

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
24 December 2008 (24.12.2008)

PCT

(10) International Publication Number
WO 2008/157137 A1

(51) International Patent Classification:

A61C 8/00 (2006.01)

(21) International Application Number:

PCT/US2008/066455

(22) International Filing Date: 10 June 2008 (10.06.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

60/943,923 14 June 2007 (14.06.2007) US

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

[Continued on next page]

(54) Title: DENTAL IMPLANT SYSTEM FOR USE WITH COAXIALLY NON-ALIGNED PROSTHESIS

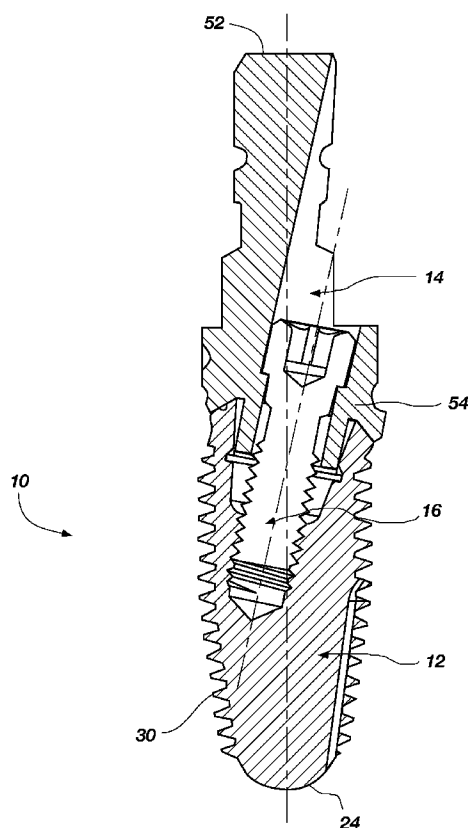


FIG. 1

(57) Abstract: An implant system includes an implantable implant body and an axially elongated fixture mount which is detachably coupled thereto. The implant body is elongated along an axis extending from an upper proximal-most end to a lower apical end. The upper-most region of the implant body is provided as a smooth coronal portion and lower distal-most region provided for bone engagement. The distal-most region includes a cylindrical portion is proximate to the coronal portion, and a tapered portion which extends from the cylindrical portion to an apical tip. External screw threads extend helically about each of the cylindrical and tapered portions for use in anchoring the body in position in bone. An internal bore formed inwardly from the proximal-most end is inclined on an angle of between about 50 and 20° relative to the longitudinal axis of the implant body.



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- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

RELATED APPLICATIONS

This application claims the benefit under 35 U.S.C. §119(e) to United States Patent Application Serial No. 60/943,923, filed 14 June 2007 and entitled "Angulated Dental Implant Having an Internal Connection, and Implant Tool".

SCOPE OF THE INVENTION

The present invention relates to implant systems used in the connection of a prosthesis to bone, and more preferably a dental implant system which includes an insertion tool or fixture mount, and an implant having an internal connection which is adapted for the coupling of a prosthesis, with the axis of the prosthesis angularly inclined relative to the axis of the implant body.

BACKGROUND OF THE INVENTION

Dental implant systems are well known and have received widespread acceptance in the marketplace. Conventionally, implant constructions are of a multi-part design and include an implantable body which is adapted to be recessed into a patient's jawbone, and a prosthesis in the form of a ceramic tooth which is adapted for affixation to a metal abutment which has been mechanically coupled to a proximal or upper end of the implant body.

Most typically, dental implants are formed from metals such as stainless steel or titanium, and have a cylindrical or tapered shape which is elongated in an axial direction. In placement, a recess or drill hole is drilled in the patient's jawbone at a desired site. The implant body is then press or screw-fit into the drill hole generally level with the surrounding jawbone tissues. Over time, the bone tissue grows and engages the sides of the implant body, to anchor it in position in place of the natural tooth.

Following healing and anchoring of the implant, the abutment which serves as the support for the prosthesis is coupled to the proximal end of the implant body. Conventionally,

abutments are formed with a generally flat bottom surface, and which is adapted for juxtaposed placement against a flat upper seating surface of the implant body. In this manner, forces are transmitted evenly from the prosthesis through the implant body; and to the jaw. While the mounting of prosthesis in coaxially alignment with the implant body has achieved success in the placement of dental implants in the posterior regions of patients' mouths, difficulties remain in that conventional implants have achieved limited success in replacing incisor teeth and teeth in the anterior-most regions, where high aesthetic demands exist.

In particular, in the anterior-most regions, and most pronounced in the maxillary jaw, the patient's jawbone tends to extend angularly relative to the direction of occlusal forces. To ensure optimal placement, heretofore implant bodies have been inserted into the maxillary jaw parallel to the direction of jawbone elongation and in an angular orientation of between about 5° and 25° relative to the occlusal direction. Following placement, specialized abutments are thereafter used to reposition the prosthesis in the desired angular orientation of occlusal forces. Such abutments typically have contact faces which are angled relative to the abutment axis/abutment-implant interface. Angled abutments suffer the disadvantage in that they are typically provided with thick and thin sides to provide the desired angle for mounting of the prosthesis. As a result, following placement of the prosthesis, there remains an increased likelihood of the establishment of a "biological width", around the implanted body (i.e. the distance from the peri-implant bone crest to the microgap), leading to the exposure of the thicker side of the abutment and an aesthetically displeasing metallic appearance.

Studies have shown that crestal bone remodelling will be effected by bacteria which collects at the implant/abutment interface or microgap. In particular, following initial implant placement, bone tissue will typically recover to a level of 0.5 to 1 mm below the microgap, with overlying gingival tissues typically extending 1 to 2 mm above the supporting bone. Receding support tissues or crestal bone loss around dental implants leads to an aesthetic challenge when dealing with dental restorations in the frontal regions of the patient's mouth. Alveolar bone tends to gradually disappear along the portions of the implants where engagement of the bone tissues with the implant body does not occur. This in turn results in a corresponding recession of overlying gum tissues and the exposure of the stainless or titanium steel body of the implant and/or the abutment. This may result in the thicker portion of angled metal abutments being visible either directly or through patient's gum tissues as a gray tinted band, greatly detracting from the natural look of the prosthesis.

In an effort to overcome the difficulties associated with angled abutments, United States Patent No. 5727942 to Hartmann et al., the contents of which are incorporated herein by reference, describes a dental implant system in which a cylindrical implant body is provided with an upwardly extending external hexagonal connection. The projection extends angularly relative to the implant body axis. The purpose of the angled projection is to allow the implant body to be installed at an angle relative to the occlusion direction. In Hartmann, a threaded bore extends through the external connection used in the connection of the abutment and into the upper most collar portion. While such external connections are suitable for use in anchoring of larger abutments having internal sockets, such larger abutments are most frequently used in the mounting of comparatively larger prosthesis, such as those used in the replacement of lost molars and posterior teeth.

SUMMARY OF THE INVENTION

The present implant system seeks to provide an implant which stimulates osteoblasts or bone forming cells to promote bone ingrowth and engage the implant body. Most preferably, the implant is a dental implant adapted for use in the replacement of incisor and other anterior teeth in a patient's mouth, and which maximizes the crestal surface of the re-grown bone tissue along the labial and buccal surfaces so as to substantially mirror that of a healthy tooth. Furthermore, the present invention seeks to provide an improved dental implant body for use in the anterior regions of a patient's mouth, and which minimizes loss of the patient's labial gingival and/or bone tissues.

It is an object of the present invention to provide a dental implant for use in the anterior regions of a patient's mouth, and which allows for the mounting of comparatively smaller abutments and/or prosthesis, with the prosthesis axis in an angular orientation relative to the implant body axis.

Another object of the invention is to provide an improved implant system for use in attaching a prosthesis to bone, and which includes an implant body provided with an internal connection.

A further object of the invention is to provide an improved dental implant system having a dental implant and fixture mount, or installation tool. The fixture mount most preferably enables both simplified manufacture and implant positioning in alignment with bone tissues which are angularly relative to the occlusal direction, and which permits the simplified mounting of a prosthesis thereto with the prosthesis axis oriented angularly relative to the implant axis.

Another object of the invention is to provide a dental implant body having an internal connection, and which is provided with smooth upper or coronal region, and an externally threaded bone engaging lower region having one or more bone additional engaging structures, such as porous coatings, texturing, and/or bioreactive coating along part or its entire axial length, to maximize bone remodelling and attachment thereto. Suitable porous coated surfaces could, for example, include titanium, metal or ceramic beads. Suitable coatings for use with the bone engaging surface would typically comprise bioreactive coatings, such as those formed from hydroxyapatite or other compounds suitable for stimulating bone growth.

In one possible construction, the implant body is elongated along an implant axis extending from an upper proximal-most end to a lower apical end. Although not essential, the upper-most region (in the direction of implantation) of the implant is provided as a generally smooth coronal portion having an axial length of between about 2 and 5 mm, extending to the proximal-most end. The lower distal-most region of the implant is provided for bone engagement. Most preferably, the distal-most region includes a generally cylindrical portion which is proximate to the coronal portion, and a tapered portion which extends from the cylindrical portion to the apical tip.

The implant preferably is provided with external screw threads which extend helically about the at least part of each of the cylindrical and tapered portions for use in anchoring the body in position as bone engaging structures at the desired site of implant placement. Although not essential, to maximize bone regrowth and attachment, the exterior threads most preferably extend substantially along the sides of the implant body to a point about 1 mm, and most preferably within less than 0.5 mm from the coronal region. It is to be appreciated, however, that other bone engaging features and/or surfaces could be provided in substitution or in addition to the exterior threads. These include, without restriction, textured surfaces, porous coated surfaces and/or biologically active coatings.

An internal recess or bore is formed into the interior of the implant body. The internal bore extends inwardly from the proximal-most end as a blind bore which extends to an innermost end located within or proximate to the cylindrical portion of the bone engaging region. Preferably, the bore extends along and is generally centered about a bore axis which is inclined on an angle of between about 5° and 20°, preferably 8° to 15°, and most preferably about 12° relative to the longitudinal axis of the implant body. It is to be appreciated that the final angular orientation of the bore is selected having regard to the desired positioning of the dental prosthesis relative to the implant body axis, following placement of the implant at the desired site.

Most preferably, the internal bore is provided with an internally threaded portion, and optimally also an engagement portion which is provided with one or more radially spaced sockets, grooves, slots or other longitudinally oriented openings which are formed into the sidewall of the bore, and which open to the proximal-most end. The threaded portion of the internal connection/bore are adapted to receive a retaining screw used in the securement of an abutment to the implant body. As will be described, the engagement members have a shape selected for mated contact with at least part of a drive member on a fixture mount or other suitable insertion tool. In a most simplified form, the engagement member comprises a female slot or groove-type connection having a geometric shape adapted for mated contact with one or more of the drive members. In this manner, contact between the engagement members and the drive members limits relative rotation of the fixture mount relative to the implant body. Although not essential, in a simplified construction, the internal bore may be provided with an enlarged diameter non-threaded portion spaced outwardly from the internally threaded portion, and open to the proximal-most end, with the engagement members are most preferably formed in the non-threaded portion of the bore.

The proximal-most end surface of the implant body includes a seating surface against which the abutment is secured in juxtaposed contact. In one simplified construction, the seating surface is formed as a generally flat or planar rim which extends radially about the internal bore, and which is inclined at an orientation relative to the implant axis. The rim is preferably also inclined at an angle of between 5° and 20° relative to the implant axis, preferably between about 8° and 15°, and most preferably about 12°. More preferably, the

seating surface is provided with a generally frustoconical shape which both extends concentrically about and is elongated in the direction of the bore axis.

Although not essential, the fixture mount is most preferably used to initially install the implant at a desired osteotomy. Typically, the fixture mount includes an elongated shaft or body which extends from an upper end which has a shape selected so as to be engagable in rotational movement by a suitable drive tool. By way of non-limiting example, the upper end may be provided with an octagonal or hexagonal projection which is received in a complimentary-shaped socket of the tool.

The second lower end of the fixture mount is provided with the drive projection on which are carried or formed one or more drive members (i.e. a male end of the projection or male member). Although not essential, most preferably the drive protection is mounted in an angular orientation relative to the fixture mount axis, and is sized for mated insertion within at least part of the internal bore. The projection has a shape and size which most preferably corresponds to the enlarged diameter portion of the bore, and which has the drive members integrally formed thereon. The fixture mount may be preassembled to the implant body, with the drive members in engaging contact with an associated one of the engagement members of the enlarged diameter portion. In such a construction, the fixture mount may be provided with a releasably attachment member, used to releasably couple the fixture mount in mated contact with the proximal-most end of the implant in generally co-axial alignment therewith.

In one simplified construction, an elongated cavity or access bore is formed through a side portion of the fixture mount, and which opens into the drive projection. An elongated retaining screw is insertable through the cavity, and which has provided having a screw shank and length selected for threaded engagement with the interior threads of the internal bore, to releasably mechanically couple the fixture to the implant body.

In an alternate construction, the fixture mount may be provided with one or more clips hooks, prongs or other deformable or frangible members (hereinafter generally referred to as frangible members) adapted to engage complimentary shaped grooves, slots or notches formed in the implant body and/or a coupling screw, to temporarily couple the fixture mount and implant during initial implant placement.

In use of the implant system, the desired site of implantation is initially prepared by exposing the alveolar bone at the desired location. Initially, a small diameter drill hole of preferably about 2 mm is formed in the jawbone in a direction generally parallel to the direction of jawbone elongation. Following the formation of the initial guide hole, a direction indicator may be inserted into the guide hole to verify the desired alignment between the implant body, the direction of occlusion, and the alignment of the prosthesis axis. Following correct alignment of the implant body axis, the guide hole is widened initially using a 3 mm twist drill and thereafter reamed using a tapered reamer having a profile corresponding to the radial profile of the implant body. The bore hole is formed to a depth selected to provide optimal seating of the implant in the alveolar bone, and with the proximal-most surface of the implant body adjacent to the crestal surface of the base.

Following preparation of the osteotomy, the implant body with the fixture mount affixed thereto is inserted into the hole. The fixture mount is then engaged by a driving tool, such as an air hand piece to rotate the implant body about its axis in the helical direction, screw fitting the implant in a seated position into the osteotomy. A guide member on the fixture mount and/or the implant body may be utilized to provide a visual indication of the correct angular orientation of the coronal rim relative to the jawbone to ensure the optimal angle position of the mounted prosthesis.

Once the implant is successfully seated, the retaining screw is removed to permit decoupling of the fixture mount from the implant body. Thereafter, a healing abutment may be secured to the threaded bore and the area covered with a healing abutment for a period of time to allow bone growth and implant adhesion. After healing, the healing abutment is removed, and a suitable prosthesis abutment is secured to the implant body by connecting screw. It is to be appreciated that the final abutment design is selected to enable the optimum prosthesis orientation having regard to the direction of occlusion.

Accordingly, in one aspect, the present invention resides in combination a dental implant and implant fixture mount, the dental implant comprising: an elongated implant body extending along an implant axis from a proximal-most end to an apical end, a generally cylindrical portion spaced towards said proximal-most end and an inwardly tapering portion spaced towards said apical end, external threads disposed along at least part of each of the cylindrical portion and tapering portion to assist in anchoring the implant body in bone, an

internal bore formed substantially in the cylindrical portion and extending along a bore axis from said proximal-most end to an inner bore end, the bore axis being inclined relative to said implant axis at an angle selected at between about 5° and 20°, the internal bore being delineated by a sidewall including an internally threaded region and an enlarged diameter portion spaced relative to the internally threaded region towards the proximal-most end, at least one engagement member disposed in said enlarged diameter portion, the fixture mount extending along a tool axis from a first end portion to a second end portion engagable by a rotational tool, the first end portion being configured for generally mated contact with the proximal-most end of the implant body with the tool axis generally coaxially aligned with the implant axis, the first end portion including at least one drive member configured for engaging contact with a selected one of said engagement members to limit rotational movement of the fixture mount relative to the implant body when in mated contact therewith, and a releasable attachment member releasably mechanically coupling the fixture mount to the implant body, and whereby rotation of the second end about the tool axis by the rotational tool effect rotation of the implant body about the implant axis.

In another aspect, the present invention resides in a dental implant system comprising: a dental implant for osseointegration into a patient's jawbone and an implant fixture mount, the implant including a body longitudinally elongated along an axis and extending from a proximal end to an apical end, the body having external surface features adapted for engaging jawbone tissue and including a generally cylindrical portion spaced towards the proximal end and a tapered portion extending from the cylindrical portion towards to said apical end, the tapered portion tapering inwardly towards said implant axis at an angle selected at between about 5° and 40°, an internal bore disposed substantially in the cylindrical portion and extending along a bore axis from the proximal end surface to an innermost end, the bore axis being oriented relative to said implant axis at an angle selected at between about 5° and 20°, the internal bore defined by a sidewall having an internally threaded region and at least one longitudinally extending groove open to the proximal end surface, the fixture mount being elongated along a tool axis and extending from a first end portion to a second end portion, the first end portion configured for generally abutting contact with the proximal end surface of the implant body with the tool axis generally coaxially aligned with the implant axis and including at least one tab member provided for mated insertion with an associated one of said grooves to substantially prevent rotation of the fixture mount relative to the implant body when in abutting contact therewith, a releasable attachment member to releasably couple the fixture

mount to the implant with the first end portion in abutting contact with the proximal end surface, whereby rotation of the drive tool about the tool axis rotates the implant body about the axis.

In further aspect, the present invention resides in a dental implant system comprising a dental implant and implant fixture mount, the dental implant comprising: an elongated implant body extending along an implant axis from a proximal end portion to an apical end, the body including an externally threaded region, the proximal end portion including an axially extending frustoconical seating surface for engaging contact with each of said fixture mount and an abutment for receiving a prosthesis and an internal bore formed in a proximal-most surface of the implant body and extending along a bore axis to an innermost end located part way towards the apical end, the seating surface and the bore being coaxially aligned and inclined relative to said body axis at an angle selected at between about 5° and 15°, the internal bore being delineated by a sidewall including an internally threaded region and an enlarged diameter region spaced from the threaded region towards the seating surface, a plurality of engagement members disposed in said enlarged diameter region, the fixture mount extending along a tool axis from a first end portion to a second end portion engagable by a rotational tool, the first end portion including a generally frustoconical recess configured for generally mated contact with the seating surface of the implant body with the tool axis in generally coaxially alignment with the implant axis, and a plurality of drive members configured for engaging contact with a selected one of said engagement members to limit rotational movement of the fixture mount relative to the implant body when the frustoconical recess is provided in said mated contact with said seating surface, a releasable attachment member coupling the drive tool to the implant body with the frustoconical recess in mated contact with the seating surface, and whereby rotation of the second end of the fixture mount about the tool axis by the rotational tool effects rotation of the implant body about the implant axis.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference will now be had to the following detailed description, taken together with the accompanying drawings in which:

Figure 1 shows a cross-sectional view of the implant system for use in the attachment of a dental prosthesis in a patient's jawbone in accordance with a preferred embodiment of the invention;

Figure 2 illustrates an exploded view of the implant body, fixture mount and retaining screw used in the implant system shown in Figure 1;

Figure 3 shows a cross-section view of the implant body shown in Figure 2;

Figure 4 shows a cross-sectional view of the fixture mount shown in Figure 2;

Figure 5 illustrates a cross-sectional view of a dental implant body positioned in place in an osteotomy in a patient's maxillary jawbone;

Figure 6 illustrates schematically the use of the implant body of Figure 5 in the mounting of an abutment and prosthesis in tooth replacement; and

Figure 7 shows a cross-sectional view of a dental implant system in accordance with a further embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference is made to Figures 1 and 2 which illustrate a dental implant system 10 in accordance with a preferred embodiment of the invention. The system 10 includes an implant body 12, and a fixture mount 14 which, as will be described, is releasably coupled to the implant body 12 by an elongated retention screw 16.

The implant body 12 is formed from titanium or stainless steel, and is provided for insertion in an osteotomy formed in a patient's maxillary jawbone 8 for use in mounting a prosthesis 150 (Figure 6) in the replacement of a natural tooth. The implant body 12 is elongated along an implant axis A_1 - A_1 (Figure 3) and extends from a proximal-most coronal or upper end surface 22 to a distal most apical end tip 24. Depending upon the site of implantation, the implant body 12 typically has an overall length of between about 10 and 20 mm.

Figure 3 shows best the implant body 12 as including a generally smooth upper-most (relative to the direction of implantation) coronal region 20, and distal bone engaging region 21 which is adapted for engaging contact by bone tissues. The bone engaging region 21 is shown best as extending distally from the coronal region 20, and includes an upper generally cylindrical portion 26 which extends generally distally from the region 20 midway along the length of the body 12. The cylindrical portion 26 merges at a lower-most end with an inwardly tapering portion 28, which extends from the cylindrical portion 26 to the apical tip 24. Preferably, the tapered portion 28 extends inwardly towards the tip 24 at an angle of between about 3° and 20°, and more preferably about 10°, relative to the implant axis A_I-A_I .

Exterior threads 30 (Figure 1) extend helically substantially along the length of both the tapered portion 28 and cylindrical portion 26. Preferably the threads 30 are provided with a thread pitch of between about 0.5 and 0.7 mm. Optionally, the cylindrical and tapered portions 26,28 may further be provided with a reactive surface to stimulate bone regrowth and/or attachment to the body 12 following placement. Suitable reactive surfaces would include the application of bioreactive coatings porous coatings, as well as texturing or roughening of the exterior implant surface by abrasion or etching.

The coronal end region 20 of the implant body 12 extends 1 to 4 mm from the proximal-most end surface 22, with the end surface 22 oriented at an angle of between about 60° and 85° relative to the implant body axis A_I-A_I . Figure 2 shows best the coronal end portion 22 as presenting a substantially smooth surface which is provided for transgingival placement, and which includes a flared collar portion 32 which extends proximally from the cylindrical portion 26. The collar 32 merges with a smooth frustoconical seating surface 55 which is used to engage and support an abutment 140 (Figure 6) in the mounting of the prosthesis 150. Although not essential, most preferably the frustoconical seating surface 55 is provided with a notch 34 or other suitable visual indicia. The notch 34 is provided for alignment with a dimple 36 provided on a shaft portion 38 of the fixture mount 14 to permit visual confirmation of the correct alignment of the fixture mount 14 and implant 12, in the event the reassembly of the implant 12 and fixture mount 14 is required.

An internal bore 40 is formed in the implant body 12 extending inwardly from the end surface 22. The bore 40 extends axially along a bore axis A_B-A_B which is inclined relative to

the implant axis A_I-A_I at an angle α of between about 5° and 20° , preferably 8° to 15° , and most preferably about 12° (Figure 2). The internal bore 40 is defined by a sidewall 44 and includes an outermost enlarged diameter portion 46 and inner threaded end portion 48. In a most performed configuration, the internal bore 40 does not substantially extend distally past the cylindrical portion 26. The threaded end portion 48 is formed radially about the bore axis A_B-A_B and is provided with a reduced sized diameter as compared to the enlarged diameter portion 46. A series of radially projecting grooves 50 are formed in the sidewall 44 along the enlarged diameter portion 46. The grooves 50 are open to the proximal-most end 22, and most preferably extend radially about and parallel to the bore axis A_B-A_B .

Figure 2 shows best the frustoconical seating surface 55 as extending both concentrically about and being elongated in the direction of along the bore axis A_B-A_B . In this regard, the seating surface 55 is provided in an orientation which is inclined or tilted relative to the implant axis A_I-A_I . The seating surface 55 furthermore preferably extends at an angle of between about 45° and 60° relative the bore axis A_B-A_B . It is be appreciated that the inclination of the seating surface 55 allows the prosthesis 150 to be mounted in an angular orientation relative to the axial direction of the implant body 12, without necessitating using conventional angled abutments and without the use of angled or transition members. This in turn allows the prosthesis 150 to be connected more closely to the implant body 12, while maintaining minimal spacing between the bone engaging region 21 of the implant 12 and the prosthesis 150 in the buccal and labial regions of the patient's mouth.

In initial placement, the fixture mount 14 is attached to implant 12 so as to compensate for the angled end portion 22, enabling the placement of the implant 12 in a substantially conventional manner. The fixture mount 14 is formed from polycarbonate, plastic or metal and extends along a mount axis A_M-A_M from a first upper end 52 to a lower end portion 54. The upper end 52 is provided with a polygonal cross-section profile which is selected to be engaged by a drive tool, such as hand piece or manual socket wrench (not shown), used to rotate the fixture mount 14 about its longitudinal axis A_M-A_M .

The lower end portion 54 of the fixture mount is adapted for mated contact against the proximal-most end surface 22 of the implant body 12. In this regard, the lower end portion 54 includes a frustoconical recess 62 and an angularly projecting drive member 64. The frustoconical recess 62 has a size and orientation adapted for juxtaposed placement against the

seating surface 55. Most preferably, the recess 62 is provided in an angled orientation relative to the fixture mount axis A_M-A_M which substantially corresponds to the angular orientation of the seating surface 55 relative to the implant axis A_I-A_I .

The drive member 64 is spaced inwardly relative to the recess 62 so as not to interfere with contact between the surfaces of the recess 62 and seating surface 55. In the embodiment shown, the drive member 64 extends angularly at an angle relative to the axis A_M-A_M and is formed as a polygonally shaped projection which is sized for mated insertion within the enlarged diameter portion 46 of the bore 40. The drive member 64 includes a series of radially spaced projections 65a,65b which have a spacing and configuration adapted for nested placement within a corresponding associated groove 50. The engagement between the projections 65a,65b within an associated groove 50 is selected to limit relative rotation between the fixture mount 14 and the implant body 12 as the fixture mount 14 is rotated about the axis A_M-A_M .

The dimple 36 may be provided for visual alignment with the notch 34, or other suitable visual indicator formed in the seating surface 55 or elsewhere on the implant body 12 to ensure the optimal relative rotational alignment of the fixture mount 14 relative to the body 12. In this manner, the fixture mount 14 is positionable on the coronal region 20 of the implant 12, with the fixture mount axis A_M-A_M substantially aligned with the implant axis A_I-A_I .

In one simplified construction, an elongated cavity 70 extends angularly through the fixture mount shaft 38. Preferably, the cavity 70 is elongated along a cavity axis A_C-A_C which is inclined relative to the fixture mount axis A_M-A_M at substantially the same angle β as the angle of inclination α of the bore axis A_B-A_B relative to the implant axis A_I-A_I . The cavity 70 includes a stepped shoulder 72 and has a dimension selected to permit the partial insertion of the retention screw 16 therein and into threaded engagement with the internally threaded end 48 of the bore 40.

Figure 2 shows best the retention screw 16 as including a threaded shaft 74 and an enlarged diameter screw head 76. It is to be appreciated that screw head 76 has a dimension selected such that when the fixture mount 14 is secured in an assembled position against the implant 12, the screw head 76 is provided in abutting contact with the stepped shoulder 72,

with the threaded shaft 74 in threaded engagement with the internal threads of the threaded end portion 48.

In the system 10, the fixture mount 14 and implant body 12 are preassembled with there respective axis A_M-A_M and A_I-A_I in alignment, the drive member 64 disposed within the enlarged diameter portion 46 of the internal bore 40, and the recess 62 seated against the seating surface 50 as shown in Figure 1. In this configuration, the threaded fastener 16 is inserted through the cavity 70 and into engagement with the stepped shoulder 72 and the internal threads of the threaded end portion 48.

As shown best in Figures 5 and 6, the applicant has appreciated that the implant 12 is particularly suited for use with an osteotomy located in anterior regions of a patient's mouth where the supporting bone tissues 8 extend angularly to the direction of natural occlusion (arrow 100). Alternately, the implant system 10 may be advantageously used where bone tissues have receded to a level which otherwise would prevent the placement of dental implants in a conventional manner, aligned in the occlusal direction.

In placement of the implant body 12 the osteotomy is initiated by perforating the cortical plate at a desired location. A pilot drill hole is formed which extends in an orientation generally parallel to the alignment of the bone tissue 8 and any adjacent teeth/implants. Subsequently, osteotomy is widened using an appropriate tapered drill (not shown) to the desired depth, and most preferably, to a depth which will allow substantially complete seating of the collar 32 with its lowermost edge flush with the bone surface 8.

The implant system 10 is most preferably provided with the fixture mount 14 preassembled to the implant 12, with the mount axis A_M-A_M and implant axis A_I-A_I aligned, and the dimple 36 providing an identification on the buccal side (B) of the patient's mouth following implant seating.

A hand piece (not shown) is secured to the first end 52 of the fixture mount 14. The hand piece is used to install the implant body 12 by rotating it about the axis A_I-A_I to drive the apical end 24 downward into the jawbone 8 to a substantially seated position. Final positioning of the implant body 12 is performed manually by the use of the a ratchet wrench (not shown) used to position the implant body 12 with the dimple 36 and raised forward edge

of the collar 32 positioned to the buccal on facial side (B), and lower collar edge 32 oriented towards the lingual side (L). In this position, the angular orientation for the upper coronal portion 20 will result in the lingual edge surface of the implant body 12 being positioned marginally below bone level. Further, the seating surface 55 is inclined towards the lingual side (L) of the patient's mouth, and most preferably extends axially in an orientation generally parallel to the occlusal direction 100.

Following implant body 12 positioning, the retention screw 16 is removed and the fixture mount 14 is uncoupled from the implant body 12. Thereafter, a covering screw (not shown) is positioned over the bore 40, and the gingival tissues 102 are sutured to allow complete abutment healing. Following healing, the covering screw is removed and the abutment 140 and prosthesis 150 (Figure 6) are secured to the implant body 12 to complete the tooth replacement protocol.

As shown best in Figure 6, the angular positioning of the seating surface 55 relative to the implant axis A_I-A_I allows the abutment 140 and prosthesis 150 to be mounted with the prosthesis axis A_P-A_P , namely the direction of operational elongation, in general alignment with the occlusal direction 100, and at an angle relative to the implant axis A_I-A_I .

Although Figures 1 and 2 illustrate the use of a retention screw 16 in the coupling of the fixture mount 14 to the implant body 12, the invention is not so limited. Other mechanisms of releasably attaching the fixture mount 14 to the implant body 12 are also envisioned and will now become apparent. Reference may be had to Figure 7 which illustrates an implant system 10 in accordance with an alternate embodiment of the invention, and where like reference numerals are used to identify like components.

The implant body 12 is provided with an internal bore 40 which extends along a bore axis A_B-A_B inclined relative to the implant axis A_I-A_I at an angle α (Figure 3) of between about 8° and 12° . The implant bore 40 is defined by a radially extending sidewall 44, and includes an enlarged diameter smooth walled outer portion 46 and in an innermost internally threaded end portion 48. The outer portion 46 may be formed with a partially conical or elliptical shape, flaring outwardly towards the implant end 22, but is most preferably substantially parallel sided. The enlarged diameter portion 46 furthermore includes a series of longitudinally extending grooves 50 which project radially into the sidewall 44, and which are

adapted for engaging contact with male projections 65 formed on the drive member 64 of the fixture mount 14 in the manner previously described.

A positioning screw 116 is provided in a recessed position within the bore 40 and in threaded engagement with the end portion 48. The screw 116 includes an enlarged screw head 118 which is provided with a plurality of locking grooves 120a, 120b, and a conventional central recess or socket 122.

The fixture mount 14 is provided with a frustoconical recess 62 and a drive member 64 which is adapted for mated placement within the enlarged diameter portion 46. As with the embodiment shown in Figure 1, the recess 62 and drive member 64 each extend angularly relative to the fixture mount axis A_M-A_M , at an angle substantially corresponding to the angle of the inclination of the bore axis A_B-A_B relative to the implant axis A_I-A_I .

A lowermost end of the drive member 64 is provided with a series of frangible prong connectors 126. Each of the prong connectors 126 are positioned for engaging contact within an associated locking groove 120a, 120b formed in the screw head 118. Engagement of the connectors 126 with an associated groove 120 mechanically couples the fixture mount 14 to the implant body 12 with the fixture mount axis A_M-A_M in substantially alignment with the implant axis A_I-A_I . The prong connectors 128 are provided with a suitable dimension selected whereby following the positioning of the implant body 12 in the osteotomy, the fixture mount 14 may be separated from the implant body 12 by a relative tilting motion, severing the connector ends 128 and enabling the drive member 64 to be slid from the bore 40.

Following the separation of the fixture mount 14, the central socket 122 is engagable by an appropriate drive tool, enabling the screw 120 to be removed from the bore 40.

It is to be appreciated as used herein, reference to “upper and lower” positions refers to the relative positioning of the implant body 12 into a bore formed in the patient’s jawbone 8.

Although the preferred embodiments describe and illustrate the implant body 12 as having a lowermost tapered portion 28, the invention is not so limited. It is to be appreciated that in alternate construction, the body 12 may be provided with a generally cylindrical shape along substantially its entire axial length.

Although the preferred embodiment of the invention describes the implant system 10 used in the placement of the implant body 12 in a maxillary jawbone 8, the invention is not so limited. It is to be appreciated that the implant construction may equally be used in the mounting of prosthesis either elsewhere in the mouth, or for that matter elsewhere in the patient's body, without departing from the spirit and scope of the invention.

Although the preferred embodiment describes the use of grooves 50 as engagement members, the invention is not so limited. Both the implant 12 and fixture mount 14 could be provided with various other structures which provide male/female type connections having complimentary shapes and sizes which when in engagement prevent or limit rotational movement of the fixture mount 14 relative to the implant body 12.

Although Figure 7 describes and illustrates the connection of the fixture mount 14 to the implant body 12 by way of frangible prongs 126, the invention is not so limited. It is to be appreciated that various other types of frangible and/or deformable members could be used to mechanically couple the fixture mount 14 in the desired axial orientation. Suitable members would include, without limitation, bendable fingers, prongs, clips, or the like which are adapted for complimentary engagement with grooves, notches or recesses formed in either a positioning screw 118 and/or the implant body 12, itself.

Although the detailed description describes and illustrates various preferred embodiments, the invention is not so limited. Many modifications and variations will now occur to persons skilled in the art. For a definition of the invention, reference may be had to the appended claims.

We claim:

1. In combination a dental implant and implant fixture mount,
the dental implant comprising:

an elongated implant body extending along an implant axis from a proximal-most end to an apical end, a generally cylindrical portion spaced towards said proximal-most end and an inwardly tapering portion spaced towards said apical end, external threads disposed along at least part of each of the cylindrical portion and tapering portion to assist in anchoring the implant body in bone,

an internal bore formed substantially in the cylindrical portion and extending along a bore axis from said proximal-most end to an inner bore end, the bore axis being inclined relative to said implant axis at an angle selected at between about 5° and 20°, the internal bore being delineated by a sidewall including an internally threaded region and an enlarged diameter portion spaced relative to the internally threaded region towards the proximal-most end, at least one engagement member disposed in said enlarged diameter portion,

the fixture mount extending along a tool axis from a first end portion to a second end portion engagable by a rotational tool, the first end portion being configured for generally mated contact with the proximal-most end of the implant body with the tool axis generally coaxially aligned with the implant axis, the first end portion including at least one drive member configured for engaging contact with a selected one of said engagement members to limit rotational movement of the fixture mount relative to the implant body when in mated contact therewith, and

a releasable attachment member releasably mechanically coupling the fixture mount to the implant body, and whereby rotation of the second end about the tool axis by the rotational tool effect rotation of the implant body about the implant axis.

2. The combination of claim 1 wherein the releasable attachment member comprises a retaining screw, a cavity being formed through a side portion of the fixture mount opening into the first end portion, the cavity including an enlarged diameter portion and a reduced diameter proximal portion spaced towards the first end, the enlarged and reduced diameter portions being sized to permit at least partial unhindered insertion of the retaining screw therein into threaded engagement with the internally threaded region of the internal bore

3. The combination of claim 1 wherein the releasable attachment member comprises at least one frangible member,
an anchor screw being disposed within said internal bore and having a screw head and at least one slot being formed in said screw head for receiving an associated one of said frangible members therein, whereby engagement of one of said frangible members with said associated slot couples the fixture mount to the anchor screw.
4. The combination of claim 1 wherein a seating surface is disposed at said proximal-most end, the seating surface comprising generally smooth frustoconical surface extending radially about and elongated along the bore.
5. The combination of claim 4 wherein the at least one engagement member comprises an elongated groove formed in said sidewall and said drive member comprises a tab extending angularly relative to said tool axis at an angle of between about 5° and 20° for mated placement within said groove.
6. The combination of claim 2 wherein the cavity extends axially along a longitudinal axis inclined relative the tool axis at an angle substantially equal to the angle of inclination of the bore axis relative to the implant axis, the first end portion of the fixture tool includes a generally frustoconical recess extending radially about and centered on the longitudinal axis, the frustoconical recess configured for substantially juxtaposed contact with the seating surface when the fixture mount is coupled to the implant body.
7. The combination as claimed in claim 4 wherein the implant body is provided with a reactive surface from generally a distalmost edge of the seating surface substantially to the apical tip.
8. The combination of claim 1 wherein the engagement member comprises a groove formed in the sidewall of internal bore, the proximal-most surface comprising a generally planar coronal lip extending about the bore axis in an orientation inclined at an angle selected at between about 5° and 12°.
9. The combination of claim 1 wherein the bore axis is inclined relative to said implant axis at an angle of between about 8° and 12°.

10. The combination of claim 9 wherein the seating surface is inclined relative to said bore axis at an angle of between about 45° and 60°.
11. The combination of claim 10 wherein the tapered portion tapers inwardly at an angle of between about 10° and 20° relative to said implant axis.
12. A dental implant system comprising:
 - a dental implant for osseointegration into a patient's jawbone and an implant fixture mount,
 - the implant including a body longitudinally elongated along an axis and extending from a proximal end to an apical end, the body having external surface features adapted for engaging jawbone tissue and including a generally cylindrical portion spaced towards the proximal end and a tapered portion extending from the cylindrical portion towards to said apical end, the tapered portion tapering inwardly towards said implant axis at an angle selected at between about 5° and 40°,
 - an internal bore disposed substantially in the cylindrical portion and extending along a bore axis from the proximal end surface to an innermost end, the bore axis being oriented relative to said implant axis at an angle selected at between about 5° and 20°, the internal bore defined by a sidewall having an internally threaded region and at least one longitudinally extending groove open to the proximal end surface,
 - the fixture mount being elongated along a tool axis and extending from a first end portion to a second end portion, the first end portion configured for generally abutting contact with the proximal end surface of the implant body with the tool axis generally coaxially aligned with the implant axis and including at least one tab member provided for mated insertion with an associated one of said grooves to substantially prevent rotation of the fixture mount relative to the implant body when in abutting contact therewith,
 - a releasable attachment member to releasably couple the fixture mount to the implant with the first end portion in abutting contact with the proximal end surface, whereby rotation of the drive tool about the tool axis rotates the implant body about the axis.

13. The implant system of claim 12 wherein the releasable attachment member comprises a retaining screw, a cavity being formed through a side portion of the fixture and opening into the first end, the cavity being sized to permit substantially unhindered insertion of at least part of the retaining screw therethrough into threaded engagement with the threaded region
14. The combination of claim 12 wherein the releasable attachment member comprised at least one frangible member,
an anchor screw being disposed within said internal bore and having a screw head and screw shaft in threaded engagement with the threaded regions and at least one slot being formed in said screw head for receiving an associated one of said frangible members therein, whereby engagement of one of said frangible members with said associated slot couples the fixture mount to the anchor screw.
15. The implant system as claimed in claim 12 wherein a seating surface is disposed at said proximal end, the seating surface comprising generally smooth frustoconical surface extending radially about and centered on the bore axis.
16. The implant system as claimed in claim 15 wherein the external surface feature comprises external helical threads extending axially along the length of the implant body from the apical tip to the seating surface.
17. The implant system of claim 16 wherein the fixture mount further includes visual indicia thereon to provide an indication of the rotational position of the frustoconical seating surface relative to a patient's jawbone.
18. The combination of claim 13 wherein the cavity extends axially along a longitudinal axis inclined relative the tool axis at an angle substantially equal to the angle of inclination of the bore axis relative to the implant axis, the first end portion of the fixture tools includes a generally frustoconical recess extending radially about and centered on the longitudinal axis, the frustoconical recess configured for substantially juxtaposed contact with a seating surface disposed on said implant when the fixture mount is coupled to the implant body.

19. The implant systems as claimed in claim 12 wherein the internal bore includes an enlarged diameter end portion, the at least one groove being formed in the enlarged end portion.
20. The implant system as claimed in claim 12 wherein the external surface feature includes an external helical thread disposed along at least part of each of said cylindrical portion and said tapered portion, and a reactive surface selected from the group consisting of a bioreactive coating, an etching, a textured coating and an abraded surface.
21. The combination of claim 16 wherein the seating surface is inclined relative to said bore axis at an angle of between about 45° and 60°.
22. A dental implant system comprising a dental implant and implant fixture mount, the dental implant comprising:
- an elongated implant body extending along an implant axis from a proximal end portion to an apical end, the body including an externally threaded region,
 - the proximal end portion including an axially extending frustoconical seating surface for engaging contact with each of said fixture mount and an abutment for receiving a prosthesis and an internal bore formed in a proximal-most surface of the implant body and extending along a bore axis to an innermost end located part way towards the apical end, the seating surface and the bore being coaxially aligned and inclined relative to said body axis at an angle selected at between about 5° and 15°, the internal bore being delineated by a sidewall including an internally threaded region and an enlarged diameter region spaced from the threaded region towards the seating surface, a plurality of engagement members disposed in said enlarged diameter region,
 - the fixture mount extending along a tool axis from a first end portion to a second end portion engagable by a rotational tool,
 - the first end portion including a generally frustoconical recess configured for generally mated contact with the seating surface of the implant body with the tool axis in generally coaxially alignment with the implant axis, and a plurality of drive members configured for engaging contact with a selected one of said engagement members to limit rotational movement of the fixture mount relative to the implant body when the frustoconical recess is provided in said mated contact with said seating surface,

a releasable attachment member to coupling the drive tool to the implant body with the frustoconical recess in mated contact with the seating surface, and whereby rotation of the second end of the fixture mount about the tool axis by the rotational tool effects rotation of the implant body about the implant axis.

23. The system of claim 22 wherein the releasable attachment member comprises an elongated retaining screw, a cavity being formed through a side portion of the fixture mount opening and being sized to permit substantially unhindered insertion of at least part of the retaining screw therein into threaded engagement with the internally threaded region of the internal bore.

24. The system of claim 22 wherein the releasable attachment member comprised at least one frangible member,

an anchor screw being disposed within said internal bore and having a screw head and at least one slot being formed in said screw head for receiving an associated one of said frangible members therein, whereby engagement of one of said frangible members with said associated slot couples the fixture mount to the anchor screw.

25. The system of claim 22 wherein each said engagement members comprises a groove or slot formed in said sidewall, and said drive members comprise a projection adapted for complementary insertion therein.

26. The system of claim 22 wherein the implant body includes a generally cylindrical body portion and a tapered body portion, the tapered body portion extending distally from the cylindrical body portion to the apical end, and the internal bore being substantially disposed in the cylindrical body portion.

27. The system of claim 22 wherein the fixture mount further includes visual indicia thereon to provide an indication of the rotational position of the frustoconical seating surface relative to a patient's jawbone.

28. The system of claim 12 wherein the engagement member comprises a groove formed in the sidewall of internal bore, the proximal-most surface comprising a generally planar

coronal lip extending about the bore axis in an orientation inclined at an angle selected at between about 8° and 12°.

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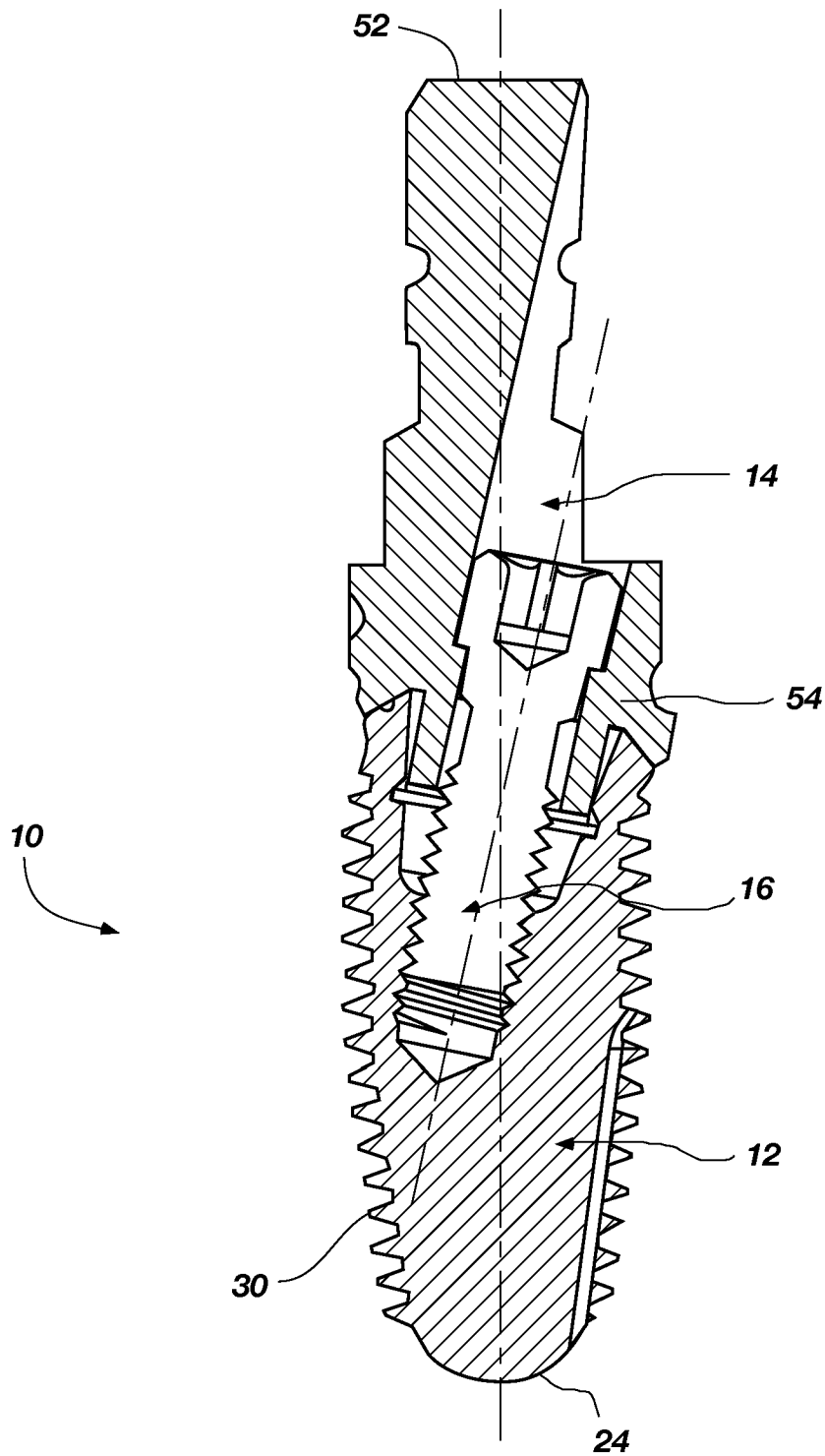


FIG. 1

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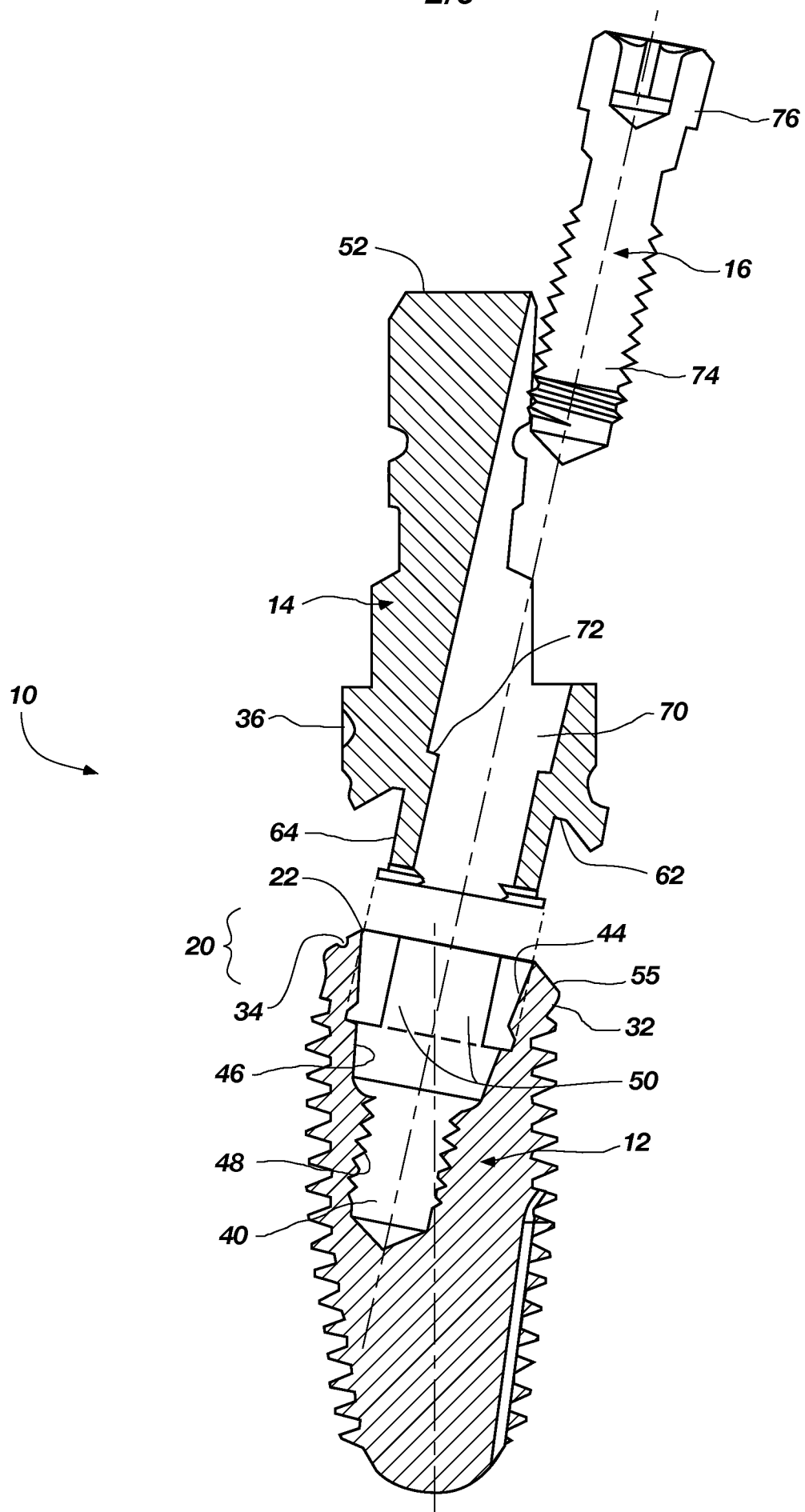


FIG. 2

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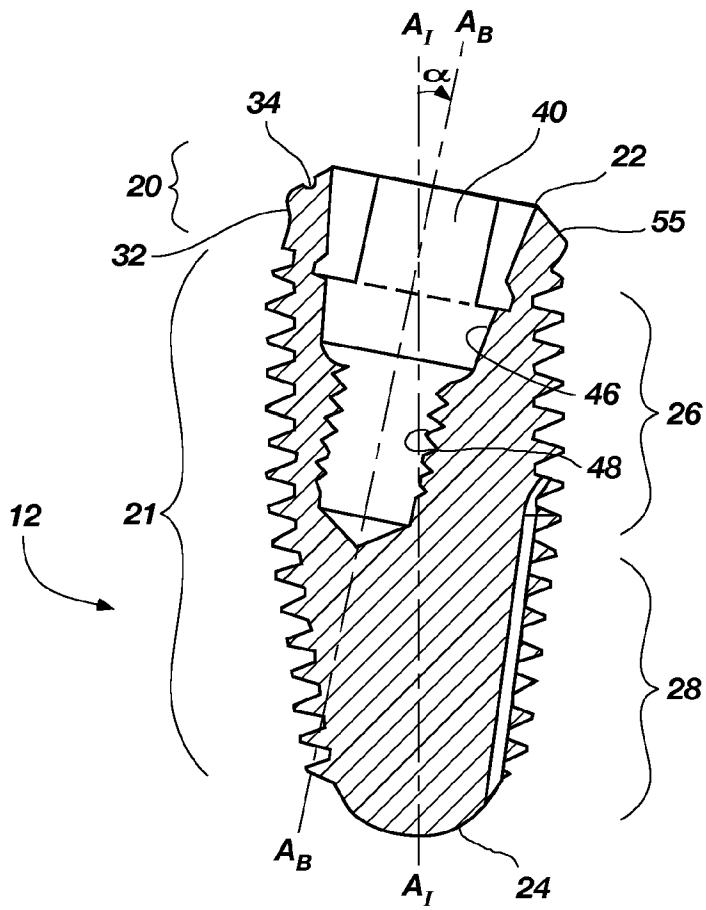
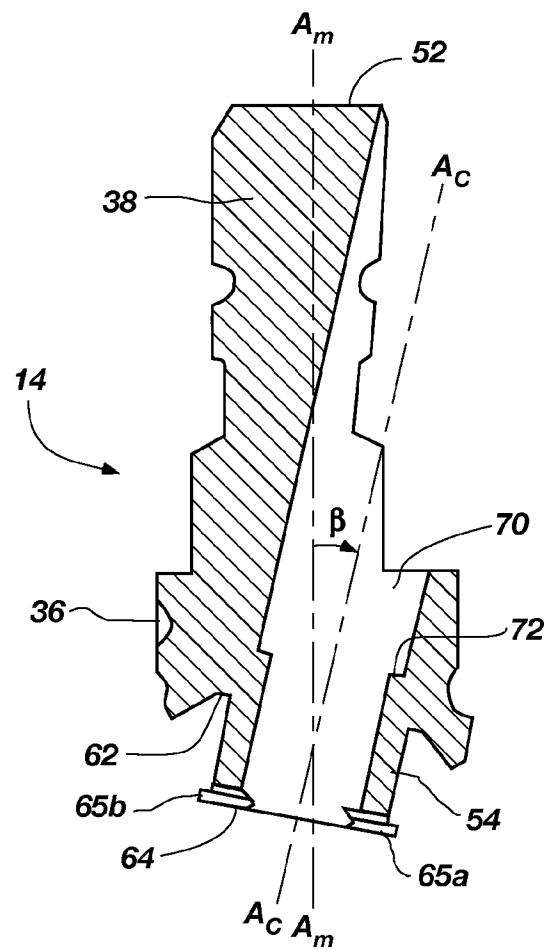
**FIG. 3**

FIG. 4

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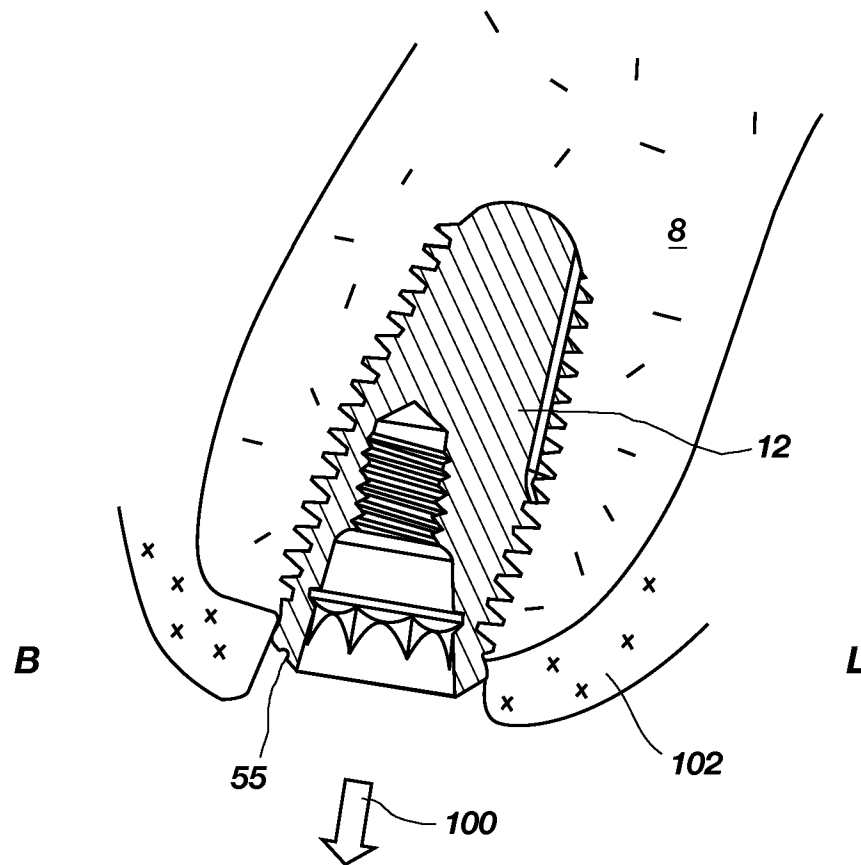
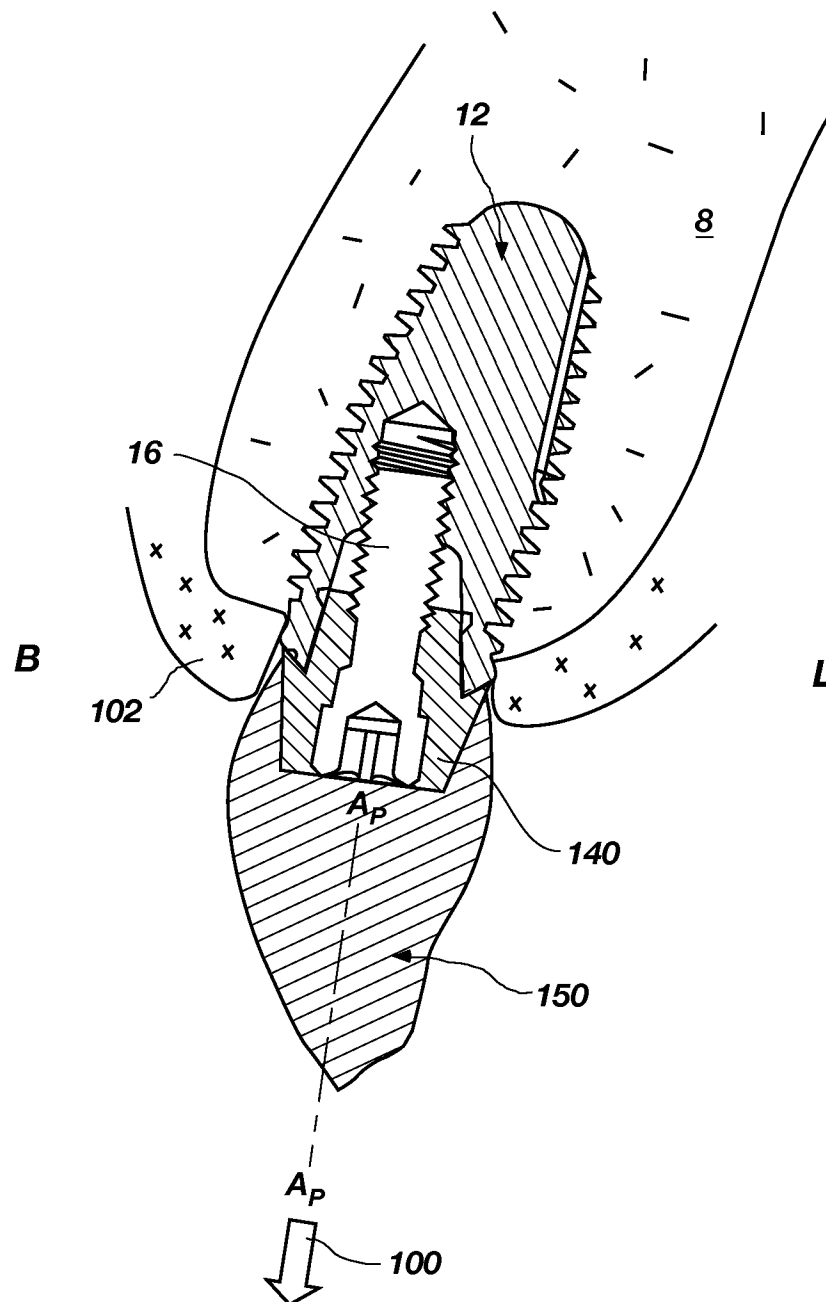


FIG. 5

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**FIG. 6**

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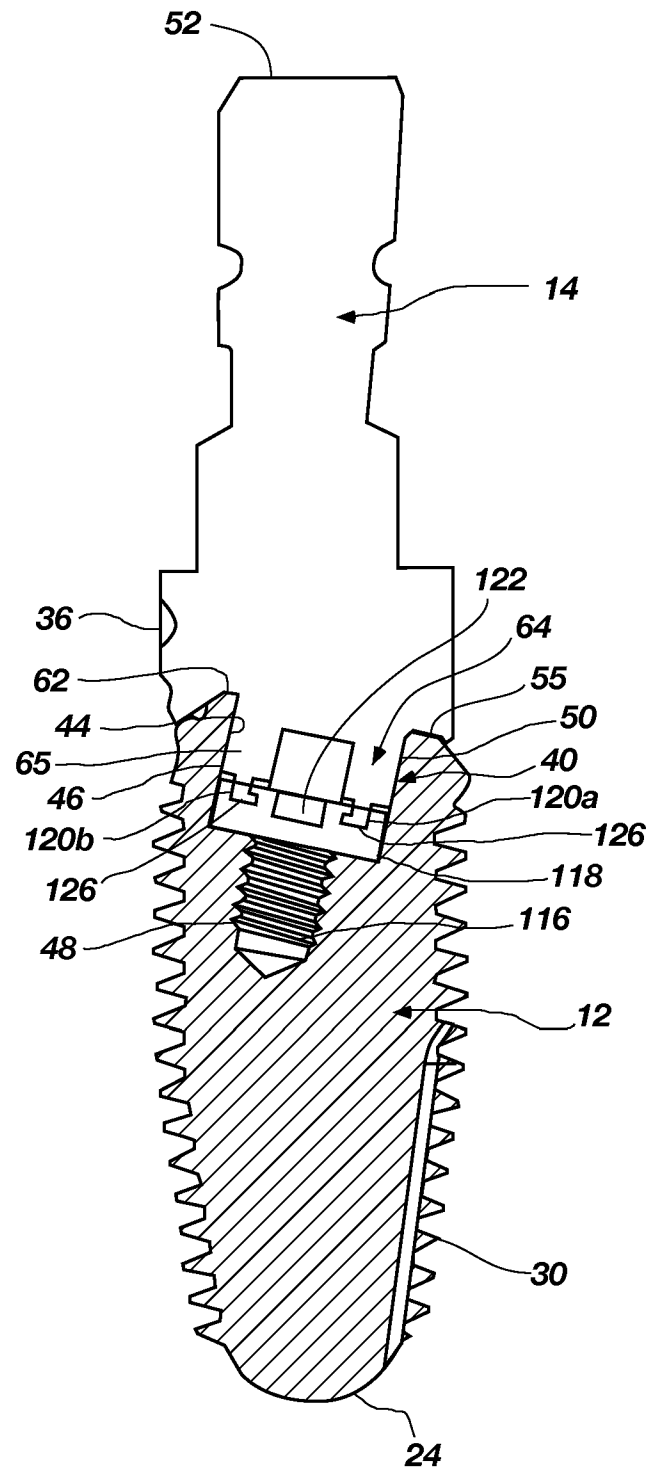


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 08/66455

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A61C 8/00 (2008.04)

USPC - 433/173

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

PC(8) - A61C 8/00 (2008.04)

USPC - 433/173

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

433/25, 167, 173, 174, 175

206/63.5, 438

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PubWEST(USPT,PGPB,EPAB,JPAB); Google Scholar;

Search Terms Used: dental implant, dental prosthesis, angle\$, inclined, bore, channel, hole, retaining screw, indicator, rotate, mark, frangible

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,312,253 A (CHALIFOUX et al.) 17 May 1994 (17.05.1994) Entire document, especially abstract, col 2, ln 30-60, col 6, ln 8-50, col 9, ln 38-67 and FIGS. 10, 41-44 & 51-54	1-28
Y	US 5,362,235 A (DAFTARY) 08 November 1998 (08.11.1998) Entire document, especially abstract, col 14, 23-30, col 15, ln 1-8 and FIG. 23.	1-28
Y	US 4,872,840 A (BORI) 10 October 1989 (10.10.1989) Abstract, col 17, ln 29-34 and FIG. 9A.	3, 14 and 24
Y	US 2004/0101808 A1 (PORTER et al.) 27 May 2004 (27.05.2004) abstract and para[0066].	17 and 27

☐ Further documents are listed in the continuation of Box C.


* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

12 October 2008 (12.10.2008)

Date of mailing of the international search report

31 OCT 2008

Name and mailing address of the ISA/US

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