. Again, base 105A, first graft containment arm 110A and second graft containment arm 115A are attached together using a tab and slot interface construction, with the first graft containment arm 110A having a first male (tab) member 120A which is received by a first female (slot) recess 125A formed in base 105A, and with the second graft containment arm 115A having a second male (tab) member 130A which is received by a second female (slot) recess 135A formed in base 105A. If desired, first male member 120A may form a friction fit in first female recess 125A, and/or second male member 130A may form a friction fit in second female recess 135A. Again, a screw 140A, received through an opening 145A in base 105A, may be used to screw base 105A to the tibia. If desired, the various components of wedge-shaped implant 100A may be provided with barbs, ridges, projections, roughening, etc., as generally indicated at B (shown in

Fig. 6 but omitted from Fig. 5 for the sake of clarity), so as to enhance engagement between the implant components and the bone.

If desired, the positions of the tabs and slots can be reversed, i.e., with the base having a first male (tab) member which is received in a first female (slot) member formed in the first graft containment arm, and with the base having a second male (tab) member which is received in a second female (slot) member formed in second graft containment arm. More particularly, and looking now at Figs. 7 and 8, there is shown a novel implant 100B which is substantially the same as implant 100 described above, except that the position of the tabs and slots is reversed; and in Figs. 9 and 10, there is shown a novel implant 100C which is substantially the same as implant 100A described above, except that the position of the tabs and slots is reversed.

Multi-Part Implant With Wedge And GrooveInterface Construction

Looking next at Figs. 11 and 12, in one preferred form of the invention, there is provided a novel
5 implant 200 which generally comprises a base 205, a first graft containment arm 210 and a second graft containment arm 215. Base 205, first graft containment arm 210 and second graft containment arm 215 are intended to be attached together, preferably in-situ,
10 so as to collectively form a generally wedge-shaped structure, with base 205 constituting the thicker end of the wedge. In the case where wedge-shaped opening 25 is formed using an antero-medial approach (e.g.,
—
such as that shown in Fig. 11), so that implant 200 is
15 positioned using an antero-medial approach, first graft containment arm 210 is disposed in the posterior position, second graft containment arm 215 is disposed in the anterior position, and base 205 is disposed in the antero-medial position, with base 205 extending
20 between and connecting together posterior graft containment arm 210 and anterior graft containment arm 215. In this setting, posterior graft containment arm

210 and anterior graft containment arm 215 are preferably disposed substantially parallel to one another, intersecting the antero-medial base 205 at non-right angles (see Fig. 11), or as otherwise appropriate for the anatomy. Furthermore, in this setting, posterior graft containment arm 210 is longer than anterior graft containment arm 215.

In this form of the invention, base 205, first graft containment arm 210 and second graft containment arm 215 are attached together using a wedge and groove interface construction, with the first graft containment arm 210 having a first male (wedge) member 220 which is received by a first female (groove) recess 225 formed in base 205, and with the second graft containment arm 215 having a second male (wedge) member 230 which is received by a second female (groove) recess 235 formed in base 205. If desired, first male member 220 may form a friction fit in first female recess 225, and/or second male member 230 may form a friction fit in second female recess 235.

If desired, the various components of wedge-shaped implant 200 may be provided with barbs, ridges,

projections, roughening, etc., as generally indicated at B (shown in Fig. 12 but omitted from Fig. 11 for the sake of clarity), so as to enhance engagement between the implant components and the bone.

5 In use, the wedge-shaped implant 200 is positioned in wedge-like opening 25 in tibia 10 so as to stabilize the tibia with the desired geometry while healing occurs. To this end, an appropriately sized base 205, an appropriately sized first graft containment arm 210
10 and an appropriately sized second graft containment arm 215 are selected from a library of parts, preferably provided to the surgeon in kit form. If desired, the selected parts can be further sized to a desired dimension, e.g., by cutting. In the setting of an
15 antero-medial approach, deployment of implant 200 may be effected by first appropriately positioning posterior graft containment arm 210 and anterior graft containment arm 215 in wedge-like opening 25, and then connecting them together with base 205. As this
20 occurs, posterior graft containment arm 210, anterior graft containment arm 215 and base 205 form a generally U-shaped perimeter which can contain bone paste, bone

cement, other bone graft materials or the like within the interior of wedge-like opening 25, whereby to facilitate healing. One or more bone screws 240, installed through openings 245, can be used to screw base 205 to the tibia.

If desired, the first graft containment arm and the second graft containment arm may be joined together by a bridge so as to form a single unit. More particularly, and looking now at Figs. 13 and 14, there is shown a novel implant 200A which comprises a base 205A, a first graft containment arm 210A, a second graft containment arm 215A, and a bridge 250A connecting together first graft containment arm 210A and second graft containment arm 215A. Again, base 205A, first graft containment arm 210A and second graft containment arm 215A are attached together using a wedge and groove interface construction, with the first graft containment arm 210A having a first male (wedge) member 220A which is received by a first female (groove) recess 225A formed in base 205A, and with the second graft containment arm 215A having a second male (wedge) member 230A which is received by a second

female (groove) recess 235A formed in base 205A. If
desired, first male member 220A may form a friction fit
in first female recess 225A, and/or second male member
230A may form a friction fit in second female recess
5 235A. Again, a screw 240A, received through an opening
245A in base 205A, may be used to screw base 205A to
the tibia. If desired, the various components of
wedge-shaped implant 200A may be provided with barbs,
ridges, projections, roughening, etc., as generally
10 indicated at B (shown in Fig. 14 but omitted from Fig.
13 for the sake of clarity), so as to enhance
engagement between the implant components and the bone.

If desired, the positions of the wedges and
grooves can be reversed, i.e., with the base having a
15 first male (wedge) member which is received in a first
female (groove) member formed in the first graft
containment arm, and with the base having a second male
(wedge) member which is received in a second female
(groove) member formed in second graft containment arm.
20 More particularly, and looking now at Figs. 15 and 16,
there is shown a novel implant 200B which is
substantially the same as implant 200 described above,

except that the position of the wedges and grooves is reversed; and in Figs. 17 and 18, there is shown a novel implant 200C which is substantially the same as implant 200A described above, except that the position of the wedges and grooves is reversed.

Multi-Part Implant With Ball And Socket

Interface Construction

Looking next at Figs. 19 and 20, in one preferred form of the invention, there is provided a novel implant 300 which generally comprises a base 305, a first graft containment arm 310 and a second graft containment arm 315. Base 305, first graft containment arm 310 and second graft containment arm 315 are intended to be attached together, preferably in-situ, so as to collectively form a generally wedge-shaped structure, with base 305 constituting the thicker end of the wedge. In the case where wedge-shaped opening 25 is formed using an antero-medial approach (e.g., such as that shown in Fig. 19), so that implant 300 is positioned using an antero-medial approach, first graft containment arm 310 is disposed in the posterior

position, second graft containment arm 315 is disposed in the anterior position, and base 305 is disposed in the antero-medial position, with base 305 extending between and connecting together posterior graft containment arm 310 and anterior graft containment arm 315. In this setting, posterior graft containment arm 310 and anterior graft containment arm 315 are preferably disposed substantially parallel to one another, intersecting the antero-medial base 305 at non-right angles (see Fig. 19), or as otherwise appropriate for the anatomy. Furthermore, in this setting, posterior graft containment arm 310 is longer than anterior graft containment arm 315.

In this form of the invention, base 305, first graft containment arm 310 and second graft containment arm 315 are attached together using a ball and socket interface construction, with the first graft containment arm 310 having a first male (ball) member 320 which is received by a first female (socket) recess 325 formed in base 305, and with the second graft containment arm 315 having a second male (ball) member 330 which is received by a second female (socket)

recess 335 formed in base 305. If desired, first male member 320 may form a friction fit in first female recess 325, and/or second male member 330 may form a friction fit in second female recess 335.

5 Significantly, the use of a ball and socket interface construction permits in-situ adjustment of the joinder angle between first graft containment arm 310 and base 305, and in-situ adjustment of the joinder angle between second graft containment arm 315 and base 10 305. This provides flexibility for addressing patient-specific variations in anatomy, and can significantly reduce inventory requirements.

 If desired, the various components of wedge-shaped implant 300 may be provided with barbs, ridges, 15 projections, roughening, etc., as generally indicated at B (shown in Fig. 20 but omitted from Fig. 19 for the sake of clarity), so as to enhance engagement between the implant components and the bone.

 In use, the wedge-shaped implant 300 is positioned 20 in wedge-like opening 25 in tibia 10 so as to stabilize the tibia with the desired geometry while healing occurs. To this end, an appropriately sized base 305,

an appropriately sized first graft containment arm 310 and an appropriately sized second graft containment arm 315 are selected from a library of parts, preferably provided to the surgeon in kit form. If desired, the selected parts can be further sized to a desired dimension, e.g., by cutting. In the setting of an antero-medial approach, deployment of implant 300 may be effected by first appropriately positioning posterior graft containment arm 310 and anterior graft containment arm 315 in wedge-like opening 25, and then connecting them together with base 305. As this occurs, posterior graft containment arm 310, anterior graft containment arm 315 and base 305 form a generally U-shaped perimeter which can contain bone paste, bone cement, other bone graft materials or the like within the interior of wedge-like opening 25, whereby to facilitate healing. One or more bone screws 340, installed through openings 345, can be used to screw base 305 to the tibia.

Again, the use of a ball and socket interface construction permits in-situ adjustment of the joinder angles between (i) first graft containment arm 310 and

base 305, and (ii) second graft containment arm 315 and base 305. This provides flexibility for addressing patient-specific variations in anatomy, and can significantly reduce inventory requirements.

5 If desired, the first graft containment arm and the second graft containment arm may be joined together by a bridge so as to form a single unit. More particularly, and looking now at Figs. 21 and 22, there is shown a novel implant 300A which comprises a base
10 305A, a first graft containment arm 310A, a second graft containment arm 315A, and a bridge 350A connecting together first graft containment arm 310A and second graft containment arm 315A. Again, base
15 305A, first graft containment arm 310A and second graft containment arm 315A are attached together using a ball and socket interface construction, with the first graft containment arm 310A having a first male (ball) member 320A which is received by a first female (socket) recess 325A formed in base 305A, and with the second
20 graft containment arm 315A having a second male (ball) member 330A which is received by a second female (socket) recess 335A formed in base 305A. If desired,

first male member 320A may form a friction fit in first female recess 325A, and/or second male member 330A may form a friction fit in second female recess 335A.

Again, a screw 340A, received through an opening 345A in base 305A, may be used to screw base 305A to the tibia. If desired, the various components of wedge-shaped implant 300A may be provided with barbs, ridges, projections, roughening, etc., as generally indicated at B (shown in Fig. 22 but omitted from Fig. 21 for the sake of clarity), so as to enhance engagement between the implant components and the bone.

If desired, the positions of the balls and sockets can be reversed, i.e., with the base having a first male (ball) member which is received in a first female (socket) member formed in the first graft containment arm, and with the base having a second male (ball) member which is received in a second female (socket) member formed in second graft containment arm. More particularly, and looking now at Figs. 23 and 24, there is shown a novel implant 300B which is substantially the same as implant 300 described above, except that the position of the balls and sockets is reversed; and

in Figs. 25 and 26, there is shown a novel implant 300C which is substantially the same as implant 300A described above, except that the position of the balls and sockets is reversed.

5

Multi-Part Implant With Flat-To-Flat

Interface Construction

Looking next at Figs. 27 and 28, in one preferred form of the invention, there is provided a novel
10 implant 400 which generally comprises a base 405, a first graft containment arm 410 and a second graft containment arm 415. Base 405, first graft containment arm 410 and second graft containment arm 415 are intended to be attached together, preferably in-situ,
15 so as to collectively form a generally wedge-shaped structure, with base 405 constituting the thicker end of the wedge. In the case where wedge-shaped opening 25 is formed using an antero-medial approach (e.g., such as that shown in Fig. 27), so that implant 400 is
20 positioned using an antero-medial approach, first graft containment arm 410 is disposed in the posterior position, second graft containment arm 415 is disposed

in the anterior position, and base 405 is disposed in the antero-medial position, with base 405 extending between and connecting together posterior graft containment arm 410 and anterior graft containment arm 415. In this setting, posterior graft containment arm 410 and anterior graft containment arm 415 are preferably disposed substantially parallel to one another, intersecting the antero-medial base 405 at non-right angles (see Fig. 27), or as otherwise appropriate for the anatomy. Furthermore, in this setting, posterior graft containment arm 410 is longer than anterior graft containment arm 415.

In this form of the invention, base 405, first graft containment arm 410 and second graft containment arm 415 are attached together using a flat-to-flat interface construction, with the first graft containment arm 410 having a first flat surface 420 which engages a first flat surface 425 formed in base 405, and with the second graft containment arm 415 having a second flat surface 430 which engages a second flat surface 435 formed in base 405. In one preferred construction (see Figs. 27 and 28), first flat surface

420 and second flat surface 430 are arranged so as to be outwardly facing, in the sense that they project away from the interior of the implant; and first flat surface 425 and second flat surface 435 are arranged so as to be inwardly facing, in the sense that they project toward the interior of the implant.

If desired, the various components of wedge-shaped implant 400 may be provided with barbs, ridges, projections, roughening, etc., as generally indicated at B (shown in Fig. 28 but omitted from Fig. 27 for the sake of clarity), so as to enhance engagement between the implant components and the bone.

In use, the wedge-shaped implant 400 is positioned in wedge-like opening 25 in tibia 10 so as to stabilize the tibia with the desired geometry while healing occurs. To this end, an appropriately sized base 405, an appropriately sized first graft containment arm 410 and an appropriately sized second graft containment arm 415 are selected from a library of parts, preferably provided to the surgeon in kit form. If desired, the selected parts can be further sized to a desired dimension, e.g., by cutting. In the setting of an

antero-medial approach, deployment of implant 400 may be effected by first appropriately positioning posterior graft containment arm 410 and anterior graft containment arm 415 in wedge-like opening 25, and then connecting them together with base 405. As this occurs, posterior graft containment arm 410, anterior graft containment arm 415 and base 405 form a generally U-shaped perimeter which can contain bone paste, bone cement, other bone graft materials or the like within the interior of wedge-like opening 25, whereby to facilitate healing. One or more bone screws 440, installed through openings 445, can be used to screw base 405 to the tibia.

If desired, the first graft containment arm and the second graft containment arm may be joined together by a bridge so as to form a single unit. More particularly, and looking now at Figs. 29 and 30, there is shown a novel implant 400A which comprises a base 405A, a first graft containment arm 410A, a second graft containment arm 415A, and a bridge 450A connecting together first graft containment arm 410A and second graft containment arm 415A. In one

preferred construction (see Figs. 29 and 30), first flat surface 420A and second flat surface 430A are arranged so as to be outwardly facing, in the sense that they project away from the interior of the implant; and first flat surface 425A and second flat surface 435A are arranged so as to be inwardly facing, in the sense that they project toward the interior of the implant. Again, base 405A, first graft containment arm 410A and second graft containment arm 415A are attached together using a flat-to-flat interface construction, with the first graft containment arm 410A having a first flat surface 420A which engages a first flat surface 425A formed in base 405A, and with the second graft containment arm 415A having a second flat surface 430A which engages a second flat surface 435A formed in base 405A. Again, a screw 440A, received through an opening 445A in base 405A, may be used to screw base 405A to the tibia. If desired, the various components of wedge-shaped implant 400A may be provided with barbs, ridges, projections, roughening, etc., as generally indicated at B (shown in Fig. 30 but omitted

from Fig. 29 for the sake of clarity), so as to enhance engagement between the implant components and the bone.

If desired, the positions of the flat surfaces can be reversed. More particularly, and looking now at

5 Figs. 31 and 32, there is shown a novel implant 400B which is substantially the same as implant 400

described above, except that the positions of the flat surfaces is reversed (i.e., first flat surface 420B and second flat surface 430B are formed on base 405B; and

10 first flat surface 425B and second flat surface 435B are formed on posterior graft containment arm 410B and anterior graft containment arm 415B, respectively); and

in Figs. 33 and 34, there is shown a novel implant 400C which is substantially the same as implant 400A

15 described above, except that the positions of the flat surfaces is reversed (i.e., first flat surface 420C and second flat surface 430C are formed on base 405C; and

first flat surface 425C and second flat surface 435C are formed on posterior graft containment arm 410C and
20 anterior graft containment arm 415C, respectively).

Other Configurations

In addition to the foregoing, it should also be appreciated that, within a given construct, one graft containment arm might have a male connector (e.g., tab, wedge, ball, etc.) and the other graft containment arm might have a female connector (e.g., slot, groove, socket, etc.).

It should be also appreciated that the various interface constructions disclosed above may be modified by providing multiple engaging elements.

Thus, with the novel implant 100 shown in Figs. 3 and 4, first graft containment arm 110 and second graft containment arm 115 could each be provided with multiple tabs, etc.; with novel implant 100A shown in Figs. 5 and 6, first graft containment arm 110A and second graft containment arm 115A could each be provided with multiple tabs, etc.; with novel implant 100B shown in Figs. 7 and 8, first graft containment arm 110B and second graft containment arm 115B could each be provided with multiple slots, etc.; with the novel implant 100C shown in Figs. 9 and 10, first graft

containment arm 110C and second graft containment arm 115C could each be provided with multiple slots, etc.

And with the novel implant 200 shown in Figs. 11 and 12, first graft containment arm 210 and second
5 graft containment arm 215 could each be provided with multiple wedges, etc.; with novel implant 200A shown in Figs. 13 and 14, first graft containment arm 210A and second graft containment arm 215A could each be
provided with multiple wedges, etc.; with novel implant
10 200B shown in Figs. 15 and 16, first graft containment arm 210B and second graft containment arm 215B could each be provided with multiple grooves, etc.; with the novel implant 200C shown in Figs. 17 and 18, first
graft containment arm 210C and second graft containment
15 arm 215C could each be provided with multiple grooves, etc.

And with the novel implants 400, 400A, 400B and 400C, shown in Figs. 27-28, 29-30, 31-32 and 33-34, respectively, multiple flat surfaces, set at various
20 angles, may be provided on the elements.

In addition, where a graft containment arm has multiple connector elements thereon, those connector

elements may be a combination of male (e.g., tab, wedge, ball, etc.), female (e.g., slot, groove, socket, etc.) and/or flat connectors.

Furthermore, the particular angles at which tabs, slots, wedges, grooves, flat surfaces, etc. are disposed may be varied as appropriate.

Materials

It should be appreciated that the aforementioned implants may be formed out of various metals (e.g., titanium, stainless steel, etc.) or other biocompatible materials, including polymers, with the materials being absorbable or non-absorbable, osteoinductive or osteoconductive, etc.

Furthermore, it should be appreciated that different components of the multi-part implant may be formed out of different materials, depending on the function of the components. By way of example but not limitation, different components may have different formulations so as to provide different strength characteristics, different absorption rates, etc.

Modifications

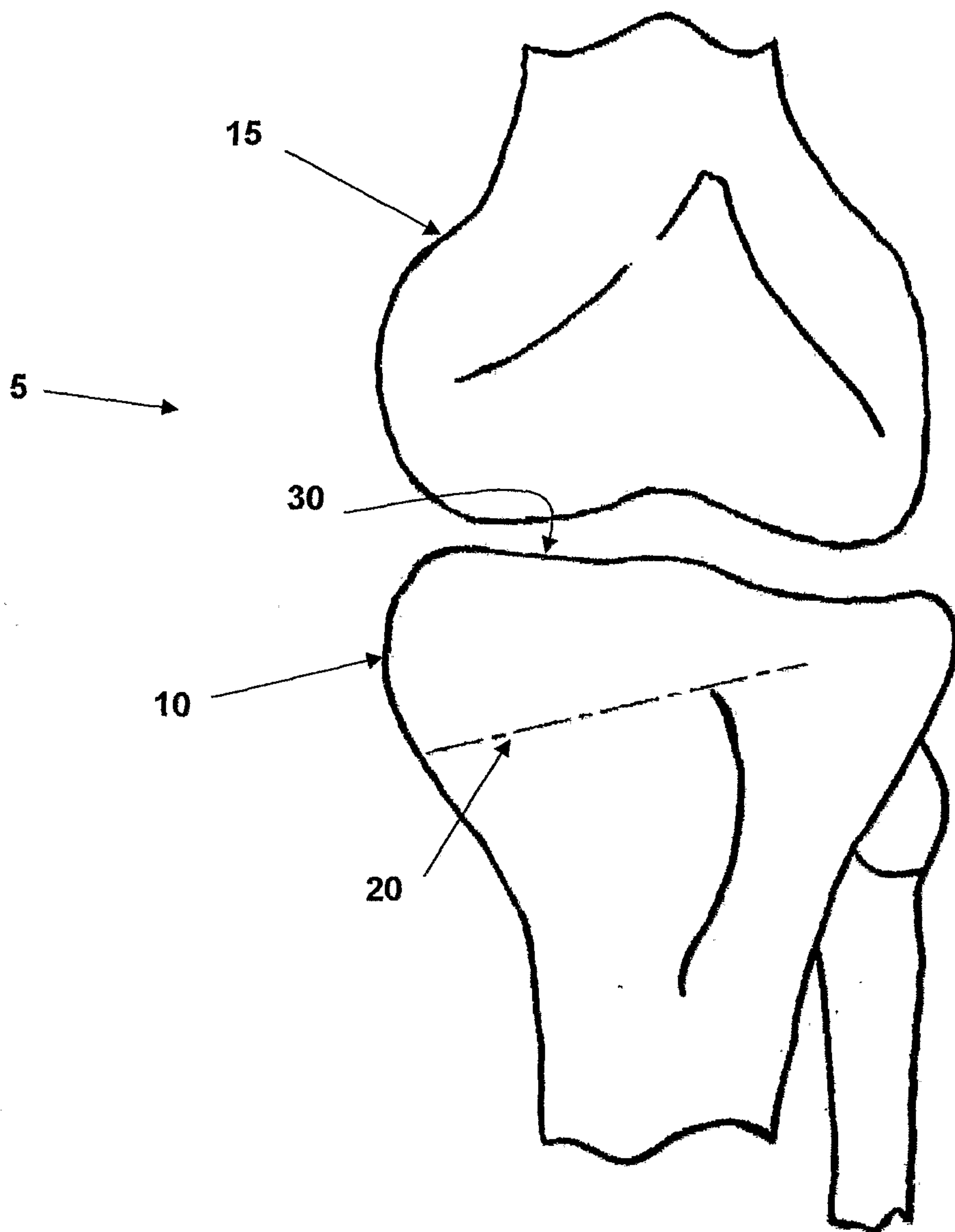
It will be understood that many additional changes in the details, materials, steps and arrangements of parts, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principles and scope of the invention as expressed in the appended claims.

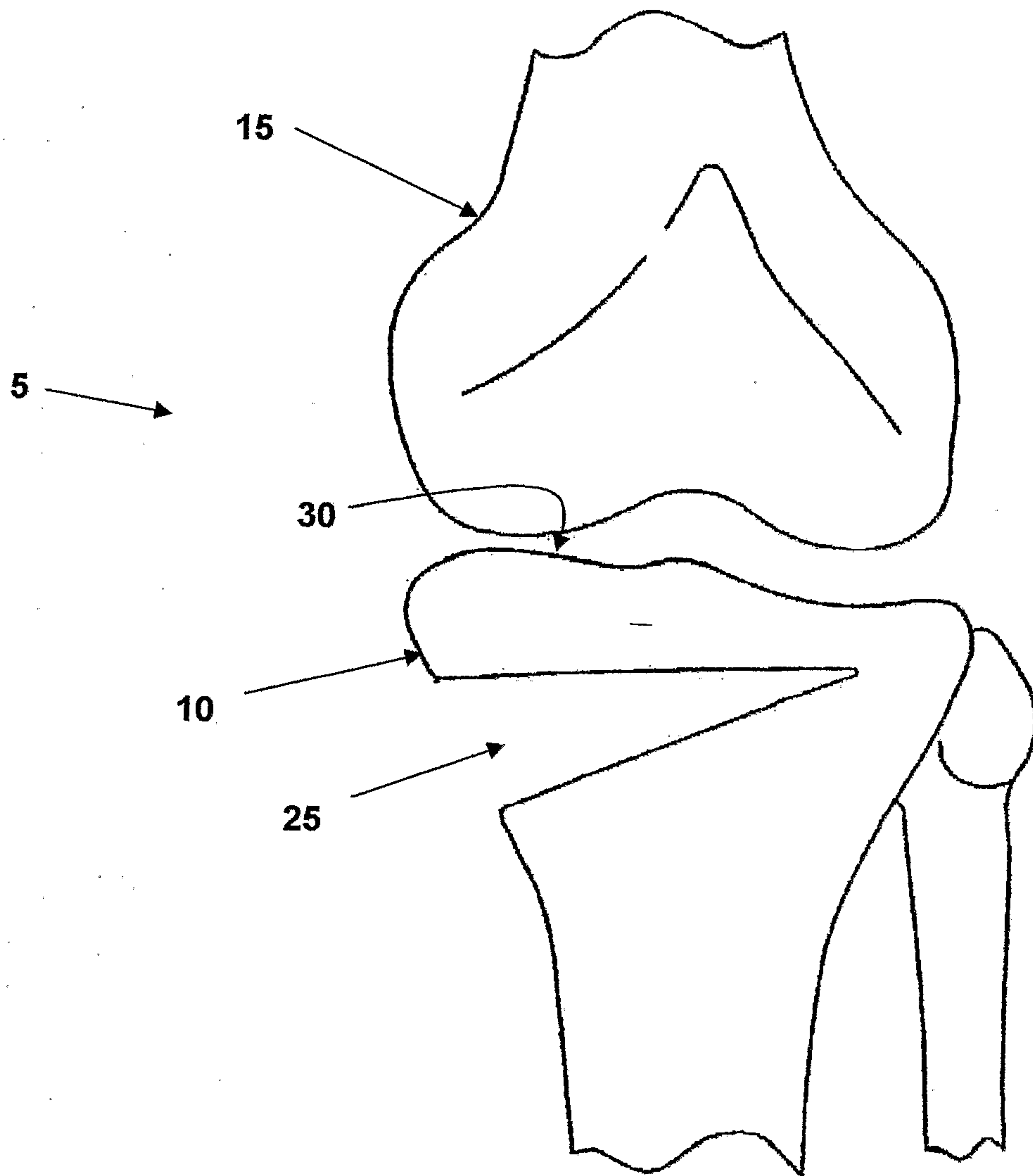
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Claims:

1. An osteotomy implant comprising:
a first graft containment arm;
a second graft containment arm; and
a base component wherein the base component selectively connects to the first graft containment arm and the second graft containment arm to one another so as to form a generally wedge-shaped structure, wherein the base component constitutes the thicker end of the wedge.
2. An osteotomy implant according to claim 1, wherein the base component is selectively connected to the first graft containment arm and second graft containment arm by a tab and slot interface connection.
3. An osteotomy implant according to claim 1, wherein the base component is selectively connected to the first graft containment arm and second graft containment arm by multiple tab and slot interface connections.
4. An osteotomy implant according to claim 2, wherein the implant is configured to be deployed with an antero-medial approach, with the first graft containment arm being disposed in a posterior position, the second graft containment arm being disposed in an anterior position, and the base component being disposed in an antero-medial position.
5. An osteotomy implant according to claim 4, wherein the implant defines an interior recess for receiving at least one of bone paste and bone cement.
6. An osteotomy implant according to claim 5, wherein the first graft containment arm and second graft containment arm are connected by a bridge.
7. An osteotomy implant according to claim 1, wherein the base component is selectively connected to the first graft containment arm and second graft containment arm by a wedge and groove interface connection.
8. An osteotomy implant according to claim 1, wherein the base component is selectively connected to the first graft containment arm and second graft containment arm by multiple wedge and groove interface connections.
9. An osteotomy implant according to claim 7, wherein the implant is configured to be deployed with an antero-medial approach, with the first graft containment arm being disposed in a posterior position, the second graft containment arm being disposed in an anterior position, and the base component being disposed in an antero-medial position.

10. An osteotomy implant according to claim 9, wherein the implant defines an interior recess for receiving at least one of bone paste and bone cement.
11. An osteotomy implant according to claim 10, wherein the first graft containment arm and second graft containment arm are connected by a bridge.
12. An osteotomy implant according to claim 1, wherein the base component is selectively connected to the first graft containment arm and second graft containment arm by a ball and socket interface connection.
13. An osteotomy implant according to claim 12, wherein the implant is configured to be deployed with an antero-medial approach, with the first graft containment arm being disposed in a posterior position, the second graft containment arm being disposed in an anterior position, and the base component being disposed in an antero-medial position.
14. An osteotomy implant according to claim 13, wherein the implant defines an interior recess for receiving at least one of bone paste and bone cement.
15. An osteotomy implant according to claim 14, wherein the first graft containment arm and second graft containment arm are connected by a bridge.
16. An osteotomy implant according to claim 1, wherein the base component is selectively connected to the first graft containment arm and second graft containment arm by a flat-to-flat interface connection.
17. An osteotomy implant according to claim 1, wherein the base component is selectively connected to the first graft containment arm and second graft containment arm by multiple flat-to-flat interface connections.
18. An osteotomy implant according to claim 16, wherein the implant is configured to be deployed with an antero-medial approach, with the first graft containment arm being disposed in a posterior position, the second graft containment arm being disposed in an anterior position, and the base component being disposed in an antero-medial position.
19. An osteotomy implant according to claim 18, wherein the implant defines an interior recess for receiving at least one of bone paste and bone cement.
20. An osteotomy implant according to claim 19, wherein the first graft containment arm and second graft containment arm are connected by a bridge.

**FIG. 1**

**FIG. 2**

Graft Containment Alignment Tabs in Implant Base Slots

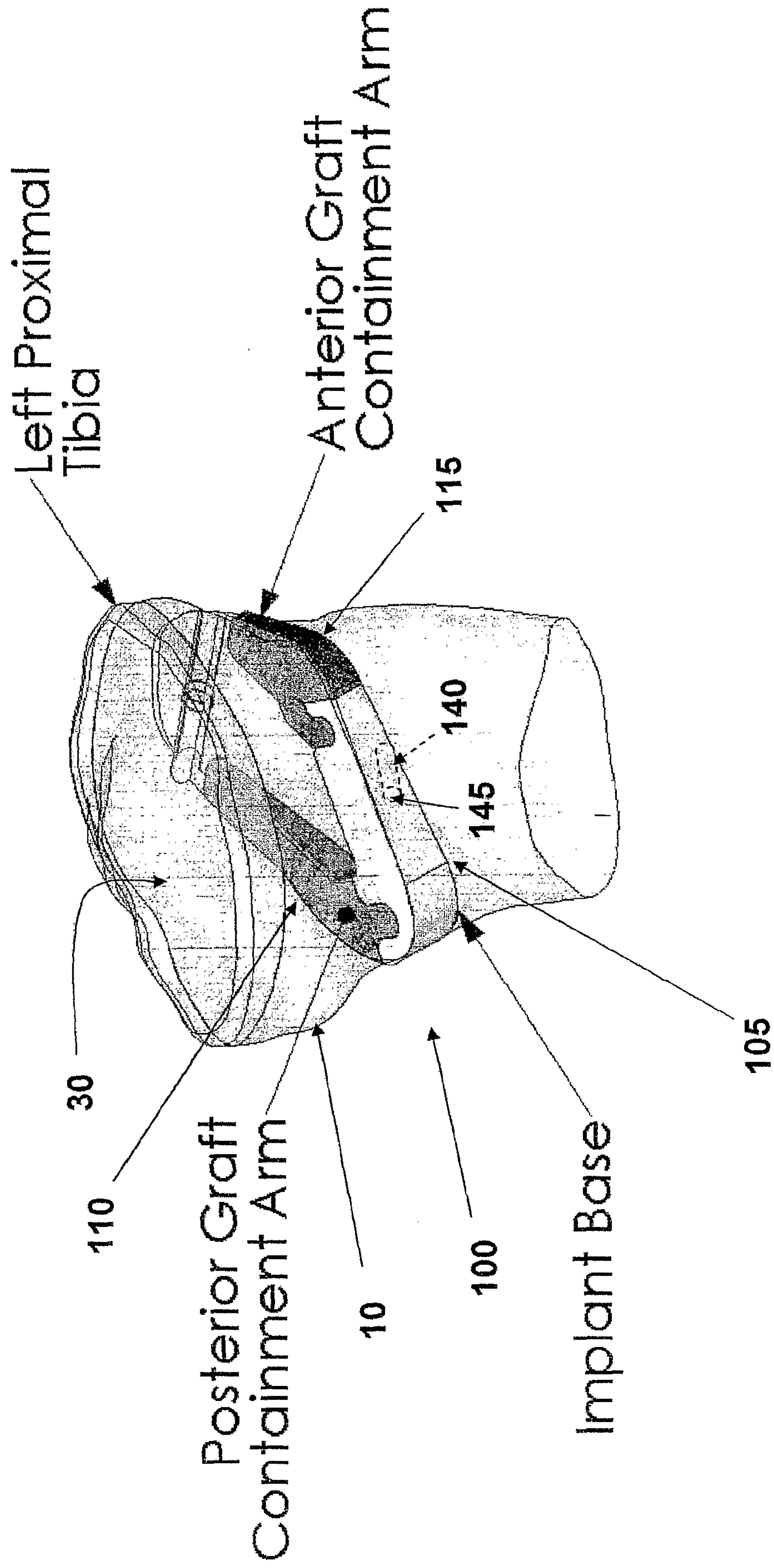


FIG. 3

Graft Containment Alignment Tabs in Implant Base Slots Exploded View

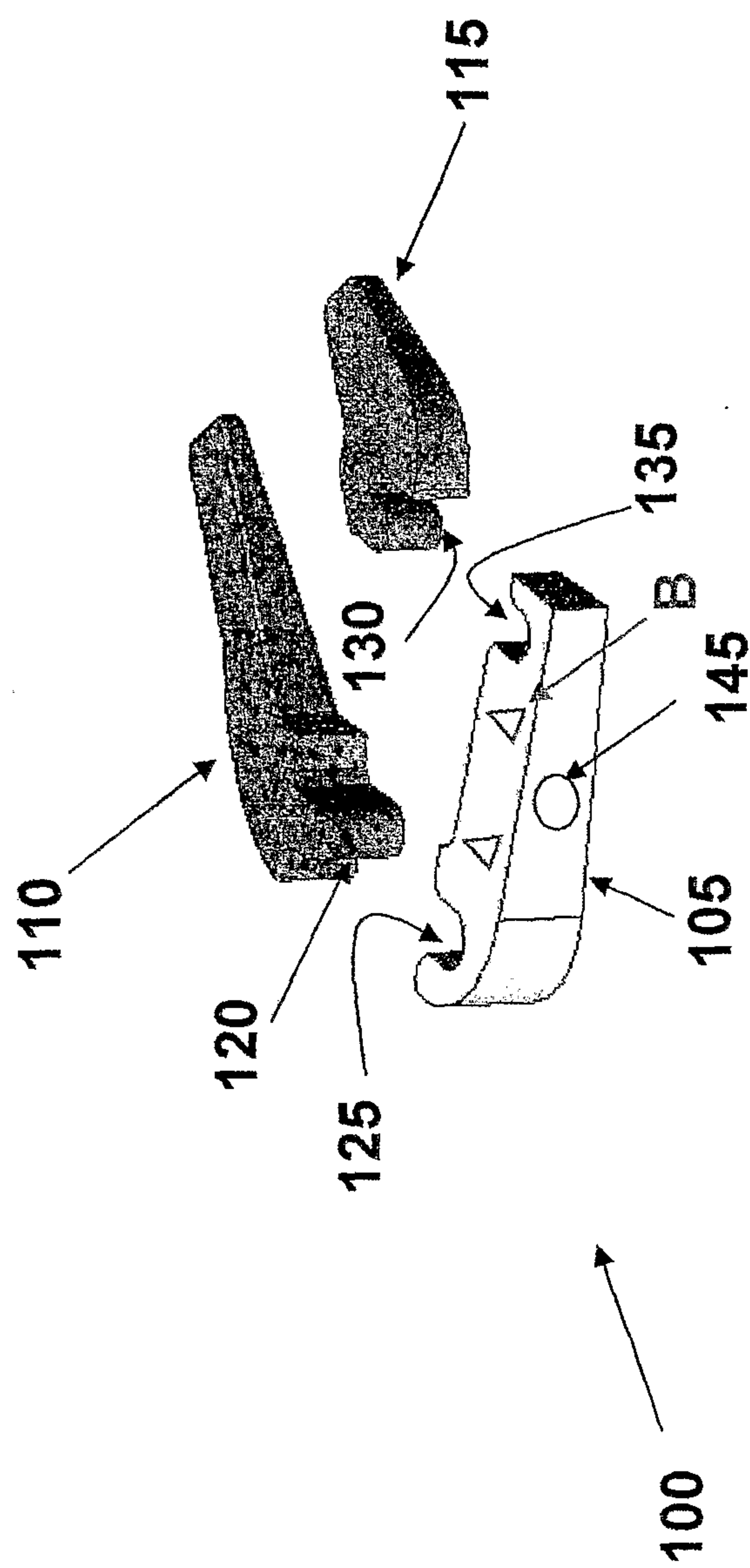


FIG. 4

Graft Containment Alignment Tabs in Implant Base Slots - U shaped

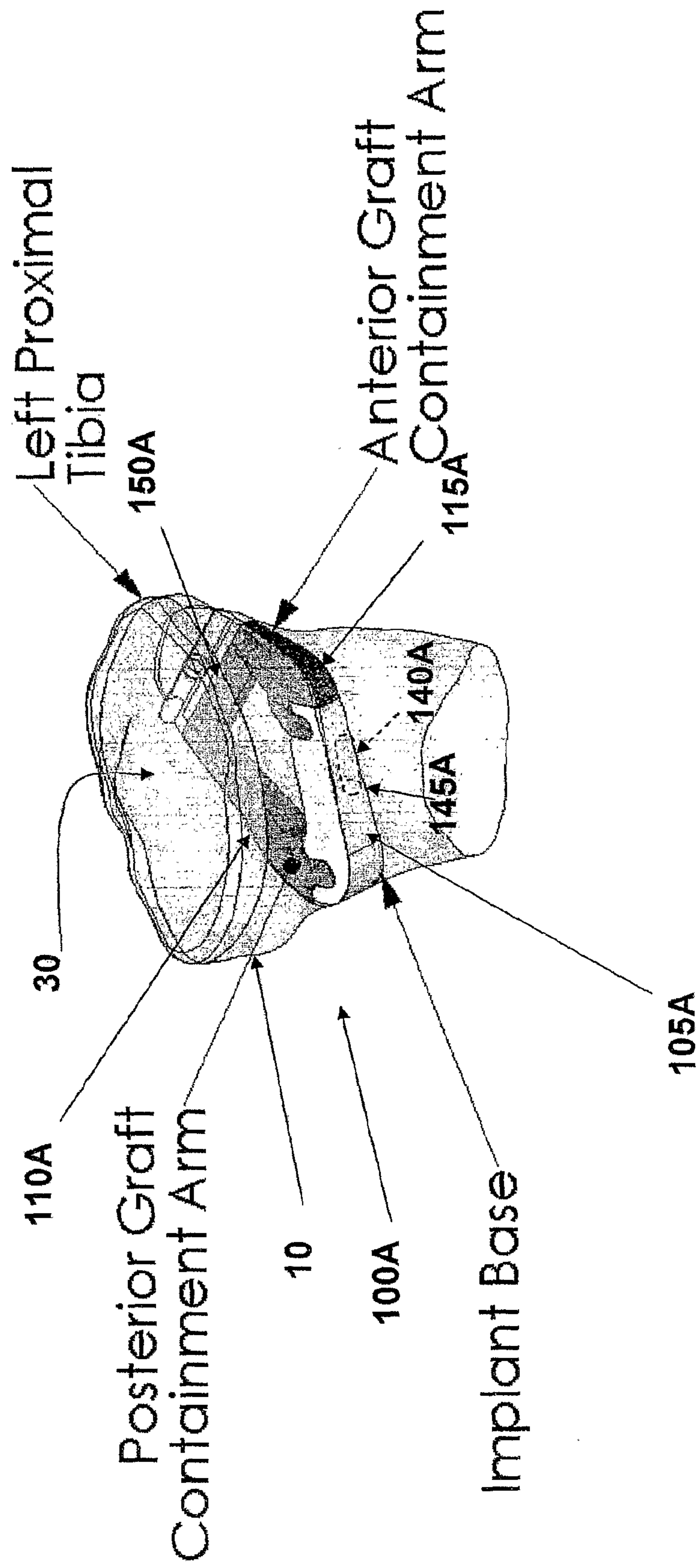


FIG. 5

Graft Containment Alignment Tabs in Implant Base Slots - U shaped Exploded View

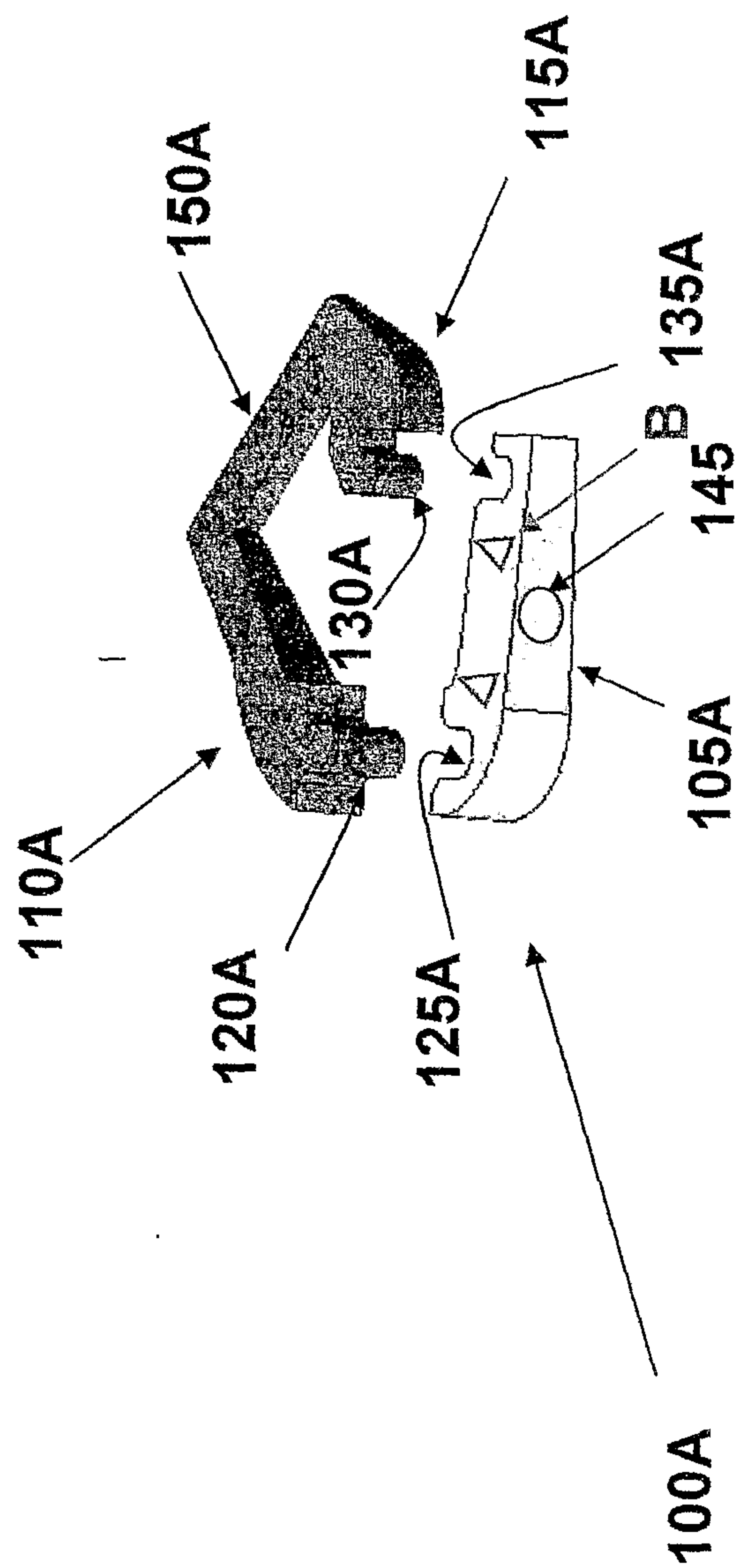


FIG. 6

Implant Base Alignment Tabs in Graft Containment Slots

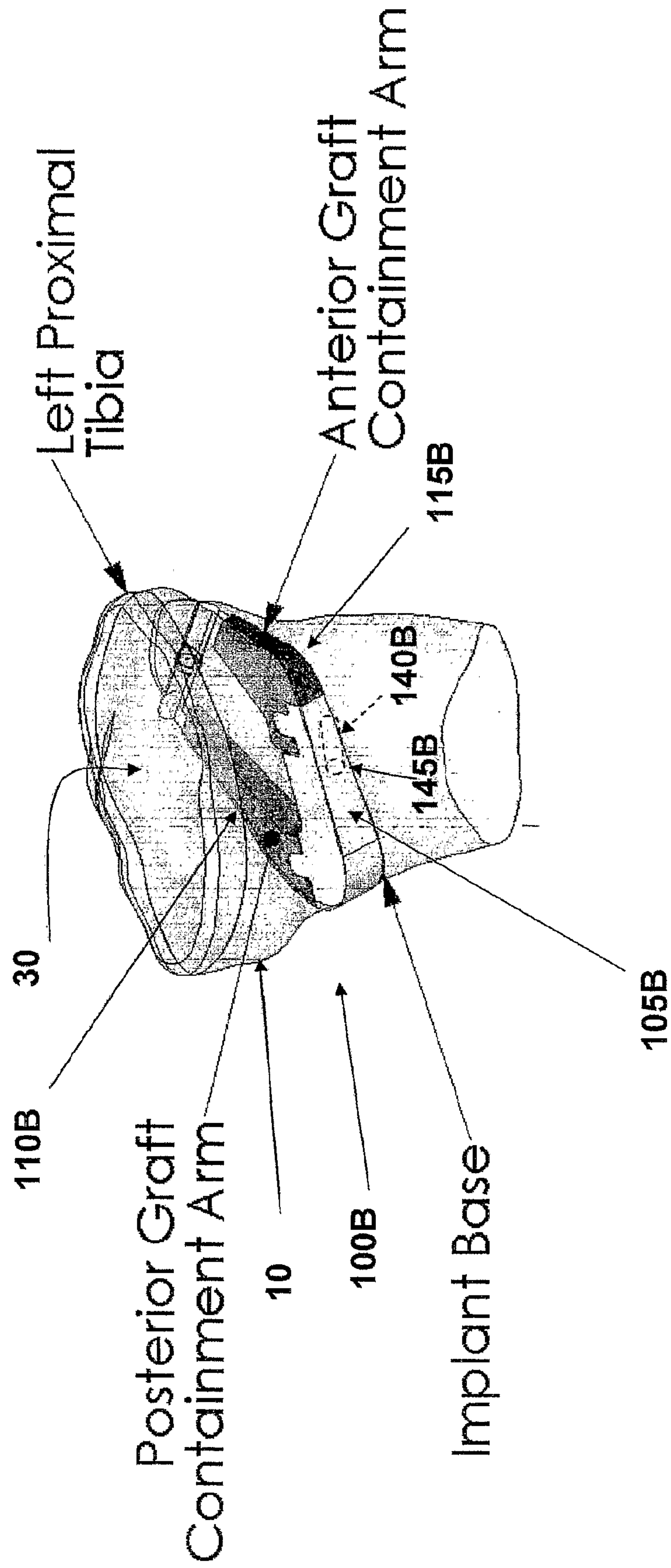


FIG. 7

Implant Base Alignment Tabs in Graft Containment Slots Exploded View

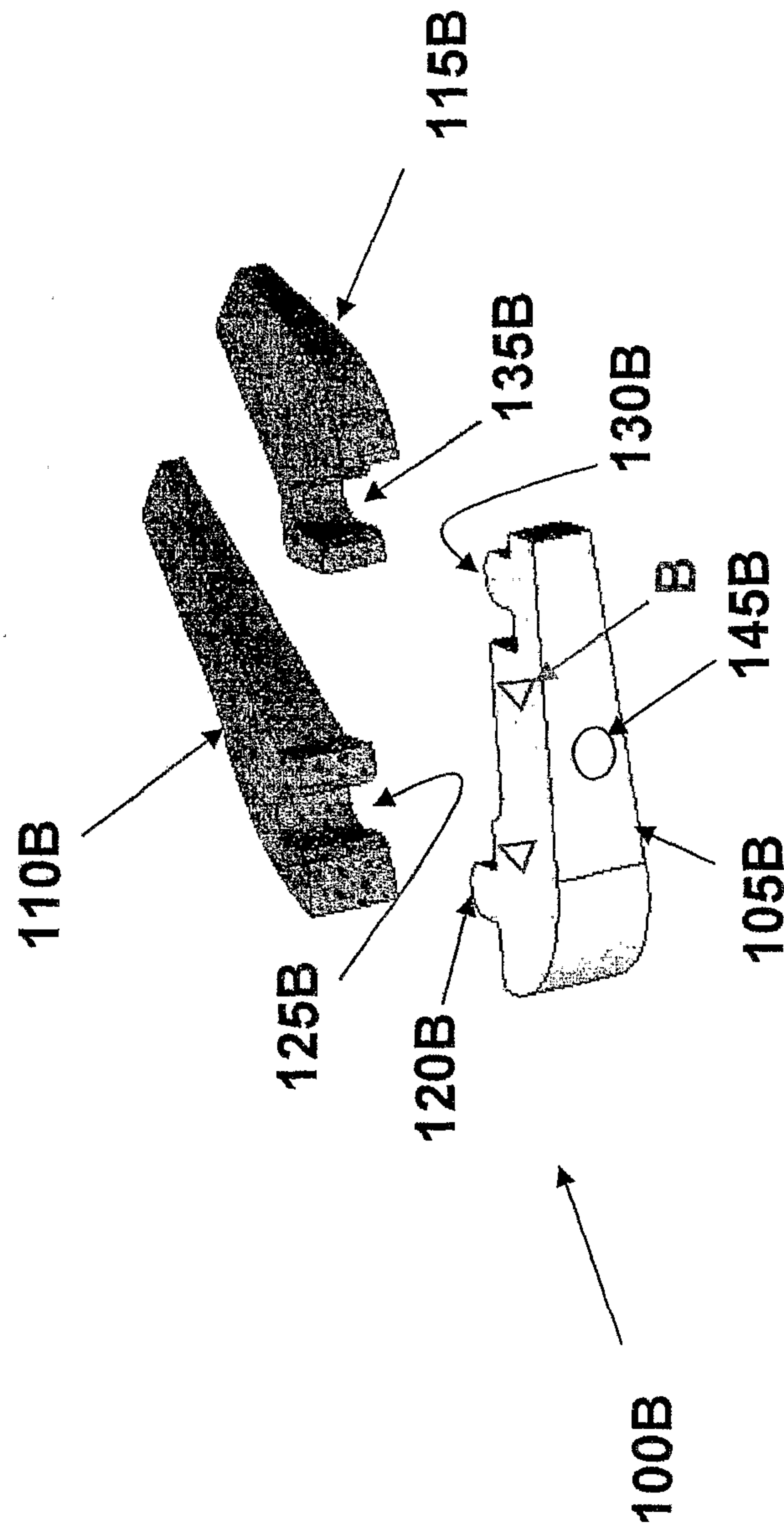


FIG. 8

Implant Base Alignment Tabs in Graft Containment Slots - U shaped

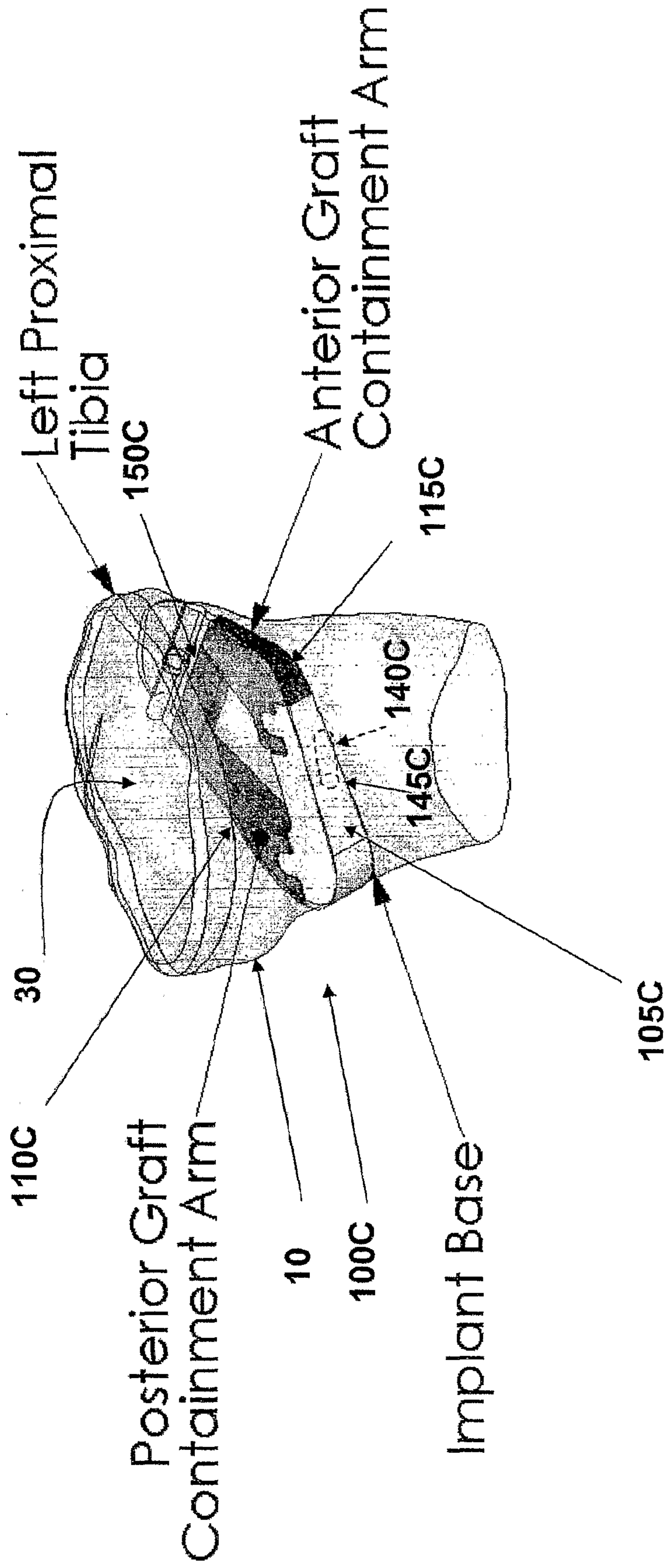


FIG. 9

Implant Base Alignment Tabs in
Graft Containment Slots - U shaped
Exploded View

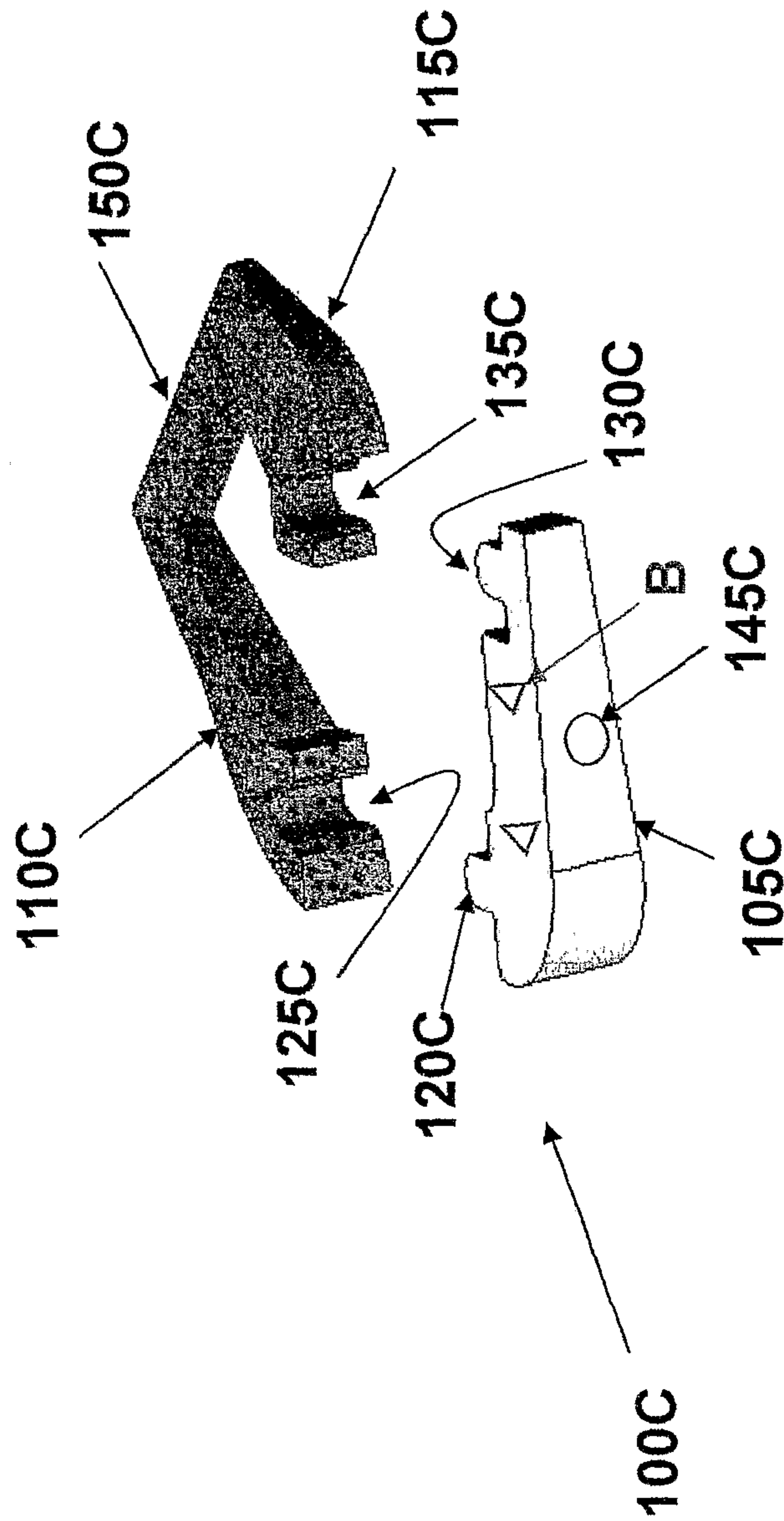


FIG. 10

Graft Containment Alignment Wedges in Implant Base Wedge-shaped Slots

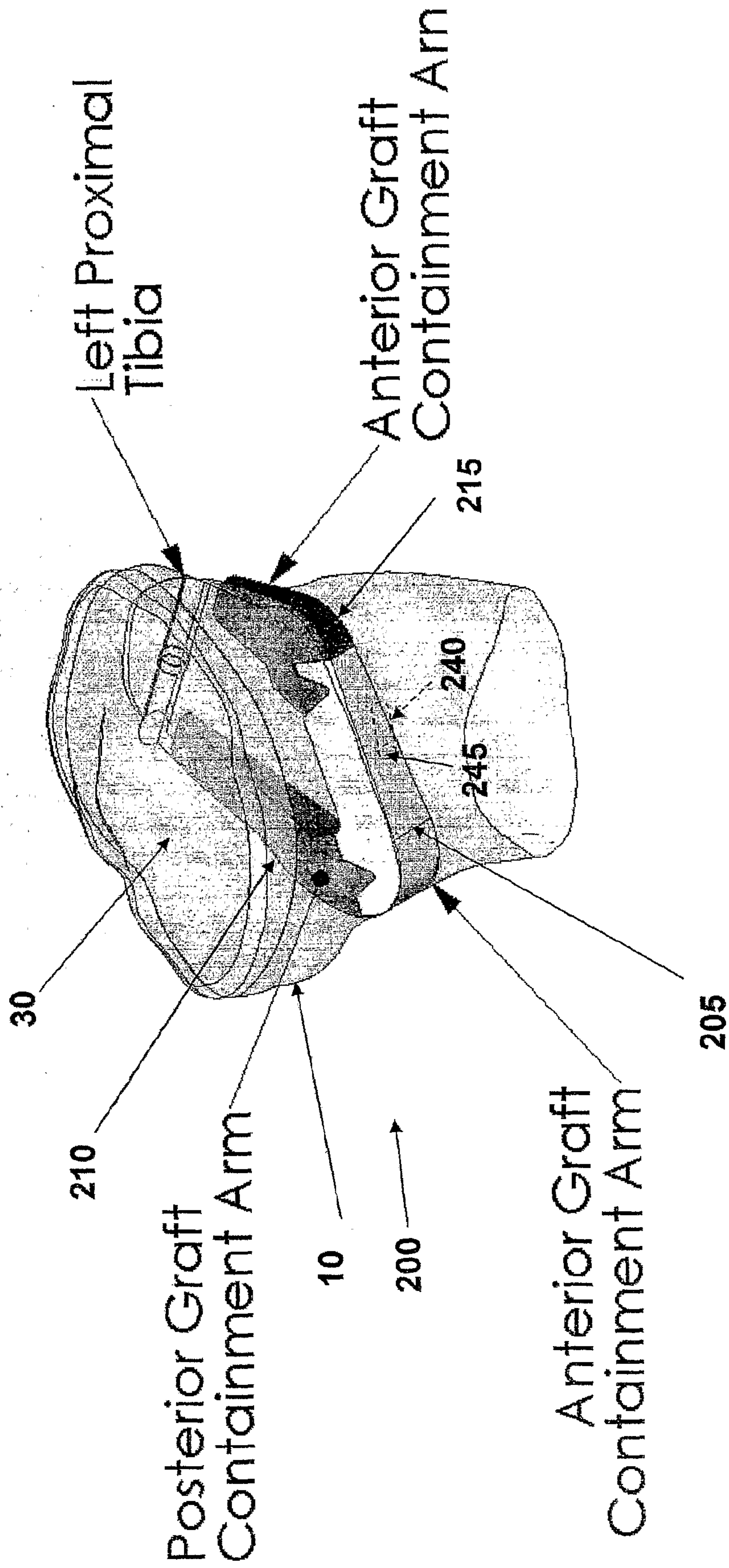


FIG. 11

Graft Containment Alignment Wedges in Implant Base Wedge-shaped Slots Exploded View

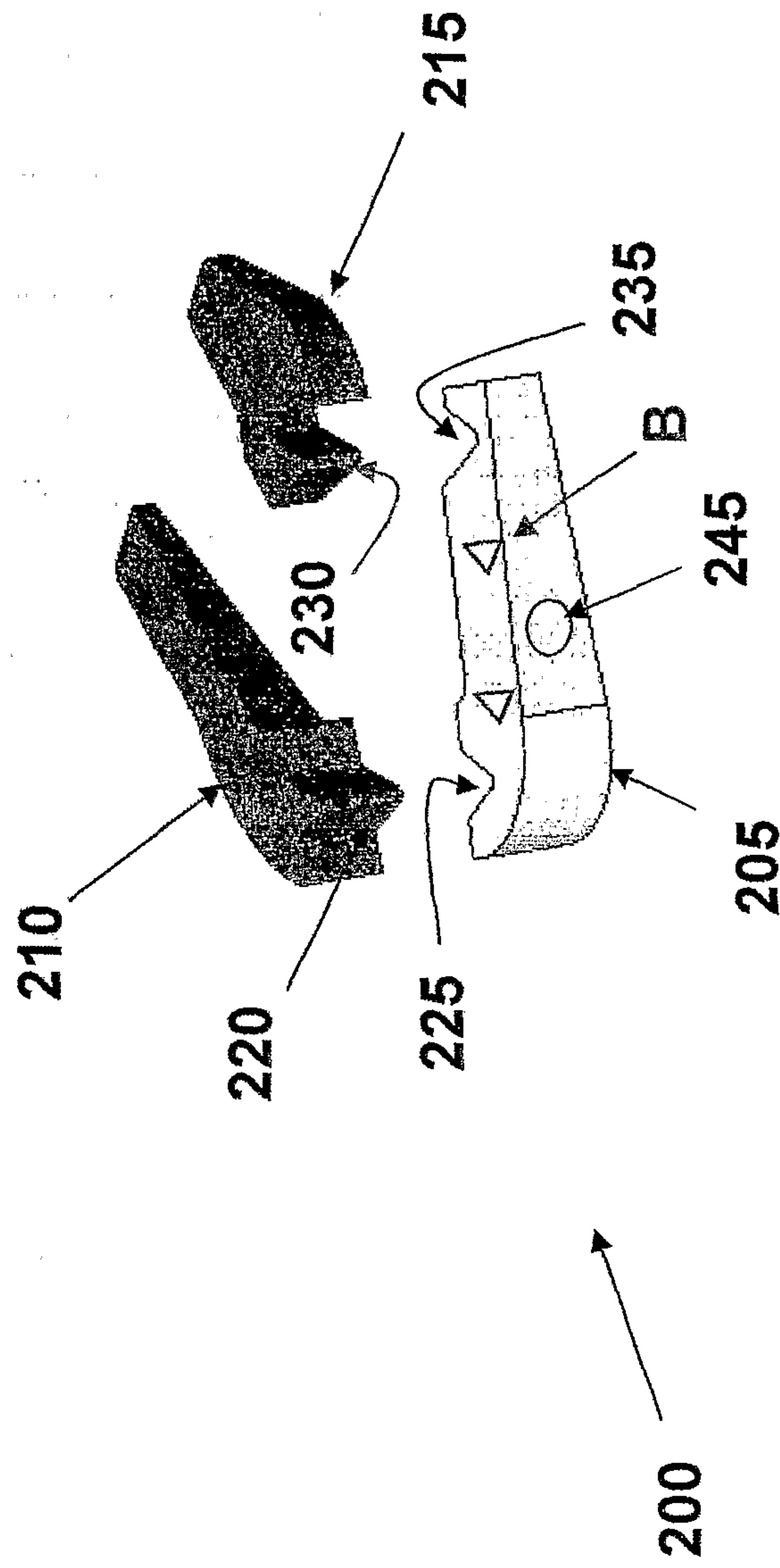


FIG. 12

Graft Containment Alignment Wedges in Implant Base Wedge-shaped Slots U-shaped, Exploded View

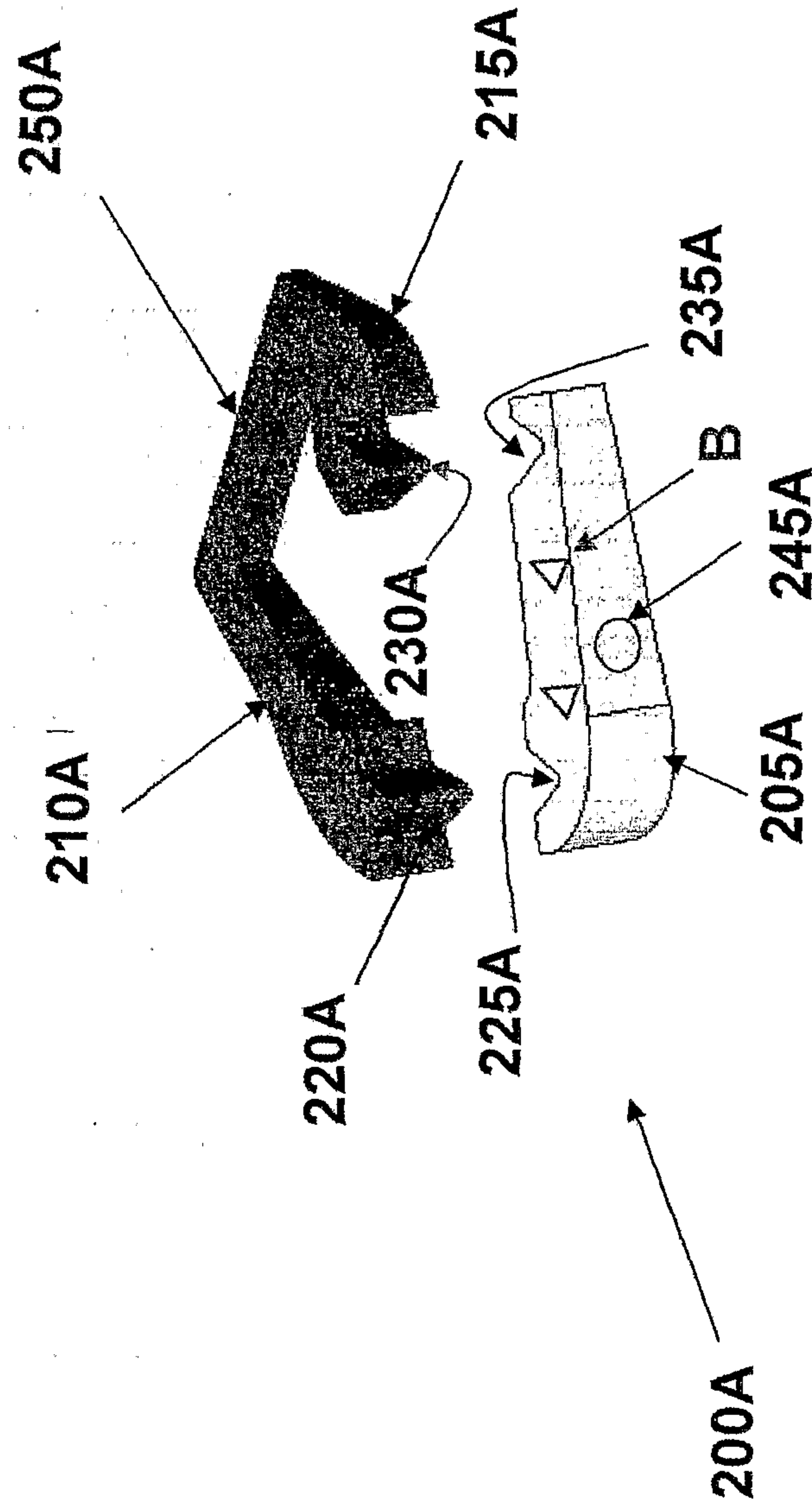


FIG. 14

Implant Base Alignment Wedges in Graft Containment Wedge-shaped Slots

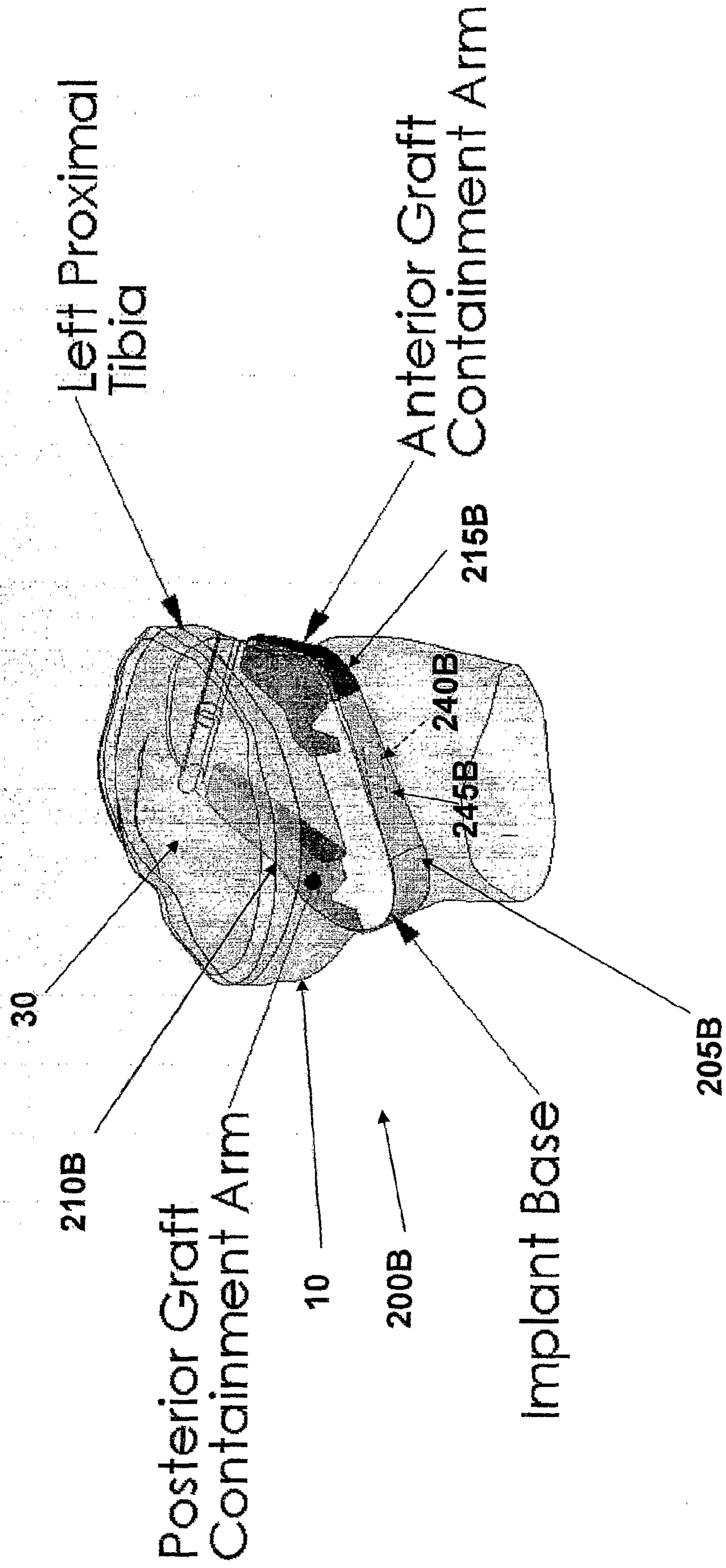


FIG. 15

Implant Base Alignment Wedges in Graft Containment Wedge-shaped Slots Exploded View

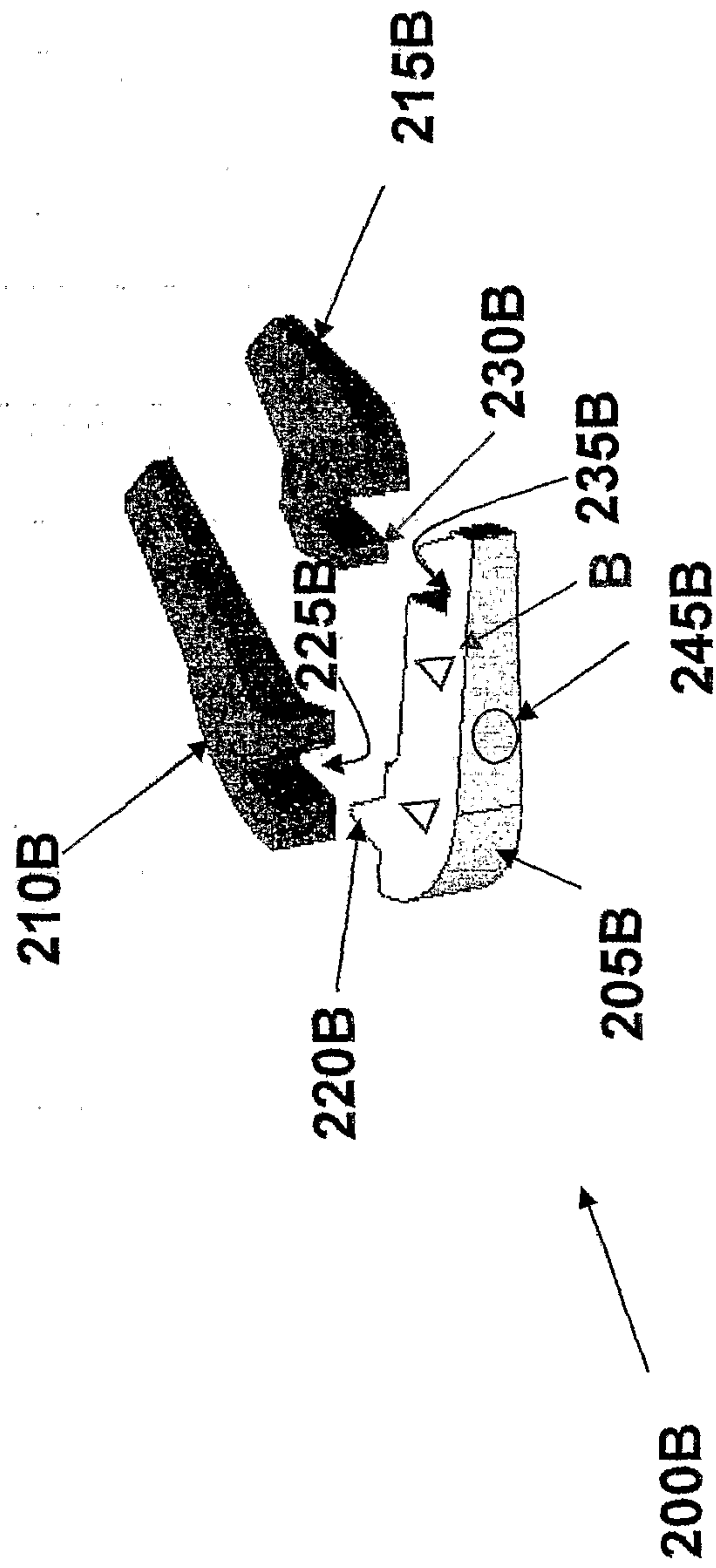


FIG. 16

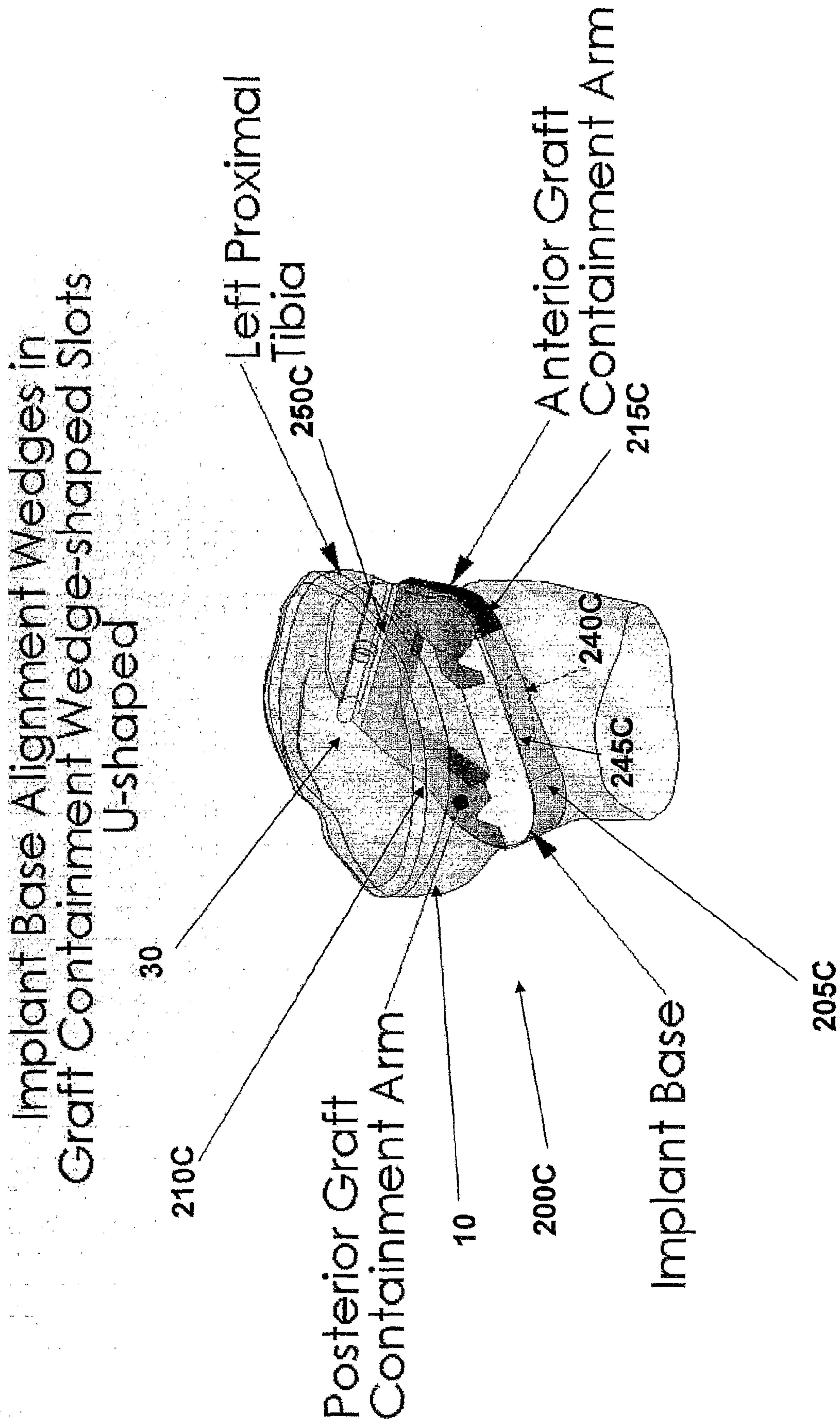


FIG. 17

Implant Base Alignment Wedges in Graft Containment Wedge-shaped Slots U-shaped, Exploded View

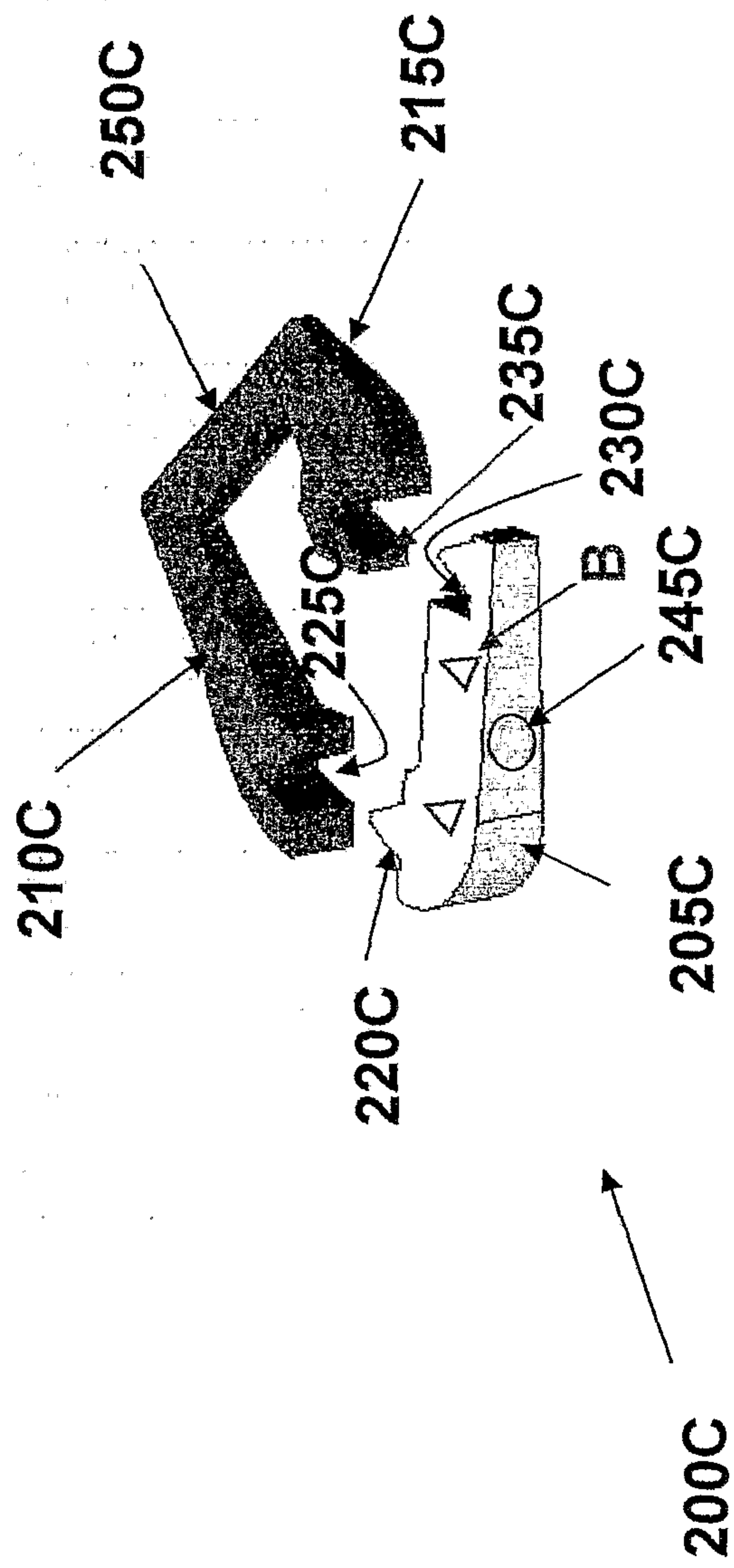


FIG. 18

Graft Containment Alignment Ball in Implant Base Socket

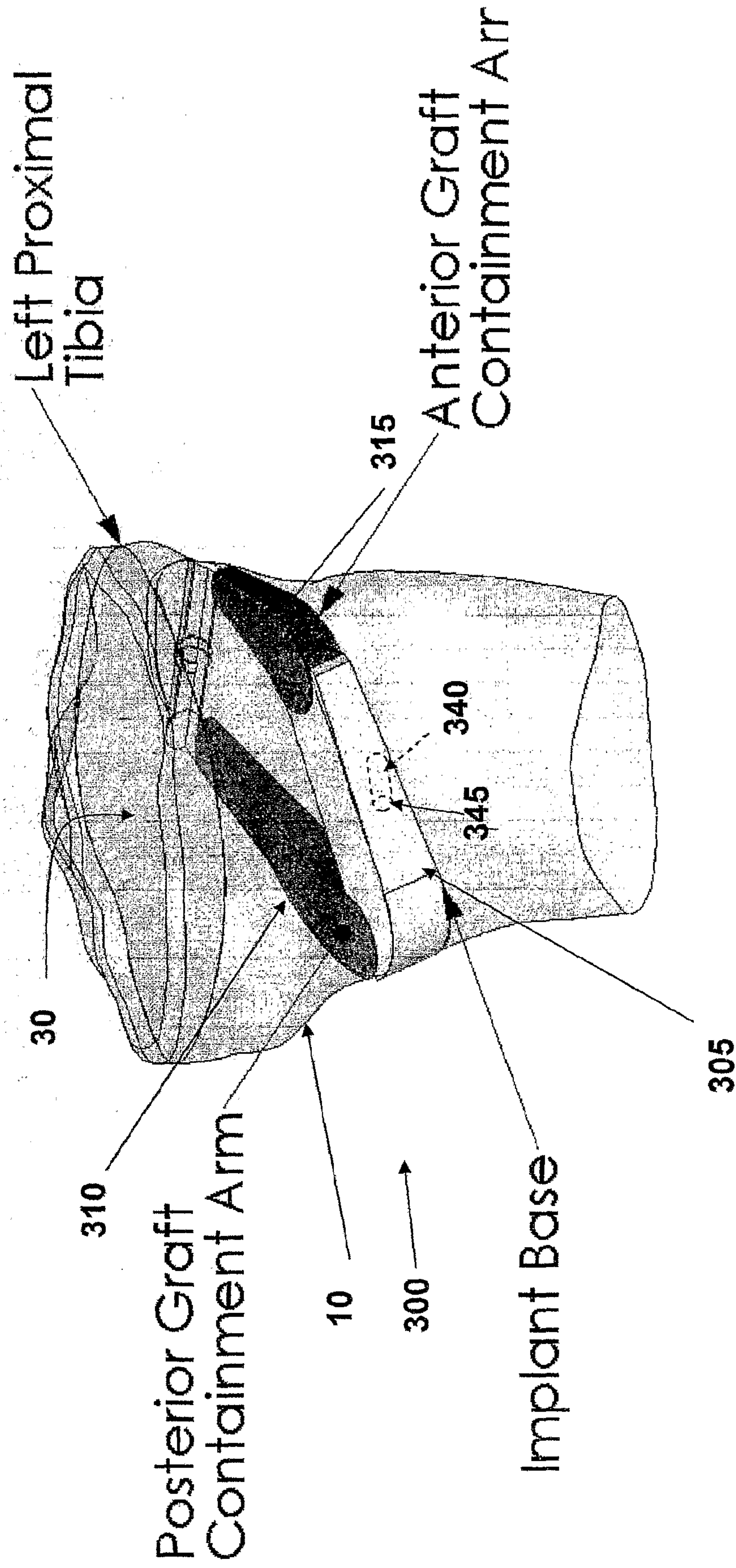


FIG. 19

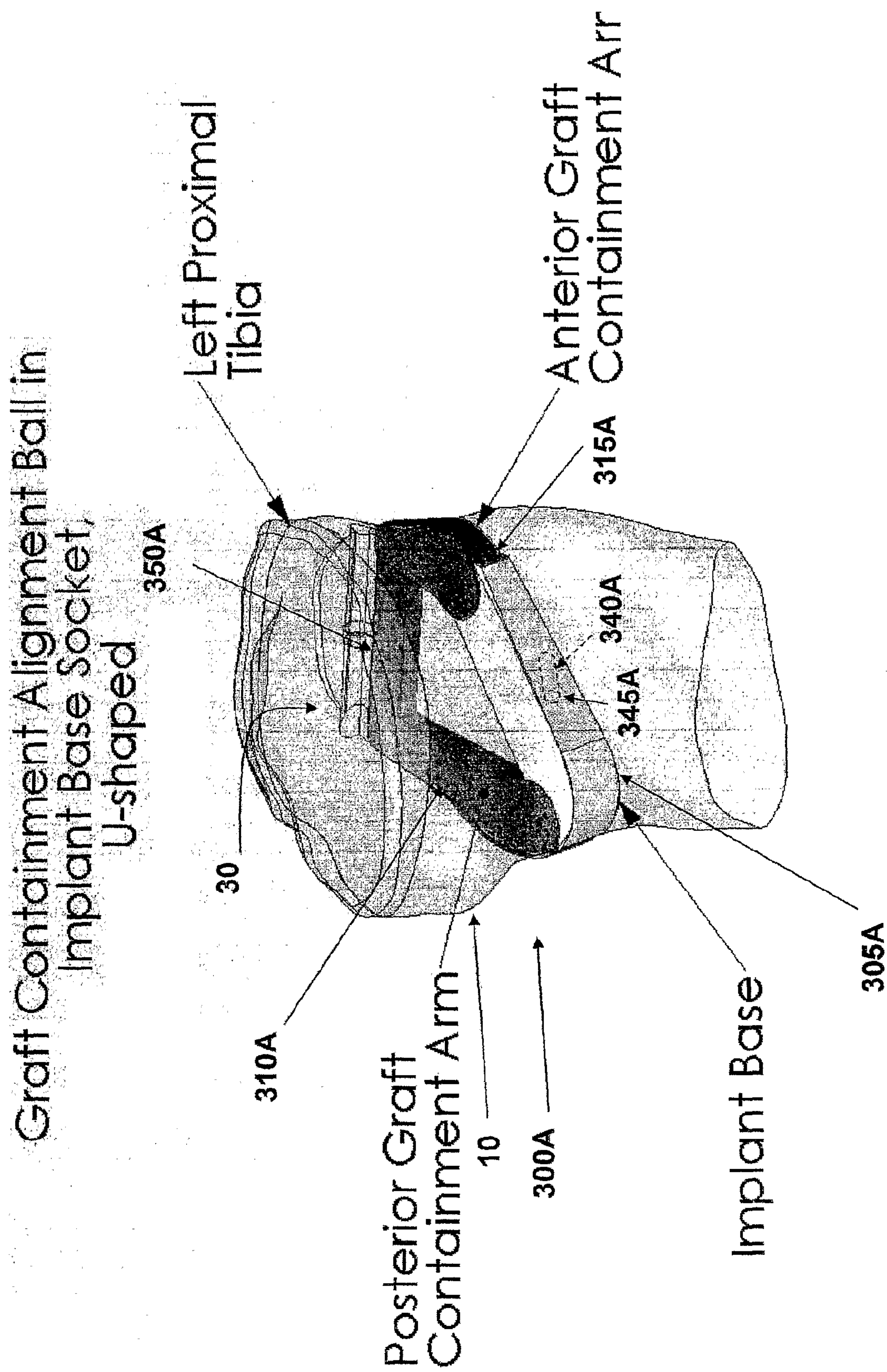


FIG. 21

Graft Containment Alignment Ball in
Implant Base Socket,
U-shaped, Exploded View

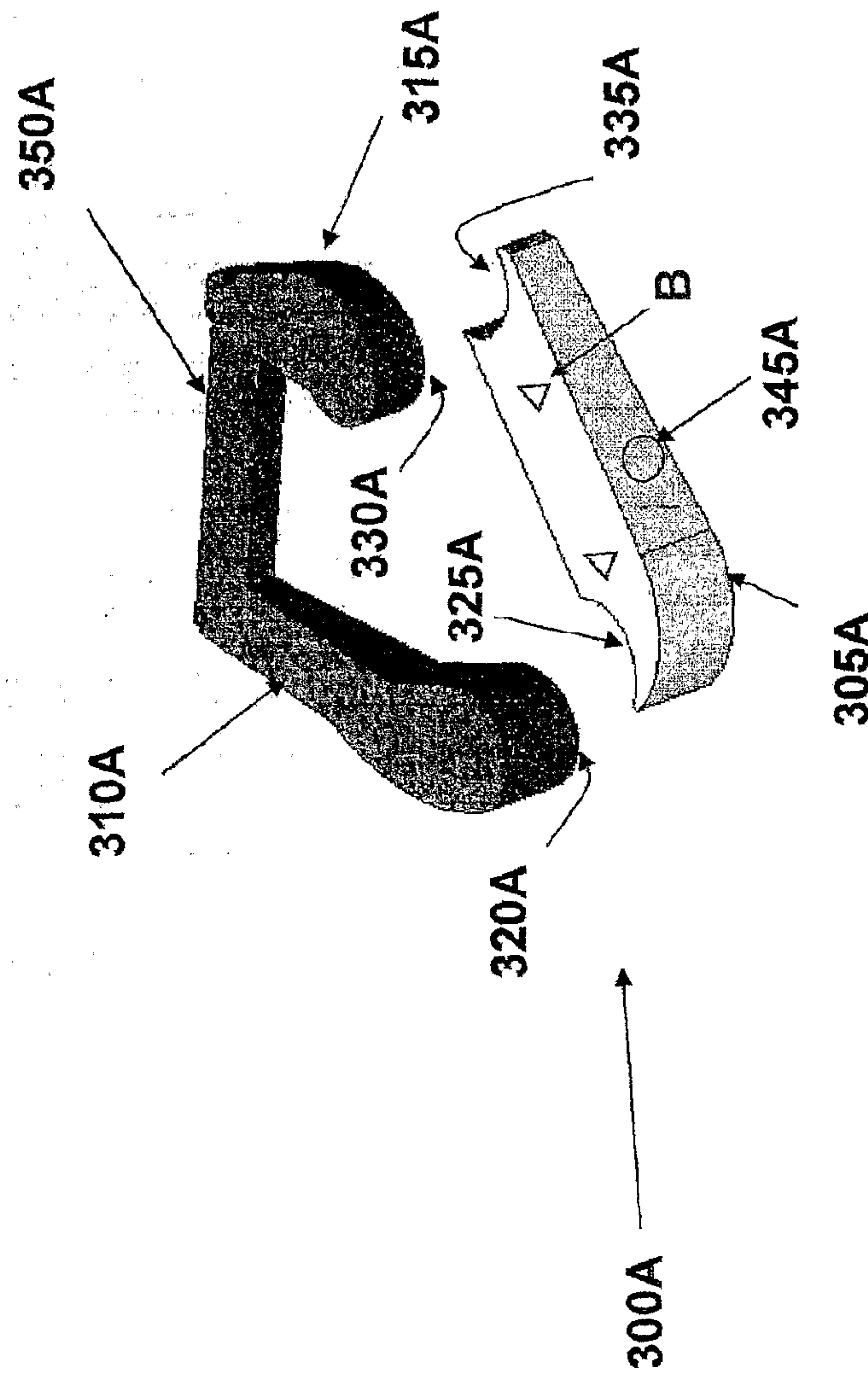


FIG. 22

Implant Base Alignment Ball in
Graft Containment Socket,
U-shaped

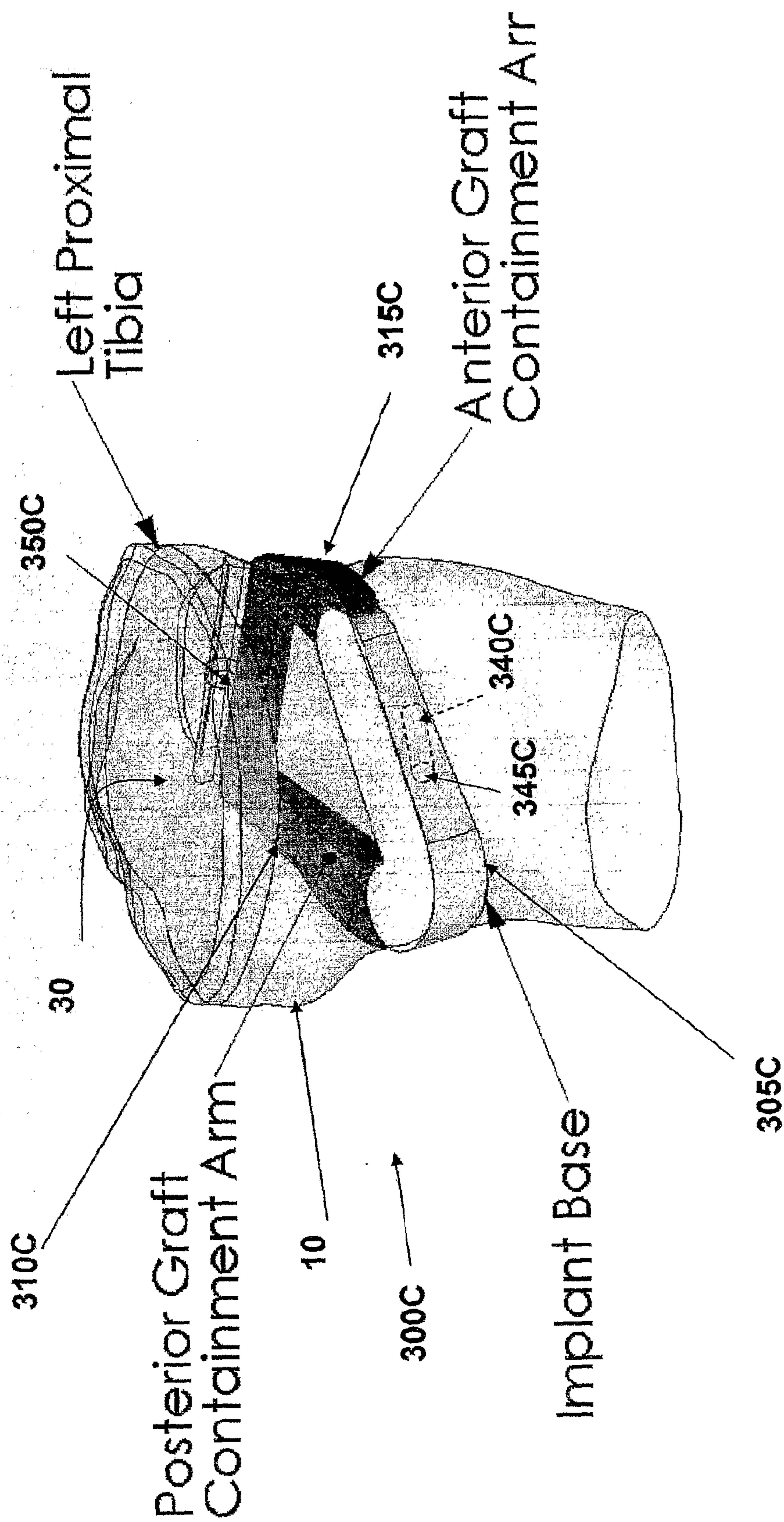


FIG. 25

Implant Base Ball in
Graft Containment Alignment Socket,
U-shaped, Exploded View

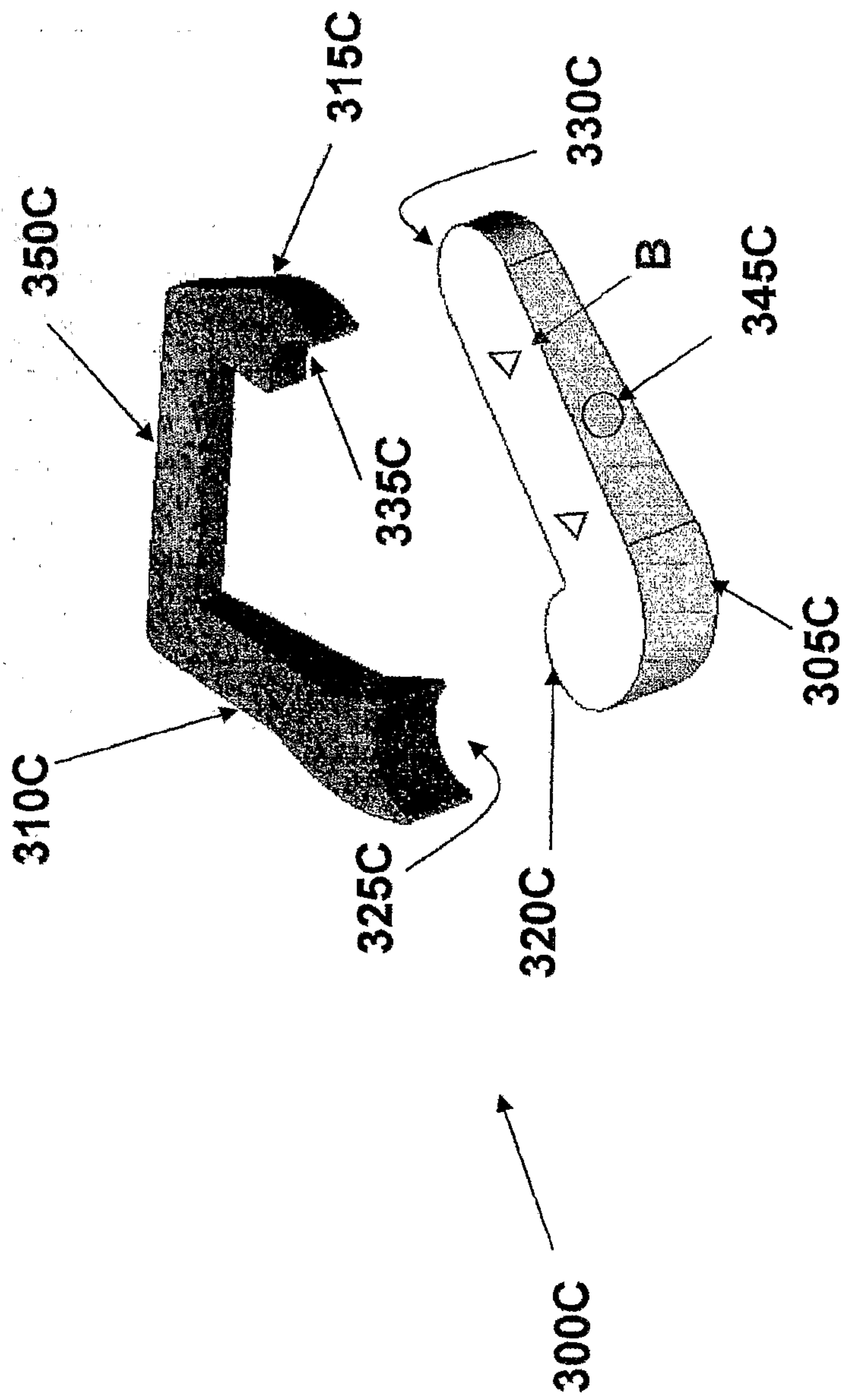
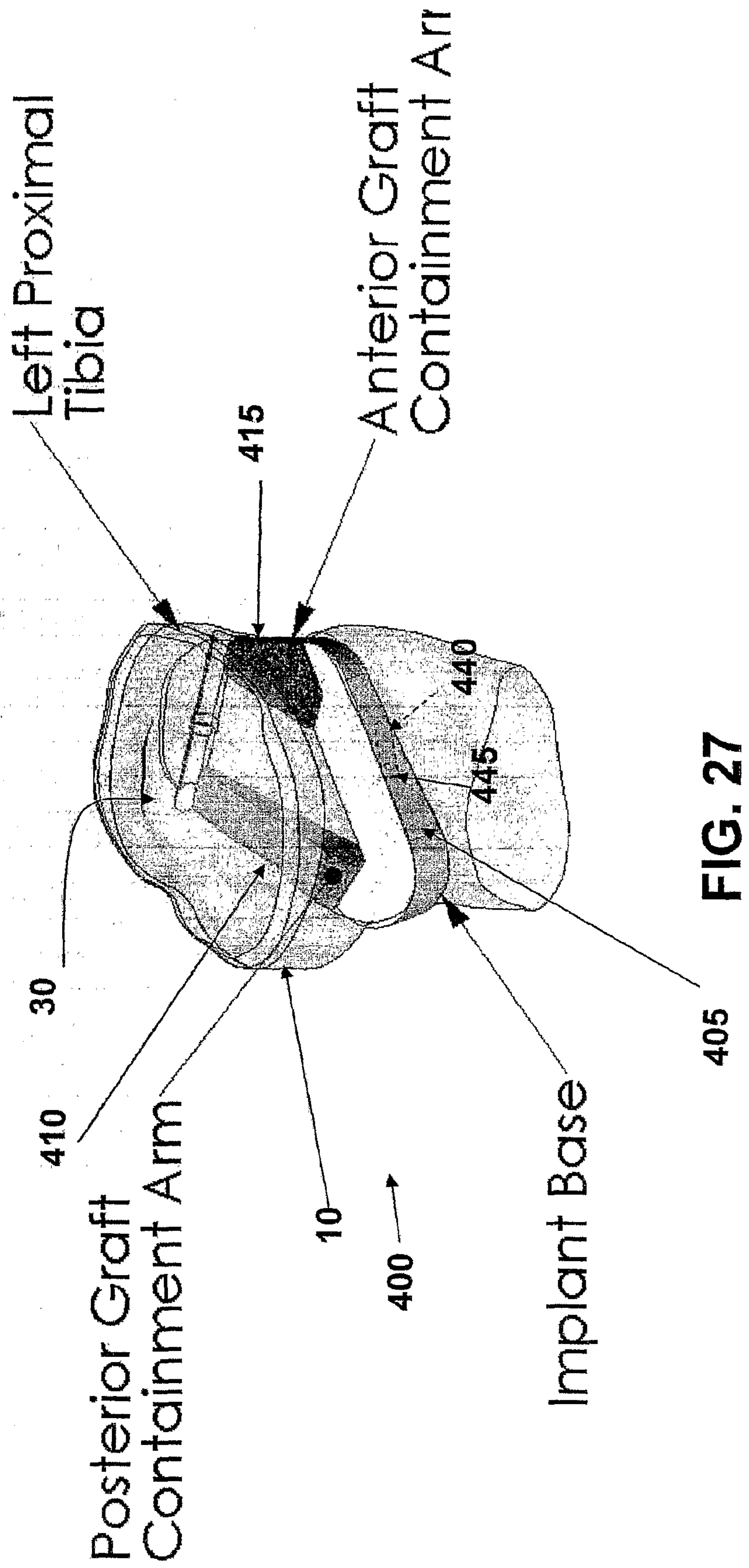


FIG. 26

Graft Containment Alignment "Flats" in Implant Base "Flats"



Graft Containment Alignment Flats in Implant Base Alignment Flats Exploded View

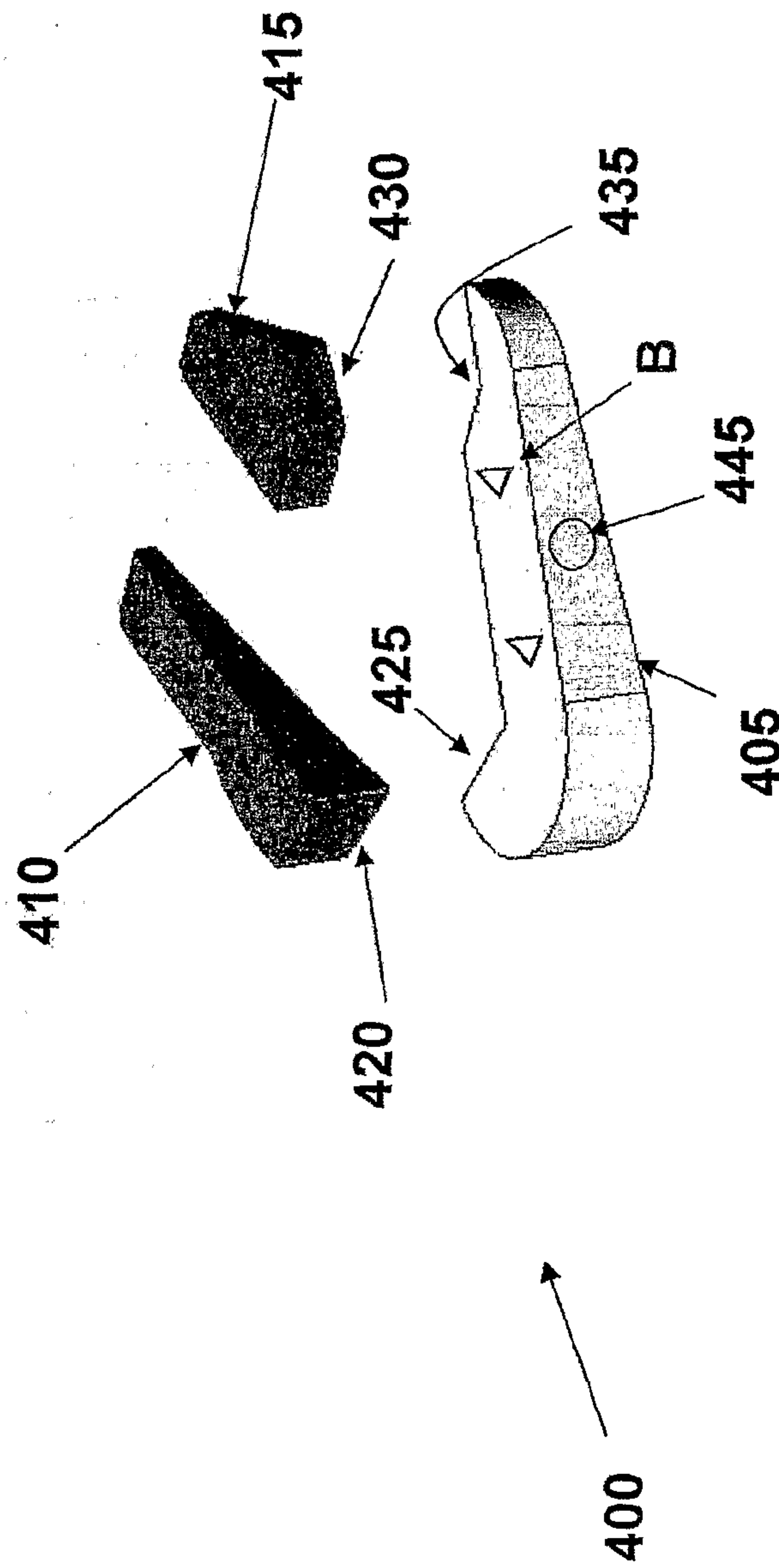


FIG. 28

Graft Containment Alignment "Flats" in Implant Base "Flats", U-shaped

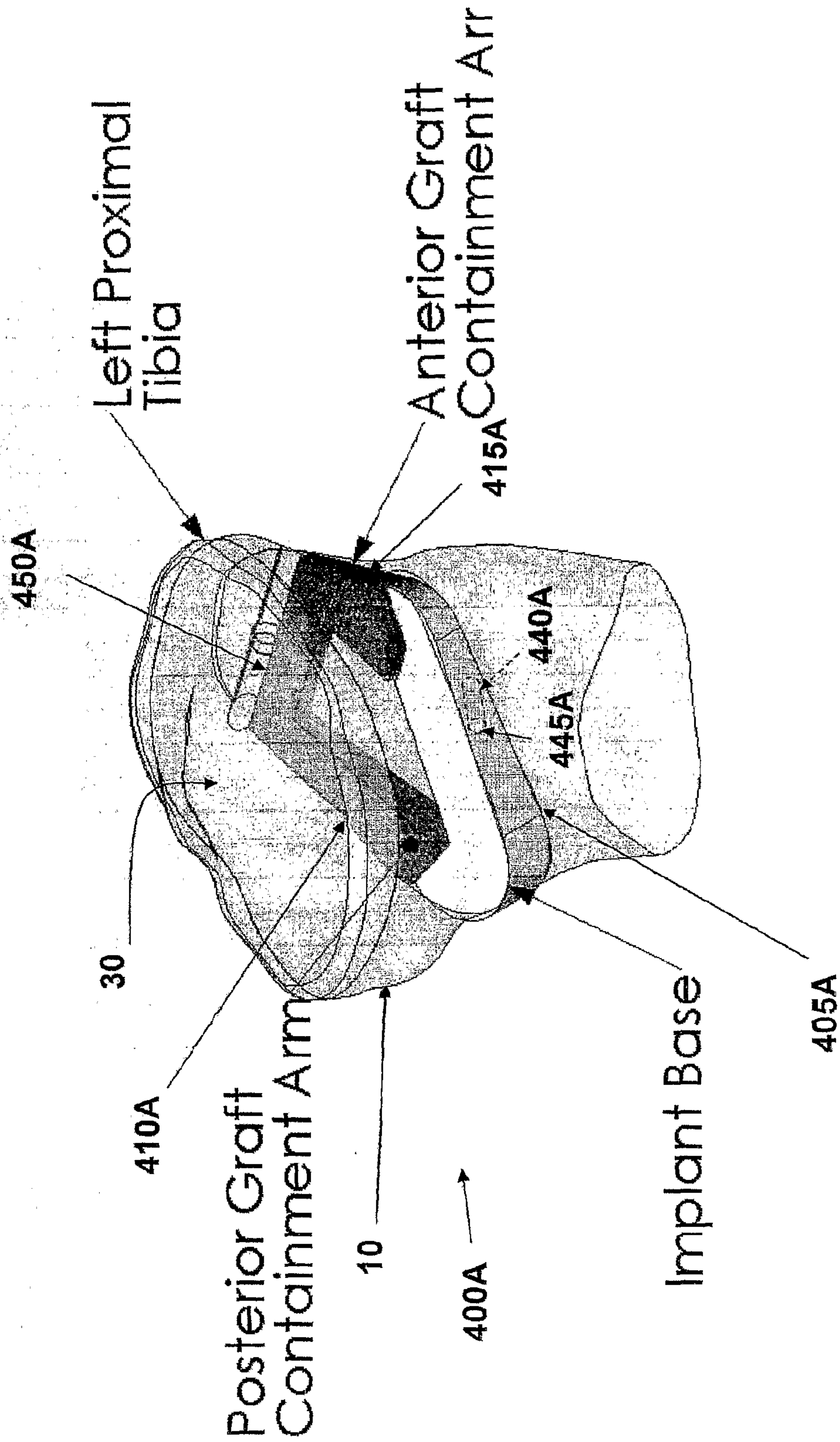


FIG. 29

Graft Containment Alignment Flats in Implant Base Alignment Flats U-shaped, Exploded View

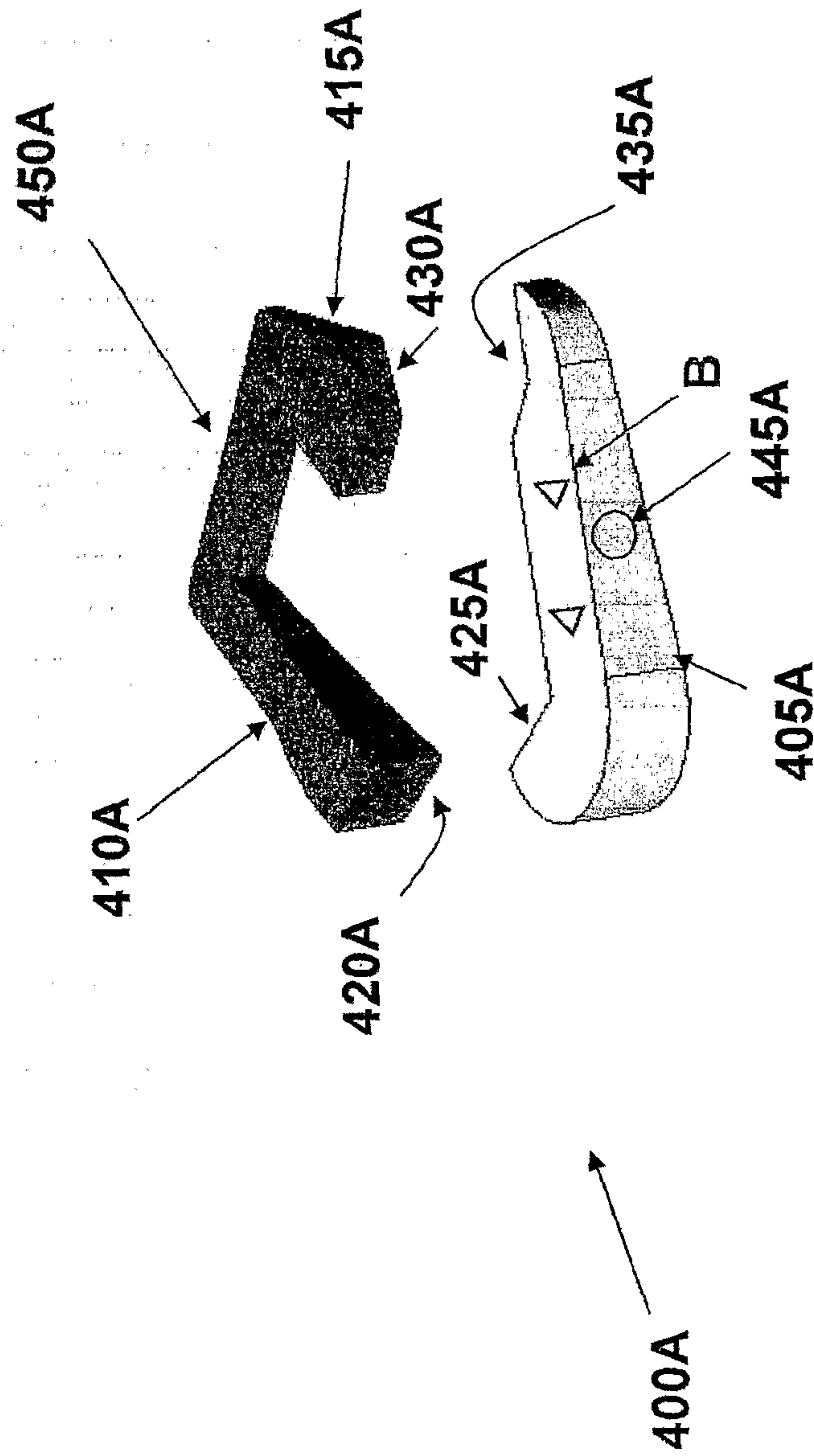


FIG. 30

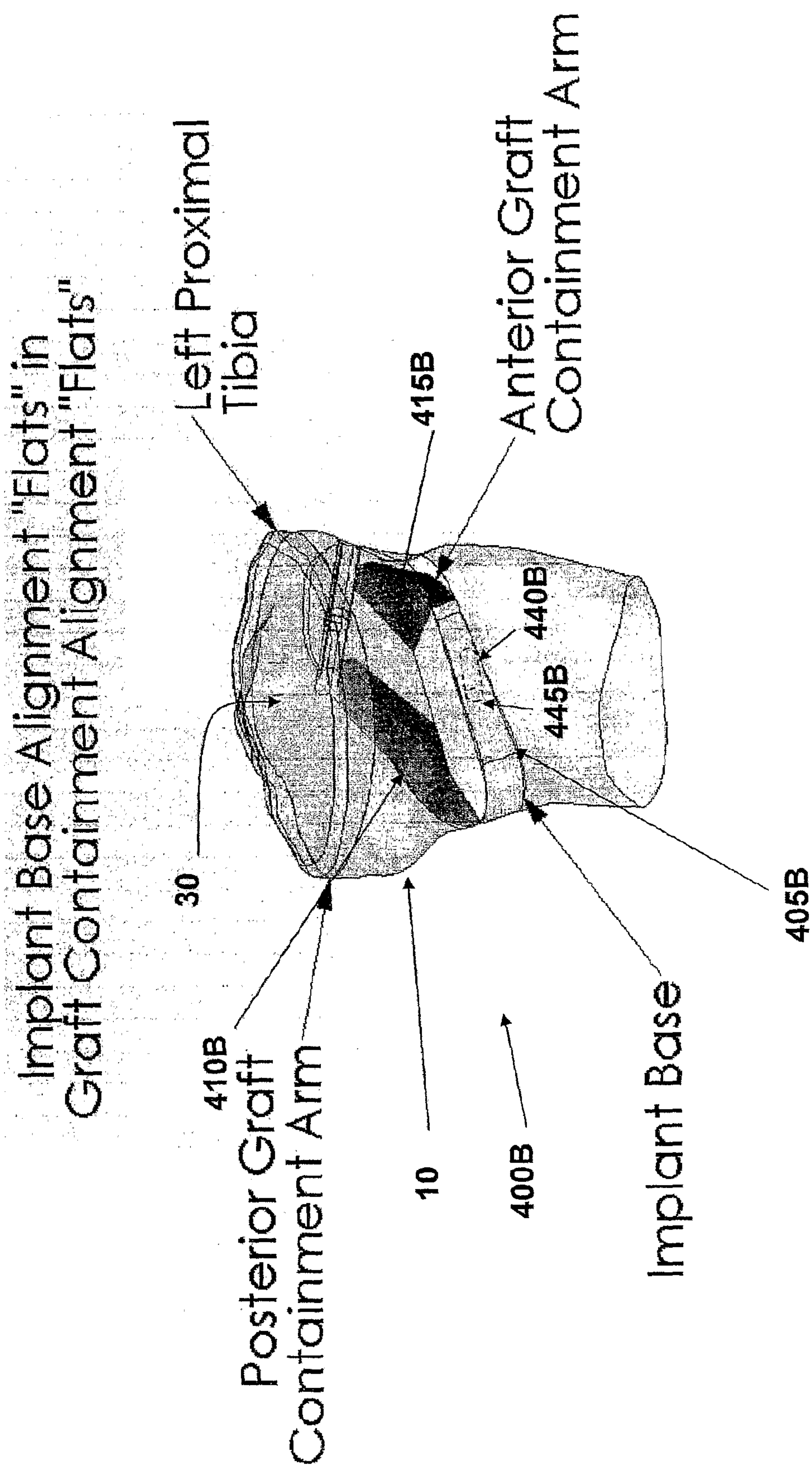


FIG. 31

Implant Base Alignment "Flats" in
Graft Containment Alignment "Flats"
Exploded View

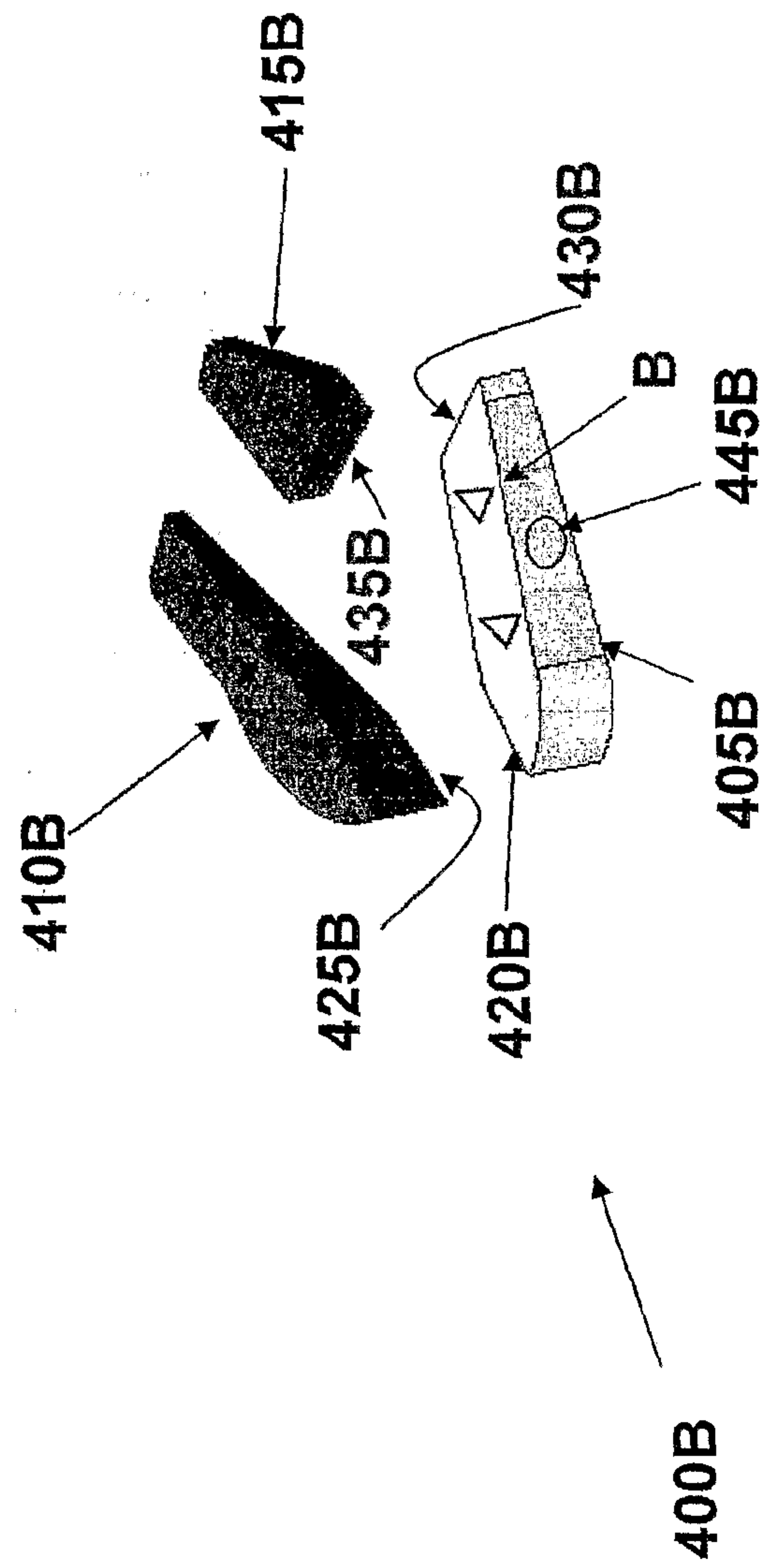


FIG. 32

Implant Base Alignment "Flats" in
Graft Containment Alignment "Flats"
U-shaped

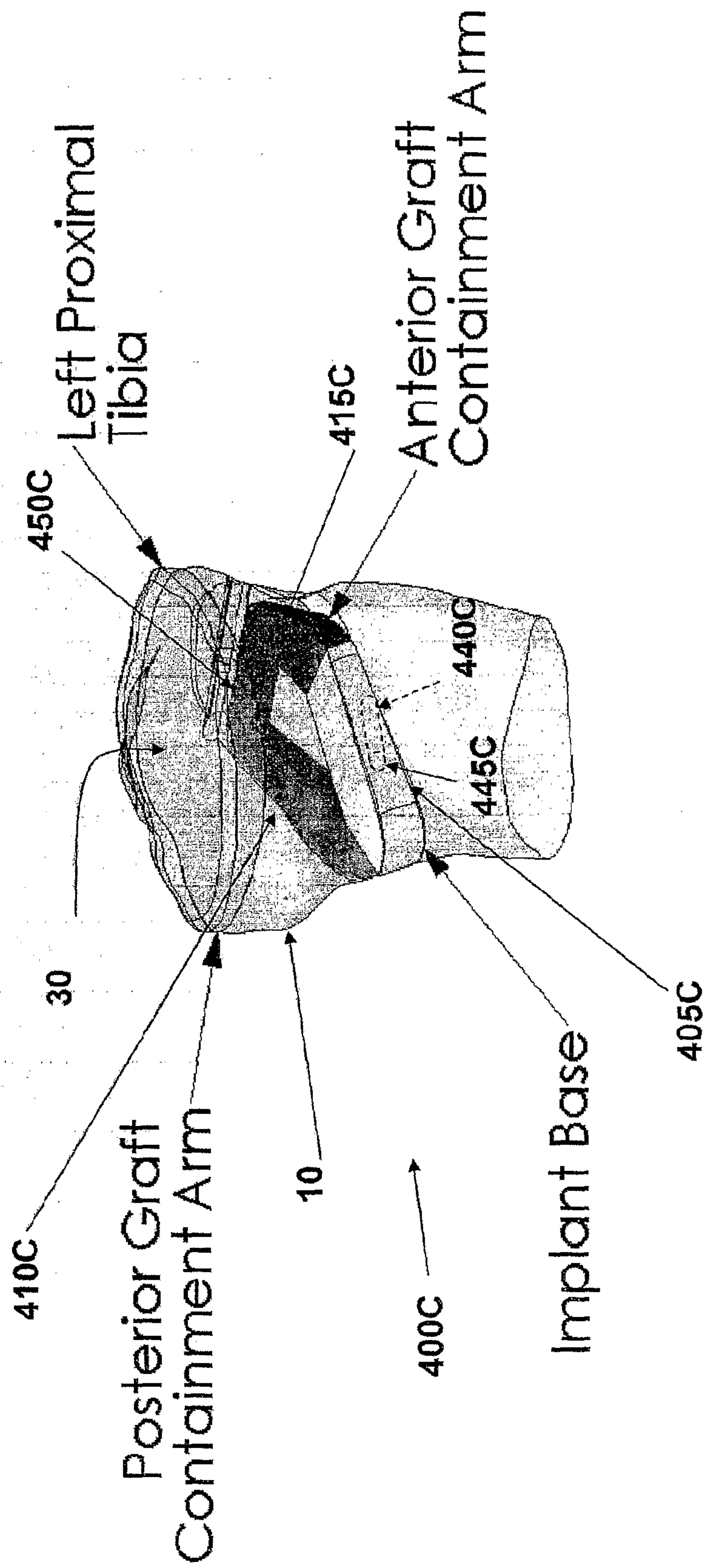


FIG. 33

Implant Base Alignment "Flats" in
Graft Containment Alignment "Flats"
U-shaped, Exploded View

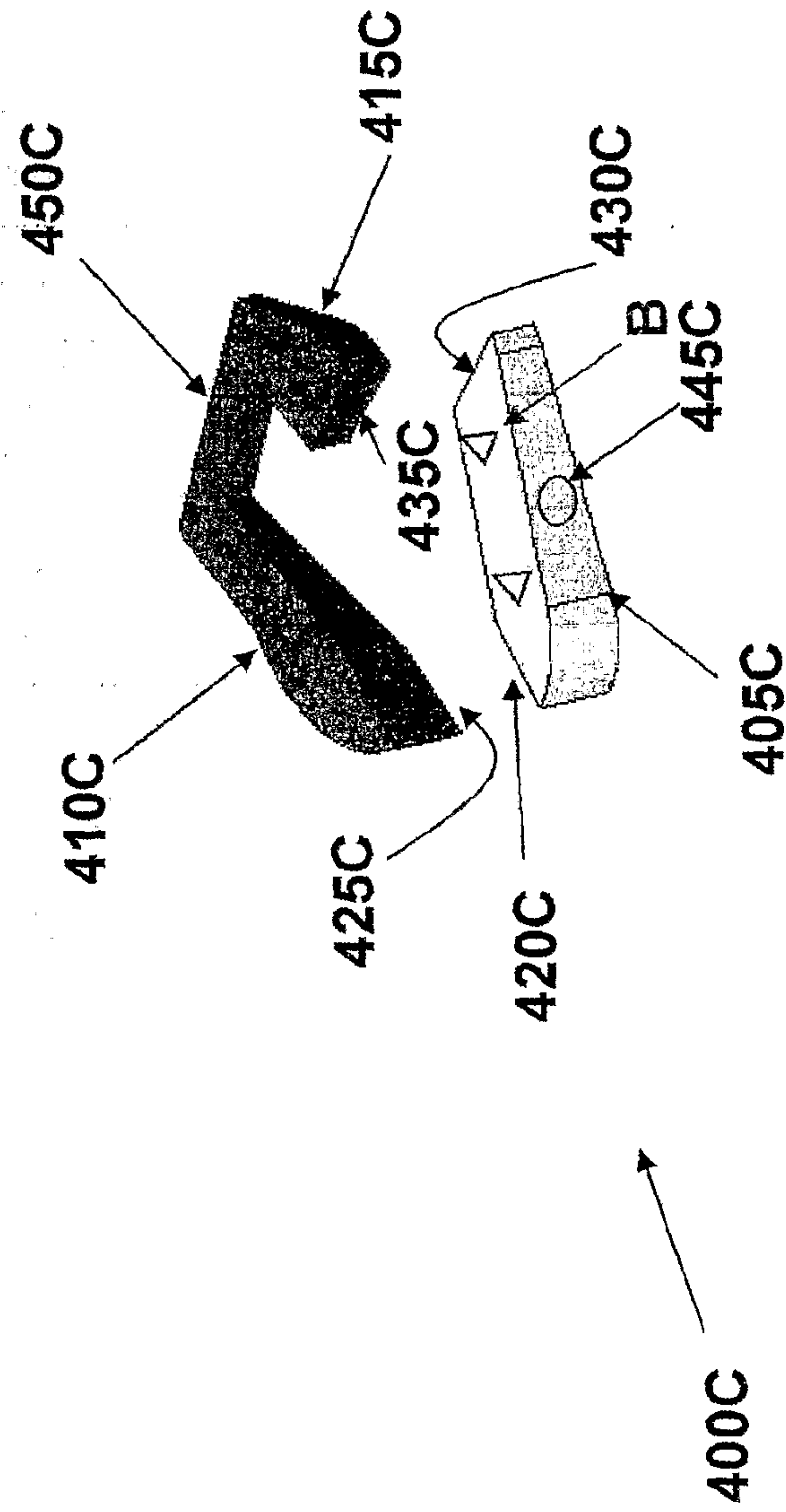


FIG. 34

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