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May 14, 2026

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Appl. No. : Confirmation No.

Applicant : Kofford, Brandon Dale and Rudisill, Charles Albert

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Customer No. : 112823

Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Miscellaneous Incoming Letter

Remarks begin on page 2 of this paper.

Remarks

The accompanying application incorporates amendments to the specification and drawings entered during the prosecution of pending application US18/424,696 to which it claims priority.

Respectfully submitted,

By /Daniel John Whittle/

Daniel John Whittle

Reg. No. 54,537

Application Data Sheet 37 CFR 1.76

The Application Data Sheet is part of the provisional or non-provisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.

Inventor Information

of inventors: 2

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Application Information

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Title of invention **Screw-attached Pick-up Dental Coping System and Methods**

Attorney docket number **SDC013**

Entity status Small

Application type Nonprovisional Application under 35 USC 111(a)

Subject matter Utility

Total number of drawing sheets 26

Suggested figure for publication 75

Filing by reference No

Publication request **REQUEST NOT TO PUBLISH** under 35 U.S.C. 122(b)



I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information

of representatives: 0

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).



Data was not provided for this section.

Domestic Benefit/National Stage Information

of benefit claims: 7

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c), 386(c), or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior app status	Pending
Application number	---
Continuity type	Continuation of
Prior app number	18424696
Filing Date	01/26/2024

Prior app status	Patented
Application number	---
Continuity type	Continuation of
Prior app number	18328730
Filing Date	06/03/2023
Patent number	11937992

Prior app status	Pending
Application number	---
Continuity type	Continuation of
Prior app number	17691108
Filing Date	03/09/2022

Prior app status	Patented
Application number	---
Continuity type	Continuation of
Prior app number	16596361
Filing Date	10/08/2019
Patent number	11311354

Prior app status	Expired
Application number	---
Continuity type	Claims benefit of provisional

Prior app number **62742942**
Filing Date 10/09/2018

Prior app status Expired
Application number ---
Continuity type **Claims benefit of provisional**
Prior app number **62774402**
Filing Date 12/03/2018

Prior app status Expired
Application number ---
Continuity type **Claims benefit of provisional**
Prior app number **62818082**
Filing Date 03/13/2019

Foreign Priority Information

of foreign priority claims: 0

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the Application Data Sheet constitutes the claim for priority as required by 35 U.S.C. 119 (b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).



Data was not provided for this section.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

Checking this box will cause the application to be examined under the first inventor to file provisions of the AIA.

☐

This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 2016, 2013, will be examined under the first inventor to file provisions of the AIA.

Authorization or Opt-Out of Authorization to Permit Access

When this Application Data Sheet is properly signed and filled with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE:

This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

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- Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h) (1).
- A.

Search Results from U.S. Application to EPO

- Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).
- B.
- The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

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Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant



- B. patent application. If this box is checked, the USPTO will not be providing the EPO with the search results from the instant application.

NOTE:

Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Applicant Information

of applicants: 0

The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46.



Data was not provided for this section.

Assignee Information including Non-Applicant Assignee Information

of assignees: 0

An assignee-applicant identified in the "Applicant" section will appear on the patent application as an applicant.

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.



Data was not provided for this section.

Signature

NOTE:

This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c)**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See CFR 1.4(d) for the manner of making signatures and certifications.

Signature	First name	Last name	Registration #	Date
/Daniel John Whittle/	Daniel	Whittle	54537	09/06/2024

SCREW-ATTACHED PICK-UP DENTAL COPING SYSTEMS AND METHODS**ABSTRACT**

A temporary alignment system and method for holding a dental coping to an implant abutment using the same threads in the abutment that are used for definitive attachment are disclosed. The disclosed temporary fasteners initially orient and hold a coping against an abutment with a force along the same axis as the semi-definitive screw. The aligned coping can be picked-up in a closed-tray impression process without unscrewing the temporary fastener. Embodiments include threaded posts that release copings from the abutment through axial forces. Some embodiments include a threaded post with separable cap that is picked-up with the coping. Methods for converting an existing prosthesis for screw attachment to implants in a single visit and digital capture of the converted prosthesis are described.

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of US Patent Application 18/424,696, filed on January 26, 2024, which is a continuation of US Patent Application 18/328,730, filed on June 3, 2023, and issued as US Patent 11,937,992, which is a continuation of US Patent Application 17/691,108, filed on March 9, 2022, which is a continuation of US Patent Application 16/596,361, filed on October 8, 2019, and issued as US Patent 11,311,354 on April 26, 2022. This disclosure claims priority of US provisional patent application number 62/742,942, filed on October 9, 2018, and US provisional patent application number 62/774,402, filed on December 3, 2018, and US provisional patent application number 62/818,082, filed on March 13, 2019. All of the above non-provisional and provisional applications are incorporated herein by reference in their entirety.

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BACKGROUND OF THE INVENTION

[0002] Different systems have been introduced for attaching dental prostheses to dental implants to replace one or more natural teeth. In order to simplify future modification or replacement needs, it is desirable to have reversable attachment between the implants and prostheses using mechanical systems as opposed to directly bonding these components together. These systems require features to provide both proper alignment and retention for acceptable use by the patient. Intermediate components such as copings and separable abutments having different lengths or orientations are often employed to provide proper registration between a dental prosthesis, one or more implants embedded in the patient's jawbone, and the soft-tissue and any remaining natural teeth. These intermediate elements may be mutually attached with screws or with ball-and-socket or other forms of snap-on mounts. In the case of a single-tooth

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crown attachment, the coping and abutment surfaces preferably include features to remove rotational symmetry in the mating of the abutment and coping surfaces. Rotational locking features may also be included in these single mount systems. When the prosthesis contains multiple copings for attachment to multiple abutments, this rotational fixation is not generally required. For example, 30-degree tapered mating surfaces for multiple interface locations are sufficient to provide complete registration.

[0003] It is common to attach a complete upper or lower denture to four or more implants. The multi-unit abutment system interfaces with mating surfaces of the final prosthetic. In some cases, these dentures may be designed or fabricated from scratch following the pulling of undesirable teeth and mounting of implants. In other cases, no teeth are pulled, but it is desirable to convert an existing removable denture to definitive mounting to new implants. In some cases, it is preferable to convert these existing dentures shortly after the implants are placed. This chair-side processing decreases patient discomfort by providing at least temporary dentures more quickly.

[0004] Dental impressions are often used to provide information on the location of implants, soft tissue and existing teeth for designing new prostheses or mounting copings in existing dentures for implant attachment conversion. Generally, the copings are mounted to implant abutments and an impression is made to provide location information for the prosthesis through the copings. Impression material is introduced and cured around the copings to define their position. In the case of transfer copings, less rigid impression material is used to form a cavity for each coping; the coping remains attached to the abutment and the cured impression is removed. Subsequently, copings are inserted into the impression. In the case of pick-up copings, the coping is directly retained in the impression material after curing. That is, the copings are picked-up when the impression is removed from the mouth. The resulting alignment of pick-up copings is generally superior to transfer copings as a result of the direct transfer of coping location information. Transfer copings introduce an indirect secondary alignment reference since the insertion of the coping into the impression may not accurately duplicate the original position, particularly in insertion depth.

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[0005] Pick-up copings can be used with either an open tray or a closed tray protocol. For snap-on systems, a closed impression tray pick-up technique may be done. The tray can be closed because there is no need to access the copings in order to disconnect them after the impression material sets. However, it is desirable to ensure that the assembly of snap-on copings can be removed without patient discomfort. The amount of force required to remove the tray or converted prosthesis depends upon the total number of implant abutment/coping sets and their position and mutual alignment. Some snap-on systems provide features to provide different retention levels, but this complicates the installation process. Special tools have been introduced to help separate impression trays or prostheses with snap-on systems but may still result in patient discomfort. Since snap-on systems are generally physically larger than dental screws, converting an existing denture may require large clearance cavities to be bored into the existing denture before it can be used as an impression tray in a pick-up coping process. These large holes may significantly reduce the mechanical stability of the existing denture. The mechanical precision required of snap-on system elements generally makes them more expensive than screw-attached systems.

[0006] The simplicity of screw-attached systems provides some benefits over snap-on systems beyond fabrication cost. The mounting pressure between the coping and abutment is readily controlled through the torque applied to the screw to tighten it. This axial tension control and the self-aligning characteristics of engaged screw threads provides more certainty in the engagement force and relative orientation of the components. Even if a screw breaks, techniques are known for removing the pieces without damage to surrounding components. Screws also have a benefit of independence for removal since each coping can be loosened individually. Tilting the prosthesis after screw removal to disengage one coping cannot cause reengagement of another coping.

[0007] A disadvantage with commercially available screw-attachment systems for pick-up copings is the requirement for using an open-tray impression in order to release the coping from the abutment after the impression material sets. By having an opening in the tray or existing denture, impression screws may be used. These impression screws

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extend through the tray beyond the impression material and can be unscrewed after the material sets. The impression screws use the same abutment threads as the semi-permanent screws used to attach the prosthesis later. As a result, the introduction of alignment uncertainty through a secondary reference may be avoided or minimized. The copings used with the impression screws are often relatively long and require modification for denture conversion. This customization may result in larger clearance holes in dentures and require additional process time by the dental practitioner. The length of the impression screws sticking through the tray can cause patient discomfort and a gag reflex. In the case of denture conversion, clearance for a set of impression screws at different angles may require additional material removal leading to a weakened denture. A schematic representation of the larger through-holes 136 required using conventional denture conversion processes for screw attachment are illustrated in FIGS. 93-94. The impression screws can also prevent the patient from applying bite pressure during the pick-up process to ensure proper registration of the modified denture and opposing teeth.

[0008] Prosthetic dentistry has rapidly moved into the realm of digital design and manufacturing. Typically, this requires that a digital model is created from a physical model or impression to allow digital design and manufacturing techniques to produce a physical prosthetic that can be delivered to a patient for restoration of dental and oral structures. When making a dental restoration with implants in this manner, an implant impression coping is often used in the mouth to reference the position of the implant geometry relative to surrounding structures such as gingiva, adjacent teeth, opposing teeth, etc. Once removed from the mouth, an implant analog is attached to the impression coping that was picked-up or transferred. With the lab implant analog attached to the impression coping in the elastomeric impression, dental stone is flowed into the impression and allowed to harden before separation from the impression with a resultant dental cast. A scan flag is attached to the lab analog on the dental stone model and is scanned in by laser or optical scanning technology. The scan flag is used for design software to reference and replicate the accurate positioning of the virtual implant relative to the adjacent teeth, gingiva and opposing tooth, as well as the timing of the implant and other pertinent implant geometries. Once the virtual implant is accurately brought into the design software, a prosthetic can be designed by following

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the workflow in the design software. A completed design is post-processed, and a CAD file is used in CAM software to direct either the 3-D printing or milling of the designed prosthesis. The manufactured prosthesis is verified on the physical model in a remote prosthetic manufacturing lab prior to delivery to the dentist or is verified directly on the dental patient if the prosthesis was manufactured in the local dental clinic. It is currently the standard of care to verify the fit, form, and function on a physical model.

[0009] Recently, an impression scan flag was introduced to the market for a few major implant systems and the most common multi-unit geometry. This scan flag allows for an impression to be digitized without the creation of a stone model. A digital model is created directly from the elastomeric impression, a prosthesis is designed digitally and processed with CAM software and both a 3-D printed model and 3-D printed or milled prosthesis is finished and tested on the 3-D printed model. The disadvantage of the 3-D printed model for full arch implant prosthetics is the positioning of the implant lab analog within the 3-D printed model introduces a degree of inaccuracy. Additionally, an impression only captures the implant or multi-unit abutment relative to the tissues and requires cumbersome steps to incorporate a provisional prosthesis or wax-up into the design software relative to the scan of the impression.

[0010] A properly converted denture provides a valuable source of information of the relative location of the implant and its abutment surfaces, copings and soft tissue and any remaining teeth of the patient. It can be used as a model for digital scanning to produce a duplicate denture if needed in the future or as a starting digital model for manipulation to improve aesthetics or other characteristics. However, if the mechanical integrity of the converted denture is compromised, the scanned information may not faithfully represent the relative geometry of these elements and result in a poor fit.

[0011] Other alignment systems have been proposed which use silicone or melting screw threads to allow closed tray transfer for definitive screw attachment, but the practicality of providing adequate alignment and seating forces with a screw diameter in the range of existing systems or overcoming the lack of disengagement independence

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required in melting all threads simultaneously without patient discomfort has not been documented. Details on removing any residual material in the abutment threads or in the prosthesis after the pick-up process have not been disclosed. Other hybrid systems that use a snap-on engagement for the pick-up coping during transfer and subsequent screw-attachment have also been proposed, but detailed information on the tradeoffs in precision and associated complexity or size required for equivalent performance to open-tray impression screw techniques have not been disclosed. A general need exists for systems that improve clinical efficiency, implant to prosthesis alignment accuracy, application to a wide range of coping designs and sources and patient comfort over existing systems.

[0012] The present disclosure includes systems and methods that address one or more of these issues in the prior art.

BRIEF SUMMARY OF THE INVENTION

[0013] Some embodiments of the invention include a screw-in fastener system used to temporarily retain a coping on an abutment during bonding of the coping into a blind hole located in the tissue-side of a removable dental element such as a removable complete denture. The temporary fastener system disclosed has features to allow easy removal of the dental prosthesis from the fastener post after pick-up of the coping into the dental prosthesis is complete, without the need for special tools or access to the fastener system to unscrew it.

[0014] Some embodiments include a temporary fastener with a male-threaded bottom portion that is installed into the screw threads of an abutment, and an axially separable top portion, or cap, that retains the coping onto the abutment. The separable portion allows removal of the coping picked-up in the dental prosthesis without requiring mechanical access to the fastener. The inventive concepts disclosed facilitate easier installation and removal on multiple abutments that may be oriented at different compound angles when compared to the conventional open-tray processes and long impression screws. The temporary fastener may engage the same screw threads of the

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abutment that are used to definitively attach the prosthesis. In this manner, the coping is held against the abutment for the pick-up process with a force oriented identically to that of the final screw mounting. The retention of the cap on the screw post can be designed to provide a desired force holding the coping to the abutment through the applied torque on the temporary fastener. The cap can be attached to the post through a combination of known mechanical attachment means including but not limited to interference fits, adhesives, snap fits or other elastic and inelastically deforming retention elements. The cap may also be formed as an integral part of the screw post that has portions that fracture as a result of an applied axial force. In addition to applied axial forces, the cap may separate from the post as a result of retention changes resulting from chemical or thermal processes and or the application of electromagnetic energy during or subsequent to the pick-up process.

[0015] Other embodiments include a threaded post that has a temporary retention feature that engages the coping without a separable cap. These embodiments engage the abutment threads in mounting the coping but release the coping after bonding to the prosthesis.

[0016] The disclosed systems and methods can be applied to single tooth prostheses with copings and abutments with orientational features or for multiple tooth prostheses using copings and abutments with symmetrical mating surfaces such as 30-degree tapers.

[0017] In some embodiments, the temporary fastener is driven into the abutment threads by a tool that engages the post. In other embodiments, the temporary fastener is driven into the abutment threads by a tool that engages the cap. The drive torque can be designed to be sufficient for holding the coping to the abutment accurately, but less than the torque that would result in movement of the cap relative to the post.

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[0018] In some embodiments, the threaded end of the post portion of the temporary fastener has a deflecting feature that allows the post to engage or disengage the abutment threads through axial motion instead of a rotary screw motion.

[0019] One embodiment describes a system for aligning a dental implant abutment, coping and separable dental element for definitive screw-attachment comprising:

- a. a temporary alignment fastener comprising:
- b. a post having an axis, a first post end and second post end, wherein the first post end is threaded for screw attachment to the implant abutment;
- c. a cap, wherein the cap is attached to the second post end;

[0020] and wherein the temporary alignment screw is configured to hold the coping against the implant abutment when the first post end is screwed into the implant abutment and wherein the cap is separable from the post through a release force directed away from the first post end.

[0021] One embodiment describes a system for aligning a separable dental element for installation to a threaded implant abutment with a definitive screw having a head and threaded shaft portion comprising:

[0022] a coping having a distal end shaped to engage with the implant abutment and a proximal end with an aperture sized to allow the shaft portion of the definitive screw to pass through;

[0023] a temporary screw having a distal end portion adapted to engage the threads of the implant abutment and a proximal end portion having temporary engagement means for attachment adjacent to the proximal end of the coping wherein the temporary screw holds the distal end of the coping in alignment against the implant abutment when the distal end portion of the temporary screw engages the implant abutment threads and wherein the temporary engagement means releases the coping without disengaging the post portion of the temporary screw upon the application of a predetermined axial force in the proximal direction.

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[0024] In some embodiments, an existing removable denture is converted to a screw attached denture by milling pockets to allow copings to be bonded in a pick-up process. In this process, the denture acts in an equivalent manner to a closed impression tray. Proper registration can be confirmed by having the patient bite down on the denture during the pick-up process. After coping pick-up, clearance for the definitive screws can be drilled using the coping as a guide. The converted denture can be used with scan flags to provide a 3-dimensional digital capture. Thus a digital model can be used to make a duplicate prosthesis or as the starting point for a new custom prosthesis.

[0025] One embodiment describes an alignment system for converting an existing denture for screw attachment to threaded implant abutments designed to perform the process of:

- a. mounting pick-up copings to the implant abutments with temporary fasteners,
- b. adhering the copings to cavities formed in the existing denture,
- c. pulling the denture with secured pick-up copings away from the implant abutments,
- d. unscrewing the threaded portions of the temporary fasteners from the implant abutments,
- e. forming definitive screw clearance holes in the denture,
- f. mounting the denture to the implant abutments with definitive screws that engage the same implant abutment threads as the temporary fasteners, wherein the unscrewing the threaded portions of the temporary fasteners and the forming definitive screw clearance holes in the denture may occur in either order.

[0026] For the purposes of this disclosure, a separable dental element is defined to be anything that incorporates one or more dental copings that can be mounted and removed from one or more implant abutments. Different coping designs are known in the dental industry, and the systems and methods disclosed here can be adapted to work with many commercially available types of copings including pick-up copings, temporary cylinders, inserts and impression copings. Implant abutments are known in

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the dental industry having compatible interfaces to these copings. Since the mechanical interface is the same, for the purposes of this disclosure, implant abutment is considered a generic term that includes abutment analogs. Description of alignment systems and process methods with copings and implant abutments that are installed in a patient's jaw should be considered to also describe equivalent inventive concepts that may be used with copings and implant abutment analogs in a dental lab. The inventive concepts disclosed herein can be used with different types of separable dental elements. The separable dental element can be any form of impression used in a dental lab to assist in creating and testing dental prostheses. A separable dental element can also be a dental prosthesis fabricated in the dental lab using a physical model made from the impression, a dental prosthesis newly fabricated, or an existing prosthesis being converted for screw attachment. A dental prosthesis is defined to include a single-tooth appliance such as a crown, or any multiple-tooth bridge or denture. These prostheses may incorporate copings to provide a separable interface to provide orientation with an appropriate abutment attached to a patient's jaw or gingiva. The abutments for use with the inventive concepts disclosed herein include screw threads to mount the prosthesis with copings onto the abutments. While the concepts describe female threads in the abutment mating with male threads on a mounting screw, this is for convenience in disclosure. The inventive concepts could be applied with systems having male threads in the abutment engaging a screw with female threads for mounting the prosthesis. These are considered to be straightforward variations of the inventive concepts.

[0027] For the purposes of this disclosure, the abutments may be integral to the implants embedded into the patient's jaw or gingiva, or they may be separate units that are attached to the implants. The inventive concepts disclosed apply to both configurations.

[0028] For the purposes of this disclosure, an existing denture should be interpreted broadly to include any prosthesis that has been created prior to the use of the innovative systems and methods disclosed. An existing denture may be a loose denture that was worn by the patient prior to the installation of implants were installed, or it may be a new denture that is in the process of first fitting in the patient's mouth.

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[0029] The systems and methods disclosed herein can be used with prostheses for attachment to both the upper and lower jaw. As a result, portions of the system that are oriented downward for the lower jaw will be oriented upward for the upper jaw and vice versa. For convenience, a disclosure of an embodiment of inventive concepts that is limited to a single jaw orientation, is considered to disclose an embodiment for the opposite jaw orientation. When referring to the perspective of a clinician, proximal portions are nearer to the clinician than distal portions. While a term such as top is the opposite of the term bottom, and proximal is the opposite of distal, their actual relative orientation will be determined by the context of their use. The term tissue-side is used interchangeably with intaglio to indicate the side of a prosthesis that is opposite the occlusal or cameo surface.

[0030] The inventive systems disclosed are beneficially applicable to screw-attached prostheses. Key benefits of screw-attachment are variable tightening torques and reversibility. The terms permanent, semi-permanent, definitive and final when referring to screw-attachment are used interchangeably in this disclosure. A conventional screw that is definitively attached can still be removed by accessing the screw and rotating it in the opposite direction that was used for attachment. For the purposes of screw-attached prostheses for this disclosure, the attachment is semi-permanent, permanent or definitive in the sense that frequent attachment and removal is not anticipated for normal use. In contrast, the temporary screw attachment is applied for a planned process duration or other anticipated interval. Removal of a semi-permanent or definitive screw is generally motivated by a problem or an opportunity for an improvement. Access to the screw to apply a tool for removal may require removal of material covering the screw for aesthetic reasons.

[0031] Other terms in the specification and claims of this application should be interpreted using generally accepted, common meanings qualified by any contextual language where they are used. The terms "a" or "an", as used herein, are defined as

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one or as more than one. The term "plurality", as used herein, is defined as two or as more than two. The term "another", as used herein, is defined as at least a second or more. The terms "including" and/or "having", as used herein, are defined as comprising (i.e., open language). The term "coupled", as used herein, is defined as connected, although not necessarily directly, and not necessarily mechanically. The terms "about" and "essentially" mean ± 10 percent. Reference throughout this document to "one embodiment", "certain embodiments", and "an embodiment" or similar terms means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, the appearances of such phrases or in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments without limitation. The term "or" as used herein is to be interpreted as an inclusive or meaning any one or any combination. Therefore, "A, B or C" means any of the following: "A; B; C; A and B; A and C; B and C; A, B and C". An exception to this definition will occur only when a combination of elements, functions, steps or acts are in some way inherently mutually exclusive.

[0032] The drawings featured in the figures are for the purpose of illustrating certain convenient embodiments of the present invention and are not to be considered as limitation thereto. The term "means" preceding a present participle of an operation indicates a desired function for which there is one or more embodiments, i.e., one or more methods, devices, or apparatuses for achieving the desired function and that one skilled in the art could select from these or their equivalent in view of the disclosure herein and use of the term "means" is not intended to be limiting. Other objects, features, embodiments and/or advantages of the invention will be apparent from the following specification taken in conjunction with the following drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

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- [0033] FIG. 1 is a top exploded isometric view of a first embodiment of a system for aligning a dental implant abutment, coping and prosthesis for definitive screw-attachment.
- [0034] FIG. 2 is a side plan view of a first embodiment of a system for aligning a dental implant abutment, coping and prosthesis for definitive screw-attachment.
- [0035] FIG. 3 is a top plan view of a first embodiment of a system for aligning a dental implant abutment, coping and prosthesis for definitive screw-attachment.
- [0036] FIG. 4 is a side cross-sectional view of the system for aligning a dental implant abutment, coping and prosthesis for definitive screw-attachment along the line indicated in FIG. 3.
- [0037] FIG. 5 is a side cross-sectional view of the embodiment of FIG. 4 attached to the jaw and prosthesis prior to the pick-up process.
- [0038] FIG. 6 is a side cross-sectional view of the embodiment of FIG. 5 after the pick-up process.
- [0039] FIG. 7 is a side cross-sectional view of the embodiment of FIG. 6 showing a drill bit creating a pilot hole for a definitive screw.
- [0040] FIG. 8 is a side cross-sectional view of the embodiment of FIG. 7 showing a stepped drill bit creating a clearance for the head and shaft of a definitive screw.
- [0041] FIG. 9 is side cross-sectional view of the embodiment of FIG. 8 showing the definitive screw holding the prosthesis to the implant.
- [0042] FIG. 10 is an exploded top isometric view of a second embodiment of a system for aligning a dental implant abutment, coping and prosthesis for definitive screw-attachment illustrating a single abutment and a temporary screw with breakaway tool.
- [0043] FIG. 11 is an exploded side isometric view of the second embodiment of FIG. 10 prior to installation to the implant abutment.
- [0044] FIG. 12 is an exploded side isometric view of the embodiment of FIG. 10 with the breakaway tool pushed onto the post and the coping placed on the implant abutment.
- [0045] FIG. 13 is an exploded side isometric view of the embodiment of FIG. 10 schematically showing the tool being rotated to screw the post into the implant abutment.

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- [0046] FIG. 14 is an exploded side isometric view of the embodiment of FIG. 10 schematically showing the tool breaking away from the cap after the coping is secured on the abutment.
- [0047] FIG. 15 is an exploded side isometric view of the embodiment of FIG. 10 schematically showing the prosthesis being marked for positioning a clearance hole.
- [0048] FIG. 16 is a side isometric view of the marked prosthesis from FIG. 15.
- [0049] FIG. 17 is a side isometric view of the marked prosthesis from FIG. 16 with blind clearance hole and boring tool.
- [0050] FIG. 18 is an exploded side isometric view of the prepared embodiment of FIG. 17 as adhesive is schematically applied to the coping fixed to the abutment with the temporary screw.
- [0051] FIG. 19 is a side view of the prosthesis in position for curing of the adhesive applied in FIG. 18.
- [0052] FIG. 20 is a bottom side isometric exploded view of the coping incorporated in FIG. 19 being picked up as the prosthesis is removed from the implant abutment.
- [0053] FIG. 21 is a top side isometric view schematically showing the post of the temporary screw being unscrewed from the implant abutment.
- [0054] FIG. 22 is a top side isometric view of the implant abutment prepared for attachment of a prosthesis with a definitive screw.
- [0055] FIG. 23 is a bottom isometric view of the prosthesis with picked-up coping from FIG. 20 being drilled from the bottom to provide clearance for the threaded shaft of a definitive screw following coping pick-up.
- [0056] FIG. 24 is a top isometric view of the prosthesis with picked-up coping from FIG. 20 with a drill applied from the top to provide clearance for the definitive screw head.
- [0057] FIG. 25 is top exploded isometric view of the prepared prosthesis from FIG. 24 with the definitive screw.
- [0058] FIG. 26 is a top isometric view of the prepared prosthesis from FIG. 24 after attachment to the implant abutment with the definitive screw.

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- [0059] FIG. 27 is a schematic description of a process for aligning dental implant abutments, copings and a prosthesis for definitive screw-attachment.
- [0060] FIG. 28 is an exploded bottom isometric view of a third embodiment of a system for aligning a dental implant abutment, coping and prosthesis for definitive screw-attachment with tool oriented for assembly.
- [0061] FIG. 29 is an assembled bottom isometric view of the embodiment of FIG. 28 with temporary screw and coping inserted into tool.
- [0062] FIG. 30 is a side view of the system of FIG. 29 after assembly with the implant abutment.
- [0063] FIG. 31 is a cross-sectional view of the assembly of FIG. 30 along C-C.
- [0064] FIG. 32 is a side view of the assembly of FIG. 28 after the pick-up process showing the removal end of the tool engaging the retained temporary screw post.
- [0065] FIG. 33 is a cross-sectional of the assembly of FIG. 32 along D-D.
- [0066] FIG. 34 is an exploded isometric view of another embodiment of a temporary screw of a system for aligning a dental implant abutment, coping and prosthesis for definitive screw-attachment.
- [0067] FIG. 35 is an isometric view of the temporary screw of FIG. 34 from the screw thread end.
- [0068] FIG. 36 is an isometric view of the temporary screw of FIG. 34 from the cap end.
- [0069] FIG. 37 is a bottom isometric view of a jaw with multiple abutments in preparation of marking a prosthesis as part of the process for aligning a dental implant abutment, coping and prosthesis for definitive screw-attachment.
- [0070] FIG. 38 is a top isometric view of the prosthesis of FIG. 37 showing abutment location markings.
- [0071] FIG. 39 is a top isometric view of the prosthesis with clearances milled to receive copings for pick-up.
- [0072] FIG. 40 is a bottom isometric view showing installed copings and the assembly of a coping to an implant abutment with a temporary screw and torque driver.

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[0073] FIG. 41 is a top isometric view showing adhesive being dispensed in recesses of the prosthesis.

[0074] FIG. 42 is a bottom isometric view of the abutments with attached copings in the process of being positioned into the recesses of the prosthesis after adhesive is dispensed.

[0075] FIG. 43 is a top isometric view of the copings attached to the prosthesis after adhesive curing and pick-up.

[0076] FIG. 44 is a bottom isometric view showing the removal of temporary screw posts from the implant abutments after the pick-up process.

[0077] FIG. 45 is a top view of a drill in position to create a pilot hole in the prosthesis of FIG. 43.

[0078] FIG. 46 is bottom view showing the pilot holes from the process of FIG. 45 extending through the prosthesis to exit on the occlusion side.

[0079] FIG. 47 is a bottom isometric view showing a counterbore positioned on the occlusion side of the prosthesis to provide clearance for the definitive screw.

[0080] FIG. 48 is a bottom isometric view illustrating a reamer positioned to clean residue from the bore.

[0081] FIG. 49 is a bottom isometric view of the prepared prosthesis with definitive mounting screws prior to fastening to the abutments.

[0082] FIG. 50 is a top isometric view corresponding to FIG. 49.

[0083] FIG. 51 is a top isometric view of an embodiment of a component suitable for use as a scan flag for digital capture and a laboratory analog for physical model creation.

[0084] FIG. 52 is a bottom isometric view of the component from FIG. 51.

[0085] FIG. 53 is a bottom isometric view showing the component of FIG. 51 positioned for screw attachment to the converted prosthesis of FIG. 49.

[0086] FIG. 54 is a top isometric view of FIG. 53.

[0087] FIG. 55 is a top isometric view showing the assembly of FIG. 54 mounted on a stand in preparation for scanning.

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- [0088] FIG. 56 is a side view of FIG. 55.
- [0089] FIG. 57 is an isometric view of the assembly of FIG. 54 with reinforcing bars mounted prior to pouring of dental stone.
- [0090] FIG. 58 is a schematic flow chart illustrating options for creating and attaching a permanent prosthesis.
- [0091] FIG. 59 is an exploded isometric view of the torque driver shown in FIG. 40.
- [0092] FIG. 60 is a top isometric view of the torque driver of FIG. 59 partially assembled.
- [0093] FIG. 61 is a top isometric view of the post removal tool shown in FIG. 44.
- [0094] FIG. 62 is a top isometric view of an embodiment of a temporary screw similar to FIG. 1 schematically illustrating axial motion of the cap away from the post threads from screwing after the coping contacts the abutment.
- [0095] FIG. 63 is a top isometric view of the embodiment of FIG. 62 in which the temporary screw post end has become flush with the top of the cap.
- [0096] FIG. 64 is a top isometric view of a temporary screw post embodiment having a cylindrical stem.
- [0097] FIG. 65 is a top isometric view of a split temporary screw post embodiment having deflecting sections.
- [0098] FIG. 66 is an isometric view of a temporary screw post embodiment having symmetric axial splines.
- [0099] FIG. 67 is an isometric view of a temporary screw post embodiment having a weakened portion facilitating lateral movement during pick-up.
- [0100] FIG. 68 is a bottom isometric view of a temporary screw embodiment having a spring cap.
- [0101] FIG. 69 is a bottom isometric view of a one-piece temporary screw embodiment designed to fracture under axial loading.
- [0102] FIG. 70 is a cross-sectional view of a temporary screw embodiment incorporating a rounded interface between cap and post facilitating pivotal movement as illustrated.

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- [0103] FIG. 71 is a cross-sectional view of a temporary screw embodiment incorporating a restricted interface between cap and post facilitating pivotal movement and protective film.
- [0104] FIG. 72 is a cross-sectional view of a temporary screw embodiment incorporating a spring cap with preferential axial movement in the pick-up direction.
- [0105] FIG. 73 is a cross-sectional view of a temporary screw embodiment incorporating a laminar cap fixed to the end of the post.
- [0106] FIG. 74 is a cross-sectional view of a temporary screw embodiment incorporating a compliant interface between the cap and post.
- [0107] FIG. 75 is a cross-sectional view of a temporary screw embodiment incorporating a split post that has deflecting sections with screw threads shaped to facilitate axial separation without unscrewing the post threads.
- [0108] FIG. 76 is a cross-sectional view of a temporary screw embodiment incorporating an interface material between the cap and post.
- [0109] FIG. 77 is a cross-sectional view of a temporary screw embodiment incorporating an O-ring interface between the cap and post.
- [0110] FIG. 78 is a cross-sectional view of a temporary screw embodiment incorporating a cup-shaped interface material between the cap and post.
- [0111] FIG. 79 is a bottom isometric view of a temporary screw embodiment incorporating a split collar cap.
- [0112] FIG. 80 is a top isometric view of a temporary screw embodiment incorporating a planar spring that flexes when pulled perpendicular to the diameter indicated.
- [0113] FIG. 81 is a top isometric view of a temporary screw embodiment incorporating a planar spring that flexes when pulled parallel perpendicular to the diameter indicated.
- [0114] FIG. 82 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment in which the coping is held by mechanical interference to the proximal end of the threaded post.

- [0115] FIG. 83 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment in which the coping has spring fingers holding the proximal end of the threaded post.
- [0116] FIG. 84 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment in which the coping has collet-type spring fingers holding the proximal end of the threaded post.
- [0117] FIG. 84A is a top view of the embodiment of FIG. 84.
- [0118] FIG. 85 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment in which the proximal end of threaded post has a slotted spring section holding the coping.
- [0119] FIG. 86 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment in which a compressed ring holds the coping to the proximal end of the threaded post.
- [0120] FIG. 87 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment in which a compressed ring with a u-shaped cross-section holds the coping to the proximal end of the threaded post.
- [0121] FIG. 88 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment in which a thin cap fixes the coping to the proximal end of the threaded post.
- [0122] FIG. 89 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment in which a filler material is placed in the bore of the coping at the proximal end of the threaded post.
- [0123] FIG. 90 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment showing a tool engaging features of the coping to screw in the threaded portion of the post.

[0124] FIG. 91 is a bottom isometric view schematically illustrating the material removed from an existing denture necessary with inventive concepts disclosed in preparation for pick-up.

[0125] FIG. 92 is a top isometric view schematically illustrating the material removed from an existing denture necessary with inventive concepts disclosed in preparation for pick-up.

[0126] FIG. 93 is a bottom isometric view schematically illustrating the material removed from an existing denture necessary using prior art impression screw systems.

[0127] FIG. 94 is a top isometric view schematically illustrating the material removed from an existing denture necessary using prior art impression screw systems.

DETAILED DESCRIPTION OF THE INVENTION

[0128] FIG. 1 shows an exploded view of one embodiment of a temporary alignment system 12 for use in a direct coping pick-up process for screw attachment of a prosthesis. Implant abutment 8 has a distal end which may include attachment feature portion 135 illustrated as a screw thread for direct attachment to the patient's jaw and a proximal end with an abutment shaped to accommodate a coping 9. The abutment includes threaded section 18. The coping has a central bore 16 to accommodate screw fastening and may include ridges 17 or other structures or surface treatments to increase retention to the prosthesis with adhesive. The coping and abutment mating surfaces as shown in FIG. 1 are symmetrical. The inventive concepts of this disclosure may also be applied to abutment and coping systems that are keyed to restrict mating orientation. The coping may be mounted onto the abutment through rotation of a temporary adjustment screw comprising a threaded post 10 and cap 11. The cap 11 is mechanically attached to post 10 in a manner that allows relative axial motion with the application of a predetermined force. As illustrated in FIG. 1, cap 11 has a square central bore 13 that is press-fit onto a square portion 14 of post 10. The cap 11 temporarily retains coping 9 onto the implant abutment 8 during the pick-up process of the coping into the prosthesis with a force aligned directly along the same axis as the semi-permanent screw that will be used for definitive prosthesis mounting. The portion of

the post engaging the abutment threads also prevents any pick-up material from contacting the abutment screw threads. After the coping is picked-up into the prosthesis, the cap and coping may be released from the abutment by applying an axial force. In the embodiment shown, the post threads 15 remain engaged with abutment threads 18 after the pick-up process. The post can then be removed from the abutment by unscrewing it. The prosthesis with embedded coping can be subsequently processed to accommodate semi-permanent screw attachment as will be described later.

[0129] FIGS. 2 and 3 show a side and top view of the assembled system of FIG. 1; FIG. 4 shows a cross-sectional view along the axis as indicated. As shown in FIG. 4, matching conical surfaces on the exterior of the implant abutment 8 and the interior of the coping 9 are engaged. In the orientation shown, the coping 9 is pulled into alignment by an axial force from the lower surface 11s of the cap 11 pushing against the upper surface 9s of the coping 9 from screwing the threads of post 10 into the implant abutment 8. As shown, there is a gap 219 between the temporary screw attachment post 10 and the coping 9. As also shown in FIG. 4, the width of the temporary screw cap 11 is greater than the width of the largest portion of the central aperture 16 of the coping 9. The temporary screw cap 11 holds the coping 9 in position on the implant abutment 8. As shown in FIG. 4, the cap-coping interface 210 is located at the proximal end 16p of the central aperture 16. As also shown in FIG. 4, due to the gap 219 and open space 211 between the coping 9 and the temporary screw attachment post 10 facing the implant abutment 8, the only contact between the temporary screw 190 and the coping 9 is between the temporary screw cap 11 and the proximal end of the coping 9 which provides an axial force by torquing the temporary screw 190 into the abutment 8 to hold the coping 9 on the implant abutment 8. The distal end of the abutment may be directly attached to the patient's jaw or attached to a separate implant attached to the jaw. The inventive concepts are not dependent upon the nature of the implant, so the distal end attachment feature 135 is represented schematically.

[0130] The capability for relative axial movement between the cap 11 and temporary attachment post 10 allows separation of the temporary attachment post from the cap without tools after retaining the coping onto the abutment during fitting and bonding of

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the coping into the prosthesis. These parts are accurately aligned during the bonding process since the temporary post engages the abutment threads to provide an axial force holding the coping to the abutment just like the screw used for final attachment.

[0131] The cap may be sized to have an amount of press-fit mechanical interference to the temporary attachment post to provide an axial retention force of approximately 20 to 900 grams, this force being sufficient to retain coping 9 during assembly while allowing relatively easy pick-up removal of the coping and prosthesis from the temporary attachment post after assembly. The temporary attachment post 10 may include indicators (not shown) in the end by the cap 11 to provide intermediate visual and/or tactile feedback on the depth of threaded engagement of the post during screw attachment of the coping to the abutment.

[0132] In this embodiment, screw driving torque is provided by the square cross-section of the cap aperture and temporary attachment post. In the cross-sectional view of FIG. 4, the post 10 has been screwed in so that only a small beveled surface of the post extends above the top of the cap when the post threads bottom out in the abutment. During installation, this optional configuration provides feedback to the dental practitioner when the torque increases as the threads bottom. The square drive tool engagement can also be designed to disengage at a pre-designed minimum extension of the square post above the top of the cap. Alternatively, a tool with a specified maximum torque may be used to ensure engagement of the coping and abutment surfaces.

[0133] The screw driving torque function may be accomplished by engaging other features on the temporary attachment post such as hex or spline or asymmetric features. Alternately, the cap may be used to engage a screwdriver or other tool for torquing. For example, in the case of a cylindrical temporary attachment post top portion, driving torque can be provided by the friction of the press-fit between the cap and temporary attachment post. For example, a medium press-fit of a 3 mm diameter 1 mm thick nylon cap onto a 1.3 mm diameter stainless steel cylindrical rod may produce approximately 500 grams of axial retention force and 17 gram-cm driving torque. A typical screw

thread size for appliances is m1.4 x 0.3. Note that in FIG. 4, the temporary attachment post threads 181 are illustrated making contact with the abutment threads 182 when engaged. The retention/axial force of the cap to the temporary attachment post may be determined by the degree of press-fit and frictional properties between the cap and temporary attachment post, and/or spring features incorporated into the temporary attachment post and/or cap.

[0134] In actual trial installations, polymer caps of approximately 1.2 mm thickness press fit onto posts of approximately 1.4 mm diameter with cylindrical axial bores have been sufficient for installation and pick-up removal of a single prosthesis from multiple implant abutments in which the axes of the screw threads in the implant abutments are not mutually parallel.

[0135] The separable mechanical attachment means may include any combination of techniques, including frictional forces from interference, adhesives, waxes, chemical bonding, solders, elastically or inelastically deformable spring, snap or interlocking structures, thermally or electromagnetically fusible materials, fracturing structures, etc.

[0136] FIG. 5 through FIG. 9 show example cross-sectional views of some of the different stages of installation of the temporary fastener system into a denture. FIG. 5 shows a cross-sectional view of the assembly of the first embodiment during the initial phase of the coping pick-up process. As illustrated, the implant abutment 8 is attached to a schematic implant 70. The implant 70 has an interface 7 (shown schematically) that is attached to the patient's jawbone 22. The coping 9 is held against the implant abutment 8 through the temporary screw comprising the post 10 and cap 11. A blind clearance hole 5 in the prosthesis 3 is sized to accommodate the coping and temporary screw. Pick-up material 171 is positioned in the clearance hole 5 to capture the coping in proper alignment within the prosthesis. The cap-coping interface 210 is positioned at the proximal end 9p of the coping central bore or aperture 16 and, as shown in FIG. 5, blocks pick-up material 171 from entering the coping central aperture 16. After the pick-up material 171 has set up, the prosthesis 3, coping 9 and temporary screw cap 10 are

pulled off as an assembly off the patient's jaw as shown by the arrows in FIG. 6. The coping 9 and cap 11 are released from the implant abutment 8 and post 10, while the threads of the post 10 keep it engaged in the implant abutment 8. The post 10 is subsequently removed to make the abutment threads 18 available for holding the prosthesis in proper alignment with a definitive screw.

[0137] The prosthesis/coping assembly must be processed after the pick-up process for screw attachment. A pilot hole is drilled with bit 172 from the bottom side of the assembly. As shown in FIG. 7, the diameter of the bit may be selected to use the interior bores of the coping and cap to act as guides for hand processing. Alternately, a drill guide may be employed that engages a portion of the interior of the coping to align the pilot hole. The pilot hole provides guidance for a tool to provide clearance for the definitive screw shaft and head. FIG. 8 shows a stepped drill 173 that cuts both clearances in a single process. Alternatively, the shaft and head clearance may be drilled with two drills in two process steps. If desired, the cap 11 of the temporary screw 190 can be fabricated of a material that is easier to drill than the coping material to provide feedback on the drill position. It has been found that it is possible to distinguish where the drill is positioned by feel at the interfaces between the pick-up adhesive and the top of the cap (as shown in FIG. 8) and the bottom of the cap and the top of the coping. Since pick-up material was blocked from entering the coping, drilling resistance decreases rapidly upon breaking through the bottom of the cap and entering the interior channel of the coping. Color differences in the materials can also be detected. Alternatively, a tool can be configured to fit within the bore of the coping to limit the depth of the drill.

[0138] Once clearance hole 174 for the definitive screw has been made from the top of the prosthesis, the prosthesis is ready for mounting to the implant with definitive screw 175 as shown in FIG. 9. The male threads 150 of the definitive screw are shown filling the female threads of the abutment over an engagement depth extending from a first end of the thread engagement 163 to the second end of abutment thread engagement 164 of the implant abutment threading 18. Once the most distal thread of the definitive screw 175 is engaged in an abutment thread, the engagement depth will increase by a

distance equal to the thread pitch for each complete revolution of the definitive screw 175. As shown in FIG. 4, a screw clearance hole 174 is large enough to accommodate the definitive screw head 151. A residual portion 161 of the cap 11 is shown in FIG. 9 for aligning the coping 9 to the prosthesis 3 in the closed tray pick-up process. After the definitive screw 175 is torqued into position, the screw clearance hole 174 in the prosthesis 3 may be filled with Teflon tape and color-matching composite materials for aesthetic purposes. In the illustrated embodiment, the coping bore 16 has a shoulder 152 to engage a flat surface on the underside of the definitive screw head 151 of the definitive screw 175 to pull the coping 9 into proper seating on the implant abutment 8. Alternate configurations are possible without deviating from the temporary screw system for coping pick-up disclosed.

[0139] FIG. 10 is another exploded isometric view of parts of an embodiment of the invention. In this example, cap 11 is integrated into a breakaway installation tool 18. The tool portion 19 may be used to install the temporary attachment post 10, and then section 19 broken away at mechanically weak separation feature 20, for example, when the post bottoms out in the abutment leaving the cap portion 11 in position. Alternatively, the tool can be designed to increase stress on the separation feature as the top of the post moves axially down relative to the weakened section. As illustrated, after the cap portion 11 breaks away from the tool portion 19, drive feature 21 in the tool portion may be used to remove the post 10 after the pick-up process. One or both ends of the tool may be shaped to subsequently engage and remove the temporary attachment post 10 after installation of coping 9 into the denture.

[0140] FIGS. 11-26 provide schematic isometric views of the process steps for using the elements of an exemplary embodiment introduced in FIG. 10 for a single implant system such as a crown. In FIG. 11, a schematic isometric view of a portion of the patient's jaw 22 is shown with an implant 70 (not shown) installed, and implant abutment 8 installed into the implant. The coping 9 is placed onto the implant abutment 8, the top portion of temporary attachment post 10 is assembled onto cap 11. The top portion of temporary attachment post 10 and cap 11 are configured such that there is a means to drive the temporary attachment post into the abutment, while allowing axial movement of the cap

11 relative to the temporary attachment post axis, the cap/temporary attachment post interface having sufficient retention force to keep the coping in place on the abutment during subsequent installation steps, and the temporary attachment post being removable after picking up the coping into the prosthesis. Cap 11 may be attached to a break-away installation/removal tool 18.

[0141] FIG. 12 shows the coping 9 placed on the implant abutment 8 and the cap/tool 18 installed onto temporary attachment post 10. The coping-abutment surfaces may comprise a conical or spherical concave feature on the coping 9 that mates with a complementary feature on the top of the implant abutment 8, as illustrated. Alternatively, keying features may be employed to restrict relative rotational orientation, particularly in the case of single implants.

[0142] FIG. 13 shows the temporary attachment post being threaded into the implant abutment 8, through a clearance hole in the coping 9. The cap abuts the coping to secure the coping to the abutment. The cap 11 is free to move axially along the temporary attachment post with a frictional retaining force of the cap to the temporary attachment post. A known amount of retention force of the coping to abutment is provided by the design and materials used in the cap and temporary attachment post.

[0143] FIG. 14 shows the tool portion of the cap being removed after the cap has broken away; the tool may be used for removal of the temporary attachment post at a later step.

[0144] FIG. 15 shows marking of the position of the coping onto the appliance for drilling a recess for the coping in the prosthesis.

[0145] FIG. 16 shows the prosthesis with coping drilling location marking 23.

[0146] FIG. 17 shows the prosthesis after boring the cavity for the coping; the cavity for the coping may be accurately drilled slightly larger than the coping, without significant unwanted material removal from the prosthesis.

[0147] FIG. 18 shows pick-up material being applied to the coping and/or prosthesis after confirmation of freedom to provide proper occlusion during dry testing. Although not illustrated, the cavity of the prosthesis or the coping may optionally include features to provide venting of excess pick-up material if desired.

[0148] FIG. 19 shows the bonded coping being picked up into the prosthesis

[0149] FIG. 20 shows the prosthesis removed from the temporary attachment post; the temporary attachment post/cap design allows removal of the prosthesis from the temporary attachment post. The coping is now incorporated into the prosthesis.

[0150] FIG. 21 shows the temporary attachment post being removed with the tool portion of the cap.

[0151] FIG. 22 shows the abutment installed in the implant with the temporary attachment post removed.

[0152] FIG. 23 shows drilling a small guide-hole (for example 1-2 mm diameter), through the clearance hole of the coping, into and through the prosthesis. This guide hole provides a small reference hole for enlargement of the hole to accommodate the prosthesis retaining screw.

[0153] FIG. 24 shows enlarging the guide hole to a clearance hole for prosthesis retaining screw, approximately the diameter of the head of the retaining screw (e.g., 1.5-

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2.5 mm). The clearance hole would typically be drilled down to the top surface of the coping.

[0154] FIG. 25 shows the prosthesis being installed onto the implant abutment by placing the prosthesis coping onto the abutment and installing the prosthesis retaining screw.

[0155] FIG. 26 shows the assembled prosthesis on the implant.

[0156] FIG. 27 contains a summary of a generalized process extending the basic process described above for a prosthesis attached to multiple implant abutments.

[0157] Another embodiment of a prosthesis and implant alignment system and tool are shown in FIG. 28. In this case, the cap is in the form of a hex nut 63 that is press fit onto alignment post 62 to act as the temporary alignment screw. The drive tool 64 includes a concave hex socket 68 that fits temporary post nut 63, and coping retaining portion 69 that retains coping 61 with a slight interference fit. Thus, as shown in FIG. 29, the temporary screw comprising nut 63 with post 62 is engaged with the socket portion of the tool, and the coping 61 is retained in the tool. The coping is seated onto the abutment 60 by using the hex portion of the driver to rotate the nut and engage the threads 66 on the temporary screw post 62. FIGS. 30 and 31 show an exterior and cross-sectional view of the mounting of the coping on the abutment with the tool. The tool may also have an integrated feature for removing the post as shown in FIG. 32. For example, FIG. 33 shows a tapering feature 170 on the narrow end of tool 64 which may be used to unscrew the post. FIG. 28 illustrates optional undercut 67 for stronger adhesive locking. Optional anti-rotation flat 65 is shown. Such an anti-rotation flat may be used on mating surfaces in circumstances in which there is a preferred orientation around the axis of the screw threads.

[0158] Another embodiment of the inventive concepts in which the cap of the temporary screw is shaped to engage the driving tool is shown in FIGS. 34-36. Cap 102 is mechanically attached to alignment post 101 at end portion 101A to form temporary alignment screw 100. This mechanical attachment may result from press-fitting a polymeric cap 102 onto a metal post 101 to provide adequate resistance to rotary slip to temporarily attach the coping to the implant abutment while still allowing relative axial movement during the pick-up process. The cap 102 may include a tapered surface 102B shaped to match the mating surface of an associated coping 112. A hexalobular internal (Torx) drive feature is shown in the end of the cap 102, although other bit socket shapes are possible. As previously discussed, other mechanical engagement means besides an interference fit are possible. The post may be made of different materials than these, or even be of unitary construction with weakened sections that fracture or otherwise breakaway under a desired pick-up axial force.

[0159] In a preferred embodiment the post 101 is made from stainless-steel or titanium, and the cap of polymer such as PEEK or acetal. The short length of the post and threaded fastener in this embodiment allows separation at high degrees of angularity of the assembled parts in use. This tolerance for off-axial removal has been found to be particularly advantageous when the prosthesis is to be definitively screw mounted to multiple implant abutments. Testing has verified cap axial release forces of up to about 5 pounds and the application of torque to the cap of about 1.6 inch-ounces without slipping.

[0160] The general process for converting an existing removable denture for definitive screw attachment onto four implants with this embodiment is illustrated in FIGS. 37-50. This prosthesis may be, for example, a removable denture that was used prior to implant surgery or a duplicate of such an existing denture as described in US Provisional Patent Application 62/774,402 incorporated herein in its entirety.

[0161] FIG. 37 shows a schematic representation of a human jaw portion 106 with implant abutments 107 installed. It does not matter for this discussion if the abutments

are separable from the implanted portion of the implant or not. Prosthesis 103 is shown with occlusion side 104 and intaglio side 105. Pick-up marking caps 108 are installed onto abutments 107. The location of implant abutments 107 is marked onto the prosthesis using customary methods by mating the prosthesis with the abutments. FIG. 38 shows the abutment positions 109 marked onto prosthesis 103. FIG. 39 shows the boring of blind holes 110 slightly larger than copings 112 in marked locations with burr tool 111.

[0162] FIG. 40 shows the installation of copings 112 onto abutments 107 using separable fastener assembly 100, and torque driver 113 (described in more detail later). The torque driver 113 prevents over-tightening of temporary screw 100 and possible separation of the cap 102 from the post 101 due to rotary motion. The cap 102 and/or post 101A of each separable fastener 100 may be mechanically captured or adhered to the coping 112, or may be designed to loosely fit into the bore of the coping as illustrated with axial force from tightening the separable fastener holding the copings to the abutments 107. The prosthesis is placed over the mounted copings to ensure proper fit.

[0163] FIG. 41 shows application of acrylic or other adhesive 144 into cavities 110 of prosthesis 103, which is subsequently fitted onto copings 112.

[0164] FIG. 42 shows prosthesis 103 being mated with copings 112. After the adhesive sets, the separable fasteners allow easy removal of the prosthesis from the abutments with the copings incorporated into the prosthesis. The angular tolerance for removing the prosthesis from multiple abutments allows applying pick-up forces sequentially around the edge of the prosthesis to work the caps 102 off the posts 101. The caps 102 remain in the prosthesis with the copings 112, while the posts 101 remain in the abutments.

[0165] FIG. 43 shows the prosthesis with incorporated copings 112 after the pick-up process.

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[0166] FIG. 44 shows the removal of the threaded post 101 from the implant abutment with removal tool 115. This allows the implant abutment threads to be accessible for subsequent definitive screw attachment.

[0167] FIG. 45 shows the drilling of the small pilot hole 117 (e.g., using a drill bit 116 of approximately 1.4 mm diameter), from the intaglio side 105 of the prosthesis out through the occlusion side 104. It has been found that the bore of the coping 112 and the bore of the cap provide adequate guidance for this hole, although a tooling guide could readily be designed to mate with the particular coping used. The pilot hole is drilled completely through the prosthesis to the occlusion side 104 as shown in FIG. 46.

[0168] FIG. 47 shows enlarging of the pilot hole 117 to allow clearance for a prosthetic mounting screw 121. The clearance holes 119 are drilled down to the top of the coping using counterbore drill 118. This requires only a small diameter enlargement (for example, approximately 2.4 mm).

[0169] FIG. 48 shows a step of a final hand reaming with reamer 120 of the coping bore to clean out any debris or remaining material from the cap that would interfere with the definitive screw.

[0170] FIGS. 49 and 50 show the final installation of prosthesis 103 onto abutments 107 using definitive prosthetic screws 121. The screw holes may be subsequently filled to use the modified prosthesis depending upon the anticipated use as a short-term or more permanent prosthesis. This sequence of process steps essentially follows the material provided in FIG. 27.

[0171] Note that in the above procedure very little material is removed from the prosthesis during the coping pick-up installation process. The boring process in FIG. 39

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need only be sufficient to provide clearance for the coping and temporary screw. Angular variation in the axes of the implant abutments does not appreciably increase the size of the cavity boring required in this closed tray process compared to the additional prosthesis material that must be removed with relatively long impression screws and sleeves in a conventional open tray conversion process for definitive screw attachment. FIGS. 91-92 provide a schematic comparison of the size of the recess borings required using the concepts disclosed compared to the prior art conversion process with larger through holes in FIGS. 93-94.

[0172] The converted prosthesis with copings and screw-access channels may also be used as an accurate digital scan model of abutment positioning for creating a new prosthesis. In this embodiment, dual purpose scan flag and lab analogs 122 shown in FIGS. 51-52 may be fastened to the provisional or duplicate prosthesis 103, for example, after the clearance hole cleaning shown in FIG. 48. Features that may be present on the scan-flag/analog include a scan-flag reference portion 123 near the top of the analog, reference scan-flag features such as flats 124, axial and radial retention feature 128, screw attachment 125 for scanning fixture and/or reinforcement wire attachment. The abutment features 126 are specific to various systems commercially available. The figures show a tapered abutment mating surface 126 and female thread 127.

[0173] FIGS. 53-54 show scan flag/analog 122 attached to converted prosthesis 103 with copings 112 using definitive screws 121.

[0174] FIGS. 55-56 show converted prosthesis 103 with scan flags/analog 122 mounted to fixture 130 by attaching one or more scan flags 122 to the base with adjustable means to orient the prosthesis properly for scanning. For illustration an approximate mounting angle of 45 degrees is shown. In this example, the converted prosthesis 103 is mounted to articulated arm 131 with screw 129 that fits into the threaded hole of scan-flag/analog 122. Base 132 is mounted onto the base of the scanning machine.

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[0175] The provisional or duplicate prosthesis with attached scan flags/lab analogs is scanned into the design software. This process captures the accurate position of the implant multi-unit abutment relative to the soft tissues and it also captures the tested prosthetic contours to aid in the design of the definitive prosthesis. After the prosthesis has been scanned in, a physical model may optionally be created by creating a soft tissue moulage and pouring dental stone into the provisional or duplicate prosthetic utilizing the scan flags as the laboratory analogs.

[0176] FIG. 57 schematically shows the application of solder or brazing preforms 133 to attach reinforcement bars 134 prior to pouring dental stone. Preforms 133 may be inserted into holes in the scan-flag/analog and heated to attach bars 134. Low-temperature solders, brazing compounds, and hot-melt or other adhesives may be utilized in a preform or dispensed method to increase the rigidity of the analog assembly prior to casting.

[0177] This method ensures a fast and efficient means of transferring all pertinent and relevant information from a converted denture required for designing a definitive prosthesis from digital scanning and creating the most accurate and precise physical model that can be mounted in an articulator with the aid of a bite registration in preparation for post-processing of the machined prosthesis, for example to verify passivity of fit, occlusion, etc.

[0178] In addition to the screw attachment of the scan flags to the modified prosthesis, scan flags may be attached to the prosthesis with incorporated copings of FIG. 43 prior to the drilling operations shown in FIGS. 45-47. In this case, another embodiment of the scan flag (not shown) with a post feature equivalent to post feature 101A of separable screw would be inserted into copings 112 of the modified prosthesis and retained by the embedded cap 102. If the separable fastener uses a snap-fit feature to retain the cap to the post, drilling may not be required through the prosthesis to mount the scan flags or lab analogs to the prosthesis or to attach the modified prosthesis to the abutments after lab use. For example, US Provisional Patent Application 62/774,402 describes the use

of spring fingers and O-rings for separable fastening of the coping to the abutment for lift-off, and the use of films to prevent adhesive from entering interior portions of the separable fastener. Scan flags and lab analogs may also be engaged with transferred copings using similar mounting features as the post used in the transfer pick-up process. The referenced patent application also includes separable systems in which the post attaches directly to the coping without a cap which may be applied for mounting scan flags or lab analogs as variations of the methods described above. Since the dimensions of the coping and its engagement with the abutment is precisely controlled, having snap-in scan flags engage with a cavity between the top of the coping and the separable cap or an internal groove or other feature of the coping may be desirable.

[0179] Variations of using the modified prosthesis as a digital scan model, or using the inventive concepts disclosed to create a permanent prosthesis will be recognized as possible to dental practitioners. For example, instead of using a dual-purpose scan flag and lab analog, single purpose scan flags can be mounted into the provisional prosthesis for scanning, and subsequently replaced with lab analogs prior to casting. In addition to the attachment of scan flags to a modified prosthesis for digitization, the separable fastener may be used to transfer a coping and cap to a new impression after implant surgery. A scan flag or lab analog may be attached and held to the impression with transferred coping for digitization or casting by substituting the new impression for the modified prosthesis in any of the processes above. FIG. 58 describes a workflow for using the temporary alignment fasteners with a permanent prosthesis fabricated from a digital model based on an impression.

[0180] FIGS. 59-60 show an embodiment of a simple torque-driver 113 that can be used for the temporary coping attachment process discussed in reference to FIG. 40. Shaft assembly 135 contains a spring friction cylinder portion 141 and drive portion 138 designed to engage the temporary screw 100. Spring 136 has an interference fit with cylinder 141, and thus when spring 136 is rotated in the “unwind” direction of the spring, a designed amount of slip torque is present between the spring and cylinder. In the “wind” direction, the spring binds on the cylinder. This provides unequal drive torque

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capability in the two rotation directions. Slot 139 in drive cap 137 engages spring end 140, and snaps onto the end of the shaft assembly, thus when the cap is rotated in the clockwise direction, cylinder and drive slip at a known torque. When the cap is rotated in the counterclockwise direction, the spring binds on the shaft to provide a higher screw removal torque before slipping.

[0181] FIG. 61 shows an embodiment of a temporary screw post extractor 115 which may be used to remove post 101 after the pick-up process as shown in FIG. 44. The extractor utilizes a hollow metal tubular split-cylinder end portion 142 that deflects to grip the end of the temporary screw post 101, allowing removal of the separable fastener posts or other types of fasteners. FIG. 61 illustrates a hand-operated knurled end, but other torque tool systems known in the dental industry such as 3/32" friction and latch designs may be used.

[0182] FIGS. 62-63 schematically illustrate how the position of the temporary screw post 10 of the first embodiment relative to the implant abutment can be determined. As the temporary screw is rotated clockwise, the cap 11 will be pushed axially away from the screw threads of the post by the coping. The depth of threaded engagement and the length of the temporary screw post 10 and cap can be designed to have the top of the post 10 coincide with the top of the cap 11 as shown in FIG. 63 when the temporary screw is properly positioned. At this point, a drive tool with a square socket cavity (not illustrated) would disengage from the temporary screw assembly since the post 10 would no longer extend into the tool socket cavity.

[0183] FIGS. 64-66 illustrate different embodiments of the end of the temporary screw post that engages the cap. FIG. 64 shows a modified version of the cylindrical post 101 designed for frictional engagement on cylindrical portion 85 with a cap having a circular bore similar to that shown in FIG. 34. In FIG. 65, the cylindrical post is slotted, and the resulting beam portions 86 sprung open to provide additional frictional retention of a cap through spring action with the deflecting beams. Various features such as symmetric axial splines 87 (FIG. 66), asymmetric splines or grooves, and textures may also be

used to tailor driving torque and axial retention force of the cap to the temporary attachment post. Non-symmetric features may also be utilized to tailor different installation torque and extraction forces. Surface finish and coefficients of friction of the mating materials may also be used to control the driving and retention properties. Temporary attachment posts and caps may be made from metal and polymer materials such as titanium, stainless steels, nylon and PEEK and other non-corrosive biocompatible materials.

[0184] If additional off-axis accommodation is desired when extracting the temporary attachment post from the coping after pick-up, some flexibility may be incorporated into the temporary attachment post, such as the necked down portion 88 of the temporary attachment post shown in FIG. 67, which allows the temporary attachment post to flex slightly off-axis during the pick-up process. Under tension, the alignment of the temporary screw axis with this necked-down portion can be designed to align the axis of the implant abutment threads with the coping threads but allow some bending when the tension is released. Note that this alignment flexibility will generally not be required during the final screw attachment process. The final attachment process is more accommodating of axial misalignment of multiple abutments than the coping pick-up process. During pick-up, the prosthesis with copings incorporated must be removed from all abutments simultaneously. For final attachment, each definitive screw is attached individually after the copings of the prosthesis are positioned on the implant abutments.

[0185] FIG. 68 shows an embodiment of a temporary screw cap 94 that includes spring features 95 that engage the outer diameter 96 of the temporary post. If desired the portion of the temporary screw cap with the spring features may be made of a different material than the remainder of the cap.

[0186] Although the temporary screw of FIG. 69 has a similar appearance to that shown in FIG. 68, it has distinct functionality. FIG. 69 shows an embodiment of a temporary alignment screw 58 having threaded portion 62, breakaway flange 160 and hex drive

portion 61. The flange 160 pushes down on the top of the coping as the temporary alignment screw threads 62 are rotated into the implant abutment. The flange portion may be molded onto a temporary attachment post with threaded portion 62 and drive portion 61 by insert molding if different materials are desired. Preferable, all portions of the alignment screw are molded integrally of a single material. The cap and post do not slide axially relative to one another. Instead, small break-away tabs 59 in the flange portion are designed to yield under axial force during the prosthesis and coping assembly removal after the bonding step. The breakaway portions are designed to fracture at an axial force exceeding the force applied to align the coping to the implant abutment for pick-up.

[0187] FIG. 67 employed a temporary alignment screw post with a waist that can bend during prosthesis removal in the pick-up process. It is also possible to provide additional off-axis accommodation during coping pick-up with temporary screws that do not bend. For example, in FIG. 70, a temporary alignment screw post 25 includes a rounded portion 27 that bears against the central straight bore of cap 26. FIG. 71 shows a tapered profile 29 on cap 30 which engages a straight cylindrical portion of post 28. It is preferable to prevent the incursion of adhesive in the gaps between the post and cap that allow the post to pivot. FIG. 71 includes a thin protective film 56 for this purpose. This film should be chosen to deform easily when the post is pivoted.

[0188] FIG. 72 shows a thin retaining ring 32 that engages temporary attachment post 31. The retaining ring 32 also provides a one-way insertion direction of temporary attachment post 31. This preferential insertion direction also corresponds to the relative motion of the post and retaining ring for release in the pick-up process.

[0189] FIG. 73 shows another embodiment of a temporary alignment screw that does not have relative axial sliding between the post and cap. In this embodiment a thin retainer 35 that may be comprised of a metallic or polymer sheet is attached to the top portion of temporary attachment post 33 and optional cap 34. The sheet 35 may be attached to temporary attachment post 33 using adhesives, plastic or metal welding, etc.

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After the adhesive has cured holding the coping to the implant abutment, the mechanical connection between the post and cap is overcome by axial force in the pick-up process. The mechanical connection can be designed to fail by adhesive failure or by fracture of the joint or the sheet 35.

[0190] FIG. 74 shows another embodiment of a temporary alignment screw without relative sliding between the cap portion and the post portion. In this embodiment, a compliant or frangible portion of the post 37 is used to attach a cap 38 to the post 36. Under tension, the cap portion 38 holds the coping in position against the abutment for pick-up into a prosthesis. Compliant portion 37 may be for example an elastomeric material to provide some angular motion during prosthesis removal after the pick-up material sets. The compliant portion 37 itself or one of its interfaces with the cap or post may provide a separable interface with controlled axial breakaway force. Other methods of separating a compliant portion may include exposure of compliant portion 37 made from a material easily affected by heat, any wavelength of electromagnetic energy, or a chemical reaction that may be applied externally or as part of the pick-up process.

[0191] The inventive concepts disclosed are not meant to be restricted to a temporary attachment post with standard screw threads that both engage and disengage the threads in the implant abutment through rotations. For example, alternate separable temporary attachment posts embodiments are possible providing features that allow the post to removably hold the coping to the abutment by other means than a separable cap. For example, as shown in FIG. 75 an alignment fastener post 39 may contain a separable threaded or serrated portion 40 that engages the screw threads in the abutment for pick-up, but that will release with axial force after. FIG. 75 shows a temporary fastener 190 with a head 42 portion and an attachment post portion 39. The attachment post portion 39 is shown as having a slot 41 and asymmetric threads or serrations 40 that have proximal flank 183 and a distal flank 184. This asymmetric threading still allows the temporary attachment post portion 39 to be inserted through rotation like other temporary screw embodiments for alignment for coping pick-up. The post 39 may be subsequently extracted with a separation force in the axial direction. Although the threads could be designed to provide engagement with the implant

abutment threads through axial motion in the opposite direction to the arrow shown in FIG. 75, rotation to a design torque on engagement is generally preferred. If the post 39 is designed to be pulled out of the abutment during the coping pick-up process, it will subsequently need to be removed from flange 42 and the prosthesis assembly. Since there is no processing impact on patient comfort, higher mechanical forces or a broader range of energy or chemical processing may be employed to remove the post 39 from the prosthesis 3 after coping 9 pick-up.

[0192] Further permutations of the separable alignment screw features disclosed above are possible. FIG. 76 shows an embodiment where axial flexibility and/or controlled retention between cap 44 and temporary attachment post 43 is provided by an interface material 45 such as adhesives, silicones, and elastomeric materials contained in the space between the bore of the cap 44 and the post 43. FIG. 77 shows cap 47 retained with an O-ring 48 held in grooves in the cap 47 and temporary attachment post 46. FIG. 78 shows a cup-shaped interface material 57 located within the bore of the cap 44 and extending over a portion of the end of the post 43. FIG. 79 shows a split-collar feature 51 on cap 50 which presses onto the temporary attachment post 49. FIGS. 80 and 81 show alternate designs of flexure beam features in caps gripping a post. In FIG. 80, the pressure on the post 49 is reduced by pulling the cap 52 perpendicular to a diagonal of the cap as indicated by the arrows. In FIG. 81, the pressure on the post 49 is reduced by pulling in opposite directions with moment arms on the cap 54 as shown to open the spring.

[0193] It is understood that the concept of the temporary attachment of the coping with the abutment with an axially separable temporary post is not dependent upon having a separate cap 11 or nut 63 on the post. If desired the cap or nut can be eliminated and the coping may be directly fixed and axially separable from the temporary attachment post. That is, the coping can be designed to have an equivalent mechanical interface to the post as the caps in the embodiments above. The mechanical interface between the coping and post may be tailored to provide equivalent rotational engagement and relative axial movement above a designed minimum axial force.

[0194] Example embodiments of the coping and post being the separable components include the following:

[0195] FIG. 82 shows temporary attachment post 71, engaging an interference fit of coping 72 at a position above the threaded portion. Metal, metal-reinforced, ceramic, and polymer copings, posts and fasteners may be included in this and other embodiments. Any of the parts may have surface treatments to control friction or adhesion.

[0196] FIG. 83 shows temporary attachment post 71 engaging integral spring-finger features 78 of coping 73.

[0197] FIG. 84 shows a temporary attachment post 71 engaging collet-type spring fingers 77 of coping 74, these collet-type features may be formed using slots in the coping 74 as shown in FIG. 84A.

[0198] FIG. 85 shows a slotted spring feature 79 formed in the temporary attachment post 76. The spring-features engage a smaller bore portion 90 of the coping 75. Such features may be of varied shapes including slots, eyelets, swaged portions, tubular swaged parts, etc. A film 56 (not shown) may be used to prevent the ingress of pick-up material into any voids at the top of the post/coping assembly similar to that shown in FIG. 71.

[0199] FIG. 86 shows temporary attachment post 71 and coping 75 engaged using an O-ring or washer 80. Such washers may be elastomers, polymers, metals, etc. and may be forms in varied shapes, such as the u-shaped retainer 81 of FIG. 87.

[0200] FIG. 88 shows temporary attachment post 71 retained to coping 75 using a sheet cap 82. Sheet cap 82 may be a tape, or other polymers or metals joined using

adhesives, thermal and ultrasonic bonding, welding, and brazing, etc. This is similar to the embodiment shown in FIG. 73, except the sheet cap 82 does not have thicker cap element 34.

[0201] FIG. 89 shows temporary attachment post 71 retained using a filler material 83 in the counterbore of coping 75. Fillers may include a variety of polymer adhesives or fillers, such as silicones, acrylics, epoxies, and/or soft metallic materials. Since the coping 75 in this embodiment is fixed to the post 71, the mating surfaces of the coping 75 and implant abutment must allow relative rotational motion until the predetermined torque is achieved.

[0202] Installation of these embodiments may also be accomplished with simple polymer or metal tools 84, for example, as shown in FIG. 90 that engage the flats or other features of the coping 75, and/or of features on top of the threaded post 71.

[0203] Although the descriptions above use rotational engagement of the bottom of the post with internal threads of the abutment as a preferred approach, this is not meant to be limiting. Alternate approaches for engaging a temporary attachment post with abutment threads through axial insertion without rotation are considered to be part of this disclosure. For example, the split post bottom structure shown in FIG. 75 which allows axial extraction can also be used for axial insertion. Similarly, an interference fit between the bottom of the post with the threads may also be designed to provide sufficient engagement to provide adequate alignment and fixing of the coping for the pick-up bonding process described earlier. For non-rotary extraction of the post, it is not necessary to have the extraction force of the post-abutment thread interface greater than the force required for relative movement of the coping or cap with the upper end of the post. That is, if the temporary attachment post remains fixed to the coping during the pick-up step, the post can be removed from the dental appliance after removal from the patient's mouth.

[0204] Although axially symmetric interfaces between coping and abutment have been described for most embodiments, the inventive concepts may also be applied to asymmetric abutments and copings as long as the coping doesn't need to rotate on the implant abutment as noted, for example, with the embodiment of FIG. 89 .

[0205] Various embodiments have been described to illustrate the disclosed inventive concepts, not to limit the invention. Combining inventive elements of one or more of the embodiments with known materials, components and techniques in dental science to create further embodiments using the inventive concepts is considered to be part of this disclosure.

[0206] Any of the embodiments may contain a film or deposited material on top of the cap and temporary attachment post to prevent adhesion to the temporary attachment post of materials used for pick-up, as shown in the film 56 of FIG. 71.

[0207] Temporary attachment posts may be rotationally driven into the abutment threads using either the cap, coping or the temporary attachment post itself. Temporary attachment posts and caps may have varied drive features such as male or female knurls, hex, spines, spanner notches/holes. These design alternatives are driven by functional requirements of a particular implementation.

[0208] Other means of attaching/joining a secondary separable portion include insert-molding, use of adhesives, waxes, solders or other metallic materials, heat-staking, and ultrasonic bonding.

[0209] Break-away portions may also be formed by two-shot molding, dispensing or otherwise placing a secondary mechanically, thermally, or electromagnetically fusible material on a portion of the fastener to provide the break-away function.

[0210] Thin Thin-film or thick-film metallic and polymer coatings may be applied to portions of the fastener to tailor friction and insertion and extraction forces, enhance adhesion of pick-up materials, and other properties such as corrosion-resistance.

Claims

We claim:

1. A dental system comprising:
 - a coping having a proximal end with an aperture;
 - an implant abutment having threads, wherein the implant abutment threads extend distally from a most proximal thread position;
 - a definitive screw having a proximal head end having a tool interface and a distal post portion having threads configured for securing the coping to the threads of the implant abutment, wherein the distal post portion is sized and configured to extend through the aperture of the coping; and
 - a temporary fastener having a longitudinal axis with a length measured along the longitudinal axis and a lateral dimension providing different widths along the longitudinal axis measured perpendicular to the longitudinal axis, the temporary fastener comprising a shaft comprising a distal shaft portion sized and configured for rotary engagement with the implant abutment threads,
 - wherein the shaft of the temporary fastener is configured to extend through the aperture of the coping and the distal shaft portion is configured to engage the implant abutment threads through an engagement depth measured axially between a most distal contact position with the implant abutment threads and the most proximal thread position of the implant abutment threads and is configured so that a portion of the temporary fastener holds the coping in alignment with the implant abutment prior to attachment of the definitive screw,
 - wherein the temporary fastener is configured to release at least a portion of the temporary fastener and the coping from the implant abutment as a unit when an axial release force is applied in a proximal direction to the temporary fastener,
 - wherein the distal shaft portion of the temporary fastener is sized and configured to make contact with the implant abutment threads over a first thread contact area to hold the coping against the implant abutment, wherein, after removal of the temporary fastener, the distal post portion of the definitive screw is sized and configured to make contact with the implant abutment threads over a second thread contact area to hold the coping against the implant abutment, and wherein the first thread contact area is less than the second thread contact area.

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2. The dental system of Claim 1 wherein the threads of the implant abutment comprise female threads, wherein the female threads have a radial extent bounded by a female thread minor diameter and a female thread major diameter, and wherein the female thread minor diameter is located closer to the longitudinal axis than the female thread major diameter.
3. The dental system of Claim 2 wherein a maximal width of the distal post portion of the definitive screw having threads is larger than the female thread minor diameter of the implant abutment threads, and wherein a maximal width of the distal shaft portion of the temporary screw sized and configured to make contact with the implant abutment threads is smaller than the width of the distal post portion of the definitive screw having threads.
4. The dental system of Claim 2 wherein the distal shaft portion of the temporary fastener is configured to have a temporary fastener engagement volume extending radially beyond the female thread minor diameter and axially over the engagement depth, wherein the definitive screw is configured to have a definitive screw engagement volume extending radially beyond the female thread minor diameter and axially over the engagement depth, and wherein the definitive screw engagement volume is greater than the temporary fastener engagement volume.
5. The dental system of Claim 1 wherein the distal shaft portion of the temporary fastener is configured to have discontinuous contact with the implant abutment threads throughout the engagement depth.
6. The dental system of Claim 1 wherein the axial release force is configured to be applied in a pick-up process.
7. The dental system of Claim 1 wherein the shaft of the temporary fastener includes a portion that has a smaller width than the distal shaft portion sized and configured for rotary engagement with the implant abutment threads, and wherein the portion with the smaller width is located proximally from the distal shaft portion sized and configured for rotary engagement.
8. The dental system of Claim 1 wherein the threads of the distal post portion of the definitive screw are configured to continuously engage the implant abutment threads.

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9. The dental system of Claim 1 wherein the distal shaft portion of the temporary fastener is configured to deform and disengage the implant abutment threads to release the coping and the temporary fastener as a unit as a result of the axial release force.

10. A dental system comprising:

an implant abutment having threads and an implant abutment longitudinal axis;

a coping having a proximal end with a central aperture merging into a central open channel of greater width than the central aperture;

a definitive screw having a proximal head end having a tool interface and a distal post portion having threads configured for securing the coping to the threads of the implant abutment, wherein the distal post portion having threads is sized to extend through the aperture of the coping into the central open channel;

a temporary fastener having a longitudinal axis with a length measured along the longitudinal axis and a width measured perpendicular to the longitudinal axis, the temporary fastener comprising:

a head with a proximal end having a drive tool interface configured for rotating the temporary fastener to a predetermined torque, and

a shaft coupled to or integral with the head configured to extend through the central aperture of the coping, wherein the shaft has a distal portion having an outer surface comprising threads, wherein a maximal width of the distal portion with the threads is smaller than a maximal width of the distal post portion of the definitive screw with the threads,

wherein the temporary fastener is configured so that, in position and engaged with the threads of the implant abutment at a predetermined torque, the temporary fastener cooperates with the coping to align the coping into position with the implant abutment, and wherein the temporary fastener is configured so that in response to application of an axial release force above a predefined value in a proximal direction, the coping and at least a portion of the temporary fastener are released as a unit from the implant abutment without rotation.

11. The dental system of Claim 10 wherein the distal portion of the shaft of the temporary fastener is configured to deform in response to the application of the axial release force above a predefined value in a proximal direction.

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12. The dental system of Claim 10 wherein the temporary fastener is configured to move axially in response to the axial release force without rotation.
13. The dental system of Claim 10 wherein the threads of the shaft of the temporary fastener are configured to have discontinuous contact with the threads of the implant abutment at the predefined torque.
14. The dental system of Claim 10 wherein the shaft of the temporary fastener has a portion located proximally of the distal portion comprising threads having a width smaller than the maximal width of the distal portion comprising threads.
15. A dental system comprising:
 - a coping having a proximal end with an aperture and a distal end with a coping seating surface; and
 - an implant abutment having a longitudinal axis comprising:
 - female threading, wherein the female threading resides proximate a proximal end of the implant abutment and extends distally thereof, and
 - an outer wall surrounding the female threading, the outer wall comprising an implant abutment seating surface;
 - a temporary fastener having an axis with a length measured along the axis and a lateral dimension providing different widths along the axis measured perpendicular to the axis, the temporary fastener comprising:
 - a proximal portion with a width larger than the coping aperture; and
 - a shaft comprising a distal shaft portion configured for rotary engagement with the implant abutment female threading,
 - wherein the shaft of the temporary fastener is sized to extend through the aperture of the coping, and wherein the distal shaft portion of the temporary fastener is configured to rotatably engage the female threading of the implant abutment to an engagement depth

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sufficient to hold the coping seating surface aligned with and adjacent the implant abutment seating surface, and

wherein the temporary fastener is configured to release at least a portion of the temporary fastener and the coping from the implant abutment as a unit as a result of an axial release force in a proximal direction, and

wherein the distal shaft portion of the temporary fastener does not continuously contact the female threading of the implant abutment between a most distal engagement position and a proximate end of the female threading of the implant abutment.

16. The dental system of Claim 15, wherein the axial release force is applied in a pick-up process after adhesive bonding of the coping to a prosthesis or in a closed tray impression process.
17. The dental system of Claim 15, wherein the axial release force in the proximal direction releases an entire temporary fastener and coping from the implant abutment as a unit.
18. The dental system of Claim 15, wherein the temporary fastener comprises a polymeric material.
19. The dental system of Claim 15, further comprising a definitive screw with a longitudinal axis and a width measured perpendicular to the longitudinal axis, the definitive screw comprising:

a head with a proximal end having a drive tool interface, wherein, after removal of the temporary fastener, the head is in contact with a proximal surface of the coping proximate the aperture of the coping, and

a shaft that has a width configured to extend through the aperture of the coping, the shaft comprising:

a distal portion having an outer surface comprising male threading configured to engage the female threading of the implant abutment, wherein the distal portion of the definitive screw is configured to rotatably engage the female threading of the implant abutment to a predefined fixation torque to position the coping seating surface adjacent to the implant abutment seating surface.

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20. The dental system of Claim 19, wherein the male threading of the definitive screw is configured to make continuous contact with the implant abutment female threading.
21. The dental system of Claim 19, wherein the male threading of the distal portion of the definitive screw has a greater engagement depth with the female threading of the implant abutment than the engagement depth of the temporary fastener and/or the male threading of the distal portion of the definitive screw has a longitudinal extent that is greater than a longitudinal extent of the distal shaft portion of the temporary fastener.
22. The dental system of Claim 19, wherein a maximum width of the distal portion of the definitive screw comprising the male threading is greater than a maximum width of the distal shaft portion of the temporary fastener configured to rotatably engage the implant abutment female threading.
23. A method of installing a dental prosthesis comprising:
 - providing a coping comprising an aperture and a temporary fastener comprising threads wherein the temporary fastener is configured to extend at least partially through the aperture of the coping;
 - attaching the temporary fastener to implant abutment threads of the implant abutment while the coping extends about the temporary fastener in axial alignment with the implant abutment;
 - processing the coping using a pick-up process or closed tray impression process while the temporary fastener is attached to the implant abutment;
 - releasing the coping attached to at least part of the temporary fastener as a unit in response to an axial release force applied from the processing;
 - drilling at least one hole through a dental prosthesis aligned with the aperture of the released coping;
 - aligning the dental prosthesis coupled to the released coping with the implant abutment; and
 - attaching the dental prosthesis with the released coping to the implant abutment using a definitive screw inserted through a respective at least one hole of the dental prosthesis wherein the definitive screw has threads with a maximal width that is greater than the maximal width of the threads of the temporary screw.
24. The method of Claim 23, wherein the releasing is carried out so that the temporary fastener is entirely removed attached to the coping providing the unit.

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25. The method of Claim 23, wherein the method further comprises providing a tool that is configured to at least partially surround the coping while the temporary fastener extends through the aperture of the coping and aligning the tool with the coping and temporary fastener with the implant abutment.

26. The method of Claim 25, wherein the tool comprises a through channel aligned with the temporary fastener, the method further comprising inserting a drive tool through the channel to engage a drive interface in the temporary fastener and rotating the temporary fastener to engage threads of the implant abutment, then removing the tool prior to the processing.

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UTILITY PATENT APPLICATION TRANSMITTAL (Only for new nonprovisional applications under 37 CFR 1.53(b))	Attorney Docket No.	SDC013
	First Named Inventor	Brandon Dale Kofford
	Title	SCREW-ATTACHED PICK-UP DENTAL COPING SYSTEMS AND METHODS
	Express Mail Label No.	

APPLICATION ELEMENTS <i>See MPEP chapter 600 concerning utility patent application contents.</i>	Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450
1. ☐ Fee Transmittal Form (PTO/SB/17 or equivalent)	ACCOMPANYING APPLICATION PAPERS
2. ☒ Applicant asserts small entity status. See 37 CFR 1.27	10. ☐ Assignment Papers (cover sheet & document(s)) Name of Assignee _____
3. ☐ Applicant certifies micro entity status. See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.	11. ☐ 37 CFR 3.73(c) Statement ☒ Power of Attorney (when there is an assignee)
4. ☒ Specification [Total Pages <u>51</u>] Both the claims and abstract must start on a new page. (See MPEP § 608.01(a) for information on the preferred arrangement)	12. ☐ English Translation Document (if applicable)
5. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets <u>26</u>]	13. ☐ Information Disclosure Statement (PTO/SB/08 or PTO-1449) ☐ Copies of citations attached
6. Inventor's Oath or Declaration [Total Pages <u>4</u>] (including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e))	14. ☐ Preliminary Amendment
a. ☒ Newly executed (original or copy)	15. ☐ Return Receipt Postcard (MPEP § 503) (Should be specifically itemized)
b. ☐ A copy from a prior application (37 CFR 1.63(d))	16. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)
7. ☒ Application Data Sheet * See note below. See 37 CFR 1.76 (PTO/AIA/14 or equivalent)	17. ☒ Nonpublication Request Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
8. CD-ROM or CD-R in duplicate, large table, or Computer Program (Appendix) ☐ Landscape Table on CD	18. ☒ Other: Track One AIA0424 _____ _____ _____ _____
9. Nucleotide and/or Amino Acid Sequence Submission (if applicable, items a. – c. are required)	
a. ☐ Computer Readable Form (CRF)	
b. ☐ Specification Sequence Listing on:	
i. ☐ CD-ROM or CD-R (2 copies); or	
ii. ☐ Paper	
c. ☐ Statements verifying identity of above copies	

***Note:** (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 **must** be included in an Application Data Sheet (ADS).
(2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

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Signature	/Daniel John Whittle, #54,537/			Date	09-06-2024
Name (Print/Type)	Daniel John Whittle			Registration No. (Attorney/Agent)	54537

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Application Number	
Filing Date	
First Named Inventor	Brandon Dale Kofford
Title	SCREW-ATTACHED PICK-UP DENTAL COPING SYSTEMS AND METHODS
Art Unit	
Examiner Name	
Attorney Docket Number	SDC013

SIGNATURE of Applicant or Patent Practitioner

Signature	/Daniel John Whittle, #54,537/	Date (Optional)	
Name	Daniel John Whittle	Registration Number	54,537
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

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Application Number

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The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature

Date (Optional)

9/02/2024

Name

Brandon D Kofford

Title

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SCREW-ATTACHED PICK-UP DENTAL COPING SYSTEMS AND METHODS**ABSTRACT**

A temporary alignment system and method for holding a dental coping to an implant abutment using the same threads in the abutment that are used for definitive attachment are disclosed. The disclosed temporary fasteners initially orient and hold a coping against an abutment with a force along the same axis as the semi-definitive screw. The aligned coping can be picked-up in a closed-tray impression process without unscrewing the temporary fastener. Embodiments include threaded posts that release copings from the abutment through axial forces. Some embodiments include a threaded post with separable cap that is picked-up with the coping. Methods for converting an existing prosthesis for screw attachment to implants in a single visit and digital capture of the converted prosthesis are described.

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of US Patent Application 18/424,696, filed on January 26, 2024, which is a continuation of US Patent Application 18/328,730, filed on June 3, 2023, and issued as US Patent 11,937,992, which is a continuation of US Patent Application 17/691,108, filed on March 9, 2022, which is a continuation of US Patent Application 16/596,361, filed on October 8, 2019, and issued as US Patent 11,311,354 on April 26, 2022. This disclosure claims priority of US provisional patent application number 62/742,942, filed on October 9, 2018, and US provisional patent application number 62/774,402, filed on December 3, 2018, and US provisional patent application number 62/818,082, filed on March 13, 2019. All of the above non-provisional and provisional applications are incorporated herein by reference in their entirety.

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BACKGROUND OF THE INVENTION

[0003] Different systems have been introduced for attaching dental prostheses to dental implants to replace one or more natural teeth. In order to simplify future modification or replacement needs, it is desirable to have reversable attachment between the implants and prostheses using mechanical systems as opposed to directly bonding these components together. These systems require features to provide both proper alignment and retention for acceptable use by the patient. Intermediate components such as copings and separable abutments having different lengths or orientations are often employed to provide proper registration between a dental prosthesis, one or more implants embedded in the patient's jawbone, and the soft-tissue and any remaining natural teeth. These intermediate elements may be mutually attached with screws or with ball-and-socket or other forms of snap-on mounts. In the case of a single-tooth

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crown attachment, the coping and abutment surfaces preferably include features to remove rotational symmetry in the mating of the abutment and coping surfaces. Rotational locking features may also be included in these single mount systems. When the prosthesis contains multiple copings for attachment to multiple abutments, this rotational fixation is not generally required. For example, 30-degree tapered mating surfaces for multiple interface locations are sufficient to provide complete registration.

[0004] It is common to attach a complete upper or lower denture to four or more implants. The multi-unit abutment system interfaces with mating surfaces of the final prosthetic. In some cases, these dentures may be designed or fabricated from scratch following the pulling of undesirable teeth and mounting of implants. In other cases, no teeth are pulled, but it is desirable to convert an existing removable denture to definitive mounting to new implants. In some cases, it is preferable to convert these existing dentures shortly after the implants are placed. This chair-side processing decreases patient discomfort by providing at least temporary dentures more quickly.

[0005] Dental impressions are often used to provide information on the location of implants, soft tissue and existing teeth for designing new prostheses or mounting copings in existing dentures for implant attachment conversion. Generally, the copings are mounted to implant abutments and an impression is made to provide location information for the prosthesis through the copings. Impression material is introduced and cured around the copings to define their position. In the case of transfer copings, less rigid impression material is used to form a cavity for each coping; the coping remains attached to the abutment and the cured impression is removed. Subsequently, copings are inserted into the impression. In the case of pick-up copings, the coping is directly retained in the impression material after curing. That is, the copings are picked-up when the impression is removed from the mouth. The resulting alignment of pick-up copings is generally superior to transfer copings as a result of the direct transfer of coping location information. Transfer copings introduce an indirect secondary alignment reference since the insertion of the coping into the impression may not accurately duplicate the original position, particularly in insertion depth.

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[0006] Pick-up copings can be used with either an open tray or a closed tray protocol. For snap-on systems, a closed impression tray pick-up technique may be done. The tray can be closed because there is no need to access the copings in order to disconnect them after the impression material sets. However, it is desirable to ensure that the assembly of snap-on copings can be removed without patient discomfort. The amount of force required to remove the tray or converted prosthesis depends upon the total number of implant abutment/coping sets and their position and mutual alignment. Some snap-on systems provide features to provide different retention levels, but this complicates the installation process. Special tools have been introduced to help separate impression trays or prostheses with snap-on systems but may still result in patient discomfort. Since snap-on systems are generally physically larger than dental screws, converting an existing denture may require large clearance cavities to be bored into the existing denture before it can be used as an impression tray in a pick-up coping process. These large holes may significantly reduce the mechanical stability of the existing denture. The mechanical precision required of snap-on system elements generally makes them more expensive than screw-attached systems.

[0007] The simplicity of screw-attached systems provides some benefits over snap-on systems beyond fabrication cost. The mounting pressure between the coping and abutment is readily controlled through the torque applied to the screw to tighten it. This axial tension control and the self-aligning characteristics of engaged screw threads provides more certainty in the engagement force and relative orientation of the components. Even if a screw breaks, techniques are known for removing the pieces without damage to surrounding components. Screws also have a benefit of independence for removal since each coping can be loosened individually. Tilting the prosthesis after screw removal to disengage one coping cannot cause reengagement of another coping.

[0008] A disadvantage with commercially available screw-attachment systems for pick-up copings is the requirement for using an open-tray impression in order to release the coping from the abutment after the impression material sets. By having an opening in the tray or existing denture, impression screws may be used. These impression screws

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extend through the tray beyond the impression material and can be unscrewed after the material sets. The impression screws use the same abutment threads as the semi-permanent screws used to attach the prosthesis later. As a result, the introduction of alignment uncertainty through a secondary reference may be avoided or minimized. The copings used with the impression screws are often relatively long and require modification for denture conversion. This customization may result in larger clearance holes in dentures and require additional process time by the dental practitioner. The length of the impression screws sticking through the tray can cause patient discomfort and a gag reflex. In the case of denture conversion, clearance for a set of impression screws at different angles may require additional material removal leading to a weakened denture. A schematic representation of the larger through-holes 136 required using conventional denture conversion processes for screw attachment are illustrated in FIGS. 93-94. The impression screws can also prevent the patient from applying bite pressure during the pick-up process to ensure proper registration of the modified denture and opposing teeth.

[0009] Prosthetic dentistry has rapidly moved into the realm of digital design and manufacturing. Typically, this requires that a digital model is created from a physical model or impression to allow digital design and manufacturing techniques to produce a physical prosthetic that can be delivered to a patient for restoration of dental and oral structures. When making a dental restoration with implants in this manner, an implant impression coping is often used in the mouth to reference the position of the implant geometry relative to surrounding structures such as gingiva, adjacent teeth, opposing teeth, etc. Once removed from the mouth, an implant analog is attached to the impression coping that was picked-up or transferred. With the lab implant analog attached to the impression coping in the elastomeric impression, dental stone is flowed into the impression and allowed to harden before separation from the impression with a resultant dental cast. A scan flag is attached to the lab analog on the dental stone model and is scanned in by laser or optical scanning technology. The scan flag is used for design software to reference and replicate the accurate positioning of the virtual implant relative to the adjacent teeth, gingiva and opposing tooth, as well as the timing of the implant and other pertinent implant geometries. Once the virtual implant is accurately brought into the design software, a prosthetic can be designed by following

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the workflow in the design software. A completed design is post-processed, and a CAD file is used in CAM software to direct either the 3-D printing or milling of the designed prosthesis. The manufactured prosthesis is verified on the physical model in a remote prosthetic manufacturing lab prior to delivery to the dentist or is verified directly on the dental patient if the prosthesis was manufactured in the local dental clinic. It is currently the standard of care to verify the fit, form, and function on a physical model.

[0010] Recently, an impression scan flag was introduced to the market for a few major implant systems and the most common multi-unit geometry. This scan flag allows for an impression to be digitized without the creation of a stone model. A digital model is created directly from the elastomeric impression, a prosthesis is designed digitally and processed with CAM software and both a 3-D printed model and 3-D printed or milled prosthesis is finished and tested on the 3-D printed model. The disadvantage of the 3-D printed model for full arch implant prosthetics is the positioning of the implant lab analog within the 3-D printed model introduces a degree of inaccuracy. Additionally, an impression only captures the implant or multi-unit abutment relative to the tissues and requires cumbersome steps to incorporate a provisional prosthesis or wax-up into the design software relative to the scan of the impression.

[0011] A properly converted denture provides a valuable source of information of the relative location of the implant and its abutment surfaces, copings and soft tissue and any remaining teeth of the patient. It can be used as a model for digital scanning to produce a duplicate denture if needed in the future or as a starting digital model for manipulation to improve aesthetics or other characteristics. However, if the mechanical integrity of the converted denture is compromised, the scanned information may not faithfully represent the relative geometry of these elements and result in a poor fit.

[0012] Other alignment systems have been proposed which use silicone or melting screw threads to allow closed tray transfer for definitive screw attachment, but the practicality of providing adequate alignment and seating forces with a screw diameter in the range of existing systems or overcoming the lack of disengagement independence

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required in melting all threads simultaneously without patient discomfort has not been documented. Details on removing any residual material in the abutment threads or in the prosthesis after the pick-up process have not been disclosed. Other hybrid systems that use a snap-on engagement for the pick-up coping during transfer and subsequent screw-attachment have also been proposed, but detailed information on the tradeoffs in precision and associated complexity or size required for equivalent performance to open-tray impression screw techniques have not been disclosed. A general need exists for systems that improve clinical efficiency, implant to prosthesis alignment accuracy, application to a wide range of coping designs and sources and patient comfort over existing systems.

[0013] The present disclosure includes systems and methods that address one or more of these issues in the prior art.

BRIEF SUMMARY OF THE INVENTION

[0014] Some embodiments of the invention include a screw-in fastener system used to temporarily retain a coping on an abutment during bonding of the coping into a blind hole located in the tissue-side of a removable dental element such as a removable complete denture. The temporary fastener system disclosed has features to allow easy removal of the dental prosthesis from the fastener post after pick-up of the coping into the dental prosthesis is complete, without the need for special tools or access to the fastener system to unscrew it.

[0015] Some embodiments include a temporary fastener with a male-threaded bottom portion that is installed into the screw threads of an abutment, and an axially separable top portion, or cap, that retains the coping onto the abutment. The separable portion allows removal of the coping picked-up in the dental prosthesis without requiring mechanical access to the fastener. The inventive concepts disclosed facilitate easier installation and removal on multiple abutments that may be oriented at different compound angles when compared to the conventional open-tray processes and long impression screws. The temporary fastener may engage the same screw threads of the

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abutment that are used to definitively attach the prosthesis. In this manner, the coping is held against the abutment for the pick-up process with a force oriented identically to that of the final screw mounting. The retention of the cap on the screw post can be designed to provide a desired force holding the coping to the abutment through the applied torque on the temporary fastener. The cap can be attached to the post through a combination of known mechanical attachment means including but not limited to interference fits, adhesives, snap fits or other elastic and inelastically deforming retention elements. The cap may also be formed as an integral part of the screw post that has portions that fracture as a result of an applied axial force. In addition to applied axial forces, the cap may separate from the post as a result of retention changes resulting from chemical or thermal processes and or the application of electromagnetic energy during or subsequent to the pick-up process.

[0016] Other embodiments include a threaded post that has a temporary retention feature that engages the coping without a separable cap. These embodiments engage the abutment threads in mounting the coping but release the coping after bonding to the prosthesis.

[0017] The disclosed systems and methods can be applied to single tooth prostheses with copings and abutments with orientational features or for multiple tooth prostheses using copings and abutments with symmetrical mating surfaces such as 30-degree tapers.

[0018] In some embodiments, the temporary fastener is driven into the abutment threads by a tool that engages the post. In other embodiments, the temporary fastener is driven into the abutment threads by a tool that engages the cap. The drive torque can be designed to be sufficient for holding the coping to the abutment accurately, but less than the torque that would result in movement of the cap relative to the post.

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[0019] In some embodiments, the threaded end of the post portion of the temporary fastener has a deflecting feature that allows the post to engage or disengage the abutment threads through axial motion instead of a rotary screw motion.

[0020] One embodiment describes a system for aligning a dental implant abutment, coping and separable dental element for definitive screw-attachment comprising:

- a. a temporary alignment fastener comprising:
- b. a post having an axis, a first post end and second post end, wherein the first post end is threaded for screw attachment to the implant abutment;
- c. a cap, wherein the cap is attached to the second post end;

[0021] and wherein the temporary alignment screw is configured to hold the coping against the implant abutment when the first post end is screwed into the implant abutment and wherein the cap is separable from the post through a release force directed away from the first post end.

[0022] One embodiment describes a system for aligning a separable dental element for installation to a threaded implant abutment with a definitive screw having a head and threaded shaft portion comprising:

[0023] a coping having a distal end shaped to engage with the implant abutment and a proximal end with an aperture sized to allow the shaft portion of the definitive screw to pass through;

[0024] a temporary screw having a distal end portion adapted to engage the threads of the implant abutment and a proximal end portion having temporary engagement means for attachment adjacent to the proximal end of the coping wherein the temporary screw holds the distal end of the coping in alignment against the implant abutment when the distal end portion of the temporary screw engages the implant abutment threads and wherein the temporary engagement means releases the coping without disengaging the post portion of the temporary screw upon the application of a predetermined axial force in the proximal direction.

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[0025] In some embodiments, an existing removable denture is converted to a screw attached denture by milling pockets to allow copings to be bonded in a pick-up process. In this process, the denture acts in an equivalent manner to a closed impression tray. Proper registration can be confirmed by having the patient bite down on the denture during the pick-up process. After coping pick-up, clearance for the definitive screws can be drilled using the coping as a guide. The converted denture can be used with scan flags to provide a 3-dimensional digital capture. Thus a digital model can be used to make a duplicate prosthesis or as the starting point for a new custom prosthesis.

[0026] One embodiment describes an alignment system for converting an existing denture for screw attachment to threaded implant abutments designed to perform the process of:

- a. mounting pick-up copings to the implant abutments with temporary fasteners,
- b. adhering the copings to cavities formed in the existing denture,
- c. pulling the denture with secured pick-up copings away from the implant abutments,
- d. unscrewing the threaded portions of the temporary fasteners from the implant abutments,
- e. forming definitive screw clearance holes in the denture,
- f. mounting the denture to the implant abutments with definitive screws that engage the same implant abutment threads as the temporary fasteners, wherein the unscrewing the threaded portions of the temporary fasteners and the forming definitive screw clearance holes in the denture may occur in either order.

[0027] For the purposes of this disclosure, a separable dental element is defined to be anything that incorporates one or more dental copings that can be mounted and removed from one or more implant abutments. Different coping designs are known in the dental industry, and the systems and methods disclosed here can be adapted to work with many commercially available types of copings including pick-up copings, temporary cylinders, inserts and impression copings. Implant abutments are known in

the dental industry having compatible interfaces to these copings. Since the mechanical interface is the same, for the purposes of this disclosure, implant abutment is considered a generic term that includes abutment analogs. Description of alignment systems and process methods with copings and implant abutments that are installed in a patient's jaw should be considered to also describe equivalent inventive concepts that may be used with copings and implant abutment analogs in a dental lab. The inventive concepts disclosed herein can be used with different types of separable dental elements. The separable dental element can be any form of impression used in a dental lab to assist in creating and testing dental prostheses. A separable dental element can also be a dental prosthesis fabricated in the dental lab using a physical model made from the impression, a dental prosthesis newly fabricated, or an existing prosthesis being converted for screw attachment. A dental prosthesis is defined to include a single-tooth appliance such as a crown, or any multiple-tooth bridge or denture. These prostheses may incorporate copings to provide a separable interface to provide orientation with an appropriate abutment attached to a patient's jaw or gingiva. The abutments for use with the inventive concepts disclosed herein include screw threads to mount the prosthesis with copings onto the abutments. While the concepts describe female threads in the abutment mating with male threads on a mounting screw, this is for convenience in disclosure. The inventive concepts could be applied with systems having male threads in the abutment engaging a screw with female threads for mounting the prosthesis. These are considered to be straightforward variations of the inventive concepts.

[0028] For the purposes of this disclosure, the abutments may be integral to the implants embedded into the patient's jaw or gingiva, or they may be separate units that are attached to the implants. The inventive concepts disclosed apply to both configurations.

[0029] For the purposes of this disclosure, an existing denture should be interpreted broadly to include any prosthesis that has been created prior to the use of the innovative systems and methods disclosed. An existing denture may be a loose denture that was worn by the patient prior to the installation of implants were installed, or it may be a new denture that is in the process of first fitting in the patient's mouth.

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[0030] The systems and methods disclosed herein can be used with prostheses for attachment to both the upper and lower jaw. As a result, portions of the system that are oriented downward for the lower jaw will be oriented upward for the upper jaw and vice versa. For convenience, a disclosure of an embodiment of inventive concepts that is limited to a single jaw orientation, is considered to disclose an embodiment for the opposite jaw orientation. When referring to the perspective of a clinician, proximal portions are nearer to the clinician than distal portions. While a term such as top is the opposite of the term bottom, and proximal is the opposite of distal, their actual relative orientation will be determined by the context of their use. The term tissue-side is used interchangeably with intaglio to indicate the side of a prosthesis that is opposite the occlusal or cameo surface.

[0031] The inventive systems disclosed are beneficially applicable to screw-attached prostheses. Key benefits of screw-attachment are variable tightening torques and reversibility. The terms permanent, semi-permanent, definitive and final when referring to screw-attachment are used interchangeably in this disclosure. A conventional screw that is definitively attached can still be removed by accessing the screw and rotating it in the opposite direction that was used for attachment. For the purposes of screw-attached prostheses for this disclosure, the attachment is semi-permanent, permanent or definitive in the sense that frequent attachment and removal is not anticipated for normal use. In contrast, the temporary screw attachment is applied for a planned process duration or other anticipated interval. Removal of a semi-permanent or definitive screw is generally motivated by a problem or an opportunity for an improvement. Access to the screw to apply a tool for removal may require removal of material covering the screw for aesthetic reasons.

[0032] Other terms in the specification and claims of this application should be interpreted using generally accepted, common meanings qualified by any contextual language where they are used. The terms "a" or "an", as used herein, are defined as

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one or as more than one. The term "plurality", as used herein, is defined as two or as more than two. The term "another", as used herein, is defined as at least a second or more. The terms "including" and/or "having", as used herein, are defined as comprising (i.e., open language). The term "coupled", as used herein, is defined as connected, although not necessarily directly, and not necessarily mechanically. The terms "about" and "essentially" mean ± 10 percent. Reference throughout this document to "one embodiment", "certain embodiments", and "an embodiment" or similar terms means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, the appearances of such phrases or in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments without limitation. The term "or" as used herein is to be interpreted as an inclusive or meaning any one or any combination. Therefore, "A, B or C" means any of the following: "A; B; C; A and B; A and C; B and C; A, B and C". An exception to this definition will occur only when a combination of elements, functions, steps or acts are in some way inherently mutually exclusive.

[0033] The drawings featured in the figures are for the purpose of illustrating certain convenient embodiments of the present invention and are not to be considered as limitation thereto. The term "means" preceding a present participle of an operation indicates a desired function for which there is one or more embodiments, i.e., one or more methods, devices, or apparatuses for achieving the desired function and that one skilled in the art could select from these or their equivalent in view of the disclosure herein and use of the term "means" is not intended to be limiting. Other objects, features, embodiments and/or advantages of the invention will be apparent from the following specification taken in conjunction with the following drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

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- [0034] FIG. 1 is a top exploded isometric view of a first embodiment of a system for aligning a dental implant abutment, coping and prosthesis for definitive screw-attachment.
- [0035] FIG. 2 is a side plan view of a first embodiment of a system for aligning a dental implant abutment, coping and prosthesis for definitive screw-attachment.
- [0036] FIG. 3 is a top plan view of a first embodiment of a system for aligning a dental implant abutment, coping and prosthesis for definitive screw-attachment.
- [0037] FIG. 4 is a side cross-sectional view of the system for aligning a dental implant abutment, coping and prosthesis for definitive screw-attachment along the line indicated in FIG. 3.
- [0038] FIG. 5 is a side cross-sectional view of the embodiment of FIG. 4 attached to the jaw and prosthesis prior to the pick-up process.
- [0039] FIG. 6 is a side cross-sectional view of the embodiment of FIG. 5 after the pick-up process.
- [0040] FIG. 7 is a side cross-sectional view of the embodiment of FIG. 6 showing a drill bit creating a pilot hole for a definitive screw.
- [0041] FIG. 8 is a side cross-sectional view of the embodiment of FIG. 7 showing a stepped drill bit creating a clearance for the head and shaft of a definitive screw.
- [0042] FIG. 9 is side cross-sectional view of the embodiment of FIG. 8 showing the definitive screw holding the prosthesis to the implant.
- [0043] FIG. 10 is an exploded top isometric view of a second embodiment of a system for aligning a dental implant abutment, coping and prosthesis for definitive screw-attachment illustrating a single abutment and a temporary screw with breakaway tool.
- [0044] FIG. 11 is an exploded side isometric view of the second embodiment of FIG. 10 prior to installation to the implant abutment.
- [0045] FIG. 12 is an exploded side isometric view of the embodiment of FIG. 10 with the breakaway tool pushed onto the post and the coping placed on the implant abutment.
- [0046] FIG. 13 is an exploded side isometric view of the embodiment of FIG. 10 schematically showing the tool being rotated to screw the post into the implant abutment.

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- [0047] FIG. 14 is an exploded side isometric view of the embodiment of FIG. 10 schematically showing the tool breaking away from the cap after the coping is secured on the abutment.
- [0048] FIG. 15 is an exploded side isometric view of the embodiment of FIG. 10 schematically showing the prosthesis being marked for positioning a clearance hole.
- [0049] FIG. 16 is a side isometric view of the marked prosthesis from FIG. 15.
- [0050] FIG. 17 is a side isometric view of the marked prosthesis from FIG. 16 with blind clearance hole and boring tool.
- [0051] FIG. 18 is an exploded side isometric view of the prepared embodiment of FIG. 17 as adhesive is schematically applied to the coping fixed to the abutment with the temporary screw.
- [0052] FIG. 19 is a side view of the prosthesis in position for curing of the adhesive applied in FIG. 18.
- [0053] FIG. 20 is a bottom side isometric exploded view of the coping incorporated in FIG. 19 being picked up as the prosthesis is removed from the implant abutment.
- [0054] FIG. 21 is a top side isometric view schematically showing the post of the temporary screw being unscrewed from the implant abutment.
- [0055] FIG. 22 is a top side isometric view of the implant abutment prepared for attachment of a prosthesis with a definitive screw.
- [0056] FIG. 23 is a bottom isometric view of the prosthesis with picked-up coping from FIG. 20 being drilled from the bottom to provide clearance for the threaded shaft of a definitive screw following coping pick-up.
- [0057] FIG. 24 is a top isometric view of the prosthesis with picked-up coping from FIG. 20 with a drill applied from the top to provide clearance for the definitive screw head.
- [0058] FIG. 25 is top exploded isometric view of the prepared prosthesis from FIG. 24 with the definitive screw.
- [0059] FIG. 26 is a top isometric view of the prepared prosthesis from FIG. 24 after attachment to the implant abutment with the definitive screw.

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- [0060] FIG. 27 is a schematic description of a process for aligning dental implant abutments, copings and a prosthesis for definitive screw-attachment.
- [0061] FIG. 28 is an exploded bottom isometric view of a third embodiment of a system for aligning a dental implant abutment, coping and prosthesis for definitive screw-attachment with tool oriented for assembly.
- [0062] FIG. 29 is an assembled bottom isometric view of the embodiment of FIG. 28 with temporary screw and coping inserted into tool.
- [0063] FIG. 30 is a side view of the system of FIG. 29 after assembly with the implant abutment.
- [0064] FIG. 31 is a cross-sectional view of the assembly of FIG. 30 along C-C.
- [0065] FIG. 32 is a side view of the assembly of FIG. 28 after the pick-up process showing the removal end of the tool engaging the retained temporary screw post.
- [0066] FIG. 33 is a cross-sectional of the assembly of FIG. 32 along D-D.
- [0067] FIG. 34 is an exploded isometric view of another embodiment of a temporary screw of a system for aligning a dental implant abutment, coping and prosthesis for definitive screw-attachment.
- [0068] FIG. 35 is an isometric view of the temporary screw of FIG. 34 from the screw thread end.
- [0069] FIG. 36 is an isometric view of the temporary screw of FIG. 34 from the cap end.
- [0070] FIG. 37 is a bottom isometric view of a jaw with multiple abutments in preparation of marking a prosthesis as part of the process for aligning a dental implant abutment, coping and prosthesis for definitive screw-attachment.
- [0071] FIG. 38 is a top isometric view of the prosthesis of FIG. 37 showing abutment location markings.
- [0072] FIG. 39 is a top isometric view of the prosthesis with clearances milled to receive copings for pick-up.
- [0073] FIG. 40 is a bottom isometric view showing installed copings and the assembly of a coping to an implant abutment with a temporary screw and torque driver.

[0074] FIG. 41 is a top isometric view showing adhesive being dispensed in recesses of the prosthesis.

[0075] FIG. 42 is a bottom isometric view of the abutments with attached copings in the process of being positioned into the recesses of the prosthesis after adhesive is dispensed.

[0076] FIG. 43 is a top isometric view of the copings attached to the prosthesis after adhesive curing and pick-up.

[0077] FIG. 44 is a bottom isometric view showing the removal of temporary screw posts from the implant abutments after the pick-up process.

[0078] FIG. 45 is a top view of a drill in position to create a pilot hole in the prosthesis of FIG. 43.

[0079] FIG. 46 is bottom view showing the pilot holes from the process of FIG. 45 extending through the prosthesis to exit on the occlusion side.

[0080] FIG. 47 is a bottom isometric view showing a counterbore positioned on the occlusion side of the prosthesis to provide clearance for the definitive screw.

[0081] FIG. 48 is a bottom isometric view illustrating a reamer positioned to clean residue from the bore.

[0082] FIG. 49 is a bottom isometric view of the prepared prosthesis with definitive mounting screws prior to fastening to the abutments.

[0083] FIG. 50 is a top isometric view corresponding to FIG. 49.

[0084] FIG. 51 is a top isometric view of an embodiment of a component suitable for use as a scan flag for digital capture and a laboratory analog for physical model creation.

[0085] FIG. 52 is a bottom isometric view of the component from FIG. 51.

[0086] FIG. 53 is a bottom isometric view showing the component of FIG. 51 positioned for screw attachment to the converted prosthesis of FIG. 49.

[0087] FIG. 54 is a top isometric view of FIG. 53.

[0088] FIG. 55 is a top isometric view showing the assembly of FIG. 54 mounted on a stand in preparation for scanning.

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- [0089] FIG. 56 is a side view of FIG. 55.
- [0090] FIG. 57 is an isometric view of the assembly of FIG. 54 with reinforcing bars mounted prior to pouring of dental stone.
- [0091] FIG. 58 is a schematic flow chart illustrating options for creating and attaching a permanent prosthesis.
- [0092] FIG. 59 is an exploded isometric view of the torque driver shown in FIG. 40.
- [0093] FIG. 60 is a top isometric view of the torque driver of FIG. 59 partially assembled.
- [0094] FIG. 61 is a top isometric view of the post removal tool shown in FIG. 44.
- [0095] FIG. 62 is a top isometric view of an embodiment of a temporary screw similar to FIG. 1 schematically illustrating axial motion of the cap away from the post threads from screwing after the coping contacts the abutment.
- [0096] FIG. 63 is a top isometric view of the embodiment of FIG. 62 in which the temporary screw post end has become flush with the top of the cap.
- [0097] FIG. 64 is a top isometric view of a temporary screw post embodiment having a cylindrical stem.
- [0098] FIG. 65 is a top isometric view of a split temporary screw post embodiment having deflecting sections.
- [0099] FIG. 66 is an isometric view of a temporary screw post embodiment having symmetric axial splines.
- [0100] FIG. 67 is an isometric view of a temporary screw post embodiment having a weakened portion facilitating lateral movement during pick-up.
- [0101] FIG. 68 is a bottom isometric view of a temporary screw embodiment having a spring cap.
- [0102] FIG. 69 is a bottom isometric view of a one-piece temporary screw embodiment designed to fracture under axial loading.
- [0103] FIG. 70 is a cross-sectional view of a temporary screw embodiment incorporating a rounded interface between cap and post facilitating pivotal movement as illustrated.

- [0104] FIG. 71 is a cross-sectional view of a temporary screw embodiment incorporating a restricted interface between cap and post facilitating pivotal movement and protective film.
- [0105] FIG. 72 is a cross-sectional view of a temporary screw embodiment incorporating a spring cap with preferential axial movement in the pick-up direction.
- [0106] FIG. 73 is a cross-sectional view of a temporary screw embodiment incorporating a laminar cap fixed to the end of the post.
- [0107] FIG. 74 is a cross-sectional view of a temporary screw embodiment incorporating a compliant interface between the cap and post.
- [0108] FIG. 75 is a cross-sectional view of a temporary screw embodiment incorporating a split post that has deflecting sections with screw threads shaped to facilitate axial separation without unscrewing the post threads.
- [0109] FIG. 76 is a cross-sectional view of a temporary screw embodiment incorporating an interface material between the cap and post.
- [0110] FIG. 77 is a cross-sectional view of a temporary screw embodiment incorporating an O-ring interface between the cap and post.
- [0111] FIG. 78 is a cross-sectional view of a temporary screw embodiment incorporating a cup-shaped interface material between the cap and post.
- [0112] FIG. 79 is a bottom isometric view of a temporary screw embodiment incorporating a split collar cap.
- [0113] FIG. 80 is a top isometric view of a temporary screw embodiment incorporating a planar spring that flexes when pulled perpendicular to the diameter indicated.
- [0114] FIG. 81 is a top isometric view of a temporary screw embodiment incorporating a planar spring that flexes when pulled parallel perpendicular to the diameter indicated.
- [0115] FIG. 82 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment in which the coping is held by mechanical interference to the proximal end of the threaded post.

- [0116] FIG. 83 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment in which the coping has spring fingers holding the proximal end of the threaded post.
- [0117] FIG. 84 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment in which the coping has collet-type spring fingers holding the proximal end of the threaded post.
- [0118] FIG. 84A is a top view of the embodiment of FIG. 84.
- [0119] FIG. 85 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment in which the proximal end of threaded post has a slotted spring section holding the coping.
- [0120] FIG. 86 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment in which a compressed ring holds the coping to the proximal end of the threaded post.
- [0121] FIG. 87 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment in which a compressed ring with a u-shaped cross-section holds the coping to the proximal end of the threaded post.
- [0122] FIG. 88 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment in which a thin cap fixes the coping to the proximal end of the threaded post.
- [0123] FIG. 89 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment in which a filler material is placed in the bore of the coping at the proximal end of the threaded post.
- [0124] FIG. 90 is a cross-sectional view of an embodiment of a system for aligning a dental implant abutment, coping and prosthesis for semi-permanent screw-attachment showing a tool engaging features of the coping to screw in the threaded portion of the post.

[0125] FIG. 91 is a bottom isometric view schematically illustrating the material removed from an existing denture necessary with inventive concepts disclosed in preparation for pick-up.

[0126] FIG. 92 is a top isometric view schematically illustrating the material removed from an existing denture necessary with inventive concepts disclosed in preparation for pick-up.

[0127] FIG. 93 is a bottom isometric view schematically illustrating the material removed from an existing denture necessary using prior art impression screw systems.

[0128] FIG. 94 is a top isometric view schematically illustrating the material removed from an existing denture necessary using prior art impression screw systems.

DETAILED DESCRIPTION OF THE INVENTION

[0129] FIG. 1 shows an exploded view of one embodiment of a temporary alignment system 12 for use in a direct coping pick-up process for screw attachment of a prosthesis. Implant abutment 8 has a distal end which may include attachment feature portion 135 illustrated as a screw thread for direct attachment to the patient's jaw and a proximal end with an abutment shaped to accommodate a coping 9. The abutment includes threaded section 18. The coping has a central bore 16 to accommodate screw fastening and may include ridges 17 or other structures or surface treatments to increase retention to the prosthesis with adhesive. The coping and abutment mating surfaces as shown in FIG. 1 are symmetrical. The inventive concepts of this disclosure may also be applied to abutment and coping systems that are keyed to restrict mating orientation. The coping may be mounted onto the abutment through rotation of a temporary adjustment screw comprising a threaded post 10 and cap 11. The cap 11 is mechanically attached to post 10 in a manner that allows relative axial motion with the application of a predetermined force. As illustrated in FIG. 1, cap 11 has a square central bore 13 that is press-fit onto a square portion 14 of post 10. The cap 11 temporarily retains coping 9 onto the implant abutment 8 during the pick-up process of the coping into the prosthesis with a force aligned directly along the same axis as the semi-permanent screw that will be used for definitive prosthesis mounting. The portion of

the post engaging the abutment threads also prevents any pick-up material from contacting the abutment screw threads. After the coping is picked-up into the prosthesis, the cap and coping may be released from the abutment by applying an axial force. In the embodiment shown, the post threads 15 remain engaged with abutment threads 18 after the pick-up process. The post can then be removed from the abutment by unscrewing it. The prosthesis with embedded coping can be subsequently processed to accommodate semi-permanent screw attachment as will be described later.

[0130] FIGS. 2 and 3 show a side and top view of the assembled system of FIG. 1; FIG. 4 shows a cross-sectional view along the axis as indicated. As shown in FIG. 4, matching conical surfaces on the exterior of the implant abutment 8 and the interior of the coping 9 are engaged. In the orientation shown, the coping 9 is pulled into alignment by an axial force from the lower surface 11s of the cap 11 pushing against the upper surface 9s of the coping 9 from screwing the threads of post 10 into the implant abutment 8. As shown, there is a gap 219 between the temporary screw attachment post 10 and the coping 9. As also shown in FIG. 4, the width of the temporary screw cap 11 is greater than the width of the largest portion of the central aperture 16 of the coping 9. The temporary screw cap 11 holds the coping 9 in position on the implant abutment 8. As shown in FIG. 4, the cap-coping interface 210 is located at the proximal end 16p of the central aperture 16. As also shown in FIG. 4, due to the gap 219 and open space 211 between the coping 9 and the temporary screw attachment post 10 facing the implant abutment 8, the only contact between the temporary screw 190 and the coping 9 is between the temporary screw cap 11 and the proximal end of the coping 9 which provides an axial force by torquing the temporary screw 190 into the abutment 8 to hold the coping 9 on the implant abutment 8. The distal end of the abutment may be directly attached to the patient's jaw or attached to a separate implant attached to the jaw. The inventive concepts are not dependent upon the nature of the implant, so the distal end attachment feature 135 is represented schematically.

[0131] The capability for relative axial movement between the cap 11 and temporary attachment post 10 allows separation of the temporary attachment post from the cap without tools after retaining the coping onto the abutment during fitting and bonding of

the coping into the prosthesis. These parts are accurately aligned during the bonding process since the temporary post engages the abutment threads to provide an axial force holding the coping to the abutment just like the screw used for final attachment.

[0132] The cap may be sized to have an amount of press-fit mechanical interference to the temporary attachment post to provide an axial retention force of approximately 20 to 900 grams, this force being sufficient to retain coping 9 during assembly while allowing relatively easy pick-up removal of the coping and prosthesis from the temporary attachment post after assembly. The temporary attachment post 10 may include indicators (not shown) in the end by the cap 11 to provide intermediate visual and/or tactile feedback on the depth of threaded engagement of the post during screw attachment of the coping to the abutment.

[0133] In this embodiment, screw driving torque is provided by the square cross-section of the cap aperture and temporary attachment post. In the cross-sectional view of FIG. 4, the post 10 has been screwed in so that only a small beveled surface of the post extends above the top of the cap when the post threads bottom out in the abutment. During installation, this optional configuration provides feedback to the dental practitioner when the torque increases as the threads bottom. The square drive tool engagement can also be designed to disengage at a pre-designed minimum extension of the square post above the top of the cap. Alternatively, a tool with a specified maximum torque may be used to ensure engagement of the coping and abutment surfaces.

[0134] The screw driving torque function may be accomplished by engaging other features on the temporary attachment post such as hex or spline or asymmetric features. Alternately, the cap may be used to engage a screwdriver or other tool for torquing. For example, in the case of a cylindrical temporary attachment post top portion, driving torque can be provided by the friction of the press-fit between the cap and temporary attachment post. For example, a medium press-fit of a 3 mm diameter 1 mm thick nylon cap onto a 1.3 mm diameter stainless steel cylindrical rod may produce approximately 500 grams of axial retention force and 17 gram-cm driving torque. A typical screw

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thread size for appliances is m1.4 x 0.3. Note that in FIG. 4, the temporary attachment post threads 181 are illustrated making contact with the abutment threads 182 when engaged. The retention/axial force of the cap to the temporary attachment post may be determined by the degree of press-fit and frictional properties between the cap and temporary attachment post, and/or spring features incorporated into the temporary attachment post and/or cap.

[0135] In actual trial installations, polymer caps of approximately 1.2 mm thickness press fit onto posts of approximately 1.4 mm diameter with cylindrical axial bores have been sufficient for installation and pick-up removal of a single prosthesis from multiple implant abutments in which the axes of the screw threads in the implant abutments are not mutually parallel.

[0136] The separable mechanical attachment means may include any combination of techniques, including frictional forces from interference, adhesives, waxes, chemical bonding, solders, elastically or inelastically deformable spring, snap or interlocking structures, thermally or electromagnetically fusible materials, fracturing structures, etc.

[0137] FIG. 5 through FIG. 9 show example cross-sectional views of some of the different stages of installation of the temporary fastener system into a denture. FIG. 5 shows a cross-sectional view of the assembly of the first embodiment during the initial phase of the coping pick-up process. As illustrated, the implant abutment 8 is attached to a schematic implant 70. The implant 70 has an interface 7 (shown schematically) that is attached to the patient's jawbone 22. The coping 9 is held against the implant abutment 8 through the temporary screw comprising the post 10 and cap 11. A blind clearance hole 5 in the prosthesis 3 is sized to accommodate the coping and temporary screw. Pick-up material 171 is positioned in the clearance hole 5 to capture the coping in proper alignment within the prosthesis. The cap-coping interface 210 is positioned at the proximal end 9p of the coping central bore or aperture 16 and, as shown in FIG. 5, blocks pick-up material 171 from entering the coping central aperture 16. After the pick-up material 171 has set up, the prosthesis 3, coping 9 and temporary screw cap 10 are

pulled off as an assembly off the patient's jaw as shown by the arrows in FIG. 6. The coping 9 and cap 11 are released from the implant abutment 8 and post 10, while the threads of the post 10 keep it engaged in the implant abutment 8. The post 10 is subsequently removed to make the abutment threads 18 available for holding the prosthesis in proper alignment with a definitive screw.

[0138] The prosthesis/coping assembly must be processed after the pick-up process for screw attachment. A pilot hole is drilled with bit 172 from the bottom side of the assembly. As shown in FIG. 7, the diameter of the bit may be selected to use the interior bores of the coping and cap to act as guides for hand processing. Alternately, a drill guide may be employed that engages a portion of the interior of the coping to align the pilot hole. The pilot hole provides guidance for a tool to provide clearance for the definitive screw shaft and head. FIG. 8 shows a stepped drill 173 that cuts both clearances in a single process. Alternatively, the shaft and head clearance may be drilled with two drills in two process steps. If desired, the cap 11 of the temporary screw 190 can be fabricated of a material that is easier to drill than the coping material to provide feedback on the drill position. It has been found that it is possible to distinguish where the drill is positioned by feel at the interfaces between the pick-up adhesive and the top of the cap (as shown in FIG. 8) and the bottom of the cap and the top of the coping. Since pick-up material was blocked from entering the coping, drilling resistance decreases rapidly upon breaking through the bottom of the cap and entering the interior channel of the coping. Color differences in the materials can also be detected. Alternatively, a tool can be configured to fit within the bore of the coping to limit the depth of the drill.

[0139] Once clearance hole 174 for the definitive screw has been made from the top of the prosthesis, the prosthesis is ready for mounting to the implant with definitive screw 175 as shown in FIG. 9. The male threads 150 of the definitive screw are shown filling the female threads of the abutment over an engagement depth extending from a first end of the thread engagement 163 to the second end of abutment thread engagement 164 of the implant abutment threading 18. Once the most distal thread of the definitive screw 175 is engaged in an abutment thread, the engagement depth will increase by a

distance equal to the thread pitch for each complete revolution of the definitive screw 175. As shown in FIG. 4, a screw clearance hole 174 is large enough to accommodate the definitive screw head 151. A residual portion 161 of the cap 11 is shown in FIG. 9 for aligning the coping 9 to the prosthesis 3 in the closed tray pick-up process. After the definitive screw 175 is torqued into position, the screw clearance hole 174 in the prosthesis 3 may be filled with Teflon tape and color-matching composite materials for aesthetic purposes. In the illustrated embodiment, the coping bore 16 has a shoulder 152 to engage a flat surface on the underside of the definitive screw head 151 of the definitive screw 175 to pull the coping 9 into proper seating on the implant abutment 8. Alternate configurations are possible without deviating from the temporary screw system for coping pick-up disclosed.

[0140] FIG. 10 is another exploded isometric view of parts of an embodiment of the invention. In this example, cap 11 is integrated into a breakaway installation tool 18. The tool portion 19 may be used to install the temporary attachment post 10, and then section 19 broken away at mechanically weak separation feature 20, for example, when the post bottoms out in the abutment leaving the cap portion 11 in position. Alternatively, the tool can be designed to increase stress on the separation feature as the top of the post moves axially down relative to the weakened section. As illustrated, after the cap portion 11 breaks away from the tool portion 19, drive feature 21 in the tool portion may be used to remove the post 10 after the pick-up process. One or both ends of the tool may be shaped to subsequently engage and remove the temporary attachment post 10 after installation of coping 9 into the denture.

[0141] FIGS. 11-26 provide schematic isometric views of the process steps for using the elements of an exemplary embodiment introduced in FIG. 10 for a single implant system such as a crown. In FIG. 11, a schematic isometric view of a portion of the patient's jaw 22 is shown with an implant 70 (not shown) installed, and implant abutment 8 installed into the implant. The coping 9 is placed onto the implant abutment 8, the top portion of temporary attachment post 10 is assembled onto cap 11. The top portion of temporary attachment post 10 and cap 11 are configured such that there is a means to drive the temporary attachment post into the abutment, while allowing axial movement of the cap

11 relative to the temporary attachment post axis, the cap/temporary attachment post interface having sufficient retention force to keep the coping in place on the abutment during subsequent installation steps, and the temporary attachment post being removable after picking up the coping into the prosthesis. Cap 11 may be attached to a break-away installation/removal tool 18.

[0142] FIG. 12 shows the coping 9 placed on the implant abutment 8 and the cap/tool 18 installed onto temporary attachment post 10. The coping-abutment surfaces may comprise a conical or spherical concave feature on the coping 9 that mates with a complementary feature on the top of the implant abutment 8, as illustrated. Alternatively, keying features may be employed to restrict relative rotational orientation, particularly in the case of single implants.

[0143] FIG. 13 shows the temporary attachment post being threaded into the implant abutment 8, through a clearance hole in the coping 9. The cap abuts the coping to secure the coping to the abutment. The cap 11 is free to move axially along the temporary attachment post with a frictional retaining force of the cap to the temporary attachment post. A known amount of retention force of the coping to abutment is provided by the design and materials used in the cap and temporary attachment post.

[0144] FIG. 14 shows the tool portion of the cap being removed after the cap has broken away; the tool may be used for removal of the temporary attachment post at a later step.

[0145] FIG. 15 shows marking of the position of the coping onto the appliance for drilling a recess for the coping in the prosthesis.

[0146] FIG. 16 shows the prosthesis with coping drilling location marking 23.

[0147] FIG. 17 shows the prosthesis after boring the cavity for the coping; the cavity for the coping may be accurately drilled slightly larger than the coping, without significant unwanted material removal from the prosthesis.

[0148] FIG. 18 shows pick-up material being applied to the coping and/or prosthesis after confirmation of freedom to provide proper occlusion during dry testing. Although not illustrated, the cavity of the prosthesis or the coping may optionally include features to provide venting of excess pick-up material if desired.

[0149] FIG. 19 shows the bonded coping being picked up into the prosthesis

[0150] FIG. 20 shows the prosthesis removed from the temporary attachment post; the temporary attachment post/cap design allows removal of the prosthesis from the temporary attachment post. The coping is now incorporated into the prosthesis.

[0151] FIG. 21 shows the temporary attachment post being removed with the tool portion of the cap.

[0152] FIG. 22 shows the abutment installed in the implant with the temporary attachment post removed.

[0153] FIG. 23 shows drilling a small guide-hole (for example 1-2 mm diameter), through the clearance hole of the coping, into and through the prosthesis. This guide hole provides a small reference hole for enlargement of the hole to accommodate the prosthesis retaining screw.

[0154] FIG. 24 shows enlarging the guide hole to a clearance hole for prosthesis retaining screw, approximately the diameter of the head of the retaining screw (e.g., 1.5-

2.5 mm). The clearance hole would typically be drilled down to the top surface of the coping.

[0155] FIG. 25 shows the prosthesis being installed onto the implant abutment by placing the prosthesis coping onto the abutment and installing the prosthesis retaining screw.

[0156] FIG. 26 shows the assembled prosthesis on the implant.

[0157] FIG. 27 contains a summary of a generalized process extending the basic process described above for a prosthesis attached to multiple implant abutments.

[0158] Another embodiment of a prosthesis and implant alignment system and tool are shown in FIG. 28. In this case, the cap is in the form of a hex nut 63 that is press fit onto alignment post 62 to act as the temporary alignment screw. The drive tool 64 includes a concave hex socket 68 that fits temporary post nut 63, and coping retaining portion 69 that retains coping 61 with a slight interference fit. Thus, as shown in FIG. 29, the temporary screw comprising nut 63 with post 62 is engaged with the socket portion of the tool, and the coping 61 is retained in the tool. The coping is seated onto the abutment 60 by using the hex portion of the driver to rotate the nut and engage the threads 66 on the temporary screw post 62. FIGS. 30 and 31 show an exterior and cross-sectional view of the mounting of the coping on the abutment with the tool. The tool may also have an integrated feature for removing the post as shown in FIG. 32. For example, FIG. 33 shows a tapering feature 170 on the narrow end of tool 64 which may be used to unscrew the post. FIG. 28 illustrates optional undercut 67 for stronger adhesive locking. Optional anti-rotation flat 65 is shown. Such an anti-rotation flat may be used on mating surfaces in circumstances in which there is a preferred orientation around the axis of the screw threads.

[0159] Another embodiment of the inventive concepts in which the cap of the temporary screw is shaped to engage the driving tool is shown in FIGS. 34-36. Cap 102 is mechanically attached to alignment post 101 at end portion 101A to form temporary alignment screw 100. This mechanical attachment may result from press-fitting a polymeric cap 102 onto a metal post 101 to provide adequate resistance to rotary slip to temporarily attach the coping to the implant abutment while still allowing relative axial movement during the pick-up process. The cap 102 may include a tapered surface 102B shaped to match the mating surface of an associated coping 112. A hexalobular internal (Torx) drive feature is shown in the end of the cap 102, although other bit socket shapes are possible. As previously discussed, other mechanical engagement means besides an interference fit are possible. The post may be made of different materials than these, or even be of unitary construction with weakened sections that fracture or otherwise breakaway under a desired pick-up axial force.

[0160] In a preferred embodiment the post 101 is made from stainless-steel or titanium, and the cap of polymer such as PEEK or acetal. The short length of the post and threaded fastener in this embodiment allows separation at high degrees of angularity of the assembled parts in use. This tolerance for off-axial removal has been found to be particularly advantageous when the prosthesis is to be definitively screw mounted to multiple implant abutments. Testing has verified cap axial release forces of up to about 5 pounds and the application of torque to the cap of about 1.6 inch-ounces without slipping.

[0161] The general process for converting an existing removable denture for definitive screw attachment onto four implants with this embodiment is illustrated in FIGS. 37-50. This prosthesis may be, for example, a removable denture that was used prior to implant surgery or a duplicate of such an existing denture as described in US Provisional Patent Application 62/774,402 incorporated herein in its entirety.

[0162] FIG. 37 shows a schematic representation of a human jaw portion 106 with implant abutments 107 installed. It does not matter for this discussion if the abutments

are separable from the implanted portion of the implant or not. Prosthesis 103 is shown with occlusion side 104 and intaglio side 105. Pick-up marking caps 108 are installed onto abutments 107. The location of implant abutments 107 is marked onto the prosthesis using customary methods by mating the prosthesis with the abutments. FIG. 38 shows the abutment positions 109 marked onto prosthesis 103. FIG. 39 shows the boring of blind holes 110 slightly larger than copings 112 in marked locations with burr tool 111.

[0163] FIG. 40 shows the installation of copings 112 onto abutments 107 using separable fastener assembly 100, and torque driver 113 (described in more detail later). The torque driver 113 prevents over-tightening of temporary screw 100 and possible separation of the cap 102 from the post 101 due to rotary motion. The cap 102 and/or post 101A of each separable fastener 100 may be mechanically captured or adhered to the coping 112, or may be designed to loosely fit into the bore of the coping as illustrated with axial force from tightening the separable fastener holding the copings to the abutments 107. The prosthesis is placed over the mounted copings to ensure proper fit.

[0164] FIG. 41 shows application of acrylic or other adhesive 144 into cavities 110 of prosthesis 103, which is subsequently fitted onto copings 112.

[0165] FIG. 42 shows prosthesis 103 being mated with copings 112. After the adhesive sets, the separable fasteners allow easy removal of the prosthesis from the abutments with the copings incorporated into the prosthesis. The angular tolerance for removing the prosthesis from multiple abutments allows applying pick-up forces sequentially around the edge of the prosthesis to work the caps 102 off the posts 101. The caps 102 remain in the prosthesis with the copings 112, while the posts 101 remain in the abutments.

[0166] FIG. 43 shows the prosthesis with incorporated copings 112 after the pick-up process.

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[0167] FIG. 44 shows the removal of the threaded post 101 from the implant abutment with removal tool 115. This allows the implant abutment threads to be accessible for subsequent definitive screw attachment.

[0168] FIG. 45 shows the drilling of the small pilot hole 117 (e.g., using a drill bit 116 of approximately 1.4 mm diameter), from the intaglio side 105 of the prosthesis out through the occlusion side 104. It has been found that the bore of the coping 112 and the bore of the cap provide adequate guidance for this hole, although a tooling guide could readily be designed to mate with the particular coping used. The pilot hole is drilled completely through the prosthesis to the occlusion side 104 as shown in FIG. 46.

[0169] FIG. 47 shows enlarging of the pilot hole 117 to allow clearance for a prosthetic mounting screw 121. The clearance holes 119 are drilled down to the top of the coping using counterbore drill 118. This requires only a small diameter enlargement (for example, approximately 2.4 mm).

[0170] FIG. 48 shows a step of a final hand reaming with reamer 120 of the coping bore to clean out any debris or remaining material from the cap that would interfere with the definitive screw.

[0171] FIGS. 49 and 50 show the final installation of prosthesis 103 onto abutments 107 using definitive prosthetic screws 121. The screw holes may be subsequently filled to use the modified prosthesis depending upon the anticipated use as a short-term or more permanent prosthesis. This sequence of process steps essentially follows the material provided in FIG. 27.

[0172] Note that in the above procedure very little material is removed from the prosthesis during the coping pick-up installation process. The boring process in FIG. 39

need only be sufficient to provide clearance for the coping and temporary screw. Angular variation in the axes of the implant abutments does not appreciably increase the size of the cavity boring required in this closed tray process compared to the additional prosthesis material that must be removed with relatively long impression screws and sleeves in a conventional open tray conversion process for definitive screw attachment. FIGS. 91-92 provide a schematic comparison of the size of the recess borings required using the concepts disclosed compared to the prior art conversion process with larger through holes in FIGS. 93-94.

[0173] The converted prosthesis with copings and screw-access channels may also be used as an accurate digital scan model of abutment positioning for creating a new prosthesis. In this embodiment, dual purpose scan flag and lab analogs 122 shown in FIGS. 51-52 may be fastened to the provisional or duplicate prosthesis 103, for example, after the clearance hole cleaning shown in FIG. 48. Features that may be present on the scan-flag/analog include a scan-flag reference portion 123 near the top of the analog, reference scan-flag features such as flats 124, axial and radial retention feature 128, screw attachment 125 for scanning fixture and/or reinforcement wire attachment. The abutment features 126 are specific to various systems commercially available. The figures show a tapered abutment mating surface 126 and female thread 127.

[0174] FIGS. 53-54 show scan flag/analog 122 attached to converted prosthesis 103 with copings 112 using definitive screws 121.

[0175] FIGS. 55-56 show converted prosthesis 103 with scan flags/analog 122 mounted to fixture 130 by attaching one or more scan flags 122 to the base with adjustable means to orient the prosthesis properly for scanning. For illustration an approximate mounting angle of 45 degrees is shown. In this example, the converted prosthesis 103 is mounted to articulated arm 131 with screw 129 that fits into the threaded hole of scan-flag/analog 122. Base 132 is mounted onto the base of the scanning machine.

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[0176] The provisional or duplicate prosthesis with attached scan flags/lab analogs is scanned into the design software. This process captures the accurate position of the implant multi-unit abutment relative to the soft tissues and it also captures the tested prosthetic contours to aid in the design of the definitive prosthesis. After the prosthesis has been scanned in, a physical model may optionally be created by creating a soft tissue moulage and pouring dental stone into the provisional or duplicate prosthetic utilizing the scan flags as the laboratory analogs.

[0177] FIG. 57 schematically shows the application of solder or brazing preforms 133 to attach reinforcement bars 134 prior to pouring dental stone. Preforms 133 may be inserted into holes in the scan-flag/analog and heated to attach bars 134. Low-temperature solders, brazing compounds, and hot-melt or other adhesives may be utilized in a preform or dispensed method to increase the rigidity of the analog assembly prior to casting.

[0178] This method ensures a fast and efficient means of transferring all pertinent and relevant information from a converted denture required for designing a definitive prosthesis from digital scanning and creating the most accurate and precise physical model that can be mounted in an articulator with the aid of a bite registration in preparation for post-processing of the machined prosthesis, for example to verify passivity of fit, occlusion, etc.

[0179] In addition to the screw attachment of the scan flags to the modified prosthesis, scan flags may be attached to the prosthesis with incorporated copings of FIG. 43 prior to the drilling operations shown in FIGS. 45-47. In this case, another embodiment of the scan flag (not shown) with a post feature equivalent to post feature 101A of separable screw would be inserted into copings 112 of the modified prosthesis and retained by the embedded cap 102. If the separable fastener uses a snap-fit feature to retain the cap to the post, drilling may not be required through the prosthesis to mount the scan flags or lab analogs to the prosthesis or to attach the modified prosthesis to the abutments after lab use. For example, US Provisional Patent Application 62/774,402 describes the use

of spring fingers and O-rings for separable fastening of the coping to the abutment for lift-off, and the use of films to prevent adhesive from entering interior portions of the separable fastener. Scan flags and lab analogs may also be engaged with transferred copings using similar mounting features as the post used in the transfer pick-up process. The referenced patent application also includes separable systems in which the post attaches directly to the coping without a cap which may be applied for mounting scan flags or lab analogs as variations of the methods described above. Since the dimensions of the coping and its engagement with the abutment is precisely controlled, having snap-in scan flags engage with a cavity between the top of the coping and the separable cap or an internal groove or other feature of the coping may be desirable.

[0180] Variations of using the modified prosthesis as a digital scan model, or using the inventive concepts disclosed to create a permanent prosthesis will be recognized as possible to dental practitioners. For example, instead of using a dual-purpose scan flag and lab analog, single purpose scan flags can be mounted into the provisional prosthesis for scanning, and subsequently replaced with lab analogs prior to casting. In addition to the attachment of scan flags to a modified prosthesis for digitization, the separable fastener may be used to transfer a coping and cap to a new impression after implant surgery. A scan flag or lab analog may be attached and held to the impression with transferred coping for digitization or casting by substituting the new impression for the modified prosthesis in any of the processes above. FIG. 58 describes a workflow for using the temporary alignment fasteners with a permanent prosthesis fabricated from a digital model based on an impression.

[0181] FIGS. 59-60 show an embodiment of a simple torque-driver 113 that can be used for the temporary coping attachment process discussed in reference to FIG. 40. Shaft assembly 135 contains a spring friction cylinder portion 141 and drive portion 138 designed to engage the temporary screw 100. Spring 136 has an interference fit with cylinder 141, and thus when spring 136 is rotated in the “unwind” direction of the spring, a designed amount of slip torque is present between the spring and cylinder. In the “wind” direction, the spring binds on the cylinder. This provides unequal drive torque

capability in the two rotation directions. Slot 139 in drive cap 137 engages spring end 140, and snaps onto the end of the shaft assembly, thus when the cap is rotated in the clockwise direction, cylinder and drive slip at a known torque. When the cap is rotated in the counterclockwise direction, the spring binds on the shaft to provide a higher screw removal torque before slipping.

[0182] FIG. 61 shows an embodiment of a temporary screw post extractor 115 which may be used to remove post 101 after the pick-up process as shown in FIG. 44. The extractor utilizes a hollow metal tubular split-cylinder end portion 142 that deflects to grip the end of the temporary screw post 101, allowing removal of the separable fastener posts or other types of fasteners. FIG. 61 illustrates a hand-operated knurled end, but other torque tool systems known in the dental industry such as 3/32" friction and latch designs may be used.

[0183] FIGS. 62-63 schematically illustrate how the position of the temporary screw post 10 of the first embodiment relative to the implant abutment can be determined. As the temporary screw is rotated clockwise, the cap 11 will be pushed axially away from the screw threads of the post by the coping. The depth of threaded engagement and the length of the temporary screw post 10 and cap can be designed to have the top of the post 10 coincide with the top of the cap 11 as shown in FIG. 63 when the temporary screw is properly positioned. At this point, a drive tool with a square socket cavity (not illustrated) would disengage from the temporary screw assembly since the post 10 would no longer extend into the tool socket cavity.

[0184] FIGS. 64-66 illustrate different embodiments of the end of the temporary screw post that engages the cap. FIG. 64 shows a modified version of the cylindrical post 101 designed for frictional engagement on cylindrical portion 85 with a cap having a circular bore similar to that shown in FIG. 34. In FIG. 65, the cylindrical post is slotted, and the resulting beam portions 86 sprung open to provide additional frictional retention of a cap through spring action with the deflecting beams. Various features such as symmetric axial splines 87 (FIG. 66), asymmetric splines or grooves, and textures may also be

used to tailor driving torque and axial retention force of the cap to the temporary attachment post. Non-symmetric features may also be utilized to tailor different installation torque and extraction forces. Surface finish and coefficients of friction of the mating materials may also be used to control the driving and retention properties. Temporary attachment posts and caps may be made from metal and polymer materials such as titanium, stainless steels, nylon and PEEK and other non-corrosive biocompatible materials.

[0185] If additional off-axis accommodation is desired when extracting the temporary attachment post from the coping after pick-up, some flexibility may be incorporated into the temporary attachment post, such as the necked down portion 88 of the temporary attachment post shown in FIG. 67, which allows the temporary attachment post to flex slightly off-axis during the pick-up process. Under tension, the alignment of the temporary screw axis with this necked-down portion can be designed to align the axis of the implant abutment threads with the coping threads but allow some bending when the tension is released. Note that this alignment flexibility will generally not be required during the final screw attachment process. The final attachment process is more accommodating of axial misalignment of multiple abutments than the coping pick-up process. During pick-up, the prosthesis with copings incorporated must be removed from all abutments simultaneously. For final attachment, each definitive screw is attached individually after the copings of the prosthesis are positioned on the implant abutments.

[0186] FIG. 68 shows an embodiment of a temporary screw cap 94 that includes spring features 95 that engage the outer diameter 96 of the temporary post. If desired the portion of the temporary screw cap with the spring features may be made of a different material than the remainder of the cap.

[0187] Although the temporary screw of FIG. 69 has a similar appearance to that shown in FIG. 68, it has distinct functionality. FIG. 69 shows an embodiment of a temporary alignment screw 58 having threaded portion 62, breakaway flange 160 and hex drive

portion 61. The flange 160 pushes down on the top of the coping as the temporary alignment screw threads 62 are rotated into the implant abutment. The flange portion may be molded onto a temporary attachment post with threaded portion 62 and drive portion 61 by insert molding if different materials are desired. Preferable, all portions of the alignment screw are molded integrally of a single material. The cap and post do not slide axially relative to one another. Instead, small break-away tabs 59 in the flange portion are designed to yield under axial force during the prosthesis and coping assembly removal after the bonding step. The breakaway portions are designed to fracture at an axial force exceeding the force applied to align the coping to the implant abutment for pick-up.

[0188] FIG. 67 employed a temporary alignment screw post with a waist that can bend during prosthesis removal in the pick-up process. It is also possible to provide additional off-axis accommodation during coping pick-up with temporary screws that do not bend. For example, in FIG. 70, a temporary alignment screw post 25 includes a rounded portion 27 that bears against the central straight bore of cap 26. FIG. 71 shows a tapered profile 29 on cap 30 which engages a straight cylindrical portion of post 28. It is preferable to prevent the incursion of adhesive in the gaps between the post and cap that allow the post to pivot. FIG. 71 includes a thin protective film 56 for this purpose. This film should be chosen to deform easily when the post is pivoted.

[0189] FIG. 72 shows a thin retaining ring 32 that engages temporary attachment post 31. The retaining ring 32 also provides a one-way insertion direction of temporary attachment post 31. This preferential insertion direction also corresponds to the relative motion of the post and retaining ring for release in the pick-up process.

[0190] FIG. 73 shows another embodiment of a temporary alignment screw that does not have relative axial sliding between the post and cap. In this embodiment a thin retainer 35 that may be comprised of a metallic or polymer sheet is attached to the top portion of temporary attachment post 33 and optional cap 34. The sheet 35 may be attached to temporary attachment post 33 using adhesives, plastic or metal welding, etc.

After the adhesive has cured holding the coping to the implant abutment, the mechanical connection between the post and cap is overcome by axial force in the pick-up process. The mechanical connection can be designed to fail by adhesive failure or by fracture of the joint or the sheet 35.

[0191] FIG. 74 shows another embodiment of a temporary alignment screw without relative sliding between the cap portion and the post portion. In this embodiment, a compliant or frangible portion of the post 37 is used to attach a cap 38 to the post 36. Under tension, the cap portion 38 holds the coping in position against the abutment for pick-up into a prosthesis. Compliant portion 37 may be for example an elastomeric material to provide some angular motion during prosthesis removal after the pick-up material sets. The compliant portion 37 itself or one of its interfaces with the cap or post may provide a separable interface with controlled axial breakaway force. Other methods of separating a compliant portion may include exposure of compliant portion 37 made from a material easily affected by heat, any wavelength of electromagnetic energy, or a chemical reaction that may be applied externally or as part of the pick-up process.

[0192] The inventive concepts disclosed are not meant to be restricted to a temporary attachment post with standard screw threads that both engage and disengage the threads in the implant abutment through rotations. For example, alternate separable temporary attachment posts embodiments are possible providing features that allow the post to removably hold the coping to the abutment by other means than a separable cap. For example, as shown in FIG. 75 an alignment fastener post 39 may contain a separable threaded or serrated portion 40 that engages the screw threads in the abutment for pick-up, but that will release with axial force after. FIG. 75 shows a temporary fastener 190 with a head 42 portion and an attachment post portion 39. The attachment post portion 39 is shown as having a slot 41 and asymmetric threads or serrations 40 that have proximal flank 183 and a distal flank 184. This asymmetric threading still allows the temporary attachment post portion 39 to be inserted through rotation like other temporary screw embodiments for alignment for coping pick-up. The post 39 may be subsequently extracted with a separation force in the axial direction. Although the threads could be designed to provide engagement with the implant

abutment threads through axial motion in the opposite direction to the arrow shown in FIG. 75, rotation to a design torque on engagement is generally preferred. If the post 39 is designed to be pulled out of the abutment during the coping pick-up process, it will subsequently need to be removed from flange 42 and the prosthesis assembly. Since there is no processing impact on patient comfort, higher mechanical forces or a broader range of energy or chemical processing may be employed to remove the post 39 from the prosthesis 3 after coping 9 pick-up.

[0193] Further permutations of the separable alignment screw features disclosed above are possible. FIG. 76 shows an embodiment where axial flexibility and/or controlled retention between cap 44 and temporary attachment post 43 is provided by an interface material 45 such as adhesives, silicones, and elastomeric materials contained in the space between the bore of the cap 44 and the post 43. FIG. 77 shows cap 47 retained with an O-ring 48 held in grooves in the cap 47 and temporary attachment post 46. FIG. 78 shows a cup-shaped interface material 57 located within the bore of the cap 44 and extending over a portion of the end of the post 43. FIG. 79 shows a split-collar feature 51 on cap 50 which presses onto the temporary attachment post 49. FIGS. 80 and 81 show alternate designs of flexure beam features in caps gripping a post. In FIG. 80, the pressure on the post 49 is reduced by pulling the cap 52 perpendicular to a diagonal of the cap as indicated by the arrows. In FIG. 81, the pressure on the post 49 is reduced by pulling in opposite directions with moment arms on the cap 54 as shown to open the spring.

[0194] It is understood that the concept of the temporary attachment of the coping with the abutment with an axially separable temporary post is not dependent upon having a separate cap 11 or nut 63 on the post. If desired the cap or nut can be eliminated and the coping may be directly fixed and axially separable from the temporary attachment post. That is, the coping can be designed to have an equivalent mechanical interface to the post as the caps in the embodiments above. The mechanical interface between the coping and post may be tailored to provide equivalent rotational engagement and relative axial movement above a designed minimum axial force.

[0195] Example embodiments of the coping and post being the separable components include the following:

[0196] FIG. 82 shows temporary attachment post 71, engaging an interference fit of coping 72 at a position above the threaded portion. Metal, metal-reinforced, ceramic, and polymer copings, posts and fasteners may be included in this and other embodiments. Any of the parts may have surface treatments to control friction or adhesion.

[0197] FIG. 83 shows temporary attachment post 71 engaging integral spring-finger features 78 of coping 73.

[0198] FIG. 84 shows a temporary attachment post 71 engaging collet-type spring fingers 77 of coping 74, these collet-type features may be formed using slots in the coping 74 as shown in FIG. 84A.

[0199] FIG. 85 shows a slotted spring feature 79 formed in the temporary attachment post 76. The spring-features engage a smaller bore portion 90 of the coping 75. Such features may be of varied shapes including slots, eyelets, swaged portions, tubular swaged parts, etc. A film 56 (not shown) may be used to prevent the ingress of pick-up material into any voids at the top of the post/coping assembly similar to that shown in FIG. 71.

[0200] FIG. 86 shows temporary attachment post 71 and coping 75 engaged using an O-ring or washer 80. Such washers may be elastomers, polymers, metals, etc. and may be forms in varied shapes, such as the u-shaped retainer 81 of FIG. 87.

[0201] FIG. 88 shows temporary attachment post 71 retained to coping 75 using a sheet cap 82. Sheet cap 82 may be a tape, or other polymers or metals joined using

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adhesives, thermal and ultrasonic bonding, welding, and brazing, etc. This is similar to the embodiment shown in FIG. 73, except the sheet cap 82 does not have thicker cap element 34.

[0202] FIG. 89 shows temporary attachment post 71 retained using a filler material 83 in the counterbore of coping 75. Fillers may include a variety of polymer adhesives or fillers, such as silicones, acrylics, epoxies, and/or soft metallic materials. Since the coping 75 in this embodiment is fixed to the post 71, the mating surfaces of the coping 75 and implant abutment must allow relative rotational motion until the predetermined torque is achieved.

[0203] Installation of these embodiments may also be accomplished with simple polymer or metal tools 84, for example, as shown in FIG. 90 that engage the flats or other features of the coping 75, and/or of features on top of the threaded post 71.

[0204] Although the descriptions above use rotational engagement of the bottom of the post with internal threads of the abutment as a preferred approach, this is not meant to be limiting. Alternate approaches for engaging a temporary attachment post with abutment threads through axial insertion without rotation are considered to be part of this disclosure. For example, the split post bottom structure shown in FIG. 75 which allows axial extraction can also be used for axial insertion. Similarly, an interference fit between the bottom of the post with the threads may also be designed to provide sufficient engagement to provide adequate alignment and fixing of the coping for the pick-up bonding process described earlier. For non-rotary extraction of the post, it is not necessary to have the extraction force of the post-abutment thread interface greater than the force required for relative movement of the coping or cap with the upper end of the post. That is, if the temporary attachment post remains fixed to the coping during the pick-up step, the post can be removed from the dental appliance after removal from the patient's mouth.

[0205] Although axially symmetric interfaces between coping and abutment have been described for most embodiments, the inventive concepts may also be applied to asymmetric abutments and copings as long as the coping doesn't need to rotate on the implant abutment as noted, for example, with the embodiment of FIG. 89 .

[0206] Various embodiments have been described to illustrate the disclosed inventive concepts, not to limit the invention. Combining inventive elements of one or more of the embodiments with known materials, components and techniques in dental science to create further embodiments using the inventive concepts is considered to be part of this disclosure.

[0207] Any of the embodiments may contain a film or deposited material on top of the cap and temporary attachment post to prevent adhesion to the temporary attachment post of materials used for pick-up, as shown in the film 56 of FIG. 71.

[0208] Temporary attachment posts may be rotationally driven into the abutment threads using either the cap, coping or the temporary attachment post itself. Temporary attachment posts and caps may have varied drive features such as male or female knurls, hex, spines, spanner notches/holes. These design alternatives are driven by functional requirements of a particular implementation.

[0209] Other means of attaching/joining a secondary separable portion include insert-molding, use of adhesives, waxes, solders or other metallic materials, heat-staking, and ultrasonic bonding.

[0210] Break-away portions may also be formed by two-shot molding, dispensing or otherwise placing a secondary mechanically, thermally, or electromagnetically fusible material on a portion of the fastener to provide the break-away function.

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[0211] Thin Thin-film or thick-film metallic and polymer coatings may be applied to portions of the fastener to tailor friction and insertion and extraction forces, enhance adhesion of pick-up materials, and other properties such as corrosion-resistance.

Claims

We claim:

1. A dental system comprising:
 - a coping having a proximal end with an aperture;
 - an implant abutment having threads, wherein the implant abutment threads extend distally from a most proximal thread position;
 - a definitive screw having a proximal head end having a tool interface and a distal post portion having threads configured for securing the coping to the threads of the implant abutment, wherein the distal post portion is sized and configured to extend through the aperture of the coping; and
 - a temporary fastener having a longitudinal axis with a length measured along the longitudinal axis and a lateral dimension providing different widths along the longitudinal axis measured perpendicular to the longitudinal axis, the temporary fastener comprising a shaft comprising a distal shaft portion sized and configured for rotary engagement with the implant abutment threads,
 - wherein the shaft of the temporary fastener is configured to extend through the aperture of the coping and the distal shaft portion is configured to engage the implant abutment threads through an engagement depth measured axially between a most distal contact position with the implant abutment threads and the most proximal thread position of the implant abutment threads and is configured so that a portion of the temporary fastener holds the coping in alignment with the implant abutment prior to attachment of the definitive screw,
 - wherein the temporary fastener is configured to release at least a portion of the temporary fastener and the coping from the implant abutment as a unit when an axial release force is applied in a proximal direction to the temporary fastener,
 - wherein the distal shaft portion of the temporary fastener is sized and configured to make contact with the implant abutment threads over a first thread contact area to hold the coping against the implant abutment, wherein, after removal of the temporary fastener, the distal post portion of the definitive screw is sized and configured to make contact with the implant abutment threads over a second thread contact area to hold the coping against the implant abutment, and wherein the first thread contact area is less than the second thread contact area.

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2. The dental system of Claim 1 wherein the threads of the implant abutment comprise female threads, wherein the female threads have a radial extent bounded by a female thread minor diameter and a female thread major diameter, and wherein the female thread minor diameter is located closer to the longitudinal axis than the female thread major diameter.
3. The dental system of Claim 2 wherein a maximal width of the distal post portion of the definitive screw having threads is larger than the female thread minor diameter of the implant abutment threads, and wherein a maximal width of the distal shaft portion of the temporary screw sized and configured to make contact with the implant abutment threads is smaller than the width of the distal post portion of the definitive screw having threads.
4. The dental system of Claim 2 wherein the distal shaft portion of the temporary fastener is configured to have a temporary fastener engagement volume extending radially beyond the female thread minor diameter and axially over the engagement depth, wherein the definitive screw is configured to have a definitive screw engagement volume extending radially beyond the female thread minor diameter and axially over the engagement depth, and wherein the definitive screw engagement volume is greater than the temporary fastener engagement volume.
5. The dental system of Claim 1 wherein the distal shaft portion of the temporary fastener is configured to have discontinuous contact with the implant abutment threads throughout the engagement depth.
6. The dental system of Claim 1 wherein the axial release force is configured to be applied in a pick-up process.
7. The dental system of Claim 1 wherein the shaft of the temporary fastener includes a portion that has a smaller width than the distal shaft portion sized and configured for rotary engagement with the implant abutment threads, and wherein the portion with the smaller width is located proximally from the distal shaft portion sized and configured for rotary engagement.
8. The dental system of Claim 1 wherein the threads of the distal post portion of the definitive screw are configured to continuously engage the implant abutment threads.

9. The dental system of Claim 1 wherein the distal shaft portion of the temporary fastener is configured to deform and disengage the implant abutment threads to release the coping and the temporary fastener as a unit as a result of the axial release force.

10. A dental system comprising:

an implant abutment having threads and an implant abutment longitudinal axis;

a coping having a proximal end with a central aperture merging into a central open channel of greater width than the central aperture;

a definitive screw having a proximal head end having a tool interface and a distal post portion having threads configured for securing the coping to the threads of the implant abutment, wherein the distal post portion having threads is sized to extend through the aperture of the coping into the central open channel;

a temporary fastener having a longitudinal axis with a length measured along the longitudinal axis and a width measured perpendicular to the longitudinal axis, the temporary fastener comprising:

a head with a proximal end having a drive tool interface configured for rotating the temporary fastener to a predetermined torque, and

a shaft coupled to or integral with the head configured to extend through the central aperture of the coping, wherein the shaft has a distal portion having an outer surface comprising threads, wherein a maximal width of the distal portion with the threads is smaller than a maximal width of the distal post portion of the definitive screw with the threads,

wherein the temporary fastener is configured so that, in position and engaged with the threads of the implant abutment at a predetermined torque, the temporary fastener cooperates with the coping to align the coping into position with the implant abutment, and wherein the temporary fastener is configured so that in response to application of an axial release force above a predefined value in a proximal direction, the coping and at least a portion of the temporary fastener are released as a unit from the implant abutment without rotation.

11. The dental system of Claim 10 wherein the distal portion of the shaft of the temporary fastener is configured to deform in response to the application of the axial release force above a predefined value in a proximal direction.

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12. The dental system of Claim 10 wherein the temporary fastener is configured to move axially in response to the axial release force without rotation.
13. The dental system of Claim 10 wherein the threads of the shaft of the temporary fastener are configured to have discontinuous contact with the threads of the implant abutment at the predefined torque.
14. The dental system of Claim 10 wherein the shaft of the temporary fastener has a portion located proximally of the distal portion comprising threads having a width smaller than the maximal width of the distal portion comprising threads.
15. A dental system comprising:
 - a coping having a proximal end with an aperture and a distal end with a coping seating surface; and
 - an implant abutment having a longitudinal axis comprising:
 - female threading, wherein the female threading resides proximate a proximal end of the implant abutment and extends distally thereof, and
 - an outer wall surrounding the female threading, the outer wall comprising an implant abutment seating surface;
 - a temporary fastener having an axis with a length measured along the axis and a lateral dimension providing different widths along the axis measured perpendicular to the axis, the temporary fastener comprising:
 - a proximal portion with a width larger than the coping aperture; and
 - a shaft comprising a distal shaft portion configured for rotary engagement with the implant abutment female threading,wherein the shaft of the temporary fastener is sized to extend through the aperture of the coping, and wherein the distal shaft portion of the temporary fastener is configured to rotatably engage the female threading of the implant abutment to an engagement depth

sufficient to hold the coping seating surface aligned with and adjacent the implant abutment seating surface, and

wherein the temporary fastener is configured to release at least a portion of the temporary fastener and the coping from the implant abutment as a unit as a result of an axial release force in a proximal direction, and

wherein the distal shaft portion of the temporary fastener does not continuously contact the female threading of the implant abutment between a most distal engagement position and a proximate end of the female threading of the implant abutment.

16. The dental system of Claim 15, wherein the axial release force is applied in a pick-up process after adhesive bonding of the coping to a prosthesis or in a closed tray impression process.
17. The dental system of Claim 15, wherein the axial release force in the proximal direction releases an entire temporary fastener and coping from the implant abutment as a unit.
18. The dental system of Claim 15, wherein the temporary fastener comprises a polymeric material.
19. The dental system of Claim 15, further comprising a definitive screw with a longitudinal axis and a width measured perpendicular to the longitudinal axis, the definitive screw comprising:

a head with a proximal end having a drive tool interface, wherein, after removal of the temporary fastener, the head is in contact with a proximal surface of the coping proximate the aperture of the coping, and

a shaft that has a width configured to extend through the aperture of the coping, the shaft comprising:

a distal portion having an outer surface comprising male threading configured to engage the female threading of the implant abutment, wherein the distal portion of the definitive screw is configured to rotatably engage the female threading of the implant abutment to a predefined fixation torque to position the coping seating surface adjacent to the implant abutment seating surface.

20. The dental system of Claim 19, wherein the male threading of the definitive screw is configured to make continuous contact with the implant abutment female threading.
21. The dental system of Claim 19, wherein the male threading of the distal portion of the definitive screw has a greater engagement depth with the female threading of the implant abutment than the engagement depth of the temporary fastener and/or the male threading of the distal portion of the definitive screw has a longitudinal extent that is greater than a longitudinal extent of the distal shaft portion of the temporary fastener.
22. The dental system of Claim 19, wherein a maximum width of the distal portion of the definitive screw comprising the male threading is greater than a maximum width of the distal shaft portion of the temporary fastener configured to rotatably engage the implant abutment female threading.
23. A method of installing a dental prosthesis comprising:
 - providing a coping comprising an aperture and a temporary fastener comprising threads wherein the temporary fastener is configured to extend at least partially through the aperture of the coping;
 - attaching the temporary fastener to implant abutment threads of the implant abutment while the coping extends about the temporary fastener in axial alignment with the implant abutment;
 - processing the coping using a pick-up process or closed tray impression process while the temporary fastener is attached to the implant abutment;
 - releasing the coping attached to at least part of the temporary fastener as a unit in response to an axial release force applied from the processing;
 - drilling at least one hole through a dental prosthesis aligned with the aperture of the released coping;
 - aligning the dental prosthesis coupled to the released coping with the implant abutment; and
 - attaching the dental prosthesis with the released coping to the implant abutment using a definitive screw inserted through a respective at least one hole of the dental prosthesis wherein the definitive screw has threads with a maximal width that is greater than the maximal width of the threads of the temporary screw.
24. The method of Claim 23, wherein the releasing is carried out so that the temporary fastener is entirely removed attached to the coping providing the unit.

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25. The method of Claim 23, wherein the method further comprises providing a tool that is configured to at least partially surround the coping while the temporary fastener extends through the aperture of the coping and aligning the tool with the coping and temporary fastener with the implant abutment.

26. The method of Claim 25, wherein the tool comprises a through channel aligned with the temporary fastener, the method further comprising inserting a drive tool through the channel to engage a drive interface in the temporary fastener and rotating the temporary fastener to engage threads of the implant abutment, then removing the tool prior to the processing.

**CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION
UNDER 37 CFR 1.102(e) (Page 1 of 1)**

First Named Inventor:	Kofford, Brandon Dale	Nonprovisional Application Number (if known):	
Title of Invention:	SCREW-ATTACHED PICK-UP DENTAL COPING SYSTEMS AND METHODS		

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently \$0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.
2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.
3. The applicable box is checked below:

I. ☒ Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)

- i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.
---OR---
- (b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.
- ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, or the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

II. ☐ Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)

- i. A request for continued examination has been filed with, or prior to, this form.
- ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
- iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
- iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
- v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature <u>/Daniel John Whittle/</u>	Date <u>09-06-2024</u>
Name (Print/Typed) <u>Daniel John Whittle</u>	Practitioner Registration Number <u>54,537</u>
<p>Note: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.*</p>	
<p>☒ *Total of <u>1</u> forms are submitted.</p>	

Privacy Act Statement

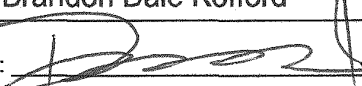
The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	SCREW-ATTACHED PICK-UP DENTAL COPING SYSTEMS AND METHODS
<p>As the below named inventor, I hereby declare that:</p> <p>This declaration is directed to: ☒ The attached application, or ☐ United States application or PCT international application number _____ filed on _____.</p> <p>The above-identified application was made or authorized to be made by me.</p> <p>I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.</p> <p>I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.</p> <p style="text-align: center;">WARNING:</p> <p>Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.</p>	
<p>LEGAL NAME OF INVENTOR</p> <p>Inventor: <u>Brandon Dale Kofford</u> Date (Optional): <u>9/04/2024</u></p> <p>Signature: <u></u></p>	
<p><small>Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.</small></p>	

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

**TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE
REGISTERED PRACTITIONERS**

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA/82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	
Filing Date	2024-08-06
First Named Inventor	Brandon D Kofford
Title	SCREW-ATTACHED PICK-UP DENTAL COPING SYSTEMS AND METHODS
Art Unit	
Examiner Name	
Attorney Docket Number	SDC013

SIGNATURE of Applicant or Patent Practitioner

Signature	/Daniel John Whittle, #54,537/	Date (Optional)	
Name	Daniel John Whittle	Registration Number	54,537
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.



*Total of 2 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)



I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above:

000112823

OR



I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:



The address associated with the above-mentioned Customer Number

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I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):



Inventor or Joint Inventor (title not required below)



Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)



Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)



Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	/Charles Albert Rudisill/	Date (Optional)	
Name	Charles Albert Rudisill		
Title	co-owner		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.



Total of 2 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

POWER OF ATTORNEY BY APPLICANT

No more than ten (10) patent practitioners total may be appointed as set forth below by name and registration number. This page need not be submitted if appointing the Patent Practitioner(s) associated with a Customer Number (see form PTO/AIA/82B):

Name	Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION # 18/827,656	RECEIPT DATE / TIME 09/06/2024 10:45:38 PM Z ET	ATTORNEY DOCKET # SDC013
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Title of Invention

Screw-attached Pick-up Dental Coping System and Methods

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	2702	FILED BY	Daniel Whittle
PATENT CENTER #	67083706	FILING DATE	-
CUSTOMER #	112823	FIRST NAMED INVENTOR	Brandon Dale Kofford
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	-

Documents

TOTAL DOCUMENTS: 11

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
generatedADS67083706.pdf	7	Application Data Sheet	150 KB
aia0424SDC013.pdf	2	Track One Request	112 KB
aia0001SDC013CAR-signed.pdf	2	Oath or Declaration filed	147 KB
aia0082SDC013CAR-signed.pdf	4	Power of Attorney	174 KB
npp-IN-figs-26JUN2024-26pg.pdf	26	Drawings-only black and white line drawings	702 KB
Remarks_SDC013-LET..docx	2	Miscellaneous Incoming Letter	21 KB
SDC013spec-APP.TEXT.docx	51	Application body structured text document	67 KB

aia0015SDC013.pdf	2	Transmittal of New Application	271 KB
Declaration for utility or design Kofford.pdf	2	Oath or Declaration filed	1523 KB
POA Kofford.pdf	4	Power of Attorney	2920 KB
SDC013spec.pdf	51	Auxiliary PDF of Application	419 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
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SDC013spec.pdf

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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC PAYMENT RECEIPT

APPLICATION # 18/827,656	RECEIPT DATE / TIME 09/06/2024 10:45:38 PM Z ET	ATTORNEY DOCKET # SDC013
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Title of Invention

Screw-attached Pick-up Dental Coping System and Methods

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CONFIRMATION #	2702	FILED BY	Daniel Whittle
PATENT CENTER #	67083706	AUTHORIZED BY	-
CUSTOMER #	112823	FILING DATE	-
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Brandon Dale Kofford

Payment Information

PAYMENT METHOD CARD / 5436	PAYMENT TRANSACTION ID E202496M49535504	PAYMENT AUTHORIZED BY Daniel Whittle
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FEE CODE	DESCRIPTION	ITEM PRICE(\$)	QUANTITY	ITEM TOTAL(\$)
2830	PROCESSING FEE, EXCEPT IN PROVISIONAL APPLICATIONS	56.00	1	56.00
2817	REQUEST FOR PRIORITIZED EXAMINATION	1680.00	1	1680.00
2111	UTILITY PATENT APPL. SEARCH FEE	280.00	1	280.00
4011	BASIC FILING FEE- UTILITY	64.00	1	64.00
2311	EXAMINATION OF ORIGINAL PATENT APPLICATION	320.00	1	320.00
2202	EACH CLAIM IN EXCESS OF 20	40.00	6	240.00
2201	EACH INDEPENDENT CLAIM IN EXCESS OF THREE	192.00	1	192.00

TOTAL AMOUNT:	\$2,832.00
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**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN
APPLICATION DATA SHEET (37 CFR 1.76)**

**Title of
Invention**

SCREW-ATTACHED PICK-UP DENTAL COPING SYSTEMS AND METHODS

As the below named inventor, I hereby declare that:

This declaration
is directed to:

☒

The attached application, or

☐

United States application or PCT international application number _____
filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Charles Albert Rudisill Date (Optional) : _____

Signature: /Charles Albert Rudisill/

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

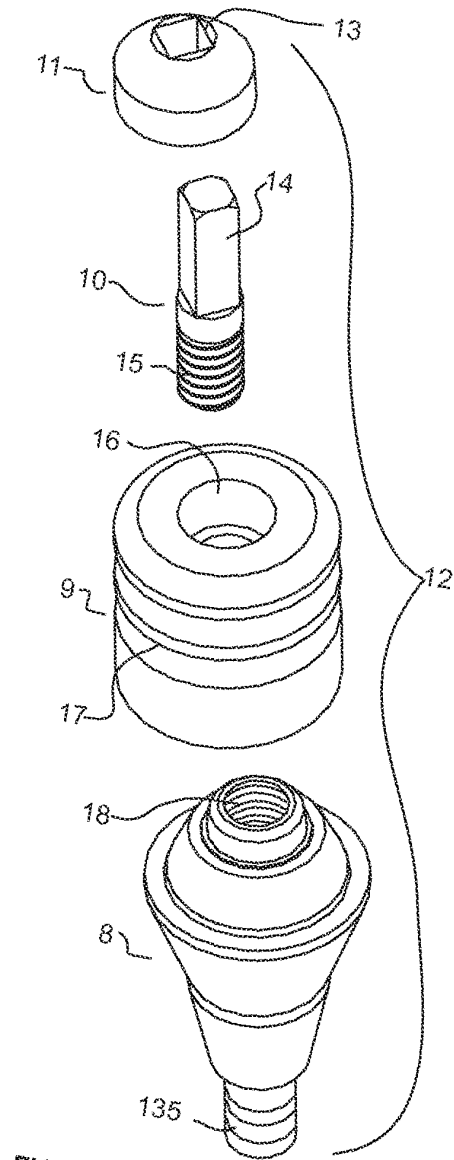


FIG. 1

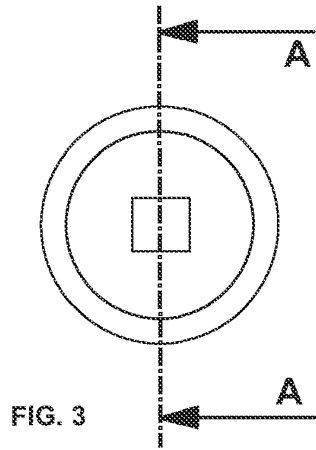


FIG. 3

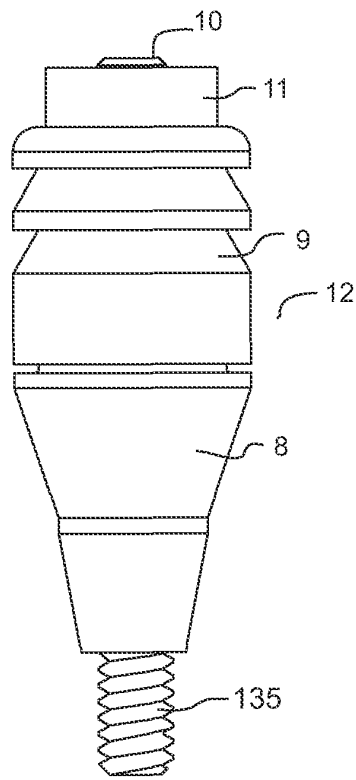


FIG. 2

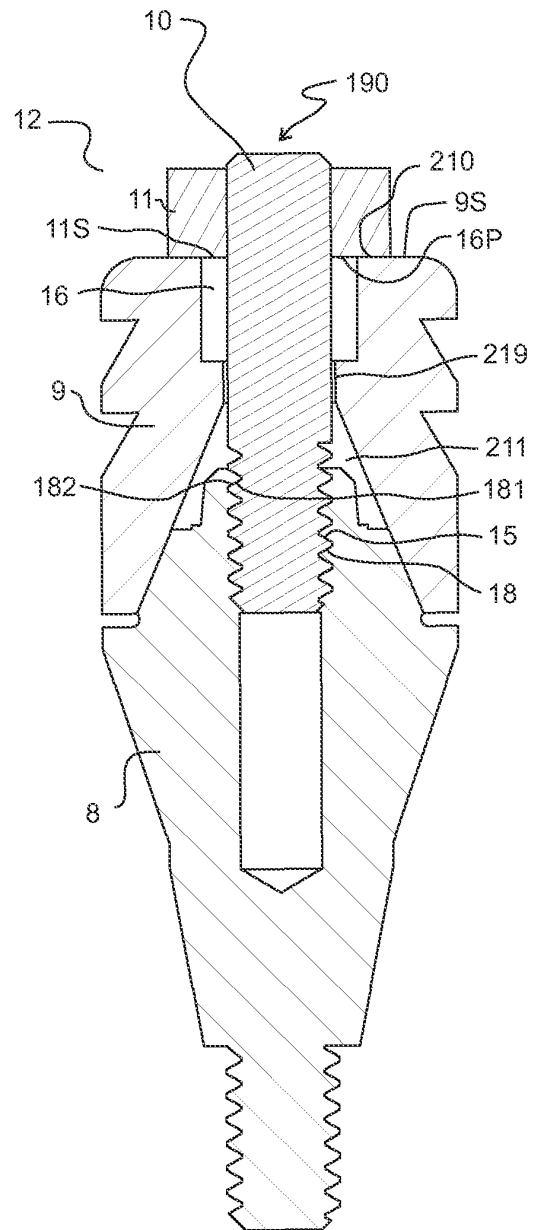


FIG. 4



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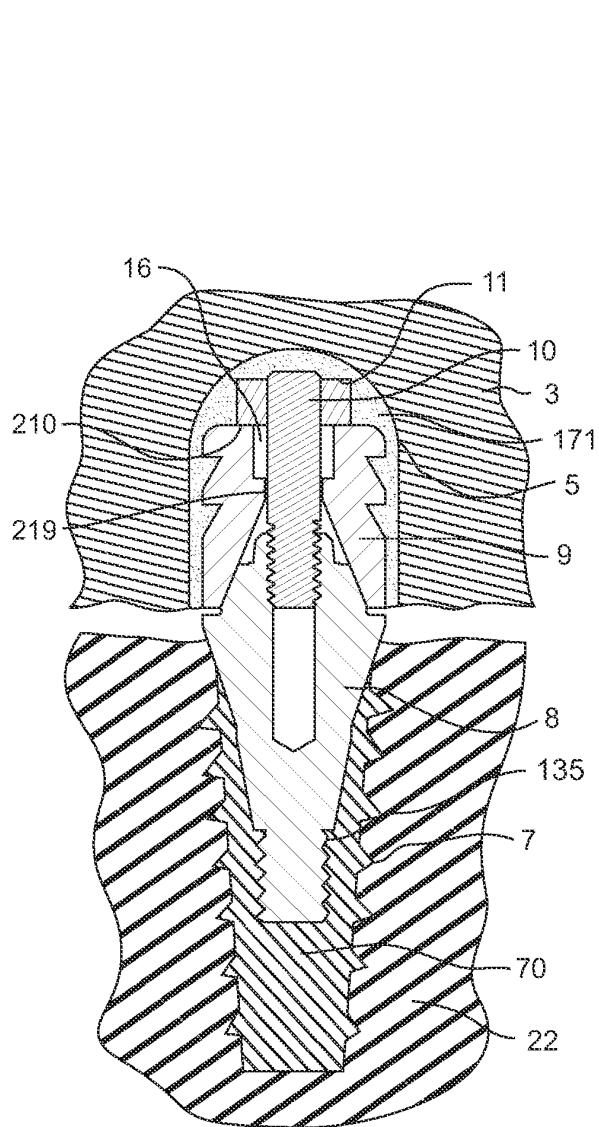


FIG. 5

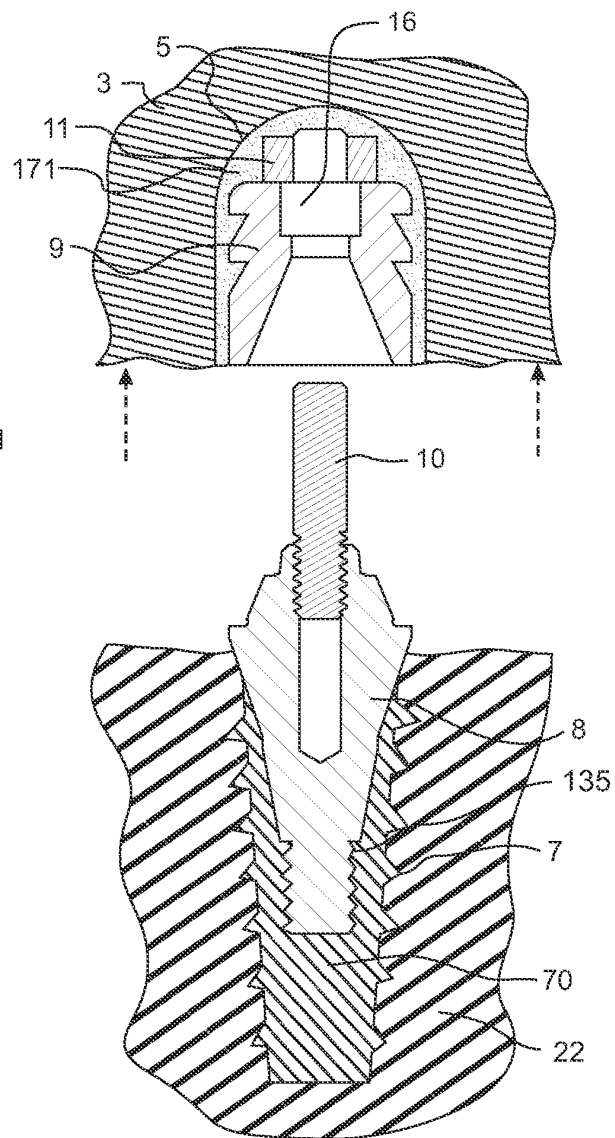


FIG. 6



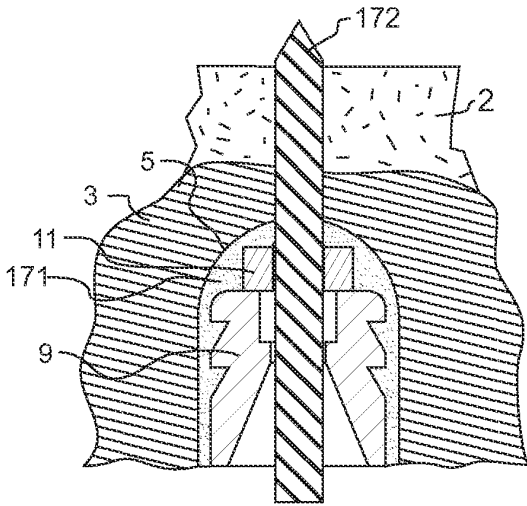


FIG. 7

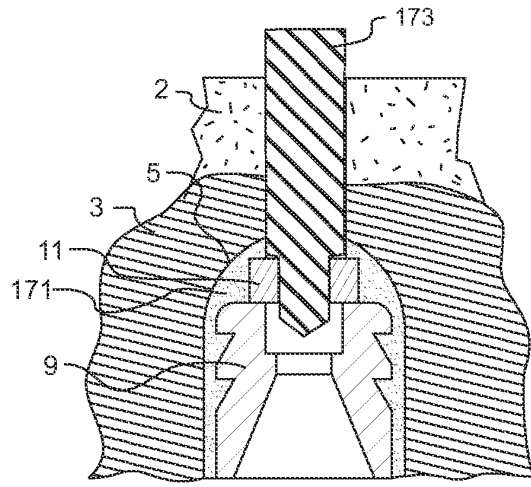


FIG. 8

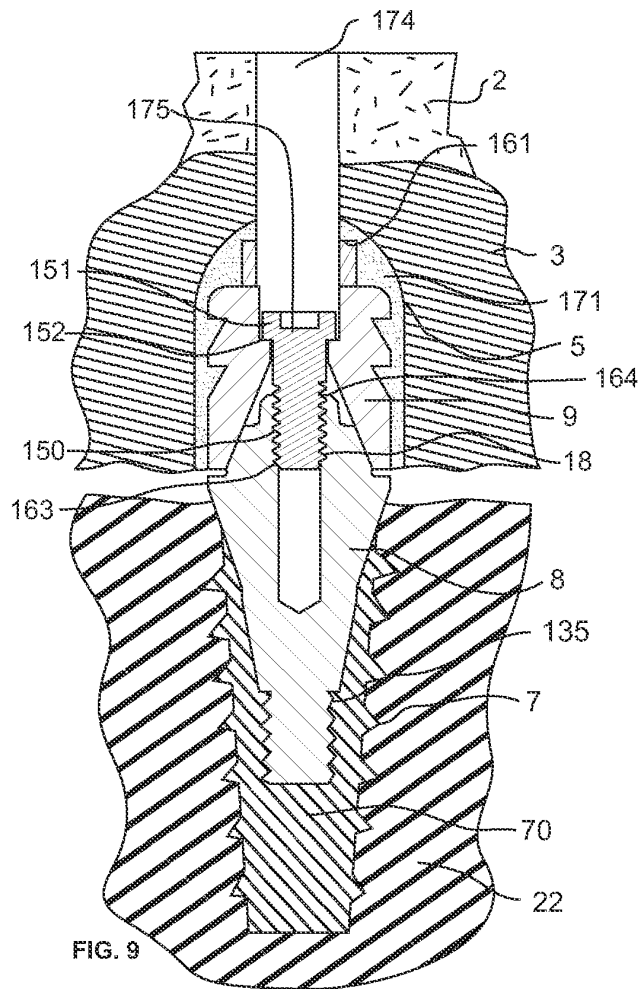
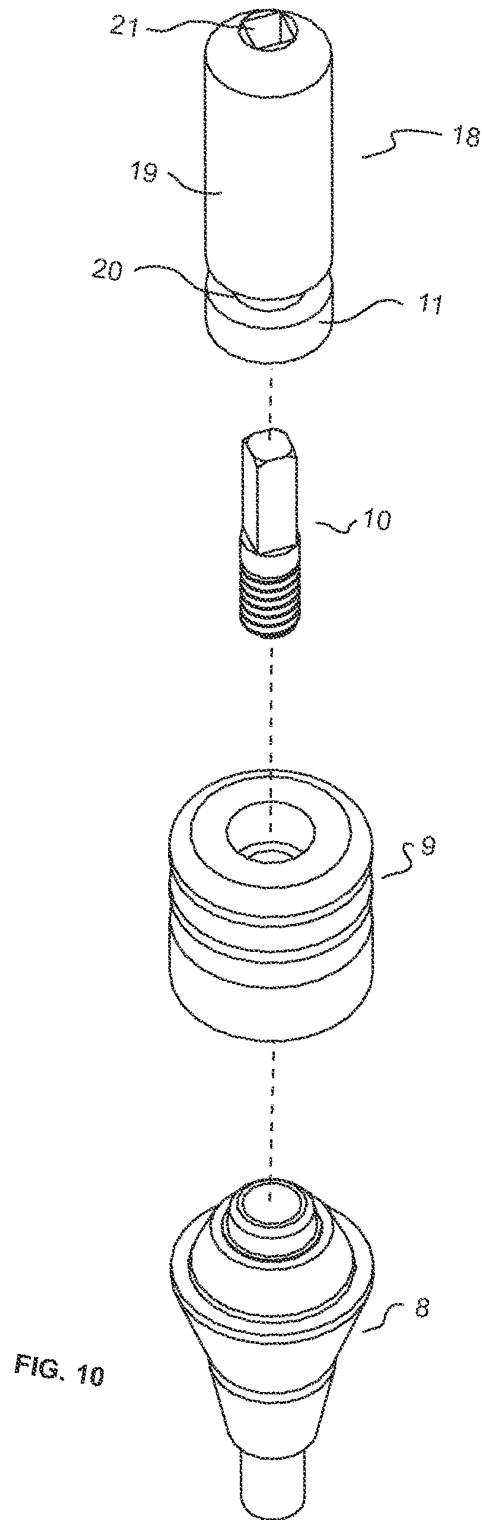


FIG. 9



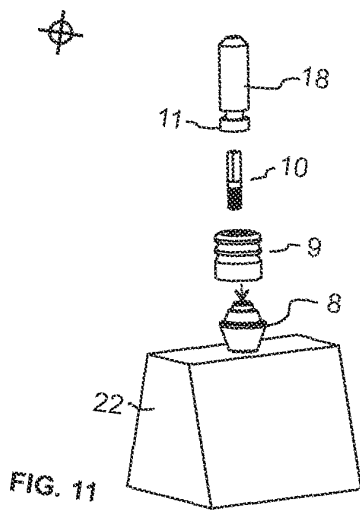


FIG. 11

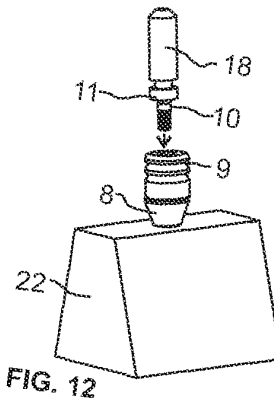


FIG. 12

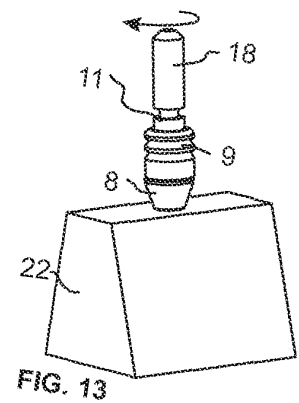


FIG. 13

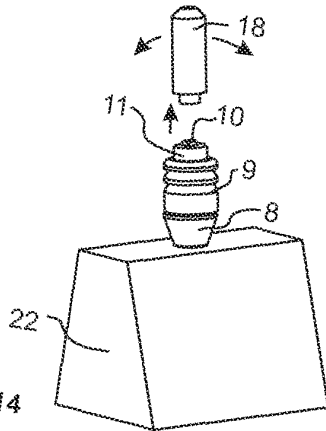


FIG. 14

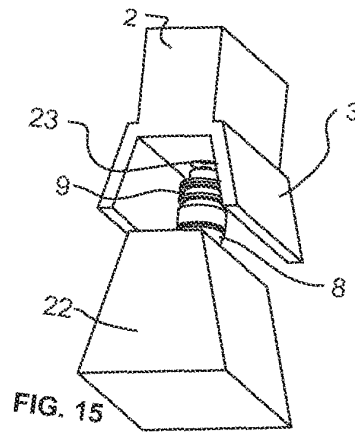


FIG. 15

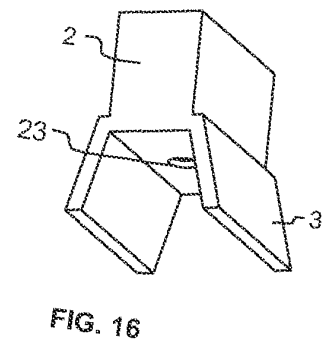


FIG. 16

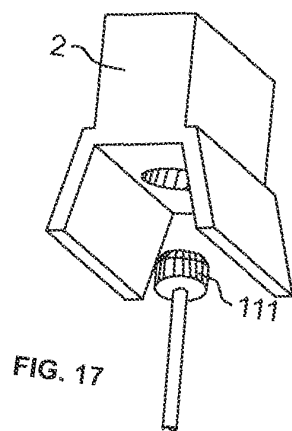


FIG. 17

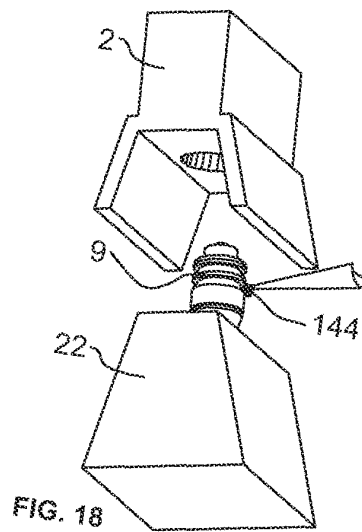


FIG. 18

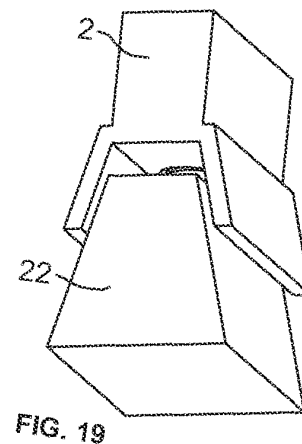


FIG. 19

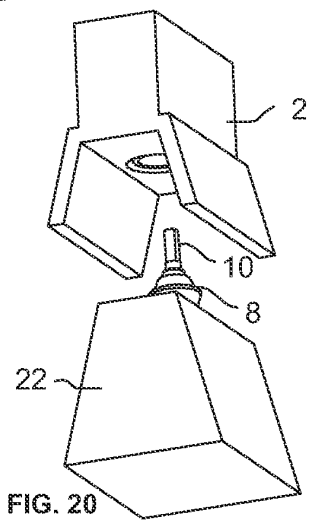


FIG. 20

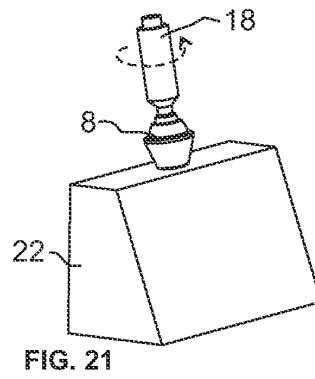


FIG. 21

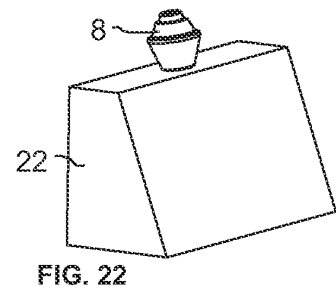


FIG. 22

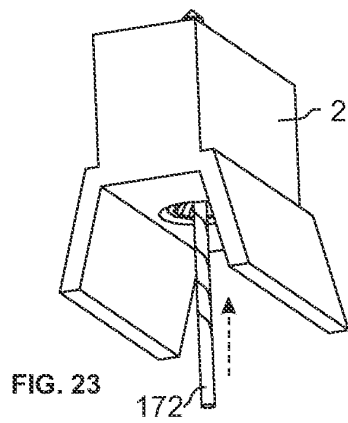


FIG. 23

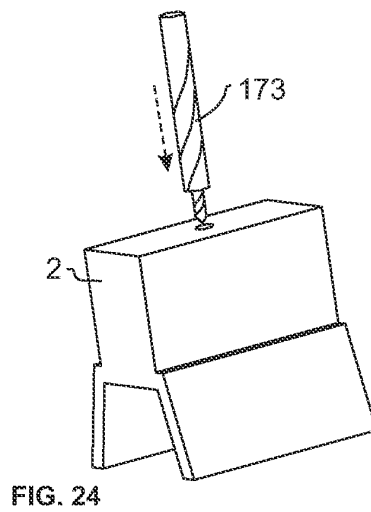


FIG. 24

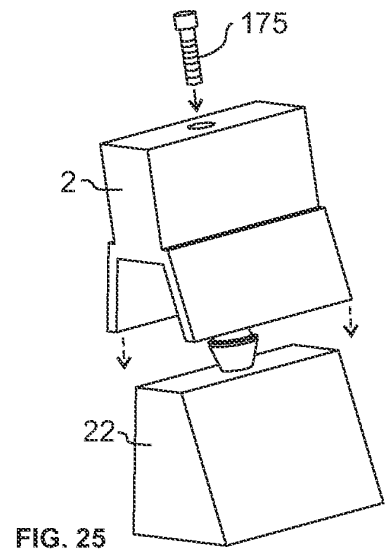


FIG. 25

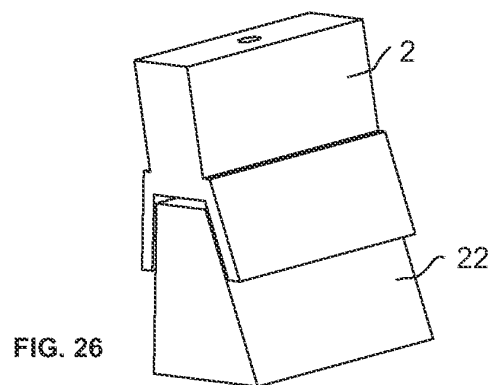
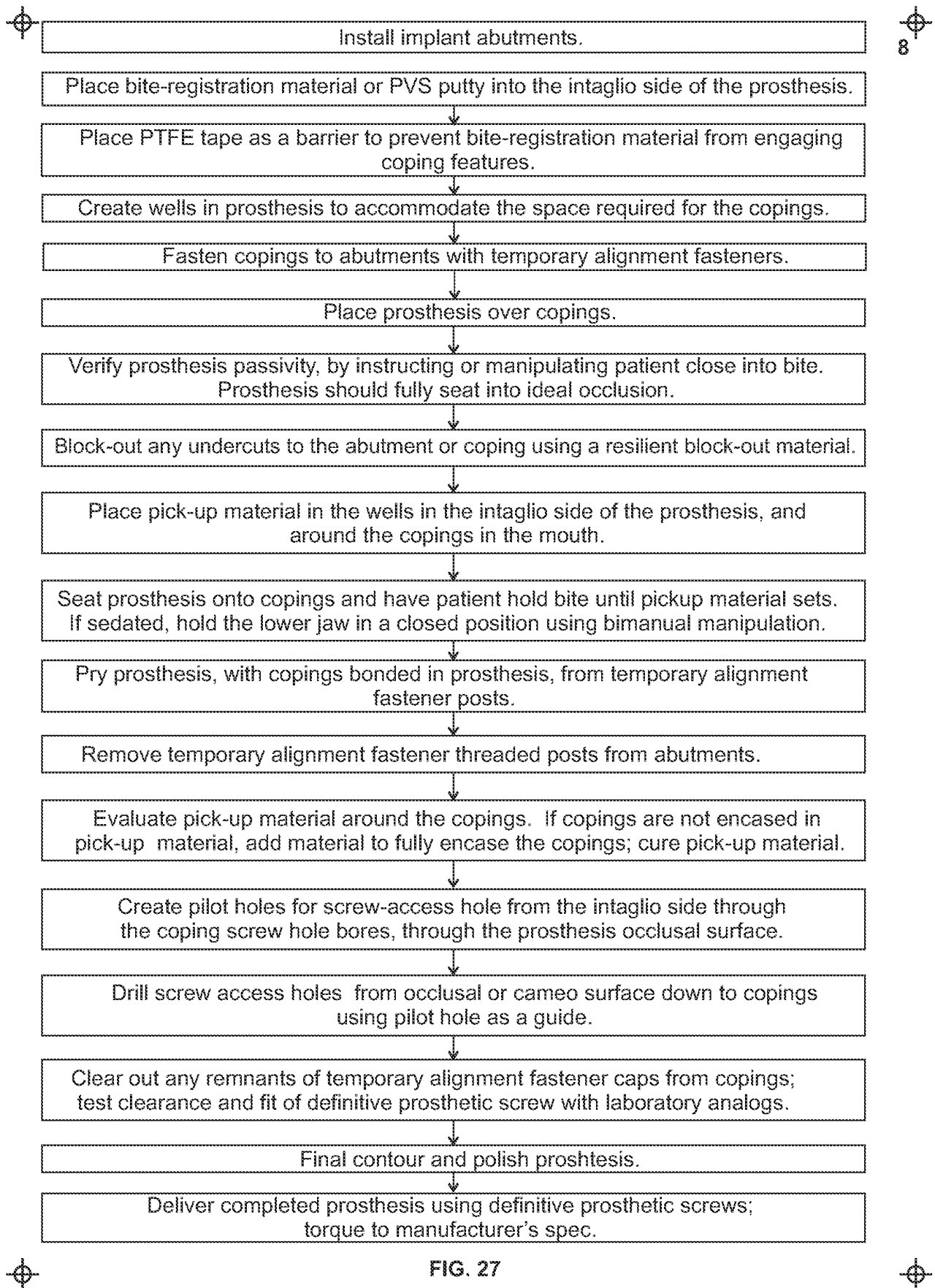


FIG. 26





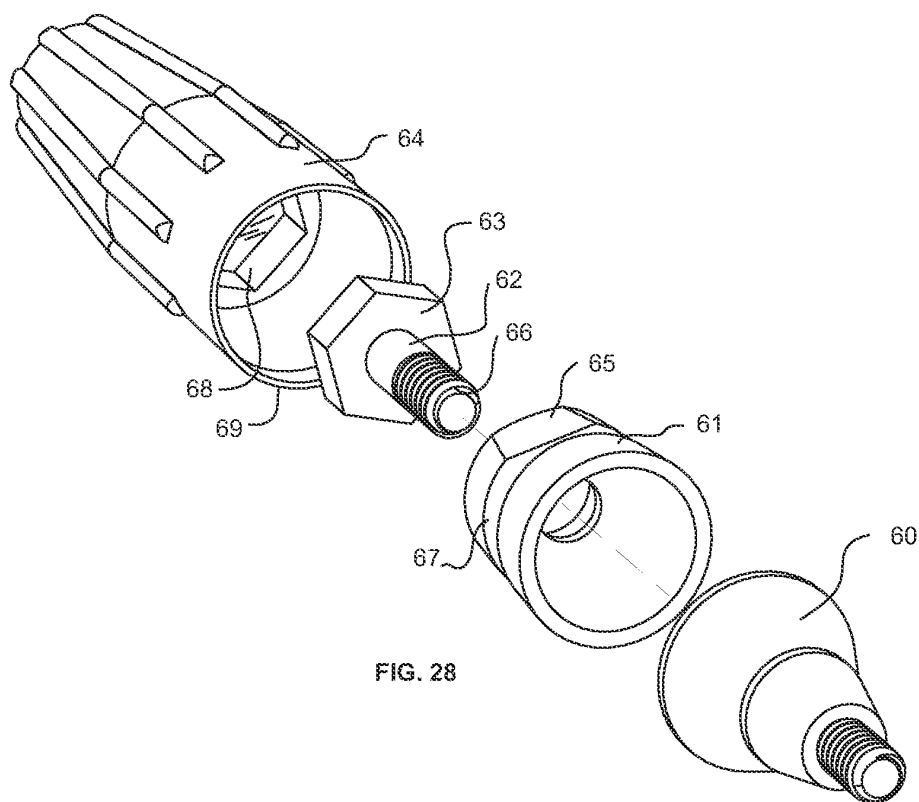


FIG. 28

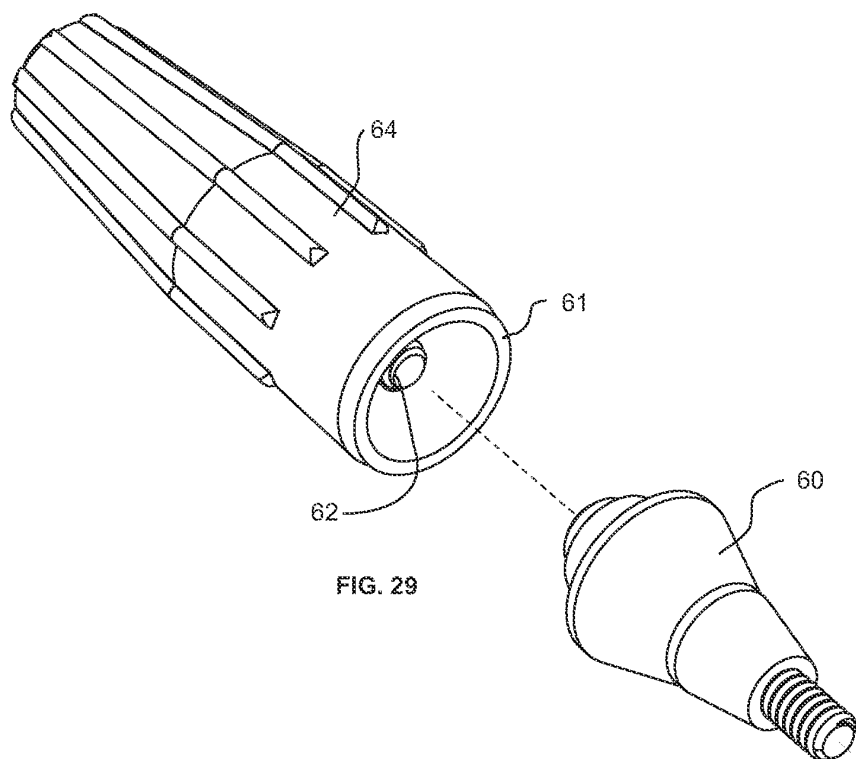
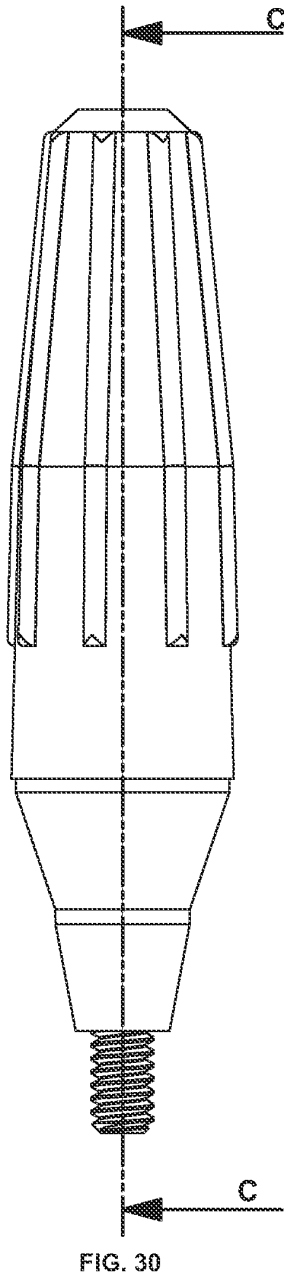
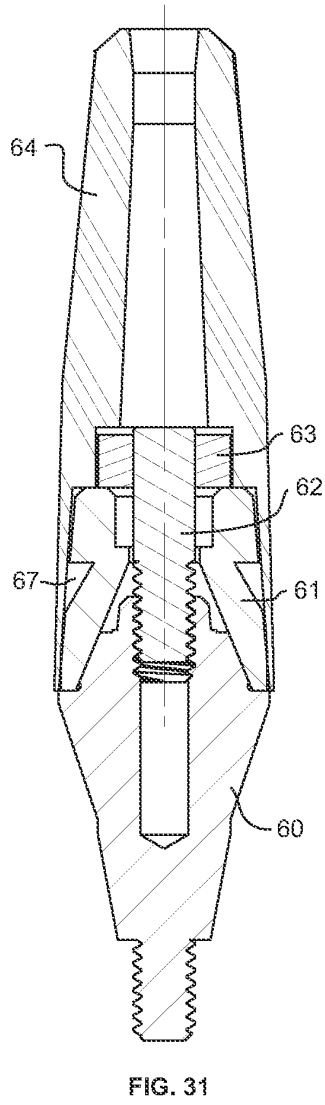
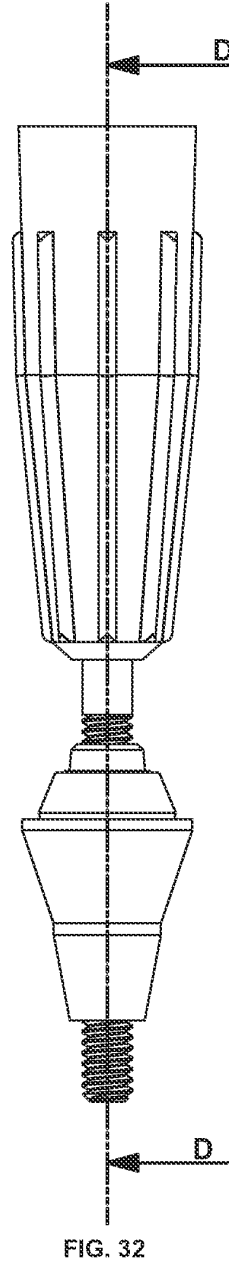
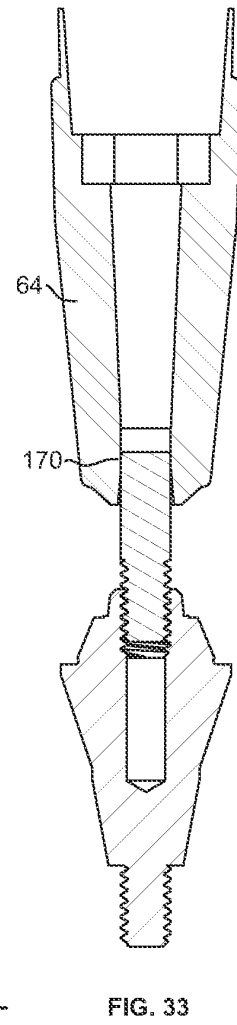


FIG. 29



11

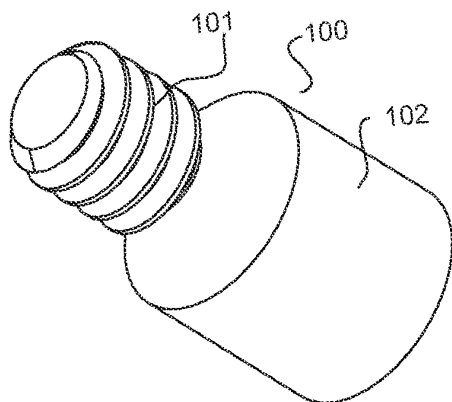


FIG. 35

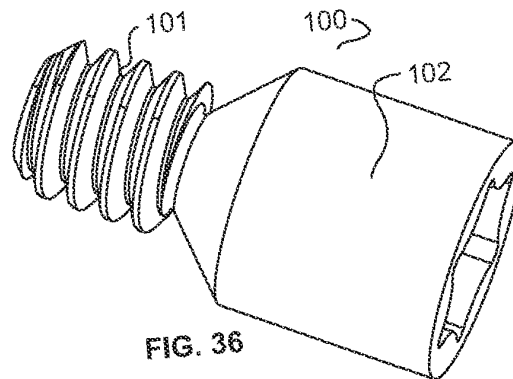


FIG. 36

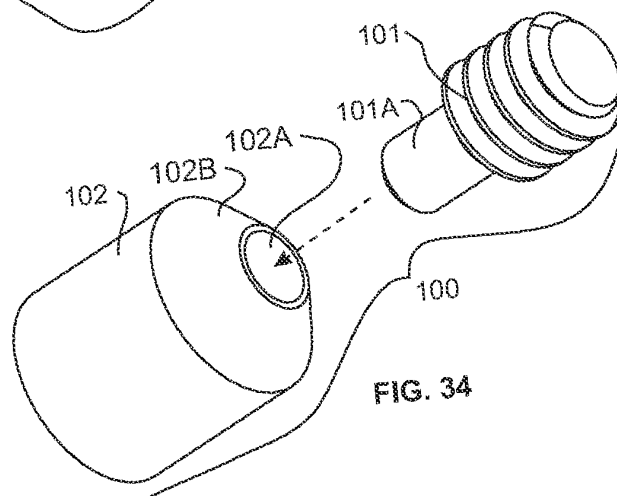


FIG. 34

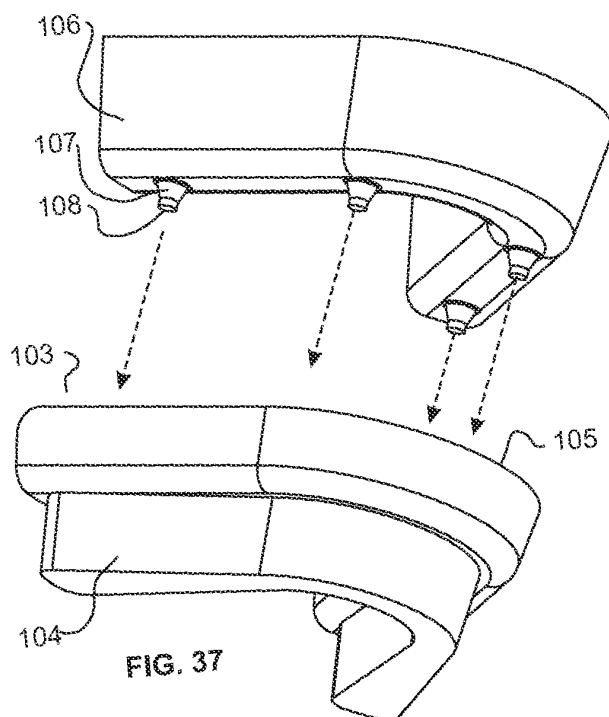


FIG. 37

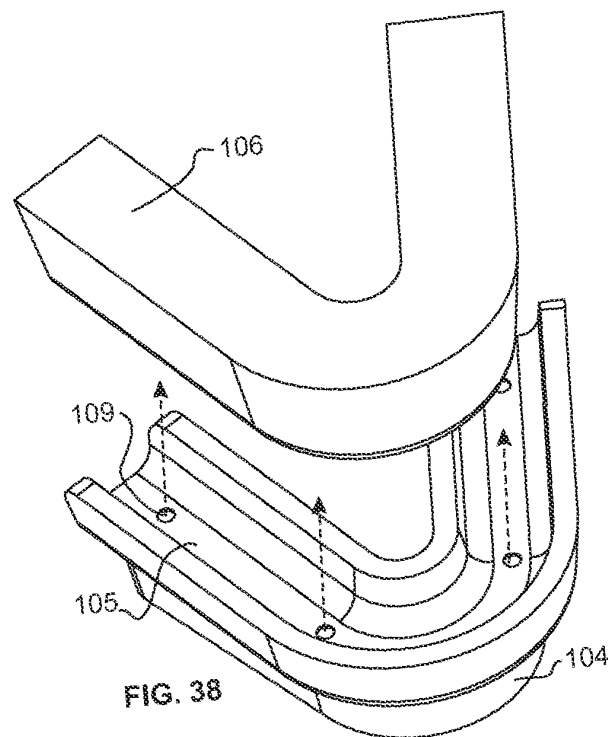
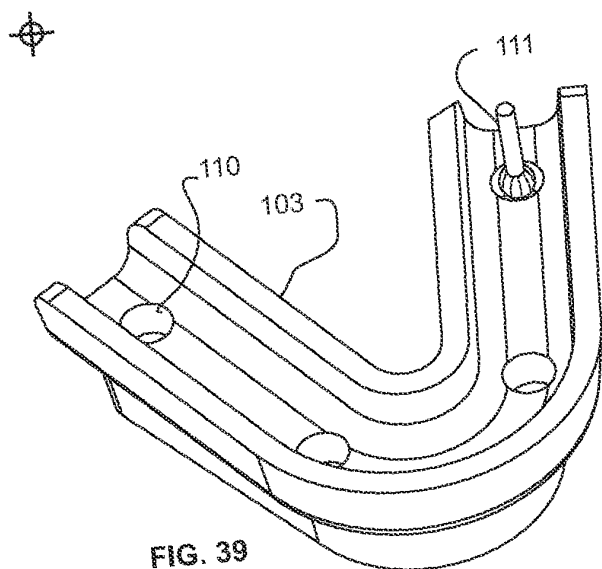
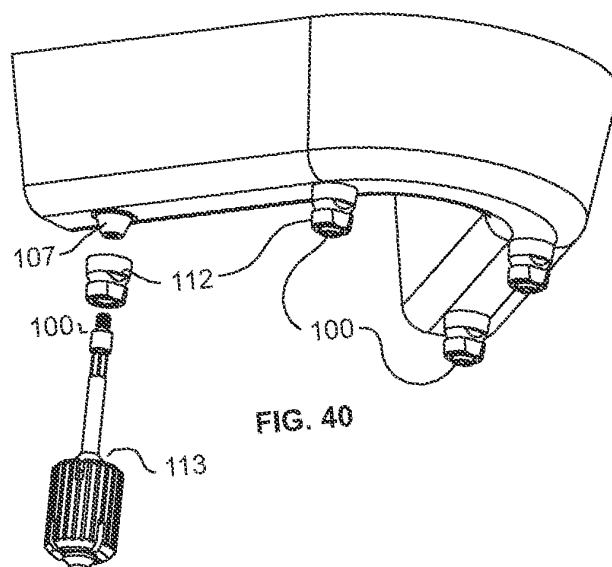
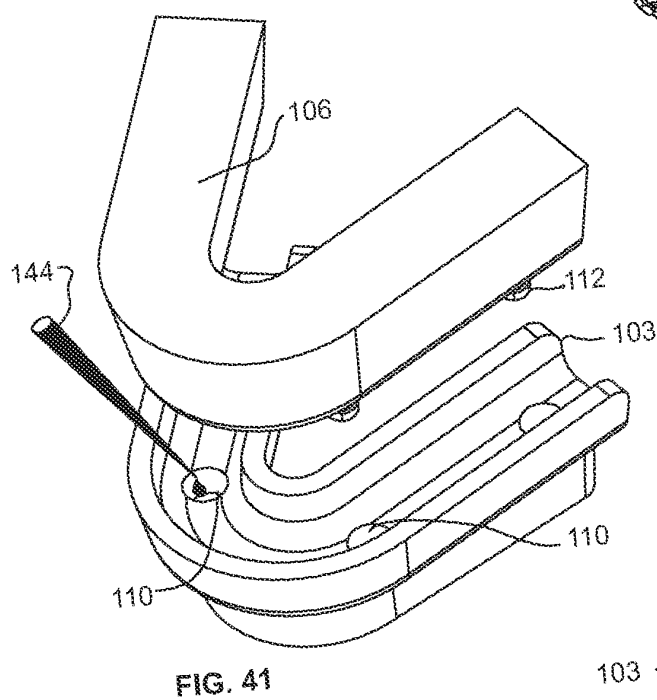
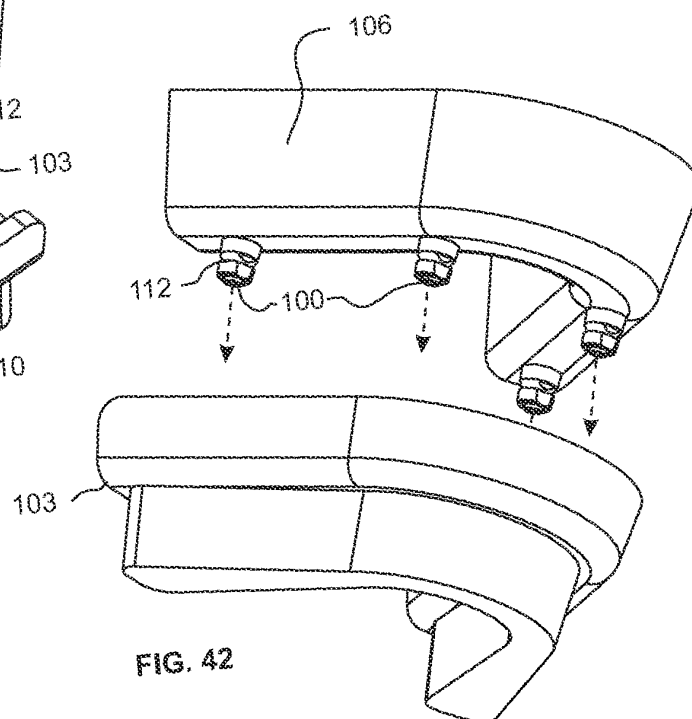


FIG. 38







13

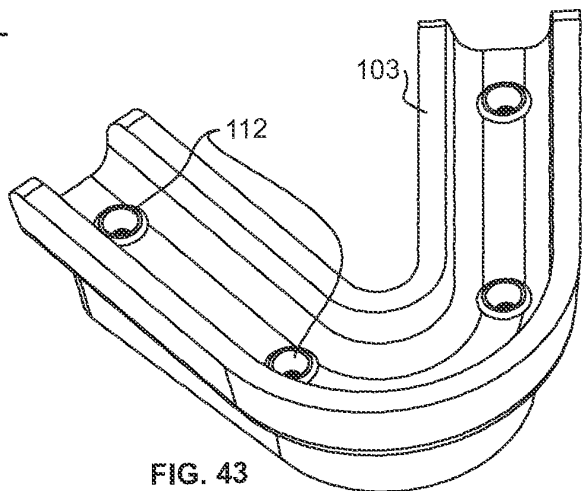


FIG. 43

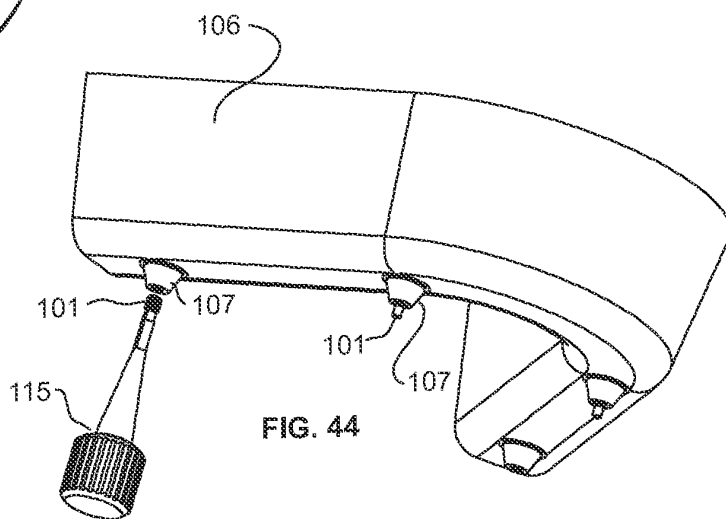


FIG. 44

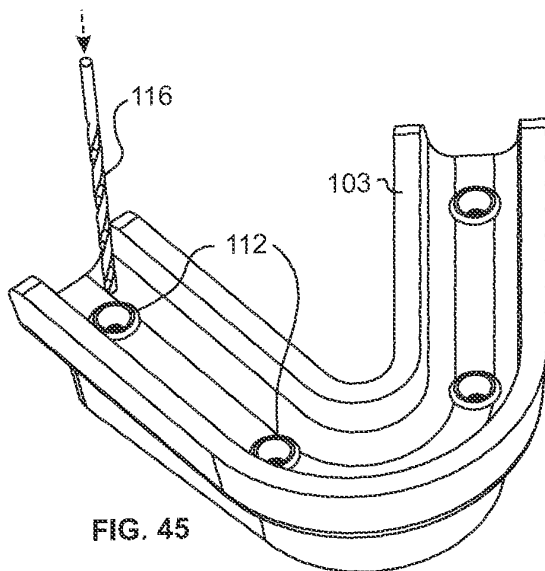


FIG. 45

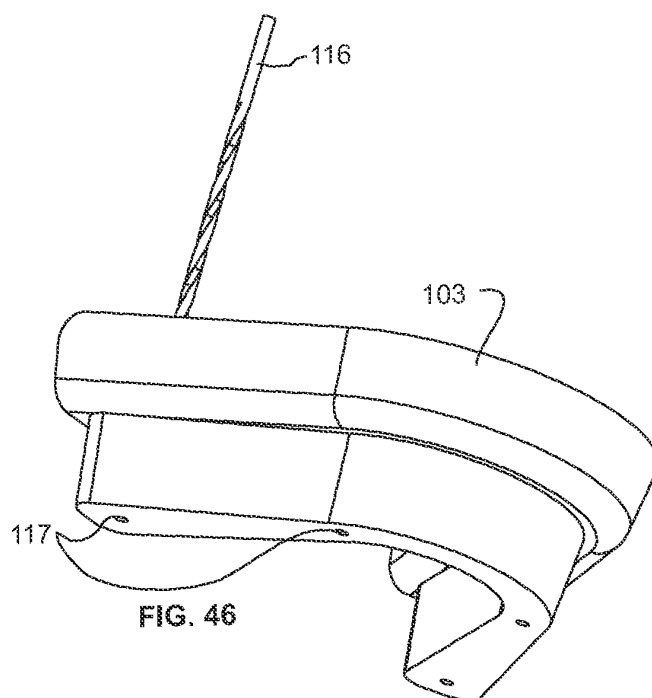


FIG. 46



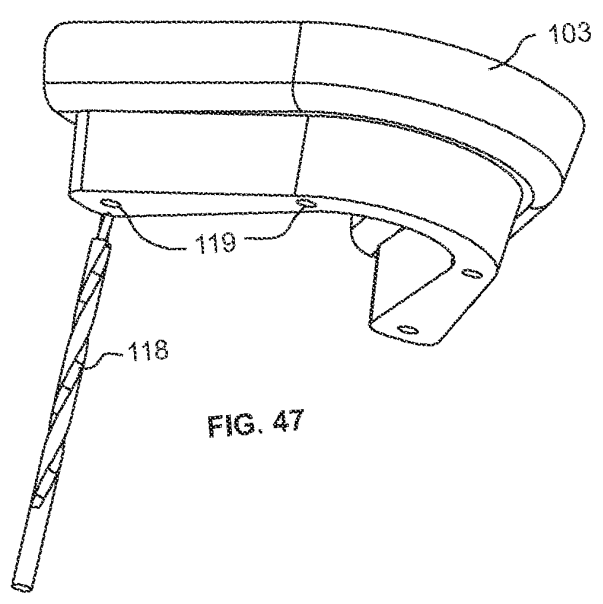


FIG. 47

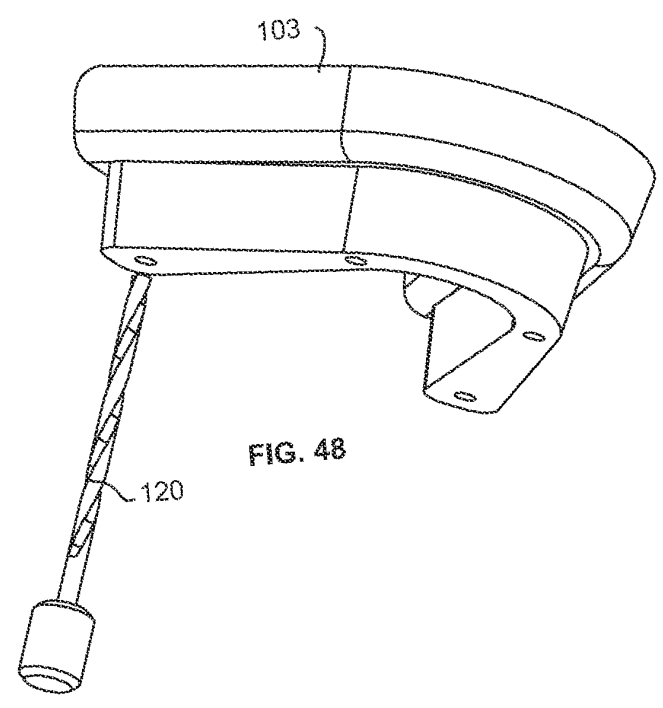


FIG. 48

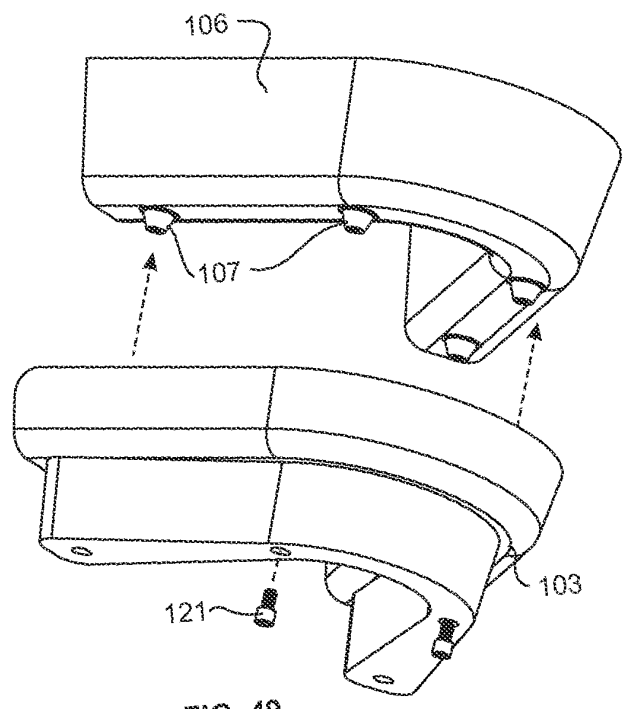


FIG. 49

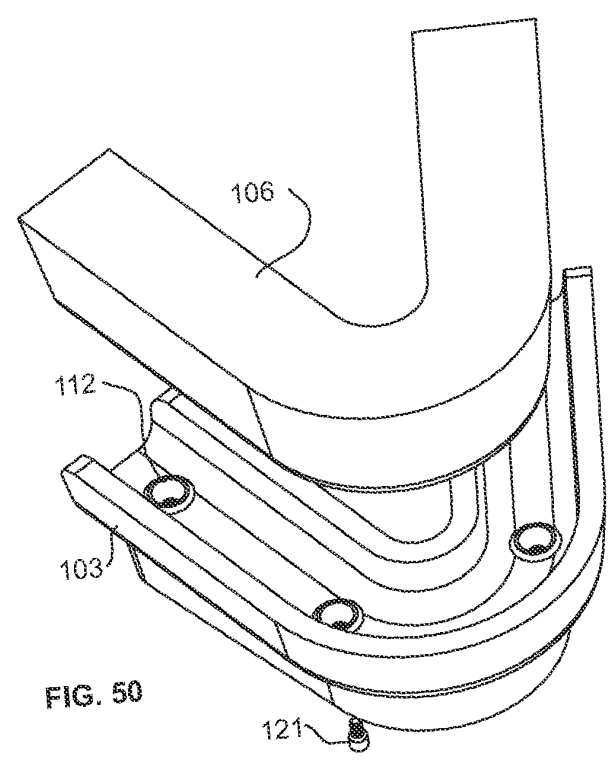
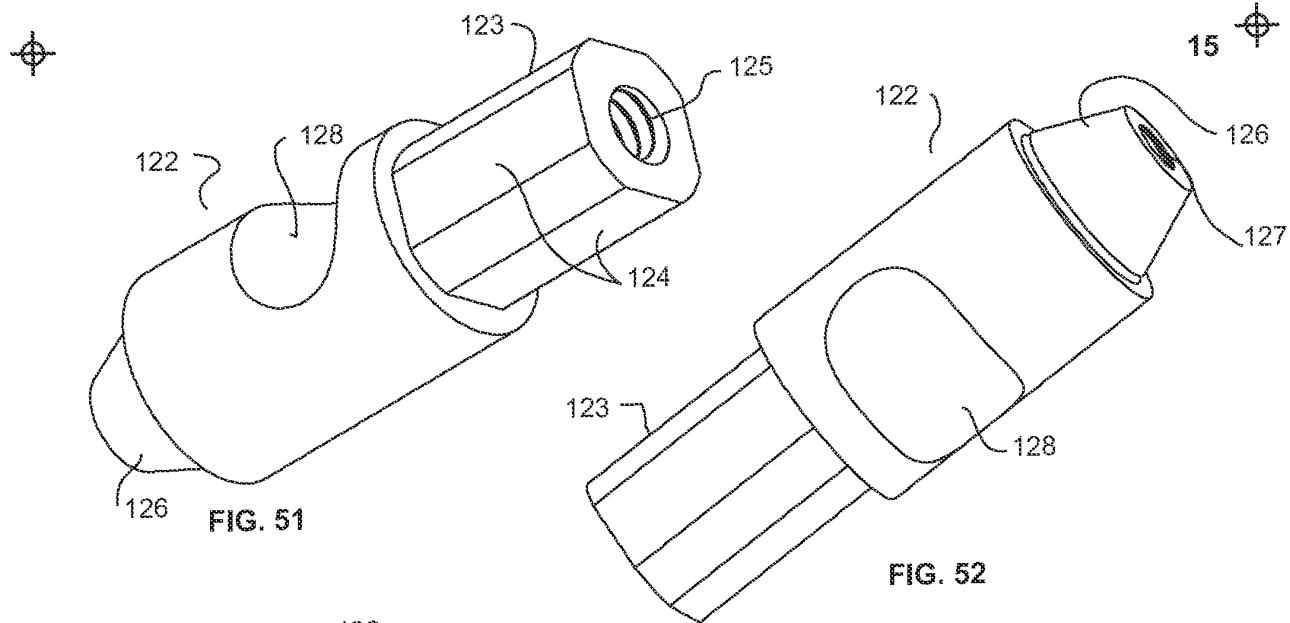
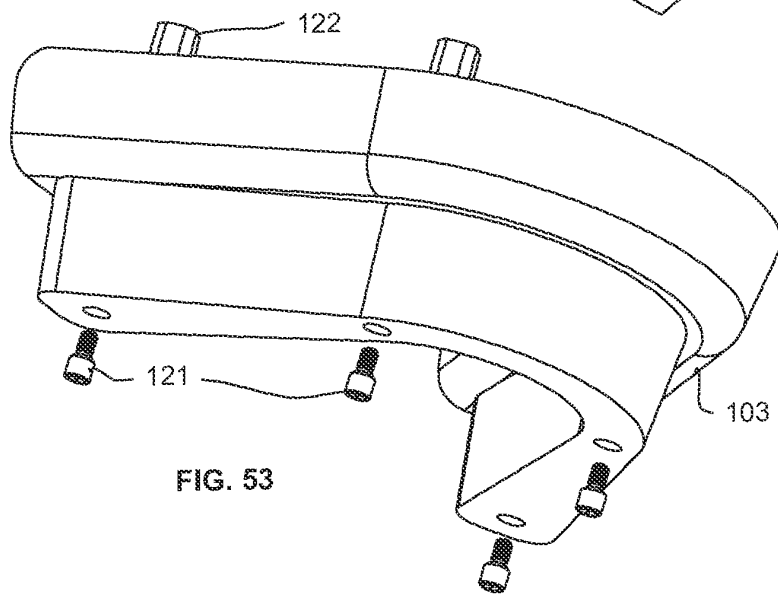
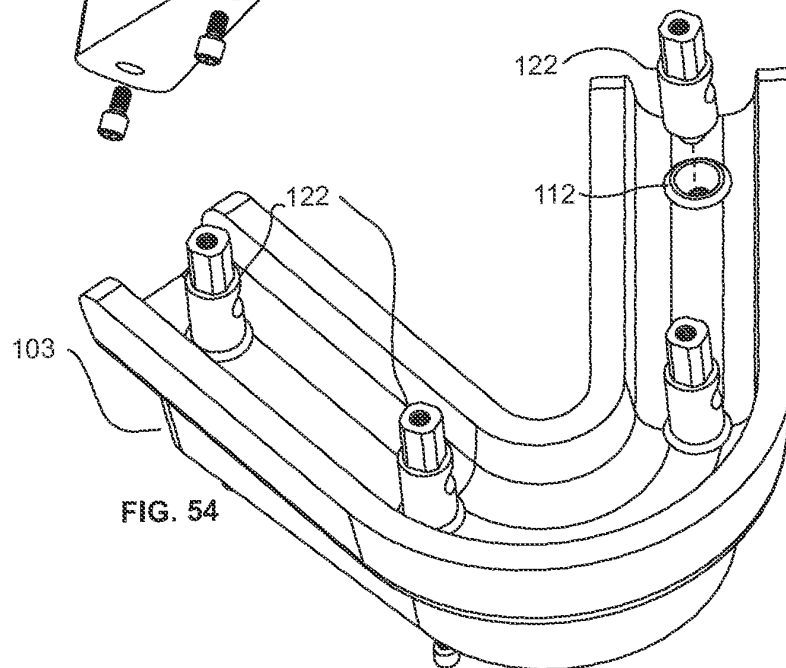


FIG. 50





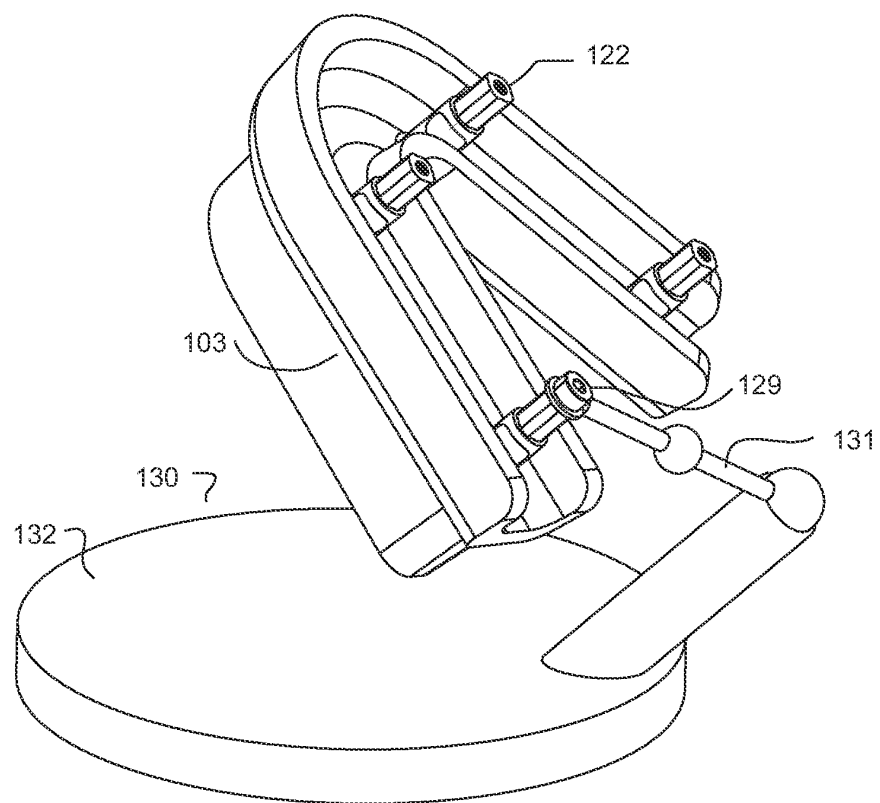


FIG. 55

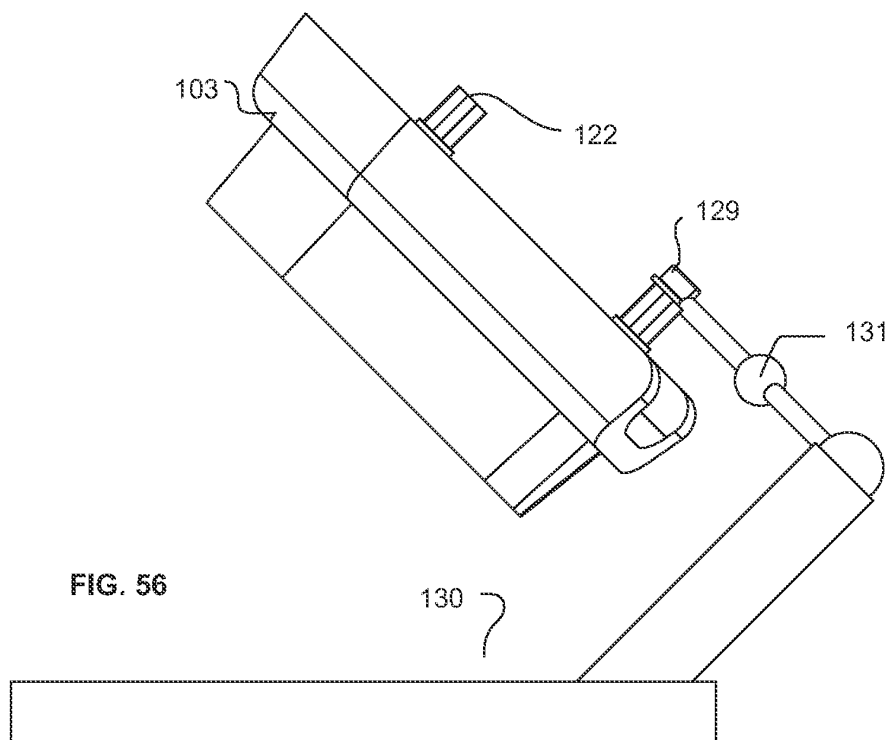
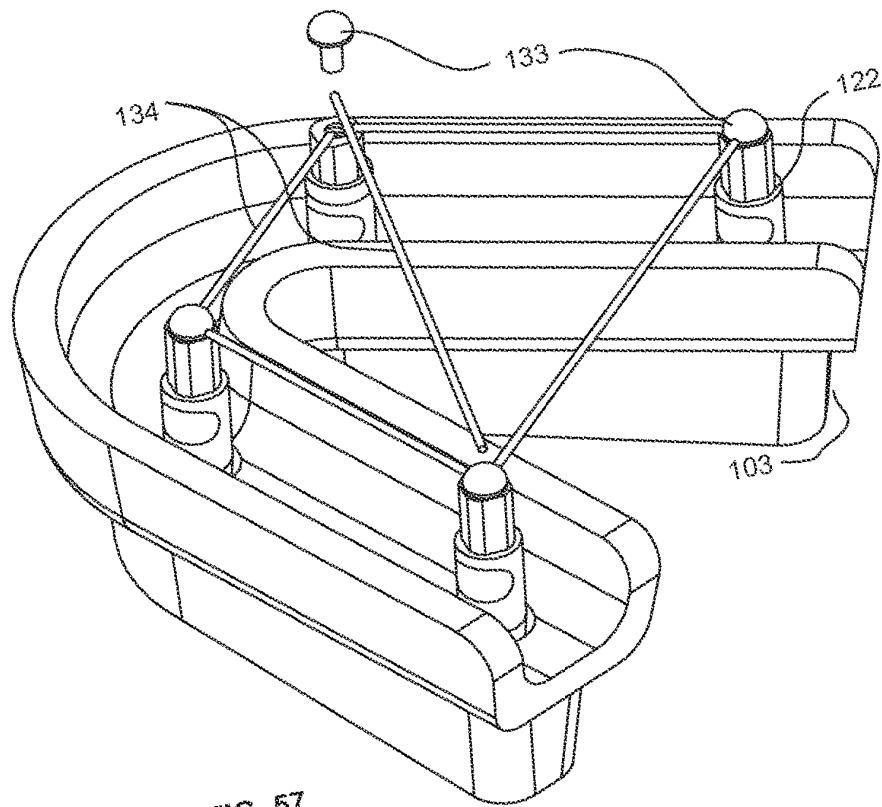


FIG. 56



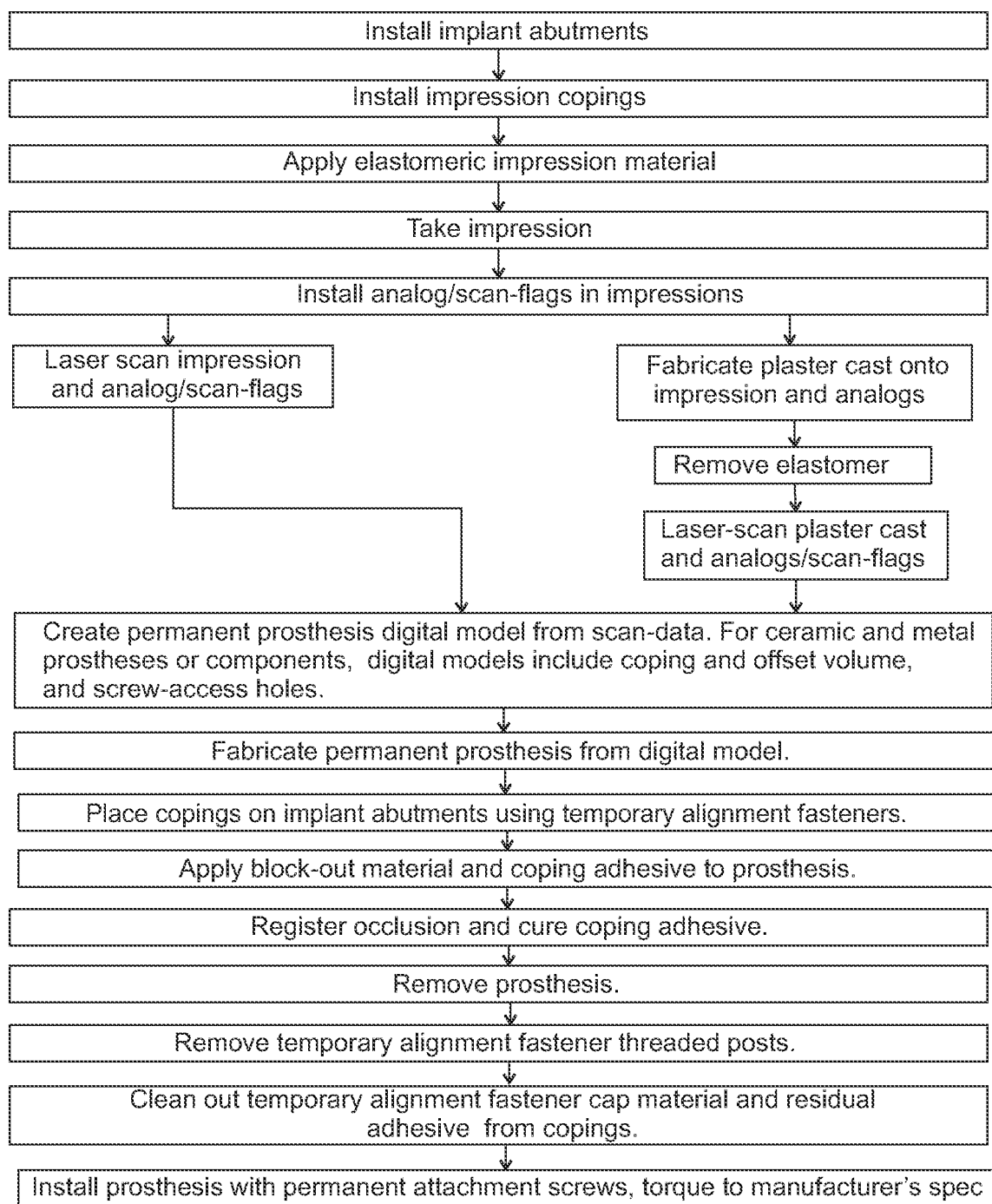


FIG. 58

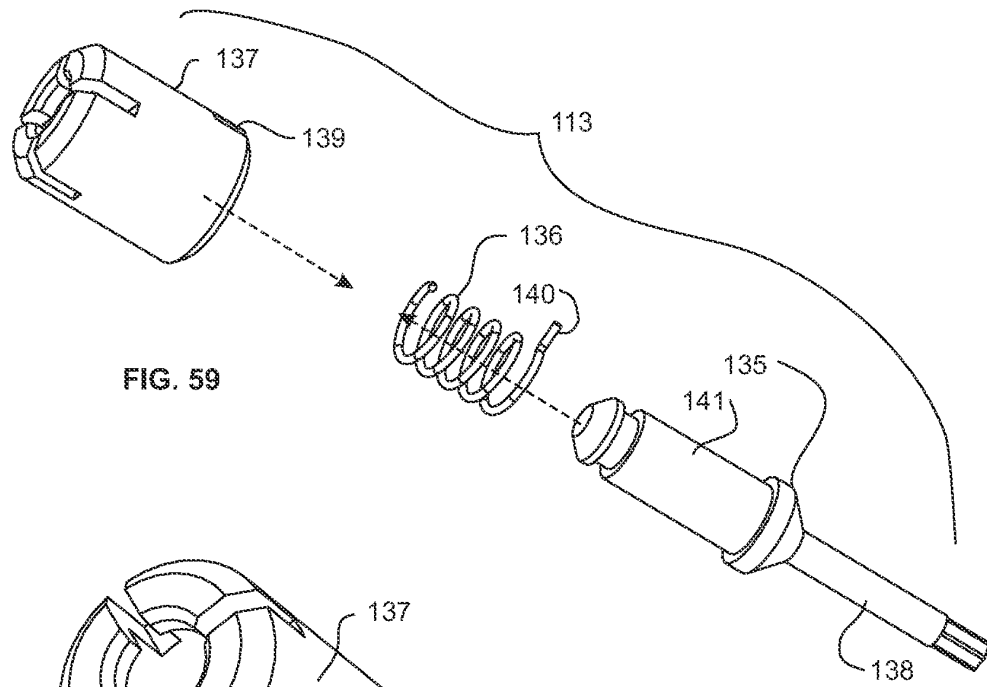


FIG. 59

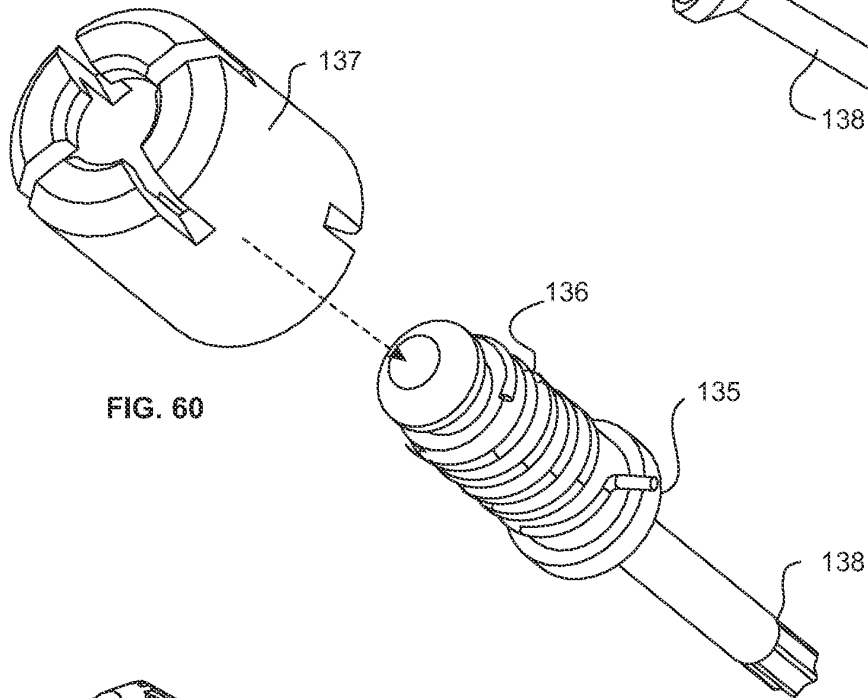


FIG. 60

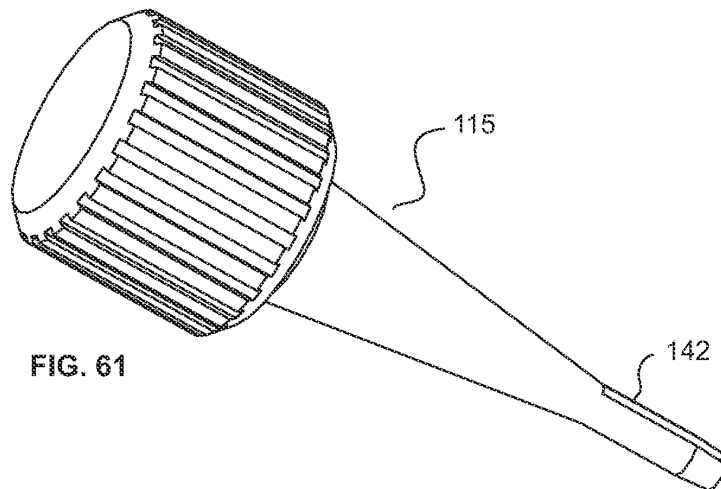
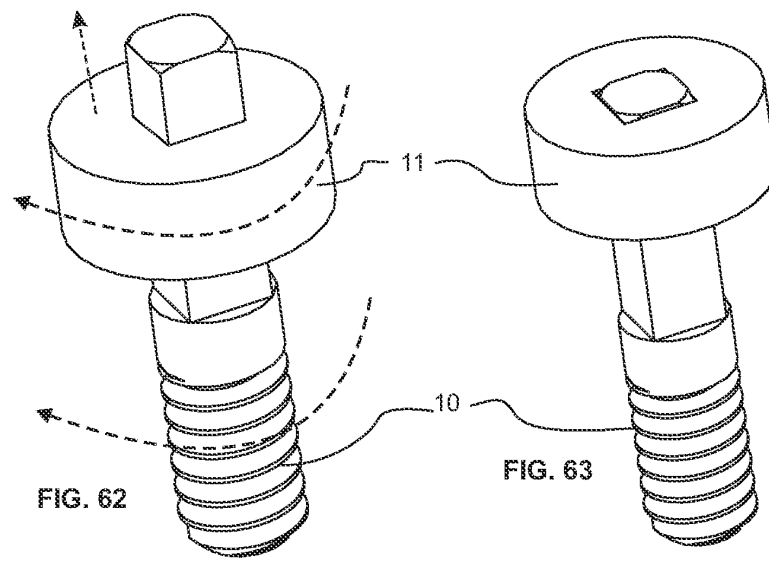
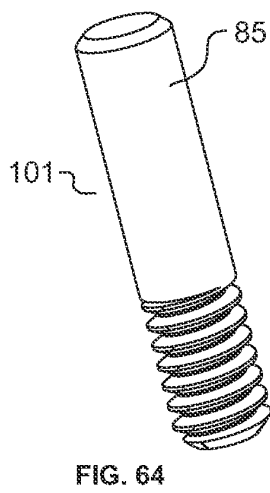
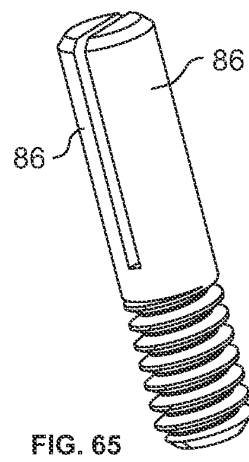
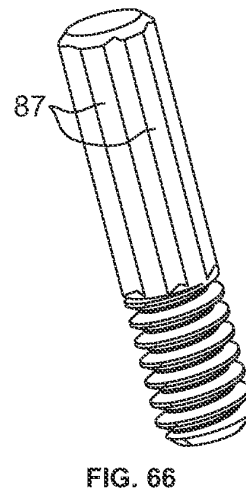
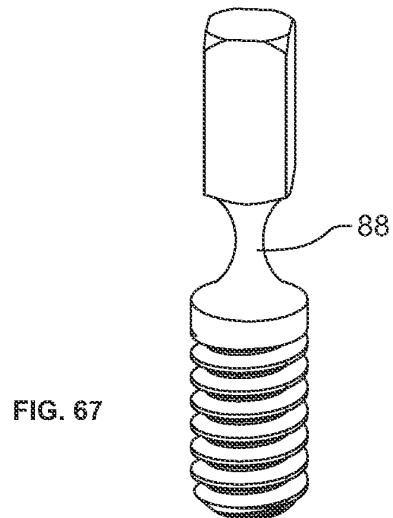


FIG. 61



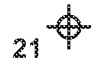
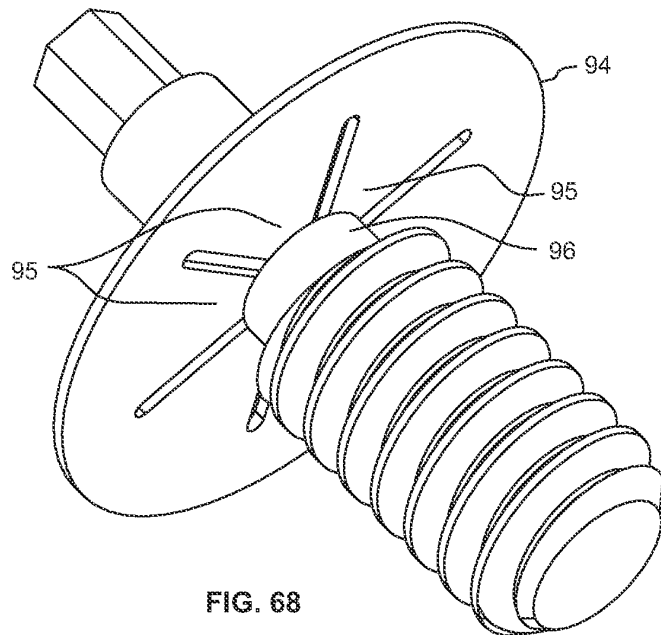


FIG. 68

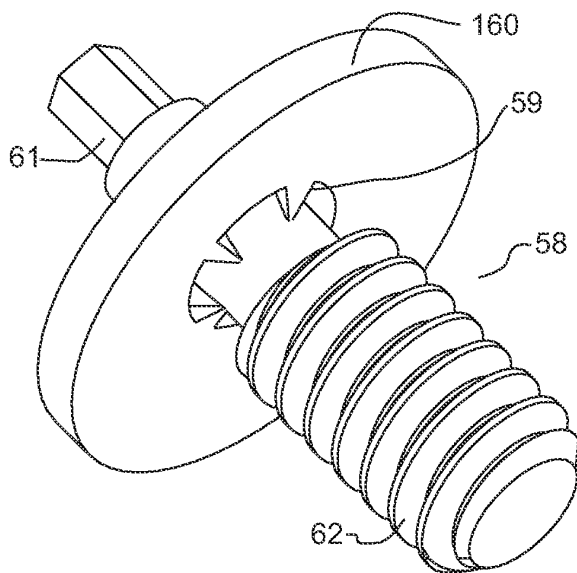
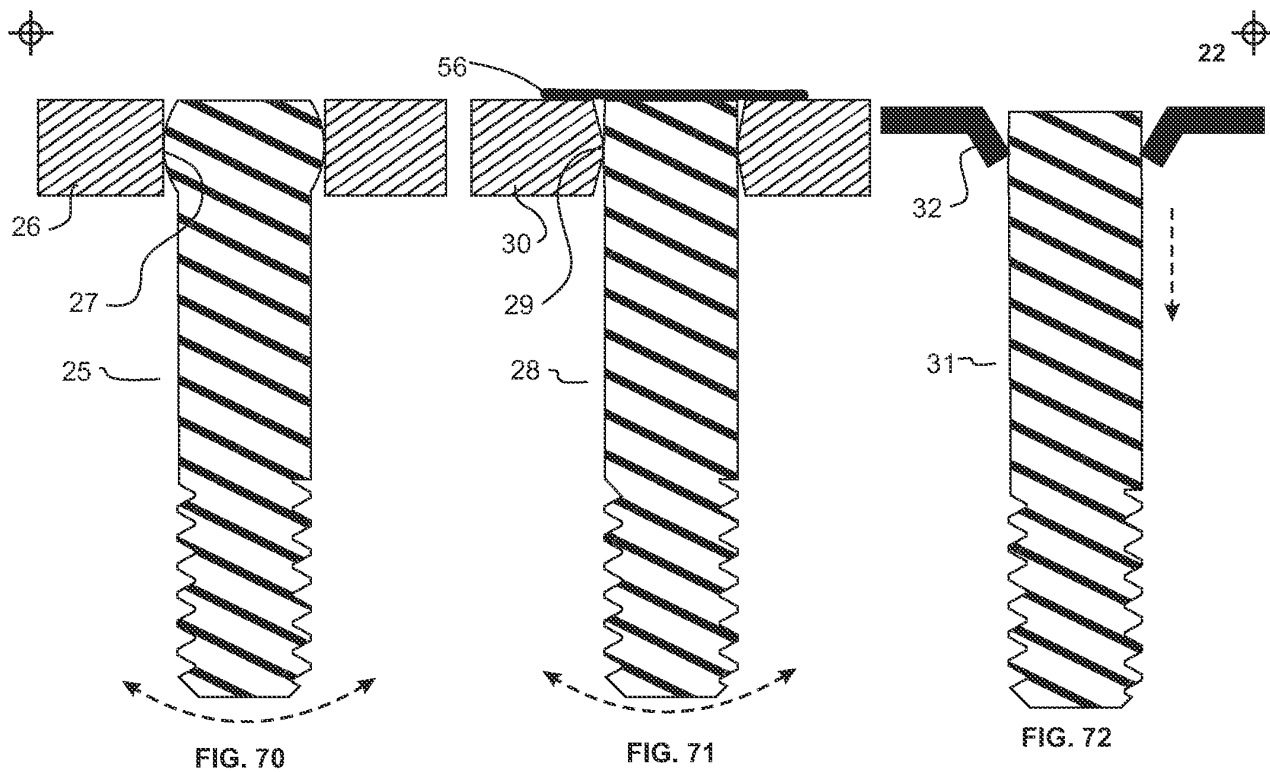
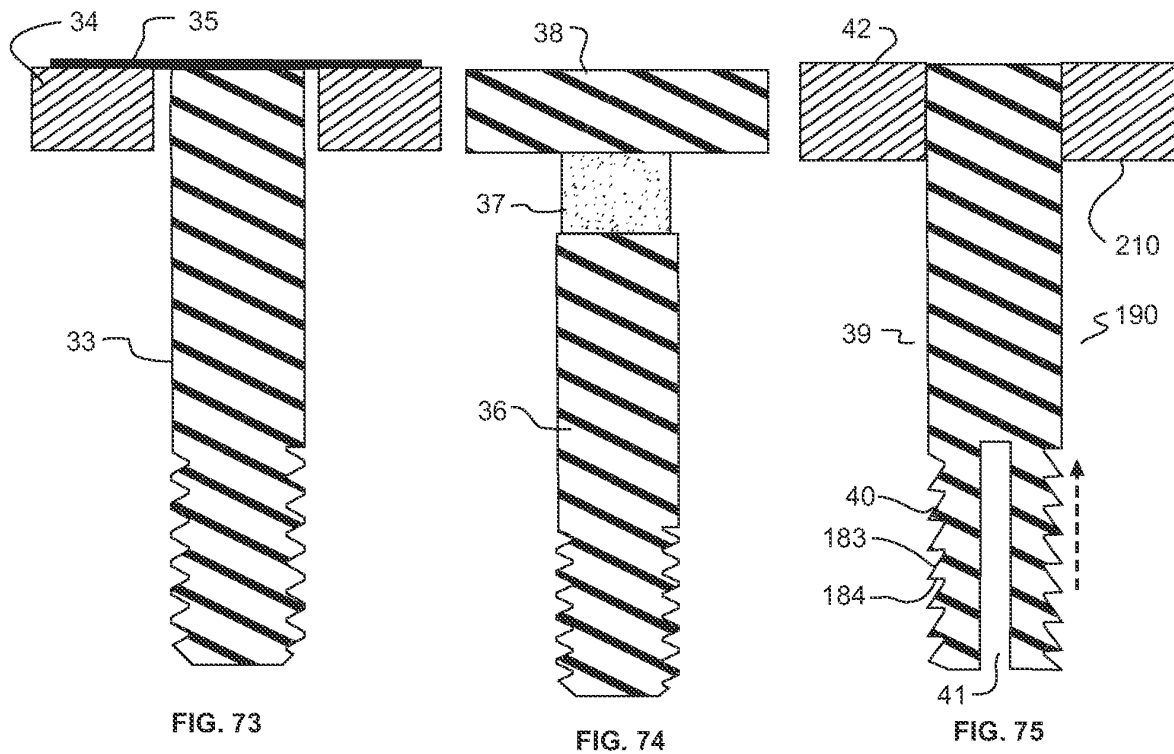


FIG. 69





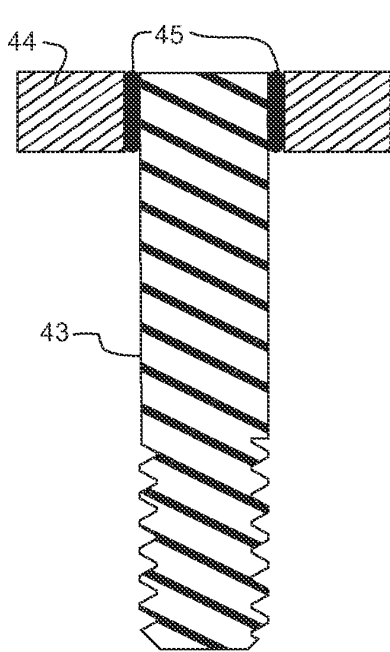


FIG. 76

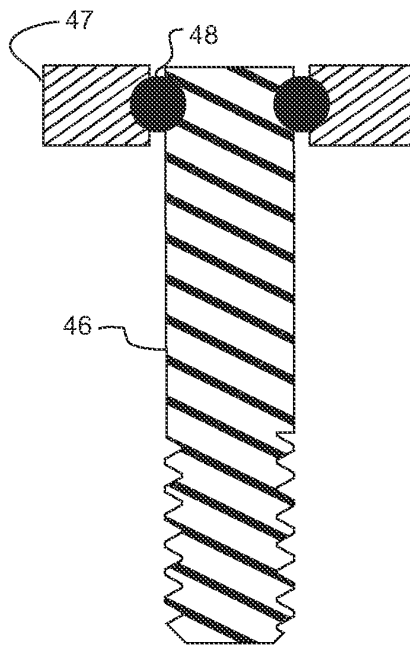


FIG. 77

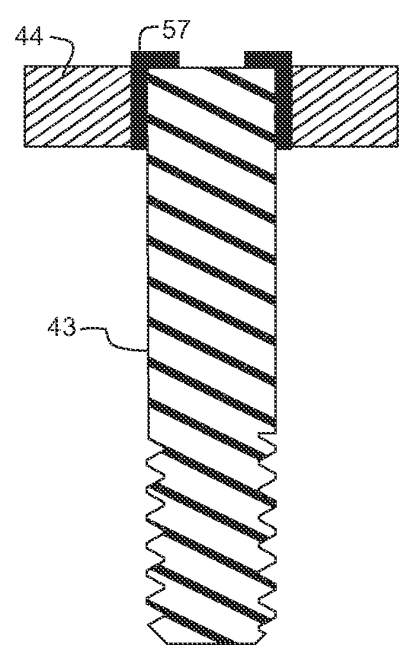


FIG. 78

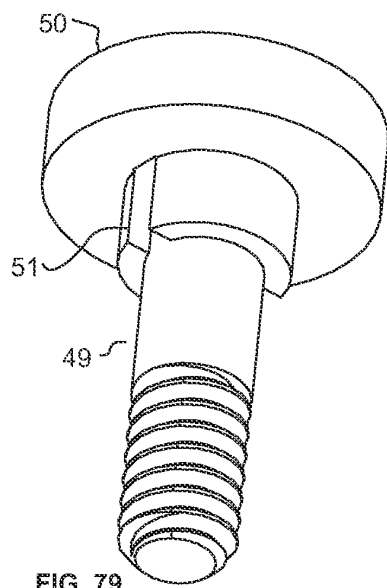


FIG. 79

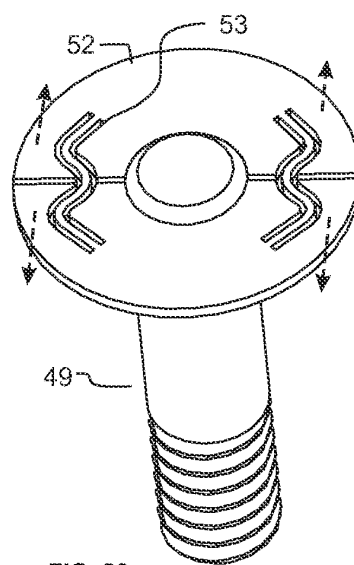


FIG. 80

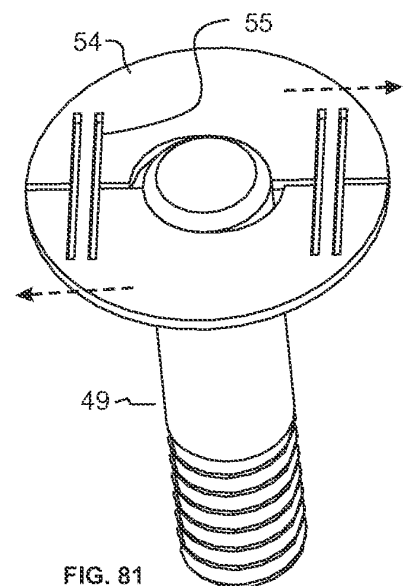


FIG. 81



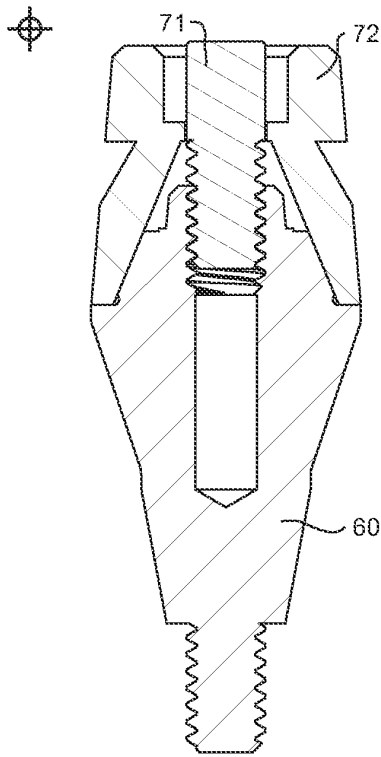


FIG. 82

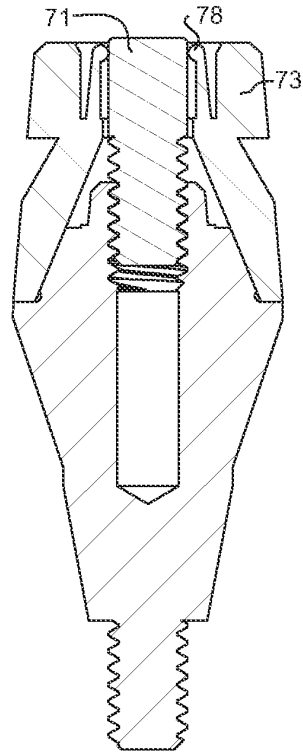


FIG. 83

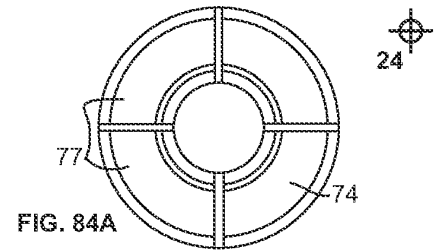


FIG. 84A

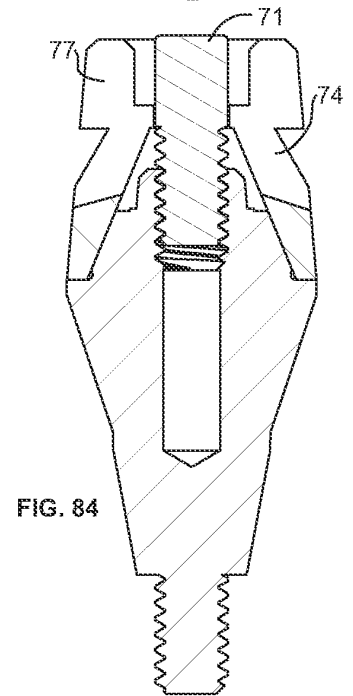


FIG. 84

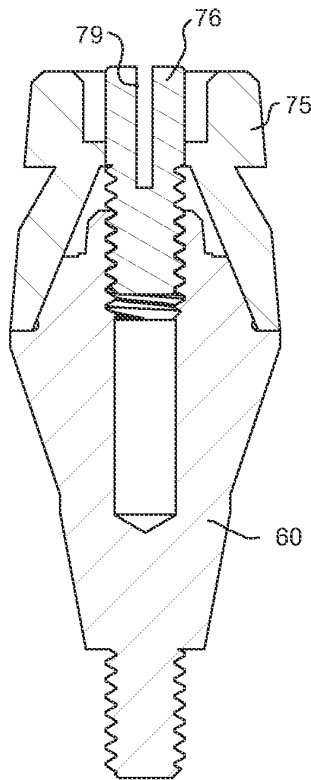


FIG. 85

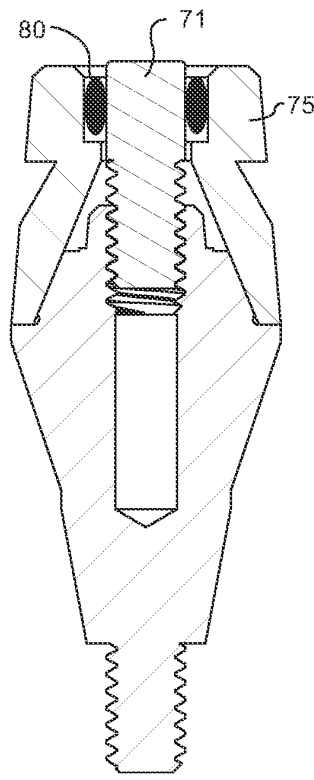


FIG. 86

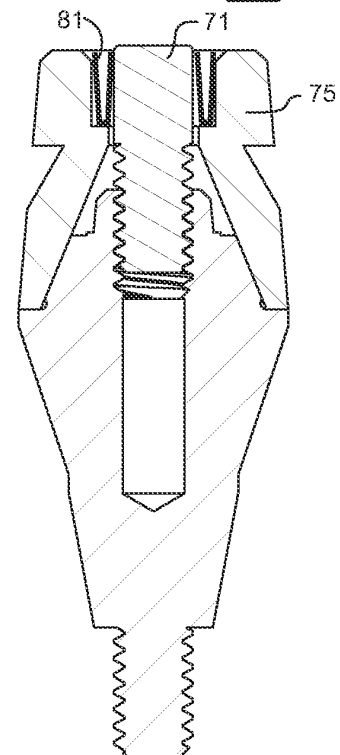


FIG. 87

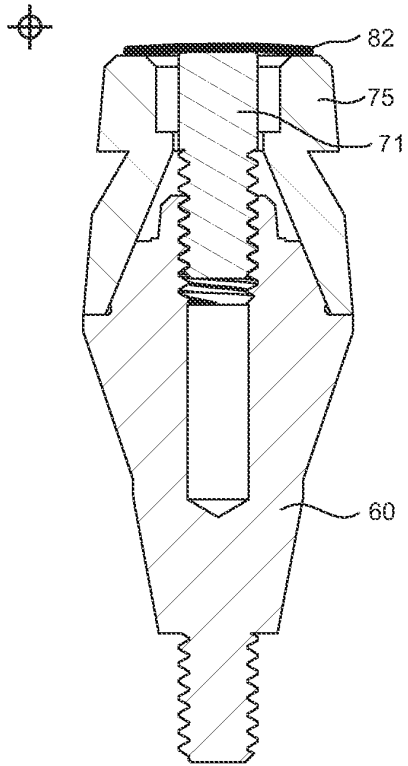


FIG. 88

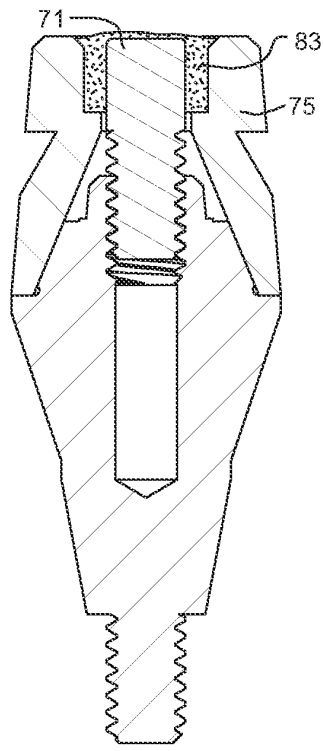


FIG. 89

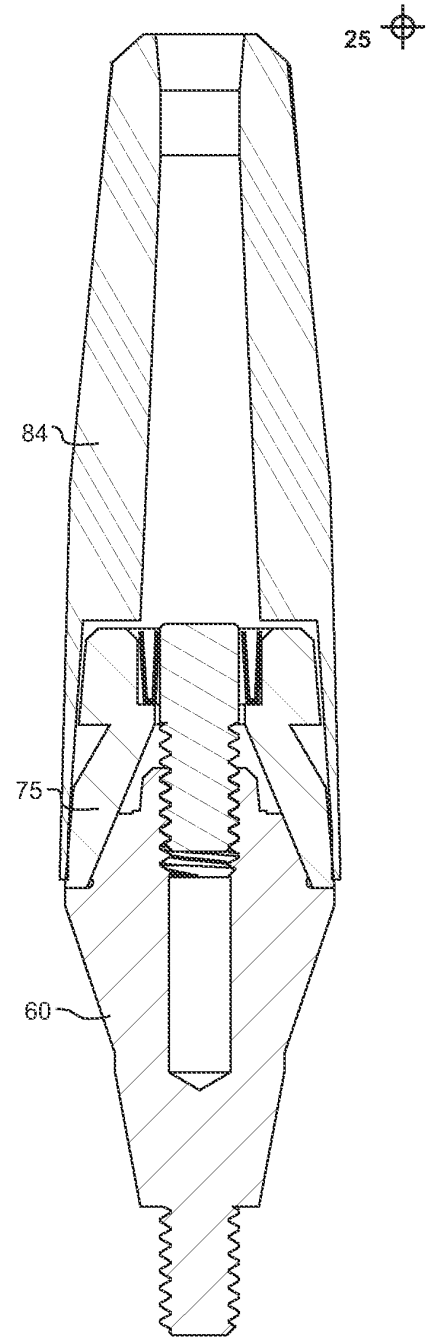


FIG. 90

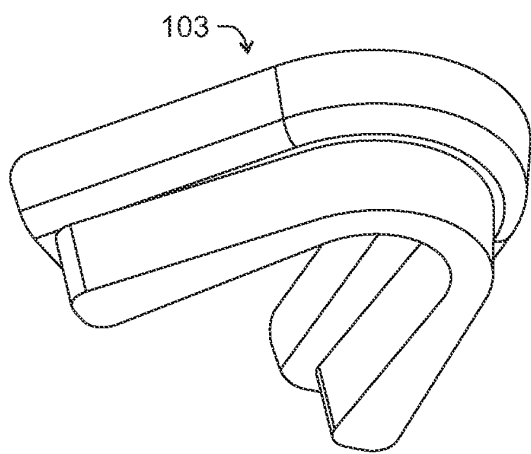


FIG. 91

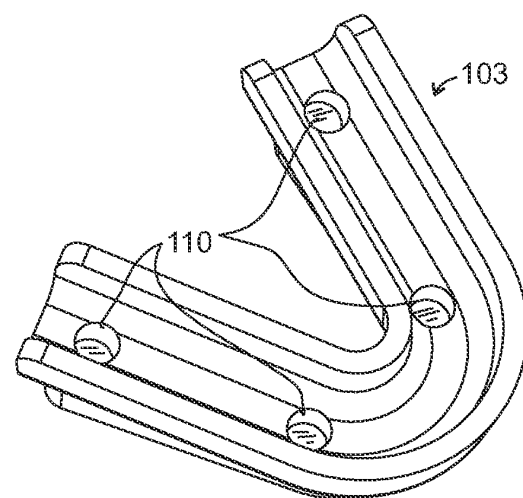


FIG. 92

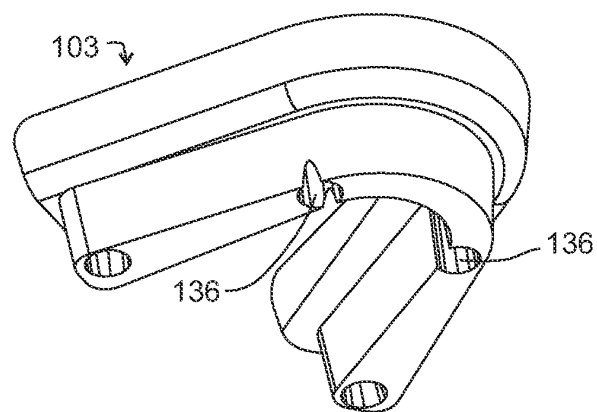


FIG. 93
(PRIOR ART)

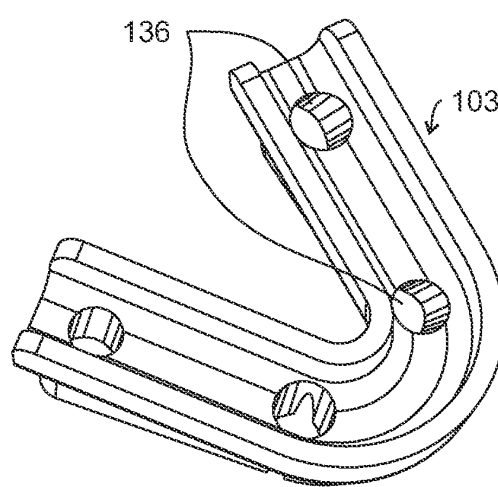


FIG. 94
(PRIOR ART)

Placeholder Sheet for Supplemental Content

Application Number: 18827656

Document Date: 09/06/2024

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
18/827,656	09/06/2024		1096	SDC013	26	4

112823
Daniel J Whittle
1229 Modoc Dr
Bellingham, WA 98229

CONFIRMATION NO. 2702 FILING RECEIPT



0000000078036263

Date Mailed: 09/19/2024

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

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Inventor(s)

Brandon Dale Kofford, Apex, NC;
Charles Albert Rudisill, Apex, NC;

Applicant(s)

Brandon Dale Kofford, Apex, NC;
Charles Albert Rudisill, Apex, NC;

Power of Attorney: The patent practitioners associated with Customer Number 000112823

Domestic Priority data as claimed by applicant

This application is a CON of 18/424,696 01/26/2024
and is a CON of 18/328,730 06/03/2023 PAT 11,937,992
and is a CON of 17/691,108 03/09/2022
and is a CON of 16/596,361 10/08/2019 PAT 11,311,354
and claims benefit of 62/742,942 10/09/2018
and claims benefit of 62/774,402 12/03/2018
and claims benefit of 62/818,082 03/13/2019

Foreign Applications for which priority is claimed (You may be eligible to benefit from the Patent Prosecution Highway program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: No

Permission to Access Search Results: No

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The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 18/827,656**

Projected Publication Date: Request for Non-Publication Acknowledged

Non-Publication Request: Yes

Early Publication Request: No

**** SMALL ENTITY ****

Title

Screw-attached Pick-up Dental Coping System and Methods

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 18/827,656			
APPLICATION AS FILED - PART I									
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY			
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)		
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	64		N/A			
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	280		N/A			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	320		N/A			
TOTAL CLAIMS (37 CFR 1.16(j))	26 minus 20 =	*	x 40 =	240	OR				
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4 minus 3 =	*	x 192 =	192					
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0					
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0					
				TOTAL		TOTAL			
				1096					
* If the difference in column 1 is less than zero, enter "0" in column 2.									
APPLICATION AS AMENDED - PART II									
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)	
	Total (37 CFR 1.16(i))	*	Minus **	x =		OR	x =		
	Independent (37 CFR 1.16(h))	*	Minus ***	x =		OR	x =		
	Application Size Fee (37 CFR 1.16(s))					OR			
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					OR			
				TOTAL ADD'L FEE		TOTAL ADD'L FEE			
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY	
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)	
	Total (37 CFR 1.16(i))	*	Minus **	x =		OR	x =		
	Independent (37 CFR 1.16(h))	*	Minus ***	x =		OR	x =		
	Application Size Fee (37 CFR 1.16(s))					OR			
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					OR			
				TOTAL ADD'L FEE		TOTAL ADD'L FEE			
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.									



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Kathi Vidal

Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office

Derrick Brent

Deputy Under Secretary of Commerce for Intellectual Property and
Deputy Director of the United States Patent and Trademark Office



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/827,656	09/06/2024	Brandon Dale Kofford	SDC013	2702
112823	7590	10/11/2024	EXAMINER	
Daniel J Whittle			CENTRAL, DOCKET	
1229 Modoc Dr			ART UNIT	
Bellingham, WA 98229			PAPER NUMBER	
			OPAP	
			MAIL DATE	
			DELIVERY MODE	
			10/11/2024	
			PAPER	

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

<i>Decision Granting Request for Prioritized Examination (Track I)</i>	Application No. 18/827,656	Applicant(s) Kofford et al.	
	Examiner FIKIRTE A GEREMEW	Art Unit OMBL	AIA (FITF) Status Yes
<p>1. THE REQUEST FILED <u>06 September 2024</u> IS GRANTED .</p> <p>The above-identified application has met the requirements for prioritized examination</p> <p>A. ☒ for an original nonprovisional application (Track I).</p> <p>B. ☐ for an application undergoing continued examination (RCE).</p> <p>2. The above-identified application will undergo prioritized examination. The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:</p> <p>A. filing a <u>petition for extension of time</u> to extend the time period for filing a reply;</p> <p>B. filing an <u>amendment to amend the application to contain more than four independent claims, more than thirty total claims</u>, or a multiple dependent claim;</p> <p>C. filing a <u>request for continued examination</u> ;</p> <p>D. filing a notice of appeal;</p> <p>E. filing a request for suspension of action;</p> <p>F. mailing of a notice of allowance;</p> <p>G. mailing of a final Office action;</p> <p>H. completion of examination as defined in 37 CFR 41.102; or</p> <p>I. abandonment of the application.</p> <p>Telephone inquiries with regard to this decision should be directed to FIKIRTE GEREMEW at (703) 756-1930. In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.</p>			
/FIKIRTE A GEREMEW/ PROGRAM SUPPORT SPECIALIST, OMBL			



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Daniel J Whittle			HUYNH, COURTNEY NGUYEN	
1229 Modoc Dr				
Bellingham, WA 98229			ART UNIT	PAPER NUMBER
			3772	
			MAIL DATE	DELIVERY MODE
			10/30/2024	PAPER

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The time period for reply, if any, is set in the attached communication.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Election/Restrictions

2. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-22, drawn to a dental system, classified in A61C 8/0068.
 - II. Claims 23-26, drawn to a method of installing a dental prosthesis, classified in A61C 8/0001.

The inventions are independent or distinct, each from the other because:

3. Inventions I and II are related as product and process of use. The inventions can be shown to be distinct if either or both of the following can be shown: (1) the process for using the product as claimed can be practiced with another materially different product or (2) the product as claimed can be used in a materially different process of using that product. See MPEP § 806.05(h). In the instant case the product as claimed can be used in a materially different process of screwing together two pieces of wood.

4. Restriction for examination purposes as indicated is proper because all the inventions listed in this action are independent or distinct for the reasons given above and there would be a serious search and/or examination burden if restriction were not required because one or more of the following reasons apply:

Inventions I and II would require a different field of search (e.g. searching different classes/subclasses or electronic resources, or employing different search queries).

Applicant is advised that the reply to this requirement to be complete must include (i) an election of an invention to be examined even though the requirement may be

traversed (37 CFR 1.143) **and (ii) identification of the claims encompassing the elected invention.**

The election of an invention may be made with or without traverse. To reserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the restriction requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable upon the elected invention.

Should applicant traverse on the ground that the inventions are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103 or pre-AIA 35 U.S.C. 103(a) of the other invention.

This application contains claims directed to the following patentably distinct species:

- A. Figs. 1-9
- B. Figs. 10-26
- C. Figs. 28-33
- D. Figs. 34-36
- E. Figs. 62-63
- F. Fig. 64
- G. Fig. 65
- H. Fig. 66
- I. Fig. 67
- J. Fig. 68
- K. Fig. 69
- L. Fig. 70

- M. Fig. 71
- N. Fig. 72
- O. Fig. 73
- P. Fig. 74
- Q. Fig. 75
- R. Fig. 76
- S. Fig. 77
- T. Fig. 78
- U. Fig. 79
- V. Fig. 80
- W. Fig. 81
- X. Fig. 82
- Y. Fig. 83
- Z. Fig. 84-84A
- AA. Fig. 85
- BB. Fig. 86
- CC. Fig. 87
- DD. Fig. 88
- EE. Fig. 89
- FF. Fig. 90

The species are independent or distinct because as disclosed the different species have mutually exclusive characteristics for each identified species. In addition, these species are not obvious variants of each other based on the current record.

Applicant is required under 35 U.S.C. 121 to elect a single disclosed species, or a single grouping of patentably indistinct species, for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. Currently, no claims are generic. There is a serious search and/or examination burden for the patentably distinct species as set forth above because at least the following reason(s) apply:

The disclosed species require a different field of search (e.g. searching different classes/subclasses or electronic resources, or employing different search queries).

Applicant is advised that the reply to this requirement to be complete must include (i) an election of a species to be examined even though the requirement may be traversed (37 CFR 1.143) **and (ii) identification of the claims encompassing the elected species or grouping of patentably indistinct species**, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

The election may be made with or without traverse. To preserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the election of species requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable on the elected species or grouping of patentably indistinct species.

Should applicant traverse on the ground that the species, or groupings of patentably indistinct species from which election is required, are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing them to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the species unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103 or pre-AIA 35 U.S.C. 103(a) of the other species.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which depend from or otherwise require all the limitations of an allowable generic claim as provided by 37 CFR 1.141.

5. During a telephone conversation with Attorney Daniel Whittle on 22 October 2024 a provisional election was made **without traverse** to prosecute the invention of **Group I, claims**

1-22, Species Q, Figure 75. Affirmation of this election must be made by applicant in replying to this Office action.

6. However, claims 3, 7, 10-14 and 21-26 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

As to claim 3, the limitation of a maximal width of the distal shaft portion of the temporary screw is smaller than the width of the distal post portion of the definitive screw having threads does not read on the elected species as a maximal width of the distal shaft portion of the temporary screw is smaller than the width of the distal post portion of the definitive screw having threads has not been disclosed or shown for the elected species of Fig. 75. Therefore, claim 3 does not read on the elected species.

As to claim 7, the limitation of a portion of the shaft of the temporary fastener that has a smaller width than the distal shaft portion which is sized and configured for rotary engagement does not read on the elected species as a portion of the shaft of the temporary fastener that has a smaller width than the distal shaft portion which is sized and configured for rotary engagement has not been disclosed or shown for the elected species of Fig. 75. Therefore, claim 7 does not read on the elected species.

As to claim 10, the limitation of a maximal width of the distal portion with the threads which is smaller than a maximal width of the distal post portion of the definitive screw with the threads does not read on the elected species as a maximal width of the distal portion with the threads which is smaller than a maximal width of the distal post portion of the definitive screw with the threads has not been disclosed or shown for the elected species of Fig. 75. Therefore, claim 10, and claims 11, 12, 13, and 14, which are dependent on claim 10, does not read on the elected species.

As to claim 21, the limitation of male threading of the distal portion of the definitive screw having a greater engagement depth with the female threading of the implant abutment than the

engagement depth of the temporary fastener, and the limitation of the male threading of the distal portion of the definitive screw having a longitudinal extent that is greater than a longitudinal extent of the distal shaft portion of the temporary fastener do not read on the elected species as these limitations have not been disclosed or shown for the elected species of Fig. 75. Therefore, claim 21 does not read on the elected species.

7. As to claim 22, the limitation of a maximum width of the distal portion of the definitive screw comprising the male threading being greater than a maximum width of the distal shaft portion of the temporary fastener configured to rotatably engage the implant abutment female threading does not read on the elected species as this limitation has not been disclosed or shown for the elected species of Fig. 75. Therefore, claim 22 does not read on the elected species.

As to claims 23-26, the claims are a part of the non-elected Group II, directed toward a method of installing a dental prosthesis.

8. Applicant is reminded that upon the cancelation of claims to a non-elected invention, the inventorship must be corrected in compliance with 37 CFR 1.48(a) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. A request to correct inventorship under 37 CFR 1.48(a) must be accompanied by an application data sheet in accordance with 37 CFR 1.76 that identifies each inventor by his or her legal name and by the processing fee required under 37 CFR 1.17(i).

9. The examiner has required restriction between product or apparatus claims and process claims. Where applicant elects claims directed to the product/apparatus, and all product/apparatus claims are subsequently found allowable, withdrawn process claims that include all the limitations of the allowable product/apparatus claims should be considered for rejoinder. All claims directed to a nonelected process invention must include all the limitations of an allowable product/apparatus claim for that process invention to be rejoined.

In the event of rejoinder, the requirement for restriction between the product/apparatus claims and the rejoined process claims will be withdrawn, and the rejoined process claims will be fully examined for patentability in accordance with 37 CFR 1.104. Thus, to be allowable, the rejoined claims must meet all criteria for patentability including the requirements of 35 U.S.C. 101, 102, 103 and 112. Until all claims to the elected product/apparatus are found allowable, an otherwise proper restriction requirement between product/apparatus claims and process claims may be maintained. Withdrawn process claims that are not commensurate in scope with an allowable product/apparatus claim will not be rejoined. See MPEP § 821.04. Additionally, in order for rejoinder to occur, applicant is advised that the process claims should be amended during prosecution to require the limitations of the product/apparatus claims. **Failure to do so may result in no rejoinder.** Further, note that the prohibition against double patenting rejections of 35 U.S.C. 121 does not apply where the restriction requirement is withdrawn by the examiner before the patent issues. See MPEP § 804.01.

Claim Objections

10. Claim 17 is objected to because of the following informalities:
 - Examiner suggests amending claim 17 line 2 to "[[an]]the entire temporary fastener and the coping".
11. Appropriate correction is required.

Claim Rejections - 35 USC § 112

12. **The following is a quotation of 35 U.S.C. 112(b):**
(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

13. **Claims 6, 16, and 19** are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention.

14. Claim 6 recites the limitation "the axial release force" in line 1. Claim 6 is unclear because in claim 1 the limitation "an axial release force" is recited functionally, however claim 6 appear to intend to recite "the axial release force" positively. This "the axial release force" is not a structural limitation but an action and cannot be "configured" since it is not structural. For purposes of examination, Examiner will interpret claim 6 broadly and suggests Applicant amend to clarify.

15. Claim 16 recites the limitation "the axial release force" in line 1. Claim 16 is unclear because in claim 15 the limitation "an axial release force" is recited functionally, however claim 16 appears to intend to recite "the axial release force" positively. For purposes of examination, Examiner will interpret claim 16 broadly and suggests Applicant amend to clarify.

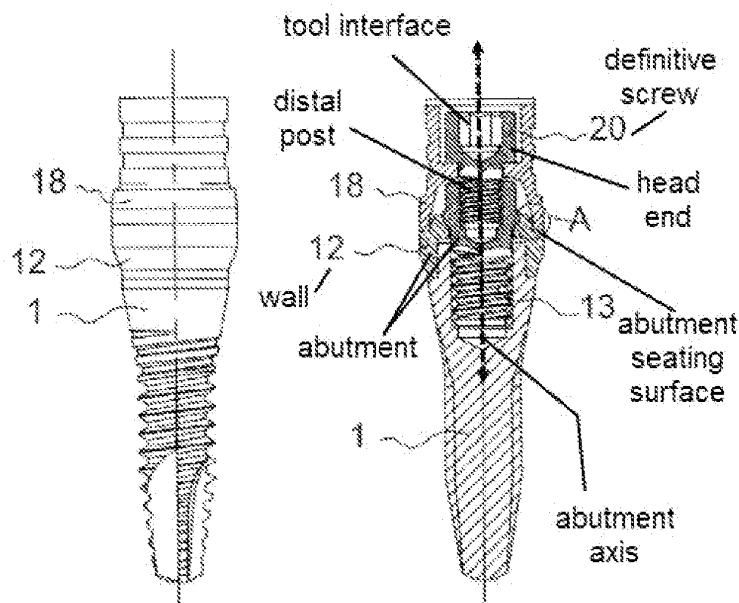
16. Claim 19 recites the limitation "wherein, after removal of the temporary fastener, the head is in contact with a proximal surface of the coping proximate the aperture of the coping" in lines 4-6. This limitation is unclear as it is unclear where the locations of the definitive screw and coping are intended to be. Claim 15 recites that the temporary fastener is "configured to release at least a portion of the temporary fastener and the coping from the implant abutment as a unit", which is a functional recitation. For purposes of examination, Examiner will interpret claim 19 lines 4-6 as "wherein, after removal of the temporary fastener, the head is configured to be in contact with a proximal surface of the coping proximate the aperture of the coping", and suggests Applicant amend to clarify.

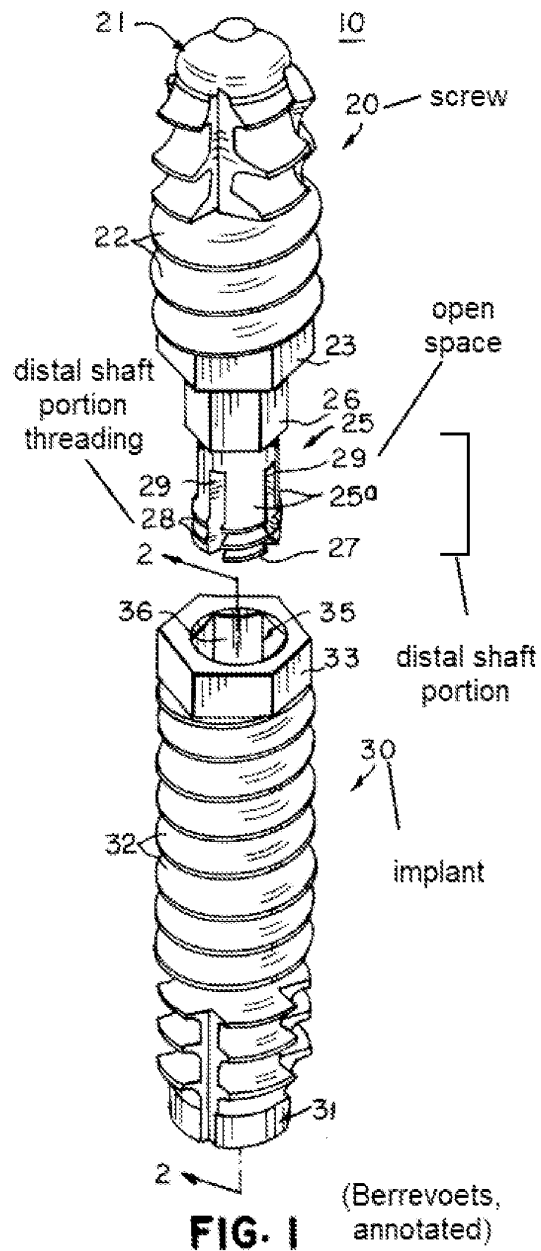
Claim Rejections - 35 USC § 103

17. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

18. **Claims 1-2, 4-6, 8-9, 15-17, and 19-20 are rejected under 35 U.S.C. 103 as being unpatentable over Aldecoa et al (U.S. Pubs 2008/0227057 A1, hereinafter "Aldecoa") in view of Berrevoets et al (U.S. Patent No. 6,517,543 B1, hereinafter "Berrevoets").**





19. In regard to claims 1 and 5, Aldecoa discloses a dental system (Figs. 16-23) comprising:

a coping (14 in Fig. 22) having a proximal end (proximal end in annotated Fig. 22) with an aperture (aperture in annotated Fig. 22);

an implant abutment (12 in annotated Fig. 22, and fig 18) having threads (36 in Fig. 17, para. 0096), wherein the implant abutment threads extend distally from a most proximal thread position (most proximal thread in annotated Fig. 22);

a definitive screw (20 in Fig. 18, paras. 0033 and 0094) having a proximal head end (head end in annotated Fig. 18) having a tool interface (tool interface in annotated Fig. 18) and a distal post portion (distal post in annotated Fig. 18) having threads (37 in Fig. 17) capable of securing the coping to the threads of the implant abutment (para. 0040, coping and gold cylinder have same interior measurements), wherein the distal post portion is sized and capable of extending through the aperture of the coping (Fig. 18, distal post portion is capable of extending through aperture); and

a temporary fastener (15 in Fig. 22) having a longitudinal axis (axis in annotated Fig. 22) with a length measured along the longitudinal axis (Fig. 22) and a lateral dimension providing different widths along the longitudinal axis measured perpendicular to the longitudinal axis (Fig. 22), the temporary fastener comprising a shaft (shaft in annotated Fig. 22) comprising a distal shaft portion (distal shaft portion in annotated Fig. 22) sized and capable of rotary engagement with the implant abutment threads (Fig. 22),

wherein the shaft of the temporary fastener is capable of extending through the aperture of the coping (Fig. 22) and the distal shaft portion is capable of engaging the implant abutment threads (Fig. 22) through an engagement depth (engagement depth in annotated Fig. 22) measured axially between a most distal contact position with the implant abutment threads and the most proximal thread position of the implant abutment threads (Fig. 22) and is configured so that a portion of the temporary fastener holds the coping in alignment with the implant abutment (Fig. 22) prior to attachment of the definitive screw (Fig. 18),

wherein the temporary fastener is capable of releasing at least a portion of the temporary fastener and the coping from the implant abutment as a unit when an axial release

force is applied in a proximal direction to the temporary fastener (para. 0040, after unscrewing the temporary fastener from the abutment),

wherein the distal shaft portion of the temporary fastener is sized and capable of making contact with the implant abutment threads over a first thread contact area (Fig. 22) to hold the coping against the implant abutment (Fig. 22), wherein, after removal of the temporary fastener, the distal post portion of the definitive screw is sized and capable of making contact with the implant abutment threads over a second thread contact area (Fig. 18) to hold the coping against the implant abutment (para. 0040, gold cylinder and coping have same internal measurements).

Aldecoa does not disclose wherein the first thread contact area is less than the second thread contact area,

wherein the distal shaft portion of the temporary fastener is configured to have discontinuous contact with the implant abutment threads throughout the engagement depth.

Berrevoets teaches an apparatus (Figs. 1-3) comprising an implant (30 in Fig. 1) having threads (38 in Fig. 3) and a screw (20 in Fig. 1) having a distal shaft portion (distal shaft portion in annotated Fig. 1) wherein the distal shaft portion is sized and configured to make contact with the threads over a first thread contact area (Fig. 1), wherein the distal shaft portion is capable of having discontinuous contact with the threads throughout an engagement depth (Figs. 1-3).

The references and the claimed invention are considered to be analogous to the claimed invention because they are in the same field of threaded fasteners.

It would have been obvious to someone of ordinary skill in the art before the effective filing date of the claimed invention to have modified the distal shaft portion of the temporary fastener of Aldecoa by specifying it is sized and configured to make contact with the threads over a first thread contact area, wherein the contact is discontinuous, as taught by Berrevoets in order to allow the distal shaft portion to have enough flexibility to be able to be deflected inwardly so that the insertion of the distal shaft portion can be accomplished without relative

rotation of the parts (Berrevoets col. 3 lines 36-45), and allow for the distal shaft portion to be inserted at a variety of different depths, so that the overall length of the system is adjustable (Berrevoets col. 3 lines 52-57) to different patients and mouth locations.

The combination of Aldecoa in view of Berrevoets teaches the dental system wherein the first thread contact area (Berrevoets, Figs. 1-3) is less than the second thread contact area (Aldecoa Fig. 18),

wherein the distal shaft portion of the temporary fastener is capable of having discontinuous contact with the implant abutment threads throughout the engagement depth (Berrevoets, Figs. 1-3).

20. In regard to claim 2, Aldecoa in view of Berrevoets discloses the invention of claim 1. Aldecoa further discloses wherein the threads of the implant abutment (36 in Fig. 17) comprise female threads (para. 0096), wherein the female threads have a radial extent bounded by a female thread minor diameter (d9 in Fig. 17) and a female thread major diameter (d12 in Fig. 17), and wherein the female thread minor diameter is located closer to the longitudinal axis than the female thread major diameter (Fig. 17).

21. In regard to claim 4, Aldecoa in view of Berrevoets discloses the invention of claim 2. Aldecoa further discloses wherein the distal shaft portion (distal shaft portion in annotated Fig. 22) of the temporary fastener is capable of having a temporary fastener engagement volume extending radially beyond the female thread minor diameter (d9 in Fig. 17) and axially over the engagement depth (Fig. 22), wherein the definitive screw is capable of having a definitive screw engagement volume extending radially beyond the female thread minor diameter and axially over the engagement depth (Fig. 18).

Aldecoa does not disclose wherein the definitive screw engagement volume is greater than the temporary fastener engagement volume.

Berrevoets teaches an apparatus (Figs. 1-3) wherein the distal shaft portion (distal shaft portion in annotated Fig. 1) is capable of having an engagement volume extending radially and axially, wherein the distal shaft portion is capable of having discontinuous contact with the threads throughout an engagement depth (Figs. 1-3).

The references and the claimed invention are considered to be analogous to the claimed invention because they are in the same field of threaded fasteners.

It would have been obvious to someone of ordinary skill in the art before the effective filing date of the claimed invention to have modified the distal shaft portion of the temporary fastener of Aldecoa by specifying it is sized and configured to have an engagement volume, wherein the contact is discontinuous, as taught by Berrevoets in order to allow the distal shaft portion to have enough flexibility to be able to be deflected inwardly so that the insertion of the distal shaft portion can be accomplished without relative rotation of the parts (Berrevoets col. 3 lines 36-45), and allow for the distal shaft portion to be inserted at a variety of different depths, so that the overall length of the system is adjustable (Berrevoets col. 3 lines 52-57) to different patients and mouth locations.

The combination of Aldecoa in view of Berrevoets teaches the dental system wherein the definitive screw engagement volume (Aldecoa, Fig. 18) is greater than the temporary fastener engagement volume (Berrevoets, Figs. 1-3).

22. In regard to claim 6, Aldecoa in view of Berrevoets discloses the invention of claim 1. Aldecoa further discloses wherein the axial release force is capable of being applied in a pick-up process (para. 0016, system is for impression coping).

23. In regard to claim 8, Aldecoa in view of Berrevoets discloses the invention of claim 1. Aldecoa further discloses wherein the threads of the distal post portion of the definitive screw are capable of continuously engaging the implant abutment threads (Fig. 18).

24. In regard to claim 9, Aldecoa in view of Berrevoets discloses the invention of claim 1. Aldecoa does not disclose wherein the distal shaft portion of the temporary fastener is configured to deform and disengage the implant abutment threads to release the coping and the temporary fastener as a unit as a result of the axial release force.

Berrevoets teaches an apparatus (Figs. 1-3) wherein the distal shaft portion (distal shaft portion in annotated Fig. 1) of the screw (20 in Fig. 1) is capable of deforming and disengaging the threads (38 in Fig. 3) to release the screw as a result of an axial release force (col. 3 lines 36-45).

The references and the claimed invention are considered to be analogous to the claimed invention because they are in the same field of threaded fasteners.

It would have been obvious to someone of ordinary skill in the art before the effective filing date of the claimed invention to have modified the distal shaft portion of the temporary fastener of Aldecoa by specifying it is capable of deforming and disengaging from the threads as taught by Berrevoets in order to allow the distal shaft portion to have enough flexibility to be able to be deflected inwardly so that the insertion of the distal shaft portion can be accomplished without relative rotation of the parts (Berrevoets col. 3 lines 36-45), and allow for the distal shaft portion to be inserted at a variety of different depths, so that the overall length of the system is adjustable (Berrevoets col. 3 lines 52-57) to different patients and mouth locations.

The combination of Aldecoa and Berrevoets teaches wherein the distal shaft portion (Aldecoa, distal shaft portion in annotated Fig. 22) is capable of deforming (Berrevoets col. 3 lines 36-45) and disengaging the implant abutment threads (Aldecoa Fig. 22) to release the coping and the temporary fastener as a unit as a result of the axial release force (Aldecoa Fig. 22).

25. In regard to claims 15, Aldecoa teaches a dental system (Figs. 16-23) comprising:

a coping (14 in Fig. 22) having a proximal end (proximal end in annotated Fig. 22) with an aperture (aperture in annotated Fig. 22) and a distal end with a coping seating surface (coping seating surface in annotated Fig. 22); and

an implant abutment (abutment in annotated Fig. 18) having a longitudinal axis (abutment axis in annotated Fig. 18) comprising:

female threading (36 in Fig. 17, para. 0096), wherein the female threading resides proximate a proximal end of the implant abutment and extends distally thereof (Fig. 18), and

an outer wall (12 in Fig. 18) surrounding the female threading, the outer wall comprising an implant abutment seating surface (abutment seating surface in annotated Fig. 18);

a temporary fastener (15 in Fig. 22) having an axis (axis in annotated Fig. 22) with a length measured along the axis and a lateral dimension providing different widths along the axis measured perpendicular to the axis (Fig. 22), the temporary fastener comprising:

a proximal portion (fastener proximal portion in annotated Fig. 22) with a width larger than the coping aperture (Fig. 22); and

a shaft (shaft in annotated Fig. 22) comprising a distal shaft portion (distal shaft portion in annotated Fig. 22) capable of rotary engagement with the implant abutment female threading (Fig. 22),

wherein the shaft of the temporary fastener is sized to extend through the aperture of the coping (Fig. 22), and wherein the distal shaft portion of the temporary fastener is capable of rotatably engaging the female threading of the implant abutment to an engagement depth (engagement depth in annotated Fig. 22) sufficient to hold the coping seating surface aligned with and adjacent the implant abutment seating surface (Fig. 22), and

wherein the temporary fastener is capable of releasing at least a portion of the temporary fastener and the coping from the implant abutment as a unit as a result of an axial release force in a proximal direction (para. 0040, after unscrewing the temporary fastener from the abutment).

Aldecoa does not disclose wherein the distal shaft portion of the temporary fastener does not continuously contact the female threading of the implant abutment between a most distal engagement position and a proximate end of the female threading of the implant abutment.

Berrevoets teaches an apparatus (Figs. 1-3) comprising an implant (30 in Fig. 1) having threading (38 in Fig. 3) and a screw (20 in Fig. 1) having a distal shaft portion (distal shaft portion in annotated Fig. 1), wherein the distal shaft portion does not continuously contact the threading between a most distal engagement position and a proximate end of the threading (Figs. 1-3).

The references and the claimed invention are considered to be analogous to the claimed invention because they are in the same field of threaded fasteners.

It would have been obvious to someone of ordinary skill in the art before the effective filing date of the claimed invention to have modified the distal shaft portion of the temporary fastener of Aldecoa by specifying it is sized and configured so that it does not continuously make contact with the threading as taught by Berrevoets in order to allow the distal shaft portion to have enough flexibility to be able to be deflected inwardly so that the insertion of the distal shaft portion can be accomplished without relative rotation of the parts (Berrevoets col. 3 lines 36-45), and allow for the distal shaft portion to be inserted at a variety of different depths, so that the overall length of the system is adjustable (Berrevoets col. 3 lines 52-57) to different patients and mouth locations.

The combination of Aldecoa in view of Berrevoets teaches the dental system wherein the distal shaft portion (Berrevoets distal shaft portion in annotated Fig. 1) of the temporary

fastener does not continuously contact the female threading of the implant abutment (Aldecoa Figs. 18 and 22) between a most distal engagement position and a proximate end of the female threading of the implant abutment (Berrevoets Figs. 1-3).

26. In regard to claim 16, Aldecoa in view of Berrevoets discloses the invention of claim 15. Aldecoa further discloses wherein the axial release force is applied in a pick-up process after adhesive bonding of the coping to a prosthesis (Fig. 22, para. 0040).

27. In regard to claim 17, Aldecoa in view of Berrevoets discloses the invention of claim 15. Aldecoa further discloses wherein the axial release force in the proximal direction releases the entire temporary fastener and the coping from the implant abutment as a unit (Fig. 22, para. 0040).

28. In regard to claim 19, Aldecoa in view of Berrevoets discloses the invention of claim 15. Aldecoa further discloses a definitive screw (20 in Fig. 18) with a longitudinal axis (Fig. 18) and a width measured perpendicular to the longitudinal axis (Fig. 18), the definitive screw comprising:

- a head (head end in annotated Fig. 18) with a proximal end having a drive tool interface (tool interface in annotated Fig. 18), wherein, after removal of the temporary fastener, the head is capable of being in contact with a proximal surface of the coping proximate the aperture of the coping (para. 0040, gold cylinder and coping have same internal measurements), and

- a shaft (distal post in annotated Fig. 18) that has a width capable of extending through the aperture of the coping (para. 0040), the shaft comprising:

- a distal portion having an outer surface comprising male threading (48 in Fig. 17) capable of engaging the female threading of the implant abutment (Fig. 18), wherein the distal portion of the definitive screw is capable of rotatably engaging the female threading of the implant abutment to a predefined fixation torque to position the coping

seating surface adjacent to the implant abutment seating surface (para. 0040, gold cylinder and coping have same internal measurements) .

29. In regard to claim 20, Aldecoa in view of Berrevoets discloses the invention of claim 19. Aldecoa further discloses wherein the male threading of the definitive screw (Fig. 18) is capable of making continuous contact with the implant abutment female threading (Fig. 18).

30. **Claim 18 is rejected under 35 U.S.C. 103 as being unpatentable over Aldecoa in view of Berrevoets in view of Klardie et al** (U.S. Patent Publication No. 2003/0211445 A1, hereinafter "Klardie").

31. In regard to claim 18, Aldecoa view of Berrevoets discloses the invention of claim 15. Aldecoa does not disclose wherein the temporary fastener comprises a polymeric material.

Klardie teaches wherein a component of the dental pick-up process system is polymeric (para. 0119).

Klardie, Aldecoa, and the claimed invention are considered to be analogous to the claimed invention because they are in the same field of dental implant impression systems.

It would have been obvious to someone of ordinary skill in the art before the effective filing date of the claimed invention to have modified the temporary fastener of Aldecoa in view of Berrevoets by specifying it is polymeric as taught by Klardie in order to allow use of a material which is compatible with dental usage (Klardie para. 0119).

Conclusion

32. Any inquiry concerning this communication or earlier communications from the examiner should be directed to COURTNEY N HUYNH whose telephone number is (571)272-7219. The examiner can normally be reached M-F 7:30AM-5:00PM (EST) flex, 2nd Friday off.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cris Rodriguez can be reached on (571) 272-4964. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: <https://patentcenter.uspto.gov>. Visit <https://www.uspto.gov/patents/apply/patent-center> for more information about Patent Center and <https://www.uspto.gov/patents/docx> for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/COURTNEY N HUYNH/
Examiner, Art Unit 3772

/Cris L. Rodriguez/
Supervisory Patent Examiner, Art Unit 3772

Notice of References Cited	Application/Control No. 18/827,656		Applicant(s)/Patent Under Reexamination Kofford et al.	
	Examiner COURTNEY N HUYNH		Art Unit 3772	Page 1 of 1

U.S. PATENT DOCUMENTS						
*		Document Number Country Code-Number-Kind Code	Date YYYY-MM-DD	Name	CPC Classification	US Classification
*	A	US-6517543-B1	2003-02-11	Berrevoets; Greg A.	A61B17/68	411/419
*	B	US-20030211445-A1	2003-11-13	Klardie, Michael R.	A61C8/0001	433/172
*	C	US-20080227057-A1	2008-09-18	Anitua Aldecoa; Eduardo	A61C8/0001	433/174
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FOREIGN PATENT DOCUMENTS						
*		Document Number Country Code-Number-Kind Code	Date YYYY-MM-DD	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS						
*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)				
	U					
	V					
	W					
	X					

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in YYYY-MM-DD format are publication dates. Classifications may be US or foreign.

<i>Index of Claims</i> 	Application/Control No. 18/827,656	Applicant(s)/Patent Under Reexamination Kofford et al.
	Examiner COURTNEY N HUYNH	Art Unit 3772

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS										
☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47										
CLAIM		DATE								
Final	Original	10/24/2024								
	1	✓								
	2	✓								
	3	N								
	4	✓								
	5	✓								
	6	✓								
	7	N								
	8	✓								
	9	✓								
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	20	✓								
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	22	N								
	23	N								
	24	N								
	25	N								
	26	N								

<i>Search Notes</i> 	Application/Control No. 18/827,656	Applicant(s)/Patent Under Reexamination Kofford et al.
	Examiner COURTNEY N HUYNH	Art Unit 3772

CPC - Searched*		
Symbol	Date	Examiner
A61C8/0001	10/24/2024	CNH

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
411	419, 414	10/24/2024	CNH

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Search patent family in Global Dossier, Espacenet, Patentscope	10/22/2024	CNH
Inventor name search in PE2E and PDP/DAV	10/22/2024	CNH
PE2E- CPC and text search	10/22/2024	CNH
PE2E- CPC and text search -A61C2201/00, A61C2008/0084, A61C13/225,2255,265,2656,275, A61C11/088, F16B37/14, F16B35/06,041, F16B33/02, A61C8/0066,0068,00,005,008,0007,0082,0087,0066,0074,0078, USPC 411/396,397,411, 433/173 - see attached search history	10/24/2024	CNH
Search in IP.com	10/24/2024	CNH

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<i>Search Notes</i> 	Application/Control No. 18/827,656	Applicant(s)/Patent Under Reexamination Kofford et al.
	Examiner COURTNEY N HUYNH	Art Unit 3772

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

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Bibliographic Data

Application No: 18/827,656

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☐ No

☐ Met After Allowance

Verified and Acknowledged: /COURTNEY N HUYNH/

Examiner's Signature

Initials

Title: Screw-attached Pick-up Dental Coping System and Methods

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
09/06/2024	433	3772	SDC013
RULE			

APPLICANTS

INVENTORS

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Charles Albert Rudisill, Apex, NC, UNITED STATES

CONTINUING DATA

This application is a CON of 18424696 01/26/2024

This application is a CON of 18328730 06/03/2023 PAT 11937992

This application is a CON of 17691108 03/09/2022

This application is a CON of 16596361 10/08/2019 PAT 11311354

This application has PRO of 62818082 03/13/2019

This application has PRO of 62774402 12/03/2018

This application has PRO of 62742942 10/09/2018

FOREIGN APPLICATIONS

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09/17/2024

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\$2,832

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	69	((("KOFFORD") near3 ("Brandon")) OR (("RUDISILL") near3 ("Charles"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2024/10/22 03:07 PM
L2	11454	(A61C8/0068).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/10/22 04:36 PM
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L9	1793	(((A61C8/0001).cpc.) OR ((A61C8/0066).cpc.) OR ((A61C2201/00).cpc.) OR ((A61C8/0068).cpc.)) AND (coping AND abutment AND screw)	IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB) (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/10/24 08:27 AM
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L12	2390	14).ccls. OR (433/173).ccls.) ((A61C2201/00).cpc. OR (A61C2008/0084).cpc. OR (A61C13/225,2255,265, 2656,275).cpc. OR (A61C11/088).cpc. OR (F16B37/14).cpc. OR (F16B35/06,041).cpc. OR (F16B33/02).cpc. OR (A61C8/0066,0068,00,0 05,008,0007,0001,0082 ,0087,0066,0074,0078). cpc. OR (411/396,397,411,419,4 14).ccls. OR (433/173).ccls.) AND (coping AND abutment AND (screw OR thread\$5))	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/10/24 08:37 AM
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L14	0	(11/815849).APP.	(USPAT; USOCR)	OR	ON	ON	2024/10/24 08:47 AM
L15	18	("2008/0227057").urpn. AND (PGPB USPT USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2024/10/24 08:47 AM
L16	0	(12/038552).APP.	(USPAT; USOCR)	OR	ON	ON	2024/10/24 08:49 AM
L17	11	("2008/0206709").urpn.	(US-PGPUB; USPAT;	OR	ON	ON	2024/10/24

L18	61	AND (PGPB USPT USOC).dbnm. ("4431416" "4955811" "5052929" "5055047" "5078606" "5098294" "5106300" "5125839" "5125841" "5213502" "5312253" "5312254" "5316477" "5328371" "5334024" "5350297" "5538426" "5549475" "5584694" "5658147" "5662476" "5674073" "5685714" "5685715" "5725375" "5733122" "5829981" "5846079" "5899695" "5904483" "5938443" "6045361").pn. OR ("6283752").urpn. AND (PGPB USPT USOC).dbnm.	USOCR) (US-PGPUB; USPAT; USOCR)	OR	ON	ON	08:49 AM 2024/10/24 08:50 AM
L19	201	("0184718" "1897196" "3103926" "3115804" "5417692" "5564921" "5782918" "6394806").pn. OR ("6517543").urpn. AND (PGPB USPT USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2024/10/24 09:02 AM
L20	50	(Artificial Intelligence) Similar to: 18/827,656 with 0 CPC Selections and 0 Text Selections Text: (US-11937992-B1 OR US-20220192793-A1 OR US-20200107914-A1 OR US-11311354-B2 OR US-11957538-B2 OR US-20230200950-A1 OR WO-2022256699-A1 OR AU-2022286486-B2 OR IL-309005-A OR KR-20170038033-A OR EP-3187144-A1 OR US-12023220-B2 OR US-20040209227-A1 OR EP-3187144-B1 OR US-8002547-B2 OR AU-2006227608-A1 OR WO-2009035968-A1 OR US-8398400-B2 OR CA-3215615-A1 OR WO-2006101957-A1	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO))	OR	ON	ON	2024/10/24 09:05 AM

L21	1891	OR CA-2699030-A1 OR US-11042979-B2 OR US-20100248180-A1 OR DE-102006042919- B3 OR US- 20200146789-A1 OR US-20100303316-A1 OR US-11816835-B2 OR EP-3426186-B1 OR US-6227856-B1 OR US-20210312623-A1 OR WO-2020176048- A1 OR US- 20180344434-A1 OR EP-3721830-B1 OR US-20100086900-A1 OR WO-2009137545- A1 OR US- 20190167387-A1 OR US-8272871-B2 OR US-6083004-A OR US- 20170258558-A1 OR JP-6860711-B2 OR WO-2017156281-A1 OR US-10136967-B2 OR JP-2005507283-A OR US-20060228672- A1 OR JP-2017525437- A OR US-5873721-A OR US-20220387144- A1 OR US-11202693- B2 OR US- 20060263747-A1 OR WO-2017141061- A1).did. ((A61C2201/00).cpc. OR (A61C2008/0084).cpc. OR (A61C13/225,2255,265, 2656,275).cpc. OR (A61C11/088).cpc. OR (F16B37/14).cpc. OR (F16B35/06,041).cpc. OR (F16B33/02).cpc. OR (A61C8/0066,0068,00,0 05,008,0007,0001,0082 ,0087,0066,0074,0078). cpc. OR (411/396,397,411,419,4 14).ccls. OR (433/173).ccls.) AND (coping AND abutment AND ((pick near3 up) OR (impression) OR (closed near3 tray))	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2024/10/24 10:16 AM
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		AND (screw OR thread\$5) AND (prosthesis OR denture OR bridge OR crown))					
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/827,656	09/06/2024	Brandon Dale Kofford	SDC013	2702
112823	7590	11/08/2024	EXAMINER	
Daniel J Whittle			HUYNH, COURTNEY NGUYEN	
1229 Modoc Dr				
Bellingham, WA 98229			ART UNIT	PAPER NUMBER
			3772	
			MAIL DATE	DELIVERY MODE
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	Filing Date		2024-09-06
	First Named Inventor	Kofford, Brandon Dale	
	Art Unit	3772	
	Examiner Name	Huynh, Courtney Nguyen	
	Attorney Docket Number	SDC013	

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	1	3115804	A	1963-12-31	Johnson	
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	Attorney Docket Number	SDC013		

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	Examiner Name	Huynh, Courtney Nguyen		
	Attorney Docket Number	SDC013		

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	Examiner Name		Huynh, Courtney Nguyen	
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	1	2014153487	WO	A2	2014-09-25	Poovey		☐
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	14	2011036268	WO	A2	2011-03-31	Bolleter et al.	☒
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	1	MCGLUMPHY et al., "The combination Implant Crown: A Cement- and Screw-Retained Restoration", Compend Contin Educ Dent, Feb. 1992, pp. 34, 36,38, 40-42, Vol. XIII, No. 1.	☐
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9	WINKLER et al. "Implant screw mechanics and the settling effect: an overview", Journal of Oral Implantology 2003;29 (5):242-5.	☐
10	TESMER "Bacterial colonization of the dental implant fixture-abutment interface: an in vitro study", J Periodontol. 2009 Dec;80(12):1991-7.	☐
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(54) **MEANS FOR FIXING PROSTHETIC SUPERSTRUCTURES TO OSTEOINTEGRATED IMPLANTS.**

(57) The fixing means are comprised of a pin (13) which penetrates into a superstructure (8) and into the implant (1), holding them efficiently and without clearance in the longitudinal direction. Transversely and in order to avoid rotations between said elements (1 and 8), the latter are secured by coupling means of the keytype. The fixing is irreversible, except by breaking with the appropriated dentist tooling a region of the pin (13). There is provided another pin which is provisional and which provides for reversible fixings without break, in order to facilitate treatments such as prosthetic superstructure and a transgingival healing of the gums, applying respectively in such cases a clinico-prosthetic superstructure and a transgingival healing bushing, specially designed. In another embodiment, there is provided a single type of pin (28) which is valid for all operations and functions, said pin presenting different and stable geometrical configurations according to its temperature. In one of said configurations, said pin may be introduced into and extracted from

its housing with much ease while in another configuration, corresponding to the human body temperature, said pin adopts a shape similar to that of the definitive pins of the other embodiment, providing for a strong securing between the implant (34) and the prosthesis (35).

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OBJECT OF THE INVENTION

As expressed in the title of this specification, the present invention refers to a means for fixing prosthetic superstructures to osteointegrated implants, whose purpose consists of providing a rapid, novel and advantageous fixing means with respect to the existing ones, among the dental implants that are connected to the jaw bone and the pieces or superstructures that are to be placed and fastened in said implants; also simplifying and shortening the corresponding clinical procedures.

It is based on the use of a clip or pin that is placed rapidly and effectively between the two bodies to be fixed, in such a way that both, the superstructure and the implant, remain in close contact, without being able to move or rotate one of said bodies with regard to the other.

Once the cited pin is put in place, the fixing is irreversible, except by destroying the same, for which purpose there is a specially designed area. However, another type of pin that is removed without the need of being destroyed has been provided for, so that different tests and provisional fixings can be done on the patient.

In another embodiment a pin in a material with thermal memory has been designed in such a way that said pin has different and stable geometric shapes according to the temperature range in which it is found; whereby the need of complementary pieces in taking impressions is eliminated, and the destruction of the pin avoided when the prosthesis is to be removed from the implant.

BACKGROUND OF THE INVENTION

Osteointegrated implants used in dentistry, consisting normally of tubular and screwed piece, preferably made out of titanium and provided with different rough areas and grooves that facilitate attachment to the patient's jaw bone, are known.

After making the implant in said bone, a certain amount of time has to be waited for healing and osteointegration before including in the free area of the implant the additional pieces that make it possible to put the prosthesis or false teeth required for the case in place.

For this inclusion, at the free ends of the implants the mouth of an inside duct or channel with threaded walls projects, in such a way that the superstructure or additional piece to be included is screwed directly in said channel by means of a threaded rod or screw provided for this purpose.

This way of including the superstructures by means of screwing has inconveniences, such as the danger of the included piece becoming loose, or such as the rotation needed to fix and tighten said piece, since said movement is very harmful to

the osteointegration of the implant.

DESCRIPTION OF THE INVENTION

To achieve the aims and to overcome the inconveniences cited above, the invention consists of a new means for fixing prosthetic superstructures to osteointegrated implants, that foresees the use of implants whose characteristics of fixing to the bone are equivalent to those of conventional implants; but instead of having, like the latter, a threaded canal inside, it has a smooth duct whose innermost end leads to a housing or hole with a larger diameter than the duct itself.

This housing allows the fixing of the end flanges of a clip-type pin that will fix the implant to the superstructure, for which purpose, the latter also has a duct that passes through it, also having a top area that will house the head of the cited pin.

The pin consists of said head and some legs that come out from the same and that end in both perpendicular flanges or elbow-shaped parts.

Upon introducing the pin through the ducts of the superstructure and of the implant, the legs thereof approach each other, bending to a certain degree. So that this bending is not limited by the contact between said legs, the pin has been designed in such a way that the same remain unaligned, that is to say, they are located at different bending planes.

The housing of the implant has a certain slant in the walls that connect with the corresponding mouth of the duct, so that upon the flanges of the legs of the pin fitting in a larger degree in these walls the contact between the implant and the superstructure is closer.

The length of the legs of the pin corresponds with the combined length of the ducts of the implant and the superstructure, in such a way that when the flanges of the pin reach the housing thereof, the head of the same rests in the bottom of the cavity provided for it in the superstructure.

Hence, the implant and the superstructure remain perfectly connected without the possibility of longitudinal movement. Besides, so that there is no possibility of rotation of the superstructure with regard to the implant, the top end of the latter has a preferably prismatic-hexagonal projection that surrounds the mouth of the duct and that corresponds with the cavity of the same shape, existing in the bottom end of the superstructure, surrounding the mouth of the canal or duct of the latter, in such a way that both pieces are fit in without the possibility of rotation.

This configuration allows the pin not to endure stresses, pressures or tensions since it remains established as a totally passive connecting element.

Other advantages of this shape are that it enables perfect and very rapid adaptation between the implant and the corresponding superstructure, which eliminates the danger of it coming loose since no screws are used and the danger of harming the osteointegration of the implant is avoided since no rotation is required to fasten the superstructure.

Once the pin has been fixed, and due to the shape of its flanges, the spontaneous reversibility of the fixing is practically impossible, since the pin would have to be broken, which is highly improbable, given that once it has been fixed it becomes a passive piece that does not endure any stress.

This irreversibility constitutes another advantage, especially when reversibility is possible and it is provided for if the physician considers it opportune, since he can break the pin, by cutting the head thereof with a diamond cutter, for which reason said head has a central thinner and especially designed area to facilitate the cutting thereof.

Besides, a provisional pin that can be easily removed since its end flanges are shorted and rounded, in such a way that upon pulling on the pin, said flanges can come out of their housing, has been provided for.

This provisional pin will normally be used to fasten a clinico-prosthetic superstructure, also different from the definitive one, to the implant in the procedure of taking impressions. The provisional pin can also be used to fasten the transgingival healing bushing for a certain period of time.

The head of the provisional pin is also different, since it includes some flanges similar to those of the free ends of the legs thereof and corresponding to the cavities existing in the clinico-prosthetic superstructure. Besides, said head is higher and includes a larger hollow space under the union of the legs thereof. These different characteristics are provided for in order to facilitate the cited procedure of taking impressions and obtaining a model that is a copy of the location of the implants in the patient's mouth.

In taking impressions the impression basin is prepared with the material chosen by the professional, and it will be introduced into the patient's mouth, who will have the clinico-prosthetic superstructures fixed to the provisional pins.

Due to the tabs or overlaps that these clinico-prosthetic superstructures have, upon removing the basin the combined removal of said superstructures and of the provisional pins is produced, obtaining the corresponding taking of impressions.

To obtain the copy of the implants in the patient's mouth some duplicate implants that will fit in the superstructures fixed to the impression taking material before placing the corresponding plaster on said material are used; in such a way that

when the plaster hardens and it is separated from the cited material, a true copy of the location of the implants in the patient's mouth will be obtained.

Another embodiment in which the use of additional removable pins is used, as well as the destruction thereof when the prosthesis is to be removed from the implant has been provided for. However, there is a fixing at least as effective as with the non-removable pin of the above mentioned embodiment.

This other embodiment consists of varying slightly the geometric shape of the pin so that it can penetrate in and be removed from the axial canal of the implant without any problem. Besides, the pin is made out of an alloy or material that has a clearly defined thermal memory, such as for example an alloy of nickel and titanium, 60 and 40 % respectively. Good results are also obtained with other combinations of metals such as gold and cadmium, iron and platinum, or aluminum and nickel, though the alloy cited first of all is the one that provides the best practical results.

The slight variation of the geometric shape of the pin consists of bending the legs thereof inwardly, whereby the lateral extensions of the ends of the same have a total length approximately equal to the combined top part of the legs, right below the head of the pin. This geometry is given for a temperature of 17 or 18° C, which will be the normal working temperature, and thus the pin can be introduced and removed without any difficulty from the canal of the implant, without the lateral extensions knocking against the top walls of the widened cavity of the bottom of the canal.

Leaving the pin long enough in the canal of the implant, it will acquire little by little but briefly the temperature of the implant, which logically corresponds to the 36 or 37° C of the human body, whereby the pin expands and the geometric shape of the legs thereof varies, in such a way that the legs separate and they lose their bend so as to remain parallel, which implies that the end lateral extensions of the same are introduced in the cavity of the bottom of the canal of the implant, determining a retention as effective as when, as it happened in the previous embodiment, said extensions were introduced in the cavity of the implant by the elastic jump of the same.

The basic advantage of the pin of this last embodiment is that if desired or if it is necessary to remove it, it is not necessary to break it at the weakened area of its head, but rather it need merely be adequately cooled so that it again reaches the temperature of 17 or 18° C, which can be caused by spraying a nitrogen compound on the head of the pin, after which it is freely pulled out of its location due to the recovery of its initial geometric shape.

In this embodiment it is not necessary to give the top walls of the cavity of the implant a certain slant. Said slant was given in the previous embodiment to facilitate the removal of the traditional or removable pins, but as in this case a single pin that always has the possibility of being removed and that allows all the functions and work to be done suffices, these top walls can be perfectly horizontal, whereby the retention of the pin is even better, with the added advantage that it determines less discomfort for the patient and greater ease in the dentist's work.

Hereinafter, to provide a better understanding of this specification and forming an integral part of the same, some figures in which the object of the invention has been represented in an illustrative and non-restrictive manner, are attached hereto.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 represents a raised and diametrically sectioned view of an implant connected to a superstructure by means of a pin, according to the new fixing of prosthetic superstructures to osteointegrated implants made possible by the present invention.

Figure 2 represents a raised view of a pin according to the present invention and referred to in previous figure 1.

Figure 3 represents a profile view of the pin alluded to in figures 1 and 2.

Figure 4 represents a top plan view of the pin mentioned in the previous figures.

Figure 5 represents a bottom plan view of the superstructure according to the present invention and referred to in figure 1.

Figure 6 represents a raised view of the superstructure referred to in previous figure 5.

Figure 7 represents a top plan view of the superstructure mentioned in the previous figures 5 and 6.

Figure 8 represents a raised view of the implant according to the present invention and referred to in figure 1.

Figure 9 is a top plan view of the implant of previous figure 8.

Figure 10 represents a raised and diametrically sectioned view of an implant connected to a clinico-prosthetic superstructure by means of a provisional pin and according to the present invention.

Figure 11 represents a raised view of an implant connected to a transgingival healing bushing by means of a provisional or clinico-prosthetic pin, according to the new fixing of the present invention.

Figure 12 represents a front raised view of the pin of another embodiment of the present inven-

tion. In this figure 12 said pin has its initial geometric shape, that is to say, the one it has at a temperature lower than the temperature of the human body, and showing the characteristic bending of its legs.

Figure 13 represents a raised and diametrically sectioned view of an osteointegrated implant and a dental prosthesis, fixed with a pin like the one of the above figure 12. In this figure 13, the pin has its final geometric shape, that is to say, the one it has at a temperature similar to that of the human body.

DESCRIPTION OF SEVERAL EMBODIMENTS OF THE INVENTION

Hereinafter a description is made of several embodiments of the invention, referring to the numbering used in the figures.

Hence, the new fixing of prosthetic superstructures to osteointegrated implants of the first embodiment includes an approximately cylindrical implant (1), whose outside side surface (2) has conventional characteristics suitable for integration in the corresponding jaw bone.

However, this implant (1) has the particularity that it has a center canal (3) in the axial direction, with smooth inside surfaces, instead of the threaded canal that is conventionally included.

Other characteristic features of the implant (1) are that said canal (3) leads to an inside cavity (4) with a diameter larger than the canal (3) and whose walls (5) connecting with it have a certain slant with regard to the horizontal line and downward. Besides, the top end of the implant (1) has in the center a hexagonal projection (6) in the center of which there is a recess (7) whose contour has a circular crown shape, the inside edge of this cavity (7) connecting to the mouth of the canal (3).

This embodiment of the invention includes a superstructure (8) whose bottom end fits like a key in the top end of the implant (1), in such a way that said bottom end has a prismatic-hexagonal recess (9) from whose centers extends a cavity (10) whose contour has a circular crown shape.

Besides, the superstructure (8) includes a canal (11) that passes through it axially and whose diameter corresponds to that of the anterior canal (3).

The top end of the superstructure (8) has in the center a cylindrical cavity (12) open towards the outside and with a diameter larger than the canal (11), in such a way that the latter leads to the center of the bottom of said cylindrical cavity (12).

This key-type fitting in between the superstructure (8) and the implant (1) ensures the impossibility of rotation of one with regard to the other and stabilizes the sitting of both parts (1) and (8).

To ensure the fixing in the longitudinal direction of said parts and replacing the traditional screws, a pin (13) that joins these parts (1) and (8) in a clip fashion has been advantageously and novelly provided for.

For this purpose, this pin (13) is introduced through the consecutive canals (11) and (3) and until the head (14) of the pin (13) knocks against the bottom of the cylindrical cavity (12). At that moment, some flanges (15) of the bottom end of the pin (13) will have penetrated in the inside cavity (4) of the implant (1), producing a strong retention, since the length of the legs (16) of the pin (13) corresponds to the combined length of the canals (3) and (11). Besides, the slanted walls (5) of the inside cavity (4) optimize the total entry of the pin (13) without there remaining at the end of said entry clearance in the vertical arrangement of the pin (13).

On the other hand, the flanges (15) of the bottom end of the pin (13) have a pointed edge, which like a fishhook nail into the slanted walls (5) if an attempt is made to remove the pin, hence said removal is not possible.

The part opposite these pointed edges in the flanges (15), is rounded however to facilitate the passing of the same through the canals (11) and (3).

Other characteristics of the pin (13) are that the legs (16) thereof, being parallel, are located at different bending planes so that in the passing thereof through the canals (11) and (3) they do not knock against each other. Besides, the head (14) of the pin (13) has a central thinner area (17) that facilitates breaking thereof by means of the suitable dentist's tool, so that the pin (13) may be removed and the superstructure (8) may be separated from the implant (1) in the event that it is necessary to do so. On the contrary, spontaneous breaking of said thinner area (17) is practically impossible, since once the pin (13) has been installed it remains as a passive area that hardly endures any stress.

Aside from the described parts (1), (8) and (13), other parts are provided for to take impressions or other normal procedures in dentistry, such as a clinico-prosthetic superstructure (18), a transgingival healing bushing (19) and a provisional or clinico-prosthetic pin (20).

This superstructure (18) and this bushing (19) have the same characteristics of hexagonal key-type coupling with the implant (1) that existed in the coupling of the latter with part (8). However, the longitudinal fixing is carried out with the provisional pin (20), since in these cases the reversibility of the fixing is of interest.

To facilitate said reversibility, the corresponding flanges (21) of the provisional pin (20) are

shorter and rounded on all their edges, so that upon pulling on the pin (20) said flanges (21) can come out of the inside cavity (4) by exerting a small force.

Besides, the provisional pin (20) includes on the side ends of its head (22) other flanges (23) that act with regard to some side recesses (24) of the top cylindrical cavity (12) of the superstructure (18) in the same way that the flanges (21) act in the cavity (4). To help the bending of the flanges (23) the head (22) has some grooves (25) behind them.

On the other hand, the cited head (22) includes a larger hollow space (26) in the area of connection with the legs (16). This hollow space is provided for the entry and gripping of the impression material in the taking of impressions. For this same purpose some overlaps or tabs (27) existing in the sides of the top end of the clinico-prosthetic superstructure (18) are provided for.

The procedure for taking impressions and the subsequent obtainment of a mold that is a true copy of the location of the implants in the patient's mouth, by means of the cited provisional elements (18) and (20), is carried out just as it was described in the "description of the invention" section of this specification.

The transgingival healing bushing (19) is a part that is placed over the implant (1) from the moment when the already osteointegrated implant is exposed, until the definitive prosthesis is put in place. The main characteristic of this bushing (19) is that the entire area that has contact with the gum is rounded, to mold the papilla, and thus permit prostheses to have a better appearance. The material that provides better results is that in which the contact with the gum is made of porcelain, and custom-made by the prosthetist for each case; however there are rounded standard size preforms.

Another embodiment of the invention replaces the different pins (13) and (20) by a single special pin (28) whose legs (29) are bent towards the inside, in such a way that the width existing between the free ends of the lateral extensions thereof (30) is similar to the width existing between the top parts (31) of the areas that remain under the head (32) of the pin (28); as long as the pin (28) is at a temperature of about 18° C or below.

In these conditions the pin (28) penetrates perfectly in the canal (33) that has the corresponding osteointegrated implant (34) and the prosthesis (35) and can likewise be perfectly removed without any difficulty.

As the pin (28) heats up to the temperature of the prosthesis (35) and the implant (34), which will be the temperature of the human body, said pin (28) expands and its legs (29) take on a straight configuration parallel to each other, losing the bend

that we mentioned above; in such a way that they adjust to the walls of the canal (33) and in such a way that the lateral extensions (30) are introduced in a cylindrical cavity (36) of the top horizontal wall, existing in the implant (34), in the bottom of the canal (33) and having a larger diameter than the latter.

This determines a strong and continuous fastening of the prosthesis (34) to the implant (35), maintaining all the advantages that the previous embodiment had and adding the characteristic, also advantageous, that this pin (28) whose design and constitution are definitive or permanent, can be removed without the need of breaking it, for which purpose it suffices to cool it by means of any method so that it recovers its original geometric shape upon reaching 18° C again. This cooling can be done rapidly by spraying any nitrogen compound thereon.

So that the transfer of temperature is done rapidly and so that the thermal memory of the pin (28) is suitable, the pin is made out of a metal alloy of 60% nickel and 40% titanium in the present embodiment, as it is the one that has experimentally provided the best results; though as it has already been indicated above there are other alloys that also provide satisfactory results.

(received by the International Office on 24 May 1995 (24.05.95) claims 1-7 replaced by modified claims 1-11 (4 pages))

(Original claim 1 has been divided up into modified claims 1 and 4.

Original claim 2 has been divided up into modified claims 2, 3 and 5.

Original claims 3-4 have been replaced by modified claims 6-7.

Original claim 5 has been divided up into modified claims 8 and 9.

Original claims 6-7 have been replaced by modified claims 10-11.)

1. A system for fastening an odontological prosthetic superstructure (8), (18), (35) to an osteointegrated implant (1) (34) without the use of screws; characterized in that the implant (1),(34) includes a first straight and axial canal that leads into an inside cavity (4),(36) existing in the implant (1),(34); the superstructure (8), (18), (35) includes projections (10) and recesses (9) in a first contact end and the implant (1),(34) includes corresponding recesses (7) and projections (6) in a second contact end, said projections (6),(10) and recesses (7),(9) shaped so as to allow the key-type fitting between the implant (1),(34) by means of said projections (6),(10) and recesses (7),(9); the superstructure (8),(18) includes a second axial canal (11) located in such a way that it communicates with the first canal (3) upon the superstructure (8),(18) being

inserted in the implant (1), (34), the second canal (11) leading into an outside cavity (12) open towards the outside in a free end of the superstructure (8),(18),(35); the system including a fixing means that comprises a pin (13),(20),(28) that comprises one elongated part, a first end and a second end, the first end being shaped in such a way that it is capable of being introduced in the second canal (11) and the first canal (3) and remaining supported on a top wall (5) of the inside cavity (4),(36) while the second end is shaped in such a way that it is capable of remaining supported on a bottom wall of the outside cavity, the pin (13),(20),(28) thus defining an anchoring means between the implant (1),(34) and the superstructure (8),(18),(35).

2. A system according to claim 1, wherein the pin (13),(20),(28) comprises a head (14),(22),(32) that constitutes said second end, two legs (16),(29) that constitute the elongated part and that are joined by the head (14),(22), as well as two flanges (15),(2)(30) that constitute said first end, the distance between a bottom surface of the head (14),(22), (32) and a top surface of the two flanges (15),(21) essentially corresponding to the combined length of the first canal (3) and the second canal (11).

3. A system according to claim 2, wherein the elongated part of the pin (13),(20),(28) has a width that essentially corresponds to the width of the first (3) and second (11) canals.

4. A system according to any of the claims 1-3, wherein the top wall (5) of the inside cavity (4) is slanted.

5. A system according to claim 4, wherein the head (14) includes a thin area (17) that allows it to be broken by means of an suitable dentist's tool, and the flanges (15) include sharp top side ends and rounded bottom side edges; in such a way that when the head (14) of the pin (13) rests on the bottom wall of the outside cavity (12) the flanges (15) of the pin (13) remain inside the inside cavity (4) effecting a firm, irreversible anchoring without clearance.

6. A system according to any of the claims 1-4, wherein the superstructure (18) is a clinico-prosthetic superstructure provided with some tabs (27) in some sides of the top end thereof, and with some side recesses (24) in a bottom part of some side walls of the outside cavity (12) thereof; the pin (20) is a provisional pin whose head (22) extends in a greater degree, has a hollow space (26) that permits the entry of the impression material, and has some bottom grooves (25) that facilitate the bending of some end flanges (23) of said head (22) provided for the reversible anchoring in said side recesses (24); the flanges (21) have a reduced length and are

completely round, lacking pointed ends, in order to facilitate the reversibility of the fixing provided by this pin.

7. A system according to claim 6, that includes a transgingival healing bushing (19), a slightly curvi-convex side **surface** preferably made out of porcelain, that is connected to the corresponding implant (1) by means of a pin (20) in a way similar to how it is done by said implant (1) and the superstructure (18).

8. A system according to any of the claims 1-3, wherein the pin (28) is a definitive and recoverable pin that has a well defined thermal memory, corresponding to a stable condition of greater expansion at the temperature of the human body, while a stable condition corresponding to a greater contraction is found at several degrees Centigrade below.

9. A system according to claim 8, wherein the pin (28) is made out of an alloy of nickel and titanium, 60 and 40% respectively, that provides the cited conditions of thermal stability at approximately 37 and 17° C.

10. A system according to claim 9, wherein, under the head (32) of the pin (28) extend some legs (29) slightly bent towards the inside and with the convexity outward, in such a way that the width that the combination of said legs (29) has right under the head (32) decreases progressively until some end lateral extensions (30) that provide a greater width approximately equal to the initial width under the above mentioned head (32) are reached; it being provided for that said geometric shape corresponds to the condition of contraction or low temperature, in such a way that as the temperature rises, around 37° C, the legs (29) become approximately straight and parallel, being more separated, and the width determined by the end lateral extensions thereof (30) is greater than the initial width of the legs (29) under the head (32).

11. A system according to claim 10, wherein the inside cavity (36) of the implant (34) has a top horizontal wall.

Claims

1. Means for fixing prosthetic superstructures to osteointegrated implants, of the type that are used in dentistry, by advantageously and novelly avoiding the use of screws; characterized in that the implant (1) includes a straight and axial duct or canal (3) that leads into an inside cavity (4) with top inclined walls; a superstructure (8) corresponding to said implant (1) that fits in it in a key-like manner by means of projections and recesses (6, 7, 9 and 10) that both have in their contact ends; with the

particularity that the superstructure (8) includes an axial duct or canal (11) corresponding to the previous duct or canal (3), and that leads into a cavity (12) open towards the outside in the free end of the superstructure (8).

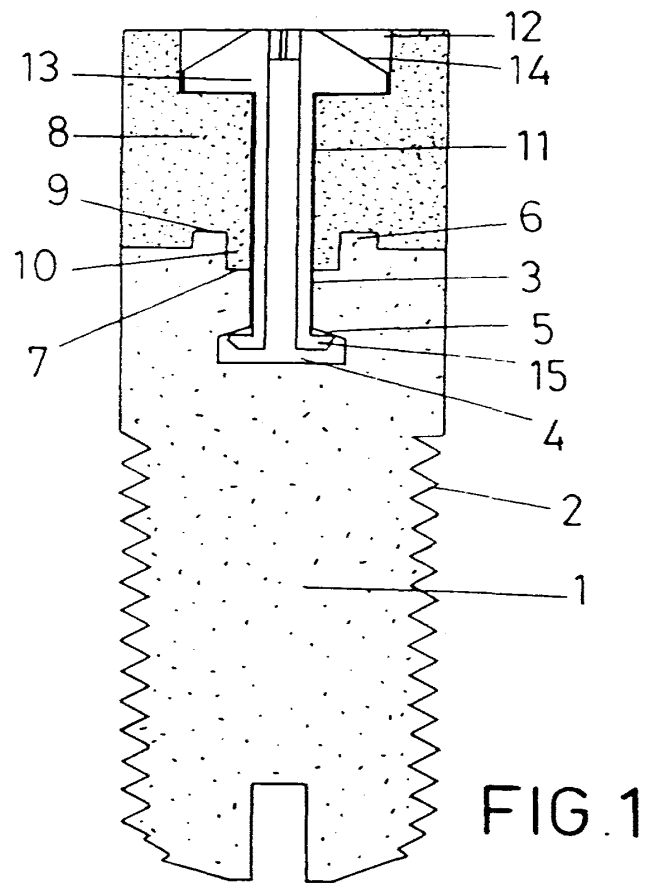
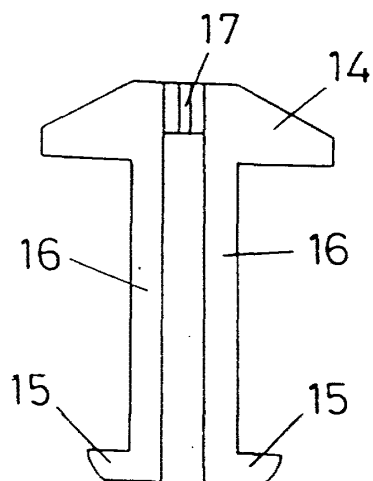
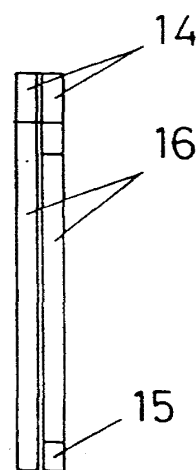
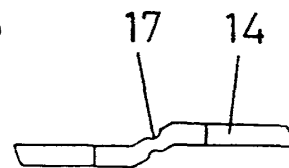
2. Means for fixing prosthetic superstructures to osteo integrated implants, according to the above claim, characterized in that it has a pin (13) provided with a head (14) with a thinner area (17) that allows the breaking thereof by means of a suitable dentist's tool, extending from the bottom part of the head (14) some legs (16) with a length corresponding to the combined length of the above mentioned canals (13) and (11), with a combined width similar to the width of these same canals (3) and (11) and the free ends thereof being bent towards the outside, in such a way that they form some flanges (15) with their pointed top side ends and with their rounded bottom side edges; in such a way that when the head (14) of the pin rests on the bottom of the open cavity (12) as the pin has passed through the ducts or canals (11) and (3) of the superstructure (8) and of the implant (1) coupled together, the flanges (15) of the pin (13) remain inside the inside cavity (4) carrying out a firm, irreversible anchoring without clearance.

3. Means for fixing prosthetic superstructures to osteointegrated implants, according to the above claims, characterized in that it has a clinico-prosthetic superstructure (18) similar to the previous definitive superstructure (8) but provided with some overlaps or tabs (27) in the sides of the top end thereof, and with some side recesses (24) in the bottom part of the walls of the open cavity thereof (12); having provided for a provisional pin (20) whose head (22) extends to a larger degree, and which has a hollow space (26) that allows the entry of the impression material, and that has some bottom grooves (25) that facilitate the bending of some end flanges (23) of said head (22) provided for the reversible anchoring in the side recesses (24) mentioned above, having provided for the flanges (21) of the free ends of the legs (16) of this provisional pin (20) being shorter and completely rounded, lacking pointed ends, in order to facilitate the reversibility of the fixings provided by this provisional pin (20); this all permitting the simplification of the procedure of taking impressions and of constructing a copy of the implants and the patient's mouth.

4. Means for fixing prosthetic superstructures to osteointegrated implants, according to the

above claims, characterized in that it has a transgingival healing bushing (19), a gently curviconvex side surface preferably made out of porcelain, that is connected to the corresponding implant (1) by means of a provisional pin (20) in a way similar to how it is done by said implant (1) with the clinico-prosthetic implant (18).

5. Means for fixing prosthetic superstructures to osteointegrated implants, according to the above claims, characterized in that a definitive and recoverable pin that has a well defined thermal memory has been provided for, the stable condition corresponding to the greater expansion to the temperature of the human body, while the one corresponding to greater contraction is found in several degrees Centigrade lower; preferably making said pin (28) out of an alloy of nickel and titanium, 60 and 40 % respectively, that provides the cited conditions of thermal stability at about 37 and 17° C.
6. Means for fixing prosthetic superstructures to osteointegrated implants, according to the above claim, characterized in that under the head (32) of the definitive and recoverable pin (28) extend some legs (29) slightly bent towards the inside and with the convexity outward, in such a way that the width that the combination of said legs (29) have under the head (32) decreases progressively until some end side extensions (30) that provide a greater width and approximately equal to the initial width under the above mentioned head (32) are reached; it being provided for that said geometric shape corresponds to the situation of contraction or low temperature, in such a way that as the temperature rises, around 37° C, the legs (29) become approximately straight and parallel, they are more separated and the width determined by the end side extensions thereof (30) is much greater than the initial width of the legs (29) under the head (32).
7. Means for fixing prosthetic superstructures to osteointegrated implants, according to claims 1, 3, 5 and 6, characterized in that the cylindrical cavity (36) of the implant (34), in the event that the definitive and recoverable pin (28) is used, has a horizontal top wall that replaces the slanted wall (5) that facilitated in the other case the removal of the provisional pins (20).



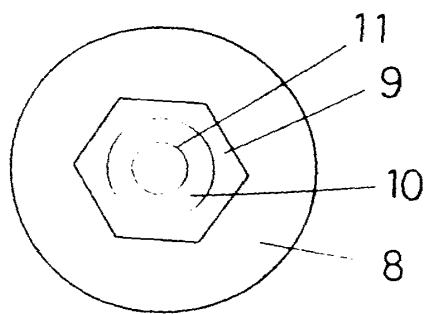


FIG. 5

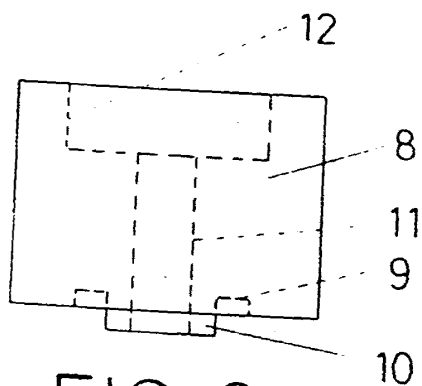


FIG. 6

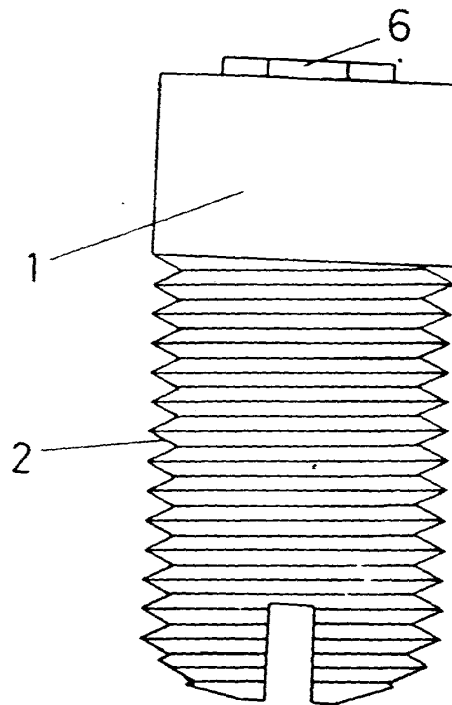


FIG. 8

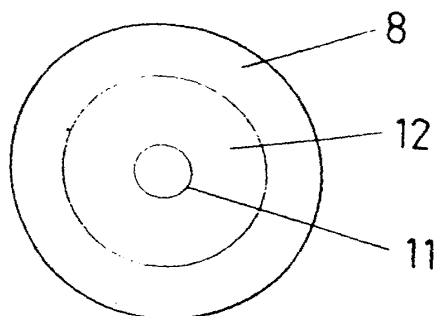


FIG. 7

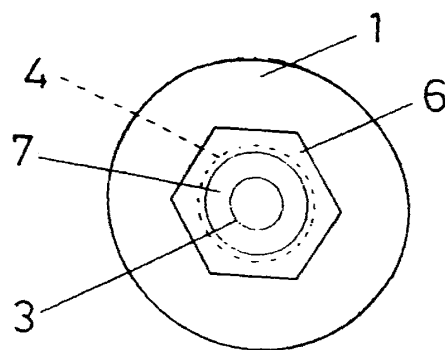
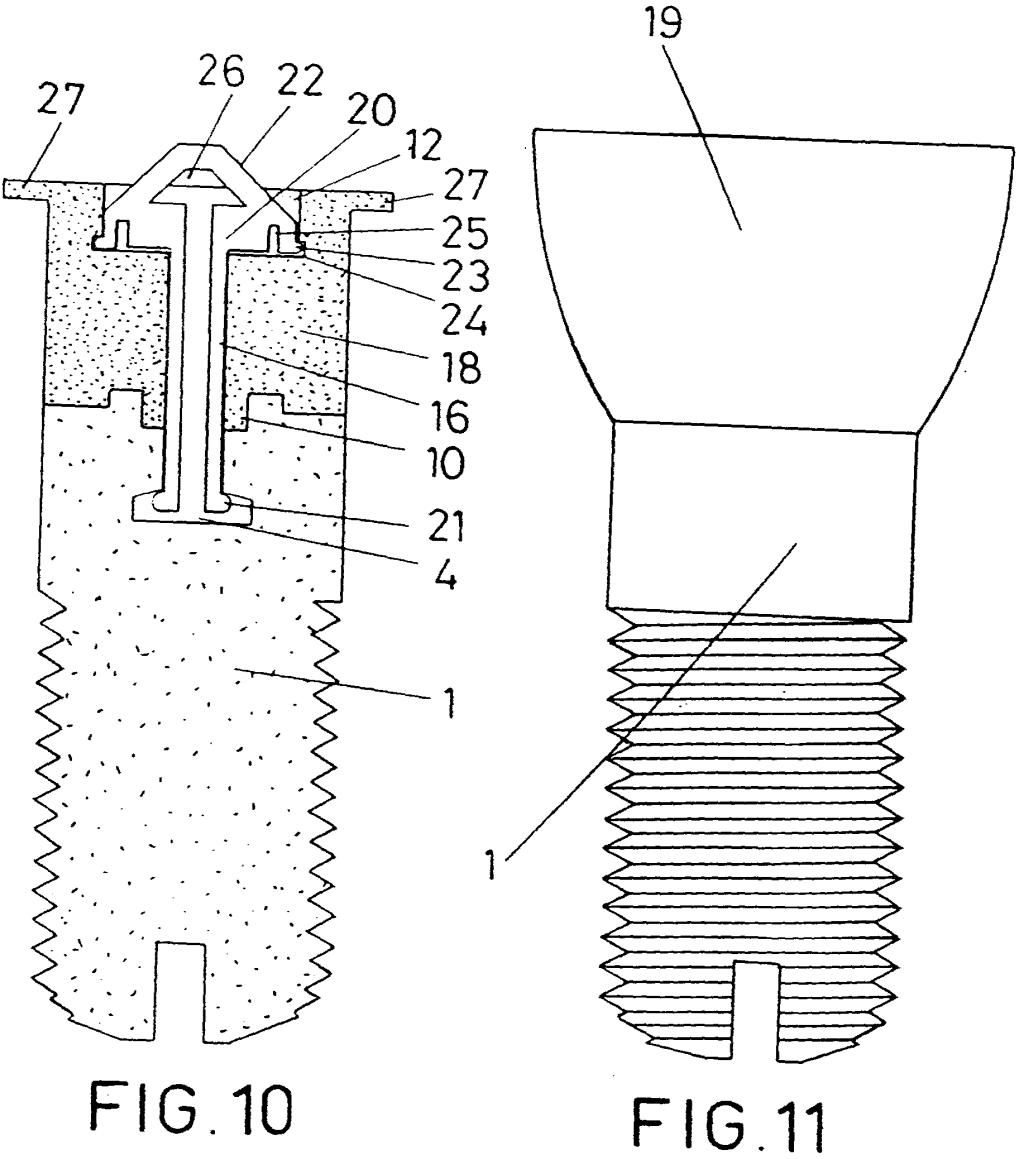


FIG. 9



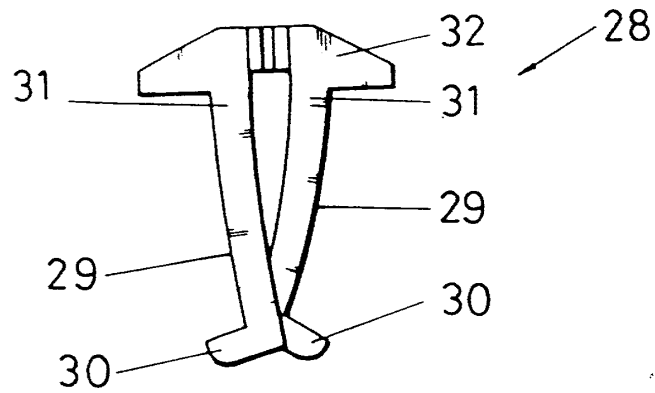


FIG. 12

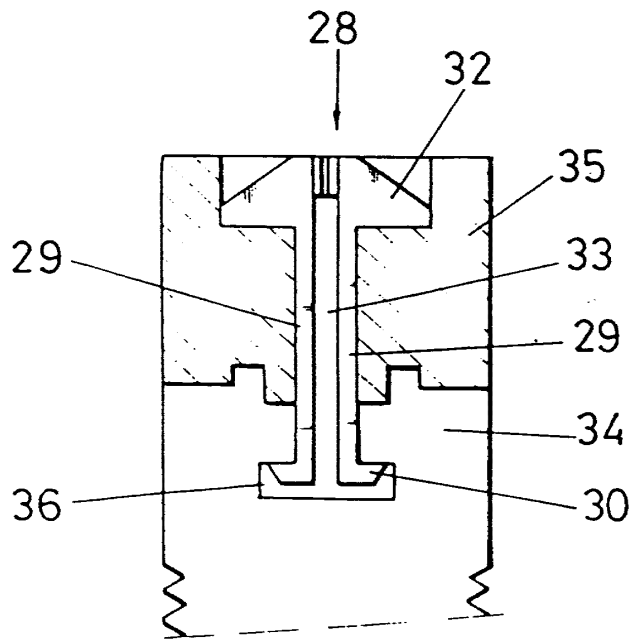


FIG. 13

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/ES 94/00131

A. CLASSIFICATION OF SUBJECT MATTER IPC 6 A61C8/00		
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) IPC 6 A61C		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE,A,33 00 764 (BADEMIS) 12 July 1984 see the whole document ---	1
A	US,A,5 197 881 (CHALIFOUX) 30 March 1993 see the whole document ---	1
A	EP,A,0 312 698 (IMPLANTO-LOCK GMBH FUER IMPLANTATFORSCHUNG UND ENTWICKLUNG) 26 April 1989 see the whole document ---	1
A	WO,A,93 20773 (PERISSE) 28 October 1993 see abstract; claim 1; figures ---	1
A	DE,U,92 14 239 (RUEHLING) 17 December 1992 see abstract -----	
☐ Further documents are listed in the continuation of box C. ☒ Patent family members are listed in annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "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 14 March 1995		Date of mailing of the international search report 04.04.95
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer Giménez Burgos, R

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No.
PCT/ES 94/00131

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A-3300764	12-07-84	NONE	
US-A-5197881	30-03-93	US-A- 5312253	17-05-94
EP-A-312698	26-04-89	DE-A- 3440952	15-05-86
		DE-A- 3515154	06-11-86
		DE-A- 3532125	19-03-87
		EP-A, B 0180247	07-05-86
		US-A- 5061285	29-10-91
		US-A- 4731085	15-03-88
WO-A-9320773	28-10-93	FR-A- 2690069	22-10-93
		CA-A- 2118408	28-10-93
		EP-A- 0637228	08-02-95
DE-U-9214239	17-12-92	NONE	

Form PCT ISA 210 (patent family annex) (July 1992)

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	Filing Date	2024-09-06	
	First Named Inventor	Kofford, Brandon Dale	
	Art Unit	3772	
	Examiner Name	Huynh, Courtney Nguyen	
Total Number of Pages in This Submission	102	Attorney Docket Number	SDC013

ENCLOSURES (Check all that apply)		
☐ Fee Transmittal Form ☐ Fee Attached ☐ Amendment/Reply ☐ After Final ☐ Affidavits/declaration(s) ☐ Extension of Time Request ☐ Express Abandonment Request ☒ Information Disclosure Statement ☐ Certified Copy of Priority Document(s) ☐ Reply to Missing Parts/ Incomplete Application ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53	☐ Drawing(s) ☐ Licensing-related Papers ☐ Petition ☐ Petition to Convert to a Provisional Application ☐ Power of Attorney, Revocation Change of Correspondence Address ☐ Terminal Disclaimer ☐ Request for Refund ☐ CD, Number of CD(s) _____ ☐ Landscape Table on CD	☐ After Allowance Communication to TC ☐ Appeal Communication to Board of Appeals and Interferences ☐ Appeal Communication to TC (Appeal Notice, Brief, Reply Brief) ☐ Proprietary Information ☒ Status Letter ☒ Other Enclosure(s) (please identify below): Foreign patents/ translations not filed in related application 18/424,696 under 37 CFR 1.98(d)
<div>Remarks</div>		

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**(19) World Intellectual Property
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International Bureau



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[Continued on next page]

(54) Title: A METHOD FOR ATTACHING AND DETACHING DENTAL CONSTRUCTIONS AND A DEVICE THEREOF

(57) Abstract: The present invention relates to a flexible holding device for connecting a construction to an implant in a ridge of a mouth comprising: (a) a head for holding the construction from the inside of said construction; (b) more than one leg for holding the internal thread of said implant from the inside; and (c) a body, attached to said head and attached to said legs, for attaching said construction to said implant.

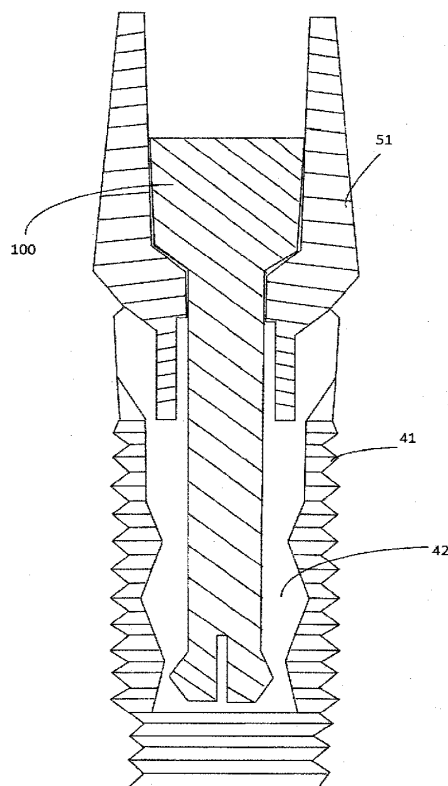


Fig. 6

WO 2013/030839 A1



SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,

Published:

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

A METHOD FOR ATTACHING AND DETACHING DENTAL CONSTRUCTIONS AND A DEVICE THEREOF

Field of the Invention

The present invention relates to the field of dentistry. More particularly, the invention relates to dental restoration systems.

Background of the Invention

The loss of permanent teeth creates the need for a denture, i.e. a dental restoration system, to replace the natural teeth. Conventional dentures rest on implants which are implanted in the gingival tissue of the ridge of the mouth. These dentures, where possible, may also be anchored to existing natural teeth. In cases where all of the teeth have been extracted from either the upper or lower jaw, or both, a full denture can be utilized.

One type of denture, used today, utilizes a prosthetic tooth, which connects to an abutment on a dental implant. After a dental implant is implanted, in the gingival tissue of the ridge, a construction, e.g. an abutment, is attached on top of the implant. The abutment is a metal cylinder that the prosthetic tooth is built onto. There are many types of abutments and they vary in length, width, angle, shape and color. On the abutment a prosthetic tooth is fastened and it should look, and function, just like any other tooth in the mouth.

A patient with a multiple implant restoration goes through the same process and the final prosthetic teeth can vary between multiple single teeth or several teeth connected by a bridge or even a partial fixed denture, based on the planning of the dentist and the needs of the patient.

Another type of denture used today, utilizes a construction such as an overdenture bar. This dental reconstruction system comprises a conventional acrylic overdenture retained by suitable attachments, such as clips, to an implant supported cast bar otherwise known as an overdenture bar, e.g. a Dolder bar. The overdenture bar is attached to the implants, in the patient's ridge, using designated screws.

In any case, after fitting the construction(s) on the implant(s), the dentist is required to take an impression of the ridge, with the attached construction(s). The impression is taken by filling a standard form with a solidifying substance such as polyvinylsiloxane and pressing it inside the mouth of the patient. Once this is completed the dentist will send the impression out to the laboratory for building a model of the mouth. In the laboratory, after receiving the impression, a solidifying material, such as plaster of Paris, is then poured into the impression for creating the model. The model is then separated from the impression. Thus, the model sculpts the patient's alveolar, ridge, implants and the construction. However, since the model is used to create a prosthetic for a patient, the model has to be accurate enough in order to provide that the created prosthetic has a precise fit to the ridge of the patient. An inaccurate prosthetic can cause subsequent inconvenience, or even injuries, to the patient. Finally, the created prosthetic is seated in the mouth of the patient. However, this kind of procedure is time consuming, problematic, and may create inconveniences to the patient.

US 6,488,501 discloses a transfer jig for implant, in a dental surgery, which uses a tubular post and a tubular coping which is attachable and detachable from the post by a snap-fit attachment. The described post has a hexagonal portion for location in a hexagonal socket in an implant and a frusto-conical portion which is a seat for the coping. The coping has a diametrically opposed pair of slots in its end that seats on the post to receive a diametrically opposed pair of pins with a snap-fit, the pins being mounted on the post so that the coping is precisely located relative to the hexagonal portions. The coping also has apertures formed through its tubular wall through which dental

impression material is forced to form structural links when a dental impression is taken. Nevertheless, the described mechanism is complicated and requires a number of specially-designed tight-fitting parts for applying the described method.

It would therefore be desired to propose a system void of the problems discussed above.

Summary of the Invention

It is an object of the present invention to provide a method for creating an accurate impression of the mouth ridge.

It is another object of the present invention to provide a method for creating comfortable and accurate dental restorations.

It is still another object of the present invention to provide a method for attaching and detaching dental constructions for measurements.

It is still another object of the present invention to provide a flexible device, for firmly holding a dental restoration construction in its place, over the implants in the ridge, and for allowing an easy detachment of the construction from the implants in the ridge when detaching the impression.

It is still another object of the present invention to provide a flexible device for firmly holding the dental restoration construction in its place over the implants in the ridge, even if the implants are not parallel to one another.

Other objects and advantages of the invention will become apparent as the description proceeds.

The present invention relates to a method for attaching and detaching a construction to an implant in a ridge of a mouth comprising the steps of: (a) inserting at least one flexible holding device into said construction, where said flexible holding device head is held inside said construction; (b) attaching said construction to said implant by fastening the legs of said holding device into said implant; and (c) detaching said construction by applying a pulling force, in an opposite direction to the implant, on said construction.

Preferably, the detaching is done by applying a pulling force on the form with an impression which engulfs the construction.

In one embodiment, the method is used for connecting and detaching an abutment.

In one embodiment, the method is used for connecting and detaching an overdenture bar.

In one embodiment, the method is used for connecting the overdenture bar to a number of implants which are not parallel to one another in the ridge of the mouth.

The present invention also relates to a flexible holding device for connecting a construction to an implant in a ridge of a mouth comprising: (a) a head for holding the construction from the inside of said construction; (b) more than one leg for holding the internal thread of said implant from the inside; and (c) a body, attached to said head and attached to said legs, for attaching said construction to said implant.

Preferably, the device is made of Polyacetal.

Preferably, the device has two legs.

In one embodiment, the device is used instead of a transfer.

Brief Description of the Drawings

Some embodiments of the invention are herein described, by way of example only, with reference to the accompanying drawings. With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of embodiments of the invention. In this regard, the description and the drawings make apparent to those skilled in the art how embodiments of the invention may be practiced.

In the drawings:

- Fig. 1 is a schematic diagram of the different dental parts of a prior art prosthetic tooth.
- Fig. 2 is a diagram of a mouth of a patient with an abutment secured, in a prior art fashion, in the mouth.
- Fig. 3 is a diagram of an impression taken, in a prior art fashion, in a mouth of a patient.
- Fig. 4 is a schematic diagram of an overdenture bar above the ridge of a mouth, before attaching the overdenture bar to the dental implant analogues, according to a prior art process.
- Fig. 5 is a schematic diagram of a flexible holding device, according to an embodiment of the invention.
- Fig. 6 is a schematic diagram of the flexible holding device attaching a construction to a typical dental implant analogue, according to an embodiment of the invention.

Detailed Description of Preferred Embodiments

The term "ridge" refers to the alveolar ridge which comprises gingival tissue and contains the sockets, i.e. alveoli, of the teeth.

The terms "implant analogue(s)" and "implant(s)" are used throughout the description intermittingly and are meant to include any device which is inserted into the ridge for supporting a denture.

The terms "bar" "cast bar", "denture bar", "overdenture bar", "Perci bar", and "Dolder bar" are used throughout the description intermittingly and are meant to include any bar which supports the prosthetic overdenture.

The term "construction(s)" is meant to include any dental device which can be attached to the implant, such as, an abutment, a bridge, or an overdenture bar.

The term "denture(s)" is meant to include any prosthetic device for replacing the natural teeth, such as a prosthetic tooth or a prosthetic overdenture.

Fig. 1 is a schematic diagram of the different dental parts of a prior art prosthetic tooth. At first a dental implant 41 is implanted in the gingival tissue of the ridge 44. Then, an abutment 31 is fastened to the implant 41 using a prior art screw 200. After the abutment 31 has been attached and fastened to the implant 41, the dentist is required to take an impression of the ridge and the attached abutment 31, for casting a model of the ridge with its attached abutment 31. Since the model is used afterwards to create the prosthetic tooth 30, the model needs to be as accurate as possible. Any inaccuracy in the model may result in an inaccuracy of the prosthetic tooth which in turn may cause inconvenience to the patient. In some of the cases, due to the inaccuracies, the dentist may be required to amend and smooth the tooth in the mouth of the patient, after attaching the prosthetic tooth, a feat which is not easy to the dentist and inconvenient to the patient.

Fig. 2 is a diagram of a mouth of a patient with an abutment secured, in a prior art fashion, in the mouth. The abutment 31, as describe in relations to fig. 1, is secured, using a screw, prior to taking an impression. The abutment 31, of the prior art, is designed to be

taller than the other teeth of the mouth in order to allow the dentist to unfasten the screw of the abutment 31 and pull the abutment 31.

Fig. 3 is a diagram of an impression taken, in a prior art fashion, in a mouth of a patient. In the prior art process, a hole is cut in the standard form 33 in order to equip the abutment 31. The abutment 31, as described in relations to Fig. 1 and 2, sticks out from the ridge and therefore the standard form 33 is first cut in order to take the impression with the abutment 31. The cut is made in the corresponding place of abutment 31 and then the form 33 is filled with the solidifying material such as a combination of Zhermack's Hydrorise silicon and Hydroise putty. This cut form 33, with its solidifying material, is then pressed onto the ridge of the patient and held in place until it solidifies. After which the dentist first unscrews the abutment 31 and then lifts the form and sends it the lab for casting a model of the ridge.

Fig. 4 is a schematic diagram of an overdenture bar above the ridge of a mouth, before attaching the overdenture bar to the dental implant analogues, according to a prior art process. The overdenture bar 20 comprises poles, such as pole 21, connected between them by interconnecting bars, such as bar 22. The overdenture bar 20 may have any number of poles, and interconnecting bars, according to the needs of the patient and his ridge. In this embodiment the ridge 44 has four implants, such as implant 41, for supporting the overdenture bar 20, which has four poles. The poles of the overdenture bar 20 are attached to the implants by screws such as screw 200. The top part of the screw 200 which is inside the pole 21 is depicted in silhouette. In the prior art process, after attaching the overdenture bar with screws to the implants of the ridge an impression is taken.

However, since the construction is fastened by screws to the implants, any impression of the ridge and the construction is distorted by the construction. For example when the impression material, which may be any solidifying material such as a combination of Zhermack's Hydrorise silicon and Hydroise putty, is first poured on the ridge and the

construction, the material flows around the construction, and in the spaces between the construction and the ridge, and solidifies. This however makes the task, of removing the impression intact and undamaged, time consuming and fairly difficult, since the construction is fastened with screws to the abutments of the implants in the ridge. In many cases it is almost impossible to detach the impression from the mouth of the patient without it being ripped or torn, due to the fact that the construction is secured to the ridge of the mouth and due to the fact that there is a space between the construction and the ridge and due to the fact that the impression material has solidified. In many cases the ripped and distorted impression hinders the ability to create an accurate model of the mouth of the patient which in turn may prevent the lab from creating a fitting prosthetic, whether the prosthetic is a prosthetic tooth or a prosthetic overdenture, or any other kind of construction.

Therefore, a device is proposed which can hold the construction in place when pouring the impression material, over the construction and ridge, and can easily detach from the ridge, when the impression solidifies, thus allowing the impression to keep engulfing the construction when lifted. Thus the impression, which includes the construction, may be used for casting the model of the ridge of the patient, after which the construction may be extracted from the impression and fastened to the model, effectively creating a more accurate model of the ridge and the construction of the patient. These flexible devices are designed to be used instead of the screws used for attaching the construction to the implants.

The described device may also spare the use of a transfer since it may be used as a transfer, even in cases where the implants are not implemented in the ridge in parallel.

Fig. 5 is a schematic diagram of a flexible holding device, according to an embodiment of the invention. The device 100 is designed as a flexible holding device having a head 11, a body 12, and two extended legs 13. The body 12 is designed to be slimmer than the head 11, in other words, the body 12 is designed to have a shorter circumference than the head

11. A typical dental construction is designed with a tunnel running through its axis, where the end of the tunnel is slightly slimmer in order to hold the head of the screw. The device 100 is designed to fit in a construction, instead of the designated screw. Thus the device 100 may be inserted into the construction, legs 13 first – head 11 last, and pushed to the limit, i.e. until the head 11 gets stuck close to the end of the construction, above the lower opening, and the legs 13 dangle out. The legs 13, which are designed for insertion and gripping, can then be inserted into the inside of an implant, where the legs 13 can grip the internal thread of the implant from within, due to the legs 13 elastic repelling force which repels the legs from one another. Typically, the construction can be attached to the implant by applying force on the top of the head 11 of device 100, which is in the tunnel of the construction, to force the legs 13 into the implant and gripping it from within, while the lower opening of the tunnel of the construction is on, or substantially close, to the implant.

Likewise the construction may be detached by pulling the construction from the ridge, thus forcing the legs 13 of device 100 to surrender their grip on the inner thread of the implant. The holding device 100 may be composed of Polyacetal or any other flexible and rigid material such as Toarplast POM.

In one embodiment, the wider part of legs 13, as described in relations to Fig 5, is designed as having an angle which sticks out of the device. In another embodiment the legs 13 may have their wider part rounded. Other embodiments are possible as well as long as the legs are designed to grip the internal thread of the implant from within.

In one of the embodiments, the device 100, as described in relations to Fig. 5, has more than two legs. There may be any number of legs to device 100 as long as they are designed to grip the internal thread of the implant from within.

In one embodiment the device 100, as described in relations to Fig. 5, is 10mm long, where the head 11 may be 2mm long, the body 12 may be 7mm long, and the legs 13

wider part may be 1mm long. In this embodiment the head 11 may have a diameter of 2mm, the body 12 may have a diameter of 1mm, and the legs 13 wider part may have a diameter of 2mm, when they are not pressed together. In one embodiment the legs 13 may be 2mm long. Other embodiments and other measurements are possible as well.

Fig. 6 is a schematic diagram of the flexible holding device attaching a construction to a typical dental implant analogue, according to an embodiment of the invention. The device 100, as described in relations to Fig. 5, is inserted in the construction 51 and into the implant 41. The head of device 100 secures the construction 51, and the legs, of device 100, grip the internal thread 42 of the implant 41 from within. Thus the construction 51 is held by device 100 to the implants 41. However, if an upper pulling force is applied to the construction 51, the legs of device 100 will surrender their grip and the construction 51 can be easily detached from the implant 41.

Due to the features of the described flexible holding device, it may be used for holding the constructions over implants where the implants are not parallel. Meaning, that even in cases where a number of implants are implanted in the ridge of the patient at different angles, the construction(s) may be held by a number of the described flexible devices, e.g. one for each implant, to the implants, and pulled away when necessary.

The device of the present invention is beneficial to the dental surgeon who performs the implant surgery, the dental laboratory which creates the dentures, and the patient who receives the denture. The dental surgeon can make an impression much easier since the construction is removed from the ridge along with the impression. With a securely attached construction, difficulty always is encountered with the impression material becoming lodged between the construction and the sutured gingival tissue. Since the construction is removed with the impression, no such difficulties are encountered taking the impression. Next, the dental laboratory can fashion a denture which is much tighter fitting since the construction is present in the laboratory during the denture manufacturing operation. This results in a better fit of the denture for the patient. Installation of the

construction, for usage, is accomplished easily by attaching the construction extracted from the impression into the implants in the ridge, prior to the patient being finally fitted with the custom-manufactured denture prosthetic.

While some embodiments of the invention have been described by way of illustration, it will be apparent that the invention can be carried into practice with many modifications, variations and adaptations, and with the use of numerous equivalents or alternative solutions that are within the scope of persons skilled in the art, without departing from the invention or exceeding the scope of claims.

Claims

1. A flexible holding device for connecting a construction to an implant in a ridge of a mouth comprising:
 - a. a head for holding the construction from the inside of said construction;
 - b. more than one leg for holding the internal thread of said implant from the inside; and
 - c. a body, attached to said head and attached to said legs, for attaching said construction to said implant.
2. A device according to claim 1, where the device is made of Polyacetal.
3. A device according to claim 1, where the device has two legs.
4. A device according to claim 1, where the device is used for connecting an abutment.
5. A device according to claim 1, where the device is used for connecting an overdenture bar.
6. A device according to claim 5, where the device is used for connecting the overdenture bar to a number of implants which are not parallel to one another in the ridge of the mouth.
7. A device according to claim 1, where the device is used instead of a transfer.
8. A method for attaching and detaching a construction to an implant in a ridge of a mouth comprising the steps of:
 - a. inserting at least one flexible holding device into said construction, where said flexible holding device head is held inside said construction;
 - b. attaching said construction to said implant by fastening the legs of said holding device into said implant; and
 - c. detaching said construction by applying a pulling force, in an opposite direction to the implant, on said construction.
9. A method according to claim 8, where the detaching is done by applying a pulling force on the form with an impression which engulfs the construction.

10. A method according to claim 8, where the method is used for connecting and detaching an abutment.
11. A method according to claim 8, where the method is used for connecting and detaching an overdenture bar.
12. A method according to claim 11, where the method is used for connecting the overdenture bar to a number of implants which are not parallel to one another in the ridge of the mouth.

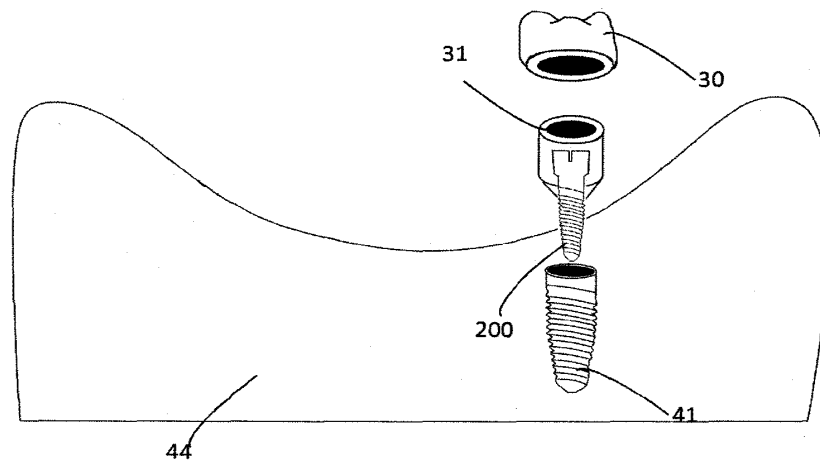


Fig. 1 (Prior Art)



Fig 2 (Prior Art)



Fig. 3 (Prior Art)

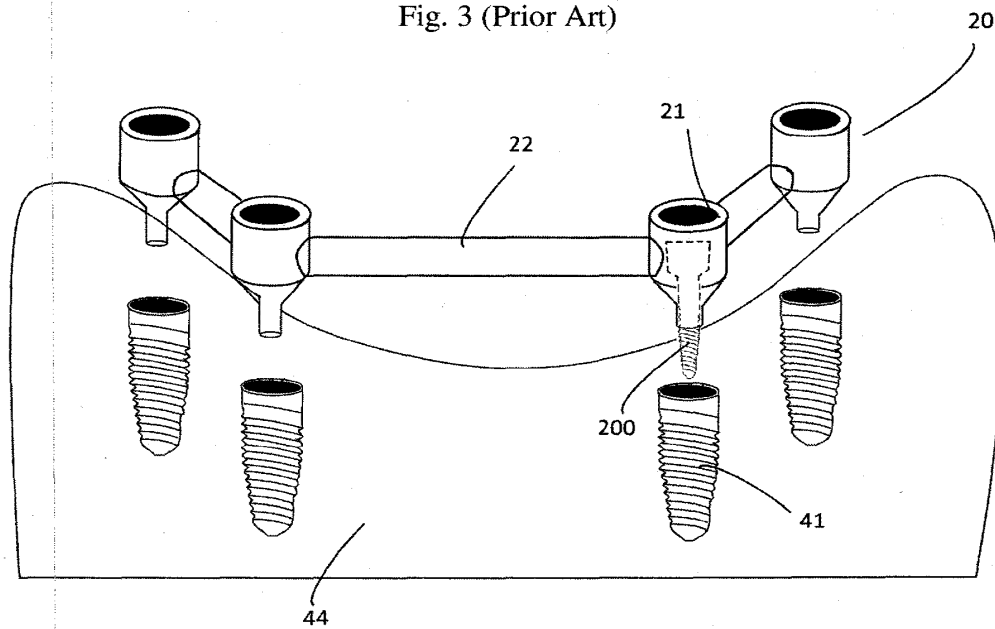


Fig. 4 (Prior Art)

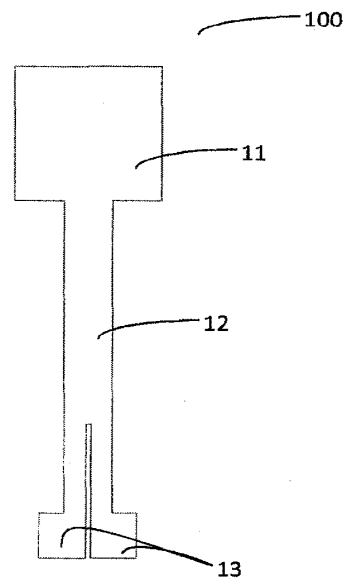


Fig. 5

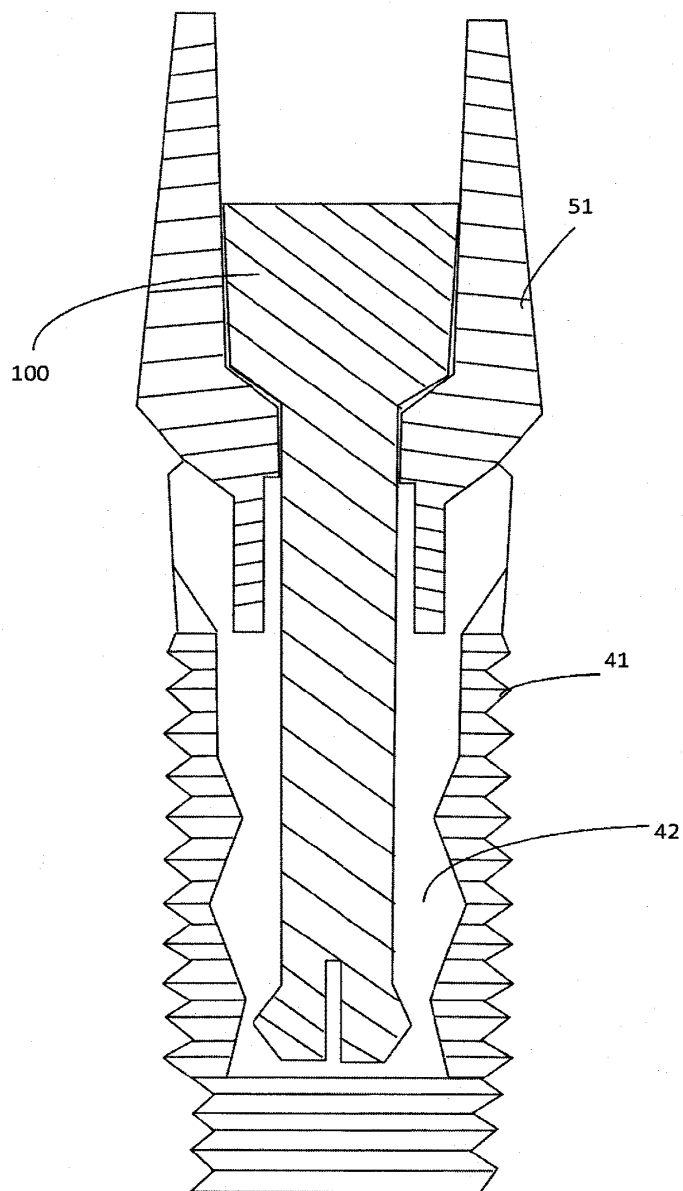


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No

PCT/IL2012/050339

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61C8/00
ADD.

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)
A61C

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

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

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	W0 2011/036268 A2 (DENTALPOINT AG [CH]; BOLLETER PHILIP [CH]; CHIUSOLO NICOLA [CH]) 31 March 2011 (2011-03-31) figure 16(b) page 16, line 5 - page 18, line 22 -----	1-8, 10-12
X	EP 0 685 209 A1 (TOBOSO RAMON JES S [ES]) 6 December 1995 (1995-12-06) figures 1,10 column 6, line 16 - column 9, line 19 -----	1-12



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"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

13 December 2012

Date of mailing of the international search report

21/12/2012

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
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Fax: (+31-70) 340-3016

Authorized officer

Fortune, Bruce

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IL2012/050339

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2011036268 A2	31-03-2011	CH 701860 A1 EP 2480161 A2 WO 2011036268 A2	31-03-2011 01-08-2012 31-03-2011
EP 0685209 A1	06-12-1995	EP 0685209 A1 WO 9515128 A1	06-12-1995 08-06-1995

Form PCT/ISA/210 (patent family annex) (April 2005)



UNITED STATES
PATENT AND TRADEMARK OFFICE

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION # 18/827,656	RECEIPT DATE / TIME 01/11/2025 07:41:17 PM Z ET	ATTORNEY DOCKET # SDC013
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Title of Invention

Screw-attached Pick-up Dental Coping System and Methods

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	2702	FILED BY	Daniel Whittle
PATENT CENTER #	68698159	FILING DATE	09/06/2024
CUSTOMER #	112823	FIRST NAMED INVENTOR	Brandon Dale Kofford
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	-

Documents

TOTAL DOCUMENTS: 6

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
SDC013_IDS_Statement_Jan2025.pdf	2	Miscellaneous Incoming Letter	108 KB
EP0685209A1.pdf	14	Foreign Reference	360 KB
sb0021.pdf	2	Transmittal Letter	265 KB
WO2013030839A1.pdf	21	Foreign Reference	1218 KB
IDS_Jan2025_SDC013.pdf	15	Information Disclosure Statement (IDS) Form (SB08)	1317 KB
WO2011036268A2wTRANSP.pdf	48	Foreign Reference	11827 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
SDC013_IDS_Statement_Jan2025.pdf	F9164884C43C3DD5DAB68ABADFF84969E18BCB308508B3EA E7AB733336416CEEBCF137A317F26C0784BADE45CAB143033A 8AA5B65136EF183DC7E25D738AD5781
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WO2011036268A2wTRANSp.pdf	1D8CCA8612E30C408E41E57CE08245A063E4CAAF560C82030 89480C2031A3B50445EF2076A3BA8A121A7EE648096D0C7B8 7F72708D3040F786A8FE21F8DF0241

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Attorney Docket No. SDC013

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Kofford et al.

Confirmation No. 2702

Application No.: 18/827,656

Group Art Unit: 3772

Filing Date: September 6, 2024

Examiner: Courtney Nguyen Huynh

For: **SCREW-ATTACHED PICK-UP DENTAL COPING SYSTEM AND
METHODS**

Date: January 11, 2025

Commissioner for Patents

Box 1450

Alexandria, VA 22313-1450

IDS Statement under 37 CFR 1.98(d)

Applicant is submitting the present IDS without copies of information provided previously for parent application 18/424,696 with a filing date of January 26, 2024.

Remarks begin on page 2 of this document.

In re: Kofford et al.
Application No. 18/827,656
Filing Date: September 6, 2024
Page 2 of 2

Remarks

The majority of information provided on the attached Information Disclosure Statement were provided for the related application 18/424,696 on March 15, 2024. As a result, copies of previously submitted foreign and non-patent literature are not provided with this filing. These are provided in order to be published with an allowed patent in the pending application.

The present IDS filing includes the following new foreign references:

WO2013030839A1 (Dorey et al.)

EP0985209A1 (Toboso Romon)

WO2011036268A (Bolleter et al.)

Copies of these new documents are provided.

CONCLUSION

The Examiner is encouraged to telephone the undersigned at 360-714-0777 for expeditious handling of any matters outstanding of resolution.

Respectfully submitted,

/Daniel John Whittle/

Daniel John Whittle
Registration No. 54,537

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES
PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
31. März 2011 (31.03.2011)



(10) Internationale Veröffentlichungsnummer
WO 2011/036268 A2

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- (22) Internationales Anmeldedatum:
24. September 2010 (24.09.2010)
- (25) Einreichungssprache: Deutsch
- (26) Veröffentlichungssprache: Deutsch
- (30) Angaben zur Priorität:
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- (71) Anmelder (für alle Bestimmungsstaaten mit Ausnahme von US): **DENTALPOINT AG** [CH/CH]; Hohlstrasse 614, CH-8048 Zürich (CH).
- (72) Erfinder; und
- (75) Erfinder/Anmelder (nur für US): **BOLLETER, Philip** [CII/CII]; Hardaustasse 21, CII-8003 Zürich (CII). **CHI-USOLO, Nicola** [CH/CH]; Weideggstrasse 11, CH-9230 Flawil (CH).
- (74) Anwalt: **RENTSCH & PARTNER**; Fraumünsterstrasse 9, P.O. Box 2441, CH-8022 Zürich (CH).

(81) Bestimmungsstaaten (soweit nicht anders angegeben, für jede verfügbare nationale Schutzrechtsart): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, 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, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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[Fortsetzung auf der nächsten Seite]

- (54) Title: DENTAL PROSTHESIS SYSTEM
- (54) Bezeichnung : ZAHNERSATZANORDNUNG

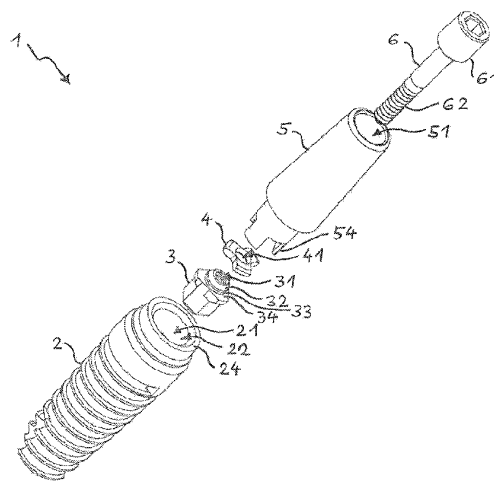


Fig. 1

(57) Abstract: The dental prosthesis system (1) comprises an enossal implant body (2) for anchoring the dental prosthesis system (1) in a jaw bone. The implant body (2) comprises an inner bore (21), in which a threaded sleeve (3) is positively anchored by way of locking means (4) attached in the implant body inner bore (21). An abutment (5), which comprises an inner abutment bore (51), is used to receive a suprastructure. A cap screw (6) connects the abutment (5) to the implant body (2), wherein a head (61) of the cap screw (6) is supported in the inner abutment bore (51) and a threaded part (62) of the cap screw (6) engages with the threaded sleeve (3). The connection between the implant body and the abutment is reversible, and the dental prosthesis system (1) can still be designed so as to be free of metal.

(57) Zusammenfassung: Die Zahnersatzanordnung (1) beinhaltet einen enossalen Implantatkörper (2) zur Verankerung der Zahnersatzanordnung (1) in einem Kieferknochen. Der Implantatkörper (2) weist eine Innenbohrung (21) auf, in welcher eine Gewindehülse (3) mittels in der Implantatkörperinnenbohrung (21) angebrachter Verriegelungsmittel (4) formschlüssig verankert ist. Ein Abutment (5), welches eine Abutmentinnenbohrung (51) aufweist, dient zur Aufnahme einer Suprakonstruktion. Eine Kopfschraube (6) verbindet das Abutment (5)

[Fortsetzung auf der nächsten Seite]

WO 2011/036268 A2



Veröffentlicht:

- *ohne internationalen Recherchenbericht und erneut zu veröffentlichen nach Erhalt des Berichts (Regel 48 Absatz 2 Buchstabe g)*

mit dem Implantatkörper (2) wobei ein Kopf (61) der Kopfschraube (6) in der Abutmentinnenbohrung (51) abgestützt ist und ein Gewindeteil (62) der Kopfschraube (6) in die Gewindehülse (3) eingreift. Die Verbindung zwischen dem Implantatkörper und dem Abutment ist reversibel, und trotzdem kann die Zahnersatzanordnung (1) metallfrei ausgeführt werden.

Zahnersatzanordnung

Die Erfindung betrifft eine Zahnersatzanordnung, ein Verriegelungsbauteil für dieselbe und ein Verfahren zum Aufbau einer Zahnersatzanordnung gemäss den Oberbegriffen der
5 unabhängigen Patentansprüche.

Unter den Begriffen „Zahnimplantat“ oder „Dentalimplantat“ werden seit Jahren verschiedene Zahnersatzanordnungen auf dem Markt angeboten und zum Teil sehr erfolgreich eingesetzt. Die heute verwendeten Zahnersatzanordnungen sind meistens mehrteilig, weil sie so mehrere Kombinationsmöglichkeiten bieten und eine Belastung während der Einheil-
10 phase vermieden werden kann. Typische mehrteilige Zahnersatzanordnungen umfassen einen enossalen Implantatkörper zur Verankerung der Anordnung im Kieferknochen und ein Abutment (auch Verbindungsteil oder Implantatpfosten genannt) zur Aufnahme der Suprakonstruktion, z. B. einer Krone oder einer Brücke. Der Implantatkörper und das Abutment werden miteinander verklebt und/oder verschraubt, die Suprakonstruktion wird auf
15 das Abutment aufgeklebt.

Implantatkörper aus Metall können mit einem Innengewinde versehen werden, in welches eine das Abutment fixierende Schraube eingeschraubt werden kann. Eine solche Schraubverbindung zwischen Implantatkörper und Abutment hat den Vorteil, bei Bedarf lösbar zu sein. Dafür haben metallische Implantatkörper andere Nachteile. Wenn nach
20 längerer Tragdauer des Zahnimplantats die Kieferschleimhaut zurückgeht, wird der Implantatkörper sichtbar und aufgrund seiner dunklen Färbung auch optisch wahrnehmbar, was ästhetisch unbefriedigend ist. Ferner werden viele metallische Werkstoffe als körperfremd erkannt und heilen nicht in den Kieferknochen ein. Ausserdem ist nicht ausgeschlossen, dass langfristig gewisse Mengen an Metall aus dem Implantatkörper gelöst werden, in
25 den Körper gelangen und dort schädlich wirken. Aus diesen ästhetischen und medizinischen

Gründen würde man Implantatkörper aus Keramik bevorzugen. Diese haben jedoch den Nachteil, dass sie keine direkte Schraubverbindung mit dem Abutment eingehen können. Stattdessen wird das Abutment im Implantatkörper mit einem Kleber oder einem Zement dauerhaft fixiert. Somit kann das Abutment zu einem späteren Zeitpunkt nicht zerstörungsfrei aus dem Implantatkörper gelöst werden. Zudem ist nicht ausgeschlossen, dass der verwendete Kleber oder Zement vom Körper aufgenommen wird und darin unerwünschte Auswirkungen hat.

Die DE-103'40'059 A1 offenbart ein Zahnimplantat, welches einen eine lösbare Schraubverbindung zwischen einem keramischen Implantatkörper und dem Abutment zulässt. Der Implantatkörper weist eine koaxial zu seiner Mittelachse verlaufende, den Implantatkörper vollständig durchdringende Innenbohrung mit einer oberen (koronalen) und einer unteren Öffnung auf. Durch die obere Öffnung ist das Abutment mit einer eigenen, zu seiner Mittelachse verlaufenden Abutmentinnenbohrung einführbar. Durch die untere Öffnung ist eine Gewindehülse in die Innenbohrung des Implantatkörpers einführbar. Das Abutment ist mittels einer in die Abutmentinnenbohrung einführbaren Kopfschraube im Implantatkörper fixierbar, wobei die Kopfschraube in der Gewindehülse festlegbar ist. Der Implantatkörper kann aus einem Keramikmaterial, die Gewindehülse aus einem metallischen Werkstoff wie Titan gefertigt sein. Problematisch ist bei dieser Lösung die Fixierung der axialen Position der eingeführten Gewindehülse, ihre Verdrehsicherung und der Abschluss der unteren Öffnung.

Gattungsgemässe Zahnersatzanordnungen sind auch aus drei Veröffentlichungen der Anmelderin des vorliegenden Schutzrechtes bekannt, die nachfolgend diskutiert werden.

In der WO-2009/009909 A1 wird ein Zahnersatzsystem mit einem Implantatkörper und einem Abutment vorgeschlagen, bei dem im Kontaktbereich zwischen der Krone und dem Implantatkörper eine Reinigungsrille vorgesehen ist. Die Reinigungsrille dient zur Aufnahme

und anschliessenden Abreinigung von überflüssigem Klebstoff, der beim Aufkleben der Krone austritt.

Gemäss der WO-2009/009910 A1 ist ein Abutmentstamm, umfassend einen Passzylinder, in einem korrespondierenden zylindrischen Passsitz einer Aufnahmeöffnung im Implantatkörper einpassbar. Dadurch wird eine optimierte Krafteinleitung vom Abutment in den Implantatkörper sichergestellt und volle Freiheit bei der Materialauswahl zugelassen. Der Implantatkörper und das Abutment können aus Titan oder Keramik hergestellt werden, und beide Bauteile können in allen möglichen Materialkombinationen zum Einsatz kommen. Dadurch wird das Einkleben von keramischen Abutments in Implantatkörper aus Titanoxid oder anderen metallischen Werkstoffen ermöglicht.

Die WO-2009/009911 A1 offenbart ein Zahnersatzsystem, bei dem durch das formschlüssige Zusammenwirken von Arretiermitteln an einer proximalen Abutmentbasis und mindestens einer Innenwand des proximalen Abschnittes einer Aufnahmeöffnung im Implantatkörper das Abutment in mindestens zwei radialen Winkelstellungen positionierbar ist. Die Arretiermittelpaarungen basieren vorzugsweise auf regelmässigen Mehrkanten. Durch die einfachen Herstellungsmöglichkeiten besteht volle Freiheit bei der Materialauswahl, so dass auch bei diesem Zahnersatzsystem beide Bauteile in allen möglichen Materialkombinationen zum Einsatz kommen können.

Es ist eine Aufgabe der vorliegenden Erfindung, eine Zahnersatzanordnung zu schaffen, welche die Vorteile eines Implantatkörpers aus Keramik und einer lösbaren Schraubverbindung zwischen dem Implantatkörper und dem Abutment vereinigt, die genannten Nachteile der DE-103'40'059 A1 jedoch vermeidet. Insbesondere soll das Abutment gegen Verschiebungen in axialer Richtung und gegen Verdrehungen um die Längsachse gesichert sein. Der Einbau und die Fixierung des Abutments im Implantatkörper soll trotzdem einfach sein.

Diese und andere Aufgaben werden durch die erfindungsgemässe Zahnersatzanordnung gelöst, wie sie im ersten Patentanspruch definiert ist. Vorteilhafte Ausführungsformen sind in den abhängigen Ansprüchen angegeben.

Die Grundidee der Erfindung ist es, Verriegelungsmittel vorzusehen, mittels derer eine Gewindehülse im einer Implantatkörperinnenbohrung formschlüssig verankert wird. Das Abutment kann dann in an sich bekannter Weise mittels einer in die Gewindehülse eingreifenden Schraube, vorzugsweise einer Kopfschraube am Implantatkörper befestigt werden. Diese Anordnung kommt ohne Klebstoff oder Zement aus, auch wenn stoffschlüssige Verbindungen gemäss der Erfindung nicht ausgeschlossen sind. Somit kann das Abutment bei Bedarf zerstörungsfrei aus dem Implantatkörper gelöst werden.

Die erfindungsgemässe Zahnersatzanordnung umfasst einen enossalen Implantatkörper zur Verankerung der Zahnersatzanordnung in einem Kieferknochen. Der Implantatkörper weist eine Innenbohrung auf. In der Implantatkörperinnenbohrung ist eine Gewindehülse form- und/oder kraftschlüssig verankerbar. Ein Abutment, das zur Aufnahme einer Suprakonstruktion dient, weist eine Abutmentinnenbohrung auf. Eine Schraube, vorzugsweise eine Kopfschraube, dient zur Verbindung des Abutments mit dem Implantatkörper, wobei ein Formschlussmittel, vorzugsweise der Kopf der Kopfschraube formschlüssig in der Abutmentinnenbohrung abgestützt ist und ein Gewindeteil der Kopfschraube in die Gewindehülse eingreift. Die Gewindehülse ist mittels Verriegelungsmittel in der Implantatkörperinnenbohrung formschlüssig verankert. Die Verriegelungsmittel sind mit der Gewindehülse wirkverbunden und an dieser befestigt, einstückig mit dieser hergestellt oder in der Implantatkörperinnenbohrung angebracht.

In einer bevorzugten Ausführungsform sind die Verriegelungsmittel in einer Ringnut abgestützt, die in einer Wand der Implantatkörperinnenbohrung angebracht ist. Die Verriegelungsmittel können als ein in radialer Richtung nach aussen spreizbares

Verriegelungsbauteil ausgebildet sein, welches in einem ungespreizten Zustand in die Implantatkörperinnenbohrung einführbar ist und in einem gespreizten Zustand in die Ringnut eingreift. Zu diesem Zweck kann das Verriegelungsbauteil mindestens zwei flügelartige, in einer zu einer Längsachse senkrechten Ebene angeordnete Sektoren beinhalten, die
5 durch dehbare, vorzugsweise elastische Verbindungsmittel miteinander verbunden sind. Das Verriegelungsbauteil kann eine Bohrung aufweisen, in welche ein konusförmiges Ende der Gewindehülse eindringt, um das Verriegelungsbauteil nach aussen zu spreizen.

Das erfindungsgemässe Verriegelungsbauteil für eine erfindungsgemässe Zahnersatzanordnung ist von einem Einführzustand, in dem es eine erste seitliche Ausdehnung hat, in einen
10 Endzustand überführbar, in dem es eine zweite seitliche Ausdehnung hat, die grösser ist als die erste seitliche Ausdehnung.

In einer bevorzugten Ausführungsform beinhaltet das Verriegelungsbauteil mindestens zwei flügelartige, in einer zu einer Längsachse senkrechten Ebene angeordnete Sektoren, die durch dehbare, vorzugsweise elastische Verbindungsmittel miteinander verbunden sind.
15 Das Verriegelungsbauteil kann eine Bohrung aufweisen und infolge eines Eindringens eines konusförmigen Gegenstandes in die Bohrung nach aussen spreizbar sein.

In einer weiteren bevorzugten Ausführungsform sind Gewindehülse und Verriegelungsmittel einstückig ausgebildet. Die formschlüssige Verankerung in einer in der der Implantatkörperinnenbohrung umlaufenden Ringnut wird durch eine Mehrzahl von
20 Verriegelungsmitteln erreicht, die als Abschnitte einer nach aussen stehenden Radialrippe auf jeweils einzelnen voneinander beabstandeten flexiblen Zungen im proximalen Bereich der Gewindehülse angeordnet sind. Beim Einführen der Gewindehülse in die Implantatkörperinnenbohrung erlauben es die flexiblen Zungen, dass die Radialrippen zusammengepresst werden und beim Erreichen der Ringnut im wesentlichen in einer zu
25 einer Längsachse senkrechten Ebene in ihre äussere Radialposition schnappen und die

Gewindehülse verriegeln. Durch das Einschrauben der Kopfschraube wird einerseits das Abutment mit dem Implantatkörper verbunden, andererseits ist die Länge der Schraube so bemessen, dass sie tief genug in die Gewindehülse eindringt um ein radiales Zusammenpressen der flexiblen Zungen gegen Innen zu verhindern. Zum Entfernen des
5 Abutments wird die Schraube gelöst und teilweise herausgedreht. Sobald der proximale Bereich der Gewindehülse mit den flexiblen Zungen freigegeben ist, kann diese durch entsprechenden Zug an der Schraube aus der Implantatkörperinnenbohrung herausgezogen werden, da die Zungen nun nach innen gedrückt werden können. Um das Einführen und das Herausziehen der Gewindehülse zu erleichtern werden die Verriegelungsmittel vorzugsweise
10 in axialer Richtung abgerundet oder zumindest angeschrägt ausgebildet. Die Gewindehülse kann derart ausgebildet sein, dass die proximalen Enden der Zungen in Ruheposition zur Längsachse hin geneigt sind und erst durch das Eindrehen der Schraube nach aussen gespreizt werden.

Im erfindungsgemässen Verfahren zum Aufbau einer erfindungsgemässen Zahnersatzanord-
15 nung wird die Kopfschraube von einer distalen Seite her in die Abutmentinnenbohrung eingeführt, so dass ihr Gewindeteil auf einer proximalen Seite aus dem Abutment herausragt. Gemäss einer Ausführungsform wird das Verriegelungsbauteil mit seiner Bohrung auf den Gewindeteil aufgesetzt und mit der Gewindehülse gesichert. Die so zusammengehaltenen Elemente werden in die Implantatkörperinnenbohrung eingeführt. Die Kopfschraube wird
20 fester angezogen, so dass das konusförmige Ende der Gewindehülse in die Verriegelungsbauteilbohrung gedrückt wird. Das Verriegelungsbauteil wird durch das Eindringen des konusförmigen Endes der Gewindehülse nach aussen in die Ringnut gespreizt.

Als Hauptvorteil der erfindungsgemässen Zahnersatzanordnung wird die Möglichkeit der
25 reversiblen Verbindung zwischen dem Implantatkörper und dem Abutment angesehen. Trotzdem kann der Implantatgrundkörper vollständig metallfrei, z. B. aus einem Keramikmaterial,

gestaltet werden. Auch das Abutment kann komplett metallfrei ausgeführt werden, z. B. aus „gehipptem“ (d. h. mit dem isostatischen Heisspressverfahren, englisch hot isostatic pressing, abgekürzt HIP, hergestellten) Keramikmaterial. Der Aufbau der erfindungsgemässen Zahnersatzanordnung ist keramikgerecht und insbesondere spannungsfrei. Seine mechanische Festigkeit genügt den Anforderungen. Die Winkellage des Abutments kann beim Einbau gewählt werden, z. B. aus sechs Positioniermöglichkeiten. Die Zahnersatzanordnung ist vergleichsweise kostengünstig herstellbar.

Die für die erfindungsgemässe Zahnersatzanordnung benötigten Implantatkörper sind im Wesentlichen mit den bereits bekannten und bewährten Implantatkörpern identisch. Der Implantatkörper der erfindungsgemässen Zahnersatzanordnung kann ausserhalb der vorliegenden Erfindung für eine stoffschlüssige Verbindung mit einem Abutment verwendet werden. Diese Verwendbarkeit des Implantatkörpers sowohl in als auch ausserhalb der erfindungsgemässen Zahnersatzanordnung erhöht die Wirtschaftlichkeit, weil dank der verschiedenen Verwendungsmöglichkeiten grössere Stückzahlen hergestellt und damit die Herstellungskosten gesenkt werden können. Zudem wird die Lagerhaltung beim Händler und in der Praxis vereinfacht, da sich ein einziger Implantattyp sowohl für Schraubverbindungen und auch für Klebeverbindungen der Abutments verwenden lässt.

Nachfolgend werden bevorzugte Ausführungsformen der Erfindung mit Bezugnahme auf die beiliegenden Zeichnungen detailliert erläutert.

Figur 1 zeigt eine Explosionszeichnung einer ersten Ausführungsform der erfindungsgemässen Zahnersatzanordnung.

Figur 2 zeigt wesentliche Teile der Zahnersatzanordnung von Fig. 1 (a) in einer Frontalansicht und (b) in einem Längsschnitt.

- Figur 3 zeigt die zusammengesetzte Zahnersatzanordnung von Fig. 1 (a) in einer Frontalansicht und (b) in einem Längsschnitt.
- Figur 4 zeigt einen Implantatkörper der Zahnersatzanordnung von Fig. 1 (a) in einer Frontalansicht und (b) in einem Längsschnitt.
- 5 Figur 5 zeigt ein Abutment und weitere Elemente der Zahnersatzanordnung von Fig. 1 in einem Einführzustand (a) in einer Frontalansicht und (b) in einem Längsschnitt.
- Figur 6 zeigt das Abutment von Fig. 6 in einem Endzustand, in welchem das Verriegelungsmittel gespreizt ist.
- 10 Figur 7 zeigt eine erste Ausführungsform eines Verriegelungsmittels für die erfindungsgemäße Zahnersatzanordnung (a) in einer perspektivischen Ansicht, (b) in einer Draufsicht und (c) in einer Seitenansicht.
- Figur 8 zeigt einen Teil einer zweiten Ausführungsform eines Verriegelungsmittels für die erfindungsgemäße Zahnersatzanordnung (a) in einer perspektivischen Ansicht, (b) in einer Draufsicht und (c) in einem Querschnitt.
- 15 Figur 9 zeigt eine dritte Ausführungsform eines Verriegelungsmittels für die erfindungsgemäße Zahnersatzanordnung (a) in einer perspektivischen Ansicht, (b) in einer Rückansicht und (c) in einer Draufsicht.
- Figur 10 zeigt einen Teil einer vierten Ausführungsform eines Verriegelungsmittels für die erfindungsgemäße Zahnersatzanordnung (a) in einer perspektivischen Ansicht, (b) in einer Rückansicht und (c) in einer Draufsicht.
- 20

Figur 11 zeigt eine fünfte Ausführungsform eines Verriegelungsmittels für die erfindungsgemässe Zahnersatzanordnung (a) in einer perspektivischen Ansicht, (b) in einer Draufsicht und (c) in einer Frontalansicht.

Figur 12 zeigt einen Implantatkörper einer zweiten Ausführungsform der erfindungsgemässen Zahnersatzanordnung (a) in einer Draufsicht und (b) in einem Längsschnitt.

Figur 13 zeigt ein Abutment der Ausführungsform gemäss Fig. 12 in einer Draufsicht.

Figur 14 zeigt zwei Füllelemente der Ausführungsform gemäss Fig. 12 in einer Draufsicht.

Figur 15 zeigt eine Explosionszeichnung einer weiteren Ausführungsform der erfindungsgemässen Zahnersatzanordnung.

Figur 16 zeigt wesentliche Teile der Zahnersatzanordnung von Fig. 15 (a) in einer Frontalansicht und (b) in einem Längsschnitt.

Figur 17 zeigt die zusammengesetzte Zahnersatzanordnung von Fig. 15 (a) in einer Frontalansicht und (b) in einem Längsschnitt.

Eine erste Ausführungsform der erfindungsgemässen Zahnersatzanordnung 1 bzw. Teile davon sind in den Figuren 1-6 in verschiedenen Ansichten und Schnittzeichnungen dargestellt, dazu passende Verriegelungsmittel 4 in den Figuren 7-11.

Die Zahnersatzanordnung 1 beinhaltet einen enossalen Implantatkörper 2 zur Verankerung
5 der Zahnersatzanordnung 1 in einem (hier nicht eingezeichneten) Kieferknochen. Der Implantatkörper 2 weist in seinem oberen (distalen) Bereich eine nicht durchgehende Innenbohrung 21 auf, die im Wesentlichen coaxial mit einer Längsachse 10 des Implantatkörpers 2 bzw. der Zahnersatzanordnung 1 verläuft. Der Implantatkörper 2 besteht vorzugsweise aus einem Keramikmaterial (z. B. ZERAMEX®) oder einem biokompatiblen
10 Metall wie Titan. Somit entspricht der Implantatkörper 2 in grossen Teilen den aus dem Stand der Technik bekannten, bewährten Implantatkörpern.

Die Implantatkörperinnenbohrung 21 dient der Verankerung einer Gewindehülse 3, auf deren Funktion weiter unten eingegangen wird. Die Gewindehülse 3 kann z. B. aus Stahl, Titan, einem Kunststoff oder einem Keramikmaterial bestehen.

15 Ferner beinhaltet die Zahnersatzanordnung 1 ein Abutment 5 zur Aufnahme einer (hier nicht eingezeichneten) Suprakonstruktion, bspw. einer Krone oder einer Brücke. Das Abutment 5 kann z. B. aus einer Zirkonoxidkeramik bestehen. Es weist eine durchgehende Innenbohrung 51 auf, die im Wesentlichen coaxial mit der Längsachse 10 des Abutments bzw. der Zahnersatzanordnung 1 verläuft.

20 Die Abutmentinnenbohrung 51 nimmt eine Kopfschraube 6 zur Verbindung des Abutments 5 mit dem Implantatkörper 2 auf. Ein Kopf 61 der Kopfschraube 6 ist formschlüssig in der Abutmentinnenbohrung 51 abgestützt, bspw. an einer im Inneren der Abutmentinnenbohrung 51 angebrachten umlaufenden Schulter 52. Ein Gewindeteil 62 der Kopfschraube 6 mit einem Aussengewinde greift in ein entsprechendes Innengewinde 31 der Gewindehülse

3 ein. Die Kopfschraube 6 kann z. B. aus Stahl, Titan, einem Kunststoff oder einem Keramikmaterial bestehen.

Die Gewindehülse 3 ist mittels eines formschlüssig in der Implantatkörperinnenbohrung 21 abgestützten Verriegelungsmittels 4 in der Implantatkörperinnenbohrung 21 verankert. In
5 der ersten Ausführungsform der Figuren 1-11 ist das Verriegelungsmittel als separates Verriegelungsbauteil 4 ausgebildet. Das Verriegelungsbauteil 4 ist mittels einer Bohrung 41 auf die Kopfschraube 6 aufgesetzt und in einer Ringnut 23 abgestützt, die in einer Wand der Implantatkörperinnenbohrung 21 angebracht ist. Das Verriegelungsbauteil 4 ist so beschaffen, dass in einem Einführzustand, in dem es in die Implantatkörperinnenbohrung
10 21 eingeführt wird, seine maximale radiale Ausdehnung kleiner ist als ein Durchmesser der Implantatkörperinnenbohrung, so dass es durch eine obere (distale) Öffnung 22 in die Implantatkörperinnenbohrung 21 eingeführt werden kann. Dieser Einführzustand ist in Figur 5 gezeigt. In einem Endzustand, der in den Figuren 3 und 6 gezeigt ist, hat das Verriegelungsbauteil 4 hingegen eine radiale Ausdehnung, die grösser ist als der Durchmesser der Implantatkörperinnenbohrung 21 und gerade noch in die Ringnut 23 passt. So
15 kommt ein Formschluss zwischen dem Verriegelungsbauteil 4 und der Ringnut 23 zustande.

Nachfolgend wird das Einsetzen, d. h. das Einführen und das Befestigen des Abutments 5 im bereits inserierten Implantatkörper 2 beschrieben. Die Kopfschraube 6 wird von oben in die Abutmentinnenbohrung 61 eingeführt, so dass ihr unterer Gewindeteil 62 aus einer unteren
20 (proximalen) Öffnung aus dem Abutment 5 herausragt. Von unten wird das Verriegelungsbauteil 4 mit seiner Bohrung 41 auf den Gewindeteil 62 aufgesetzt und mit der Gewindehülse 3 gesichert. Die Kopfschraube 6 wird angezogen, aber nur so leicht, dass das Verriegelungsbauteil 4 in seinem Einführzustand (siehe Figur 5) verbleibt. Die so zusammengehaltenen Elemente 3-6 werden nun von oben in die Implantatkörperinnenbohrung 21 eingeführt. Wenn sie ihre Endlage in der Implantatkörperinnenbohrung 21 erreicht haben, wird die Kopfschraube 6 fester angezogen. Dadurch wird ein konusförmiges oberes
25

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Ende 32 der Gewindehülse 3 in die Verriegelungsbauteilbohrung 41 gedrückt. Beim Eindringen des konusförmigen Endes 32 der Gewindehülse 3 wird die axiale Kraft durch die Keilwirkung in eine radiale Kraft umgewandelt, welche das Verriegelungsbauteil 4 nach aussen in die Ringnut 23 spreizt. Der gespreizte Endzustand ist in Figur 6 dargestellt.

5 Der Endzustand ist in Figur 3 gezeigt. Das gespreizte Verriegelungsbauteil 4 stützt sich in der Ringnut 23 ab und verankert so die Gewindehülse 3 in der Implantatkörperinnenbohrung 21. Das Abutment 5 wird mit einer durch die Anziehung der Kopfschraube 6 definierten axialen Kraft gegen einen oberen Rand 24 des Implantatkörpers 2 und gegen das im Implantatkörper 2 abgestützte Verriegelungsbauteil 4 gedrückt. Das Verriegelungsbauteil 4
10 wird durch einen zylindrischen Teil 33 am oberen Ende der Gewindehülse 3 in Position gehalten und fest zwischen dem Abutment 5 und Stützflanken 34 der Gewindehülse 3 verspannt. Durch den zylindrischen Teil 33 der Gewindehülse 3 wird die Kopfschraube 6 von den durch das Verspannen des Verriegelungsbauteils 4 auftretenden Zugkräften entlastet. Dies ermöglicht es, nach dem Einbau des Abutments 5 die metallische Kopfschraube 6 zu
15 entfernen und durch eine bspw. aus Kunststoff bestehende (nicht eingezeichnete) Sicherungsschraube zu ersetzen. So kann ein völlig metallfreier Aufbau der Zahnersatzanordnung 1 realisiert werden.

Die Implantatkörperinnenbohrung 21 kann einen vieleckigen, vorzugsweise einen dreieckigen, Querschnitt haben. Die Gewindehülse 3 ihrerseits hat einen dazu passenden, vorzugsweise sechseckigen, Aussenquerschnitt. Der Aussenquerschnitt der Stützflanken 34 der
20 Gewindehülse 3 und ein zwischen die Stützflanken 34 eingreifender unterer Teil 54 des Abutments 5 sind ebenfalls aufeinander angepasst, vorzugsweise in der Form eines Dreikants. Diese Vielkantkonstruktion sichert im Endzustand das Abutment 5 gegen Verdrehung um die Längsachse 10 im Implantatkörper 2. Ausserdem ermöglicht sie beim Einsetzen eine
25 Rotationspositionierung des Abutments 5. Mit den bevorzugten Dreikanten bzw. Sechskanten sind, analog zum bekannten ZERAMEX®-Aufbau, sechs Positionen möglich, die jeweils

um 60° gegeneinander gedreht sind. Selbstverständlich sind Drehsymmetrien mit anderen Drehsymmetriewinkeln sowie auch nicht drehsymmetrische Anordnungen möglich.

Oberhalb des Verriegelungsmittels 4 ist ein zylindrischer Abutmentpfosten 53 in einem zylindrischen Teil der Implantatkörperinnenbohrung 21 passgenau eingesetzt. Dies
5 gewährleistet einen guten Halt in radialer Richtung. Durch Anpassen der Toleranzen des Abutmentpfostens 54 können Mikrobewegungen minimiert werden. Damit kein Blut und Speichel in die Implantatkörperinnenbohrung 21 gelangt, kann auf den oberen Rand 24 des Implantatkörpers 2 eine (nicht eingezeichnete) flexible Dichtmasse aufgetragen werden. Die Dichtmasse nimmt zusätzlich Mikrobewegungen auf und dämpft sie.

10 Die Figuren 7-11 zeigen fünf verschiedene Ausführungsformen des Verriegelungsbauteils 4, wie es für die erfindungsgemässe Zahnersatzanordnung 1 gemäss den Figuren 1-6 benötigt wird. Das Verriegelungsbauteil 4 kann aus Stahl, Titan, Kunststoff oder Keramik bestehen.

Das einstückige Verriegelungsbauteil 4 der Figur 7 besteht im Wesentlichen aus drei in einer zur Längsachse 10 senkrechten Ebene drehsymmetrisch angeordneten Flügeln 42.1-42.3,
15 die durch einen elastischen, die Bohrung 41 umgebenden Ring 43 zusammen gehalten werden. Durch das oben beschriebene Eindringen des konusförmigen Endes 32 der Gewindehülse 3 in die Bohrung 41 werden der Ring 43 gedehnt und die Flügel 42.1-42.3 nach aussen in die Ringnut 23 gedrückt.

In der Ausführungsform von Figur 8 sind die drei Flügel des Verriegelungsbauteils 4 als
20 separate sektorartige Teile ausgebildet, von denen in Figur 8 nur ein Flügel 42.1 dargestellt ist. Sie werden von einem dehnbaren, vorzugsweise elastischen (nicht eingezeichneten) Ring zusammengehalten, der in Nuten 44 eingesetzt ist.

Die Ausführungsform von Figur 9 ist einstückig ausgebildet. Die drei Flügel 42.1-42.3 sind untereinander mittels dehnbarer Verbindungselemente 43.1-43.3 verbunden, die derart ausgebildet sind, dass sie ein Entfernen der Flügel 42.1-42.3 von der Längsachse 10 und voneinander erlauben.

- 5 In der Ausführungsform von Figur 10 sind die drei Flügel 42.1-42.3 des Verriegelungsbauteils 4 wiederum als separate sektorartige Teile ausgebildet. Sie weisen jeweils zwei Haken 44 auf. Auf die benachbarten Haken 44 zweier Flügel kann ein (nicht eingezeichnetes) dehnbares, bspw. ringförmiges Verbindungselement aufgesetzt werden, um die Flügel 42.1-42.3 zusammen zu halten.
- 10 Das Verriegelungsbauteil 4 von Figur 11 hat die Form eines Rings, der an einer Stelle einen radialen Schlitz 45 aufweist. Somit kann das Verriegelungsbauteil 4 nach aussen gespreizt werden.

- Eine zweite Ausführungsform der erfindungsgemässen Zahnersatzanordnung 1 bzw. Teile davon sind in den Figuren 12-14 dargestellt. Analoge Elemente sind mit denselben
- 15 Bezugszeichen bezeichnet wie in den Figuren 1-6 und brauchen hier nicht erneut erklärt zu werden.

- Im Unterschied zur ersten Ausführungsform der Figuren 1-11 wird hier nicht ein separates Verriegelungsmittel eingesetzt. Vielmehr wird das Verriegelungsmittel 4 durch die äussere Form der Gewindehülse 3 selbst gebildet, nämlich durch zwei einander gegenüber liegende
- 20 Flügel 42.1, 42.2, die sich in axialer Richtung vorzugsweise über die gesamte Länge der Gewindehülse 3 erstrecken. Die Implantatkörperinnenbohrung 21 weist zwei einander gegenüber liegende Vorsprünge 25.1, 25.2 auf, die derart an die Flügel 42.1, 42.2 bzw. an zwischen den Flügeln 42.1, 42.2 liegende Längsnuten 46.1, 46.2 an der Aussenwand der Gewindehülse 4 angepasst sind, dass die Gewindehülse 4 in die Implantatkörperinnenboh-

5 rung 21 eingesetzt werden kann. Nach dem Einsetzen wird die Gewindehülse 4 in der Implantatkörperinnenbohrung 21 um die Längsachse 10 rotiert, bis sie eine Lage einnimmt, in welcher sie durch ein Zusammenwirken der Flügel 42.1, 42.2 mit den Vorsprüngen 25.1, 25.2 formschlüssig verankert ist. Im Beispiel der Figuren 12 und 13 wird die Gewindehülse 3 zur Verankerung um 90° um die Längsachse 10 rotiert. Um die Rotation zuzulassen, hat die Implantatkörperinnenbohrung 21 zumindest im unteren Teil, der die Gewindehülse aufnimmt, einen kreisrunden Querschnitt und ist vorzugsweise zylindrisch. In dieser Ausführungsform wird also die Gewindehülse 3 mittels einer Art Bajonettverschluss im Implantatkörper 2 verankert.

10 Die in axialer Richtung verankerte Gewindehülse 3 muss noch gegen Verdrehung um die Längsachse 10 gesichert werden. Dies kann z. B. durch das Einsetzen zweier Sicherungselemente 7.1, 7.2 in die frei stehenden Längsnuten 46.1, 46.2 erfolgen. Solche Sicherungselemente 7.1, 7.2 sind in Figur 14 in einer Draufsicht dargestellt. Sie ragen im eingesetzten Zustand in axialer Richtung über die Gewindehülse 4 hinaus und stützen sich an den
15 Vorsprüngen 25.1, 25.2 ab. Für eine noch bessere Verankerung können mehrere Vorsprünge übereinander, d. h. in axialer Richtung versetzt, angeordnet sein, wobei die Aussenwand der Gewindehülse 3 entsprechend angepasst sein muss. Auch in dieser Ausführungsform sind anderszählige Drehsymmetrien oder nicht drehsymmetrische Anordnungen möglich.

20 In einer hier zeichnerisch nicht dargestellten Alternative zur zweiten Ausführungsform der Figuren 12-14 können die Verriegelungsmittel als an der Gewindehülse angebrachte Flügel ausgebildet sein, die sich nur über einen Teil der Länge der Gewindehülse erstrecken. Sie können, analog zur ersten Ausführungsform der Figuren 1-6, zwecks formschlüssiger Verankerung in eine Ringnut in der Implantatkörperinnenbohrung eingreifen. Um das Einsetzen der Gewindehülse zu ermöglichen, weist der obere Teil der
25 Implantatkörperinnenbohrung Längsnuten auf, in welche die Flügel passen. Wenn die Gewindehülse ihre endgültige axiale Lage erreicht hat, wird sie wiederum so um die Längs-

achse gedreht, dass die Flügel in die Ringnut eingreifen. Danach muss die Gewindehülse noch gegen Verdrehung um die Längsachse gesichert werden, was analog zur Ausführungsform der Figuren 12-14 oder auf andere geeignete Weise erfolgen kann. Auch in dieser Alternative kommt also eine Art Bajonettverschluss zum Einsatz.

- 5 Eine weitere Ausführungsform der erfindungsgemässen Zahnersatzanordnung 100 bzw. Teile davon sind in den Figuren 15 bis 17 in verschiedenen Ansichten und Schnittzeichnungen dargestellt.

Die Zahnersatzanordnung 100 beinhaltet einen enossalen Implantatkörper 102 zur Verankerung der Zahnersatzanordnung 100 in einem (hier nicht eingezeichneten)
10 Kieferknochen. Der Implantatkörper 102 weist in seinem oberen (distalen) Bereich eine nicht durchgehende Innenbohrung 121 auf, die im Wesentlichen coaxial mit einer Längsachse 110 des Implantatkörpers 102 bzw. der Zahnersatzanordnung 100 verläuft. Der Implantatkörper 102 besteht vorzugsweise wiederum aus einem Keramikmaterial (z. B. ZERAMEX®) oder einem biokompatiblen Metall wie Titan.

- 15 Die Implantatkörperinnenbohrung 121 dient der Verankerung einer Gewindehülse 103, auf deren Funktion weiter unten eingegangen wird. Die Gewindehülse 103 kann z. B. aus Stahl, Titan oder einem Kunststoff bestehen.

Ferner umfasst die Zahnersatzanordnung 100 ein Abutment 105 zur Aufnahme einer (hier nicht eingezeichneten) Suprakonstruktion, bspw. einer Krone oder einer Brücke. Das Abutment 105 kann z. B. aus einer Zirkonoxidkeramik bestehen. Es weist eine durchgehende
20 Innenbohrung 151 auf, die im Wesentlichen coaxial mit der Längsachse 110 des Abutments bzw. der Zahnersatzanordnung 100 verläuft.

Die Abutmentinnenbohrung 151 nimmt wiederum eine Kopfschraube 106 zur Verbindung des Abutments 105 mit dem Implantatkörper 102 auf. Ein Kopf 161 der Kopfschraube 106 ist wie bereits oben beschrieben formschlüssig in der Abutmentinnenbohrung 151 abgestützt, bspw. an einer im Inneren der Abutmentinnenbohrung 151 angebrachten
5 umlaufenden Schulter 152. Ein Gewindeteil 162 der Kopfschraube 106 mit einem Aussengewinde greift in ein entsprechendes Innengewinde 131 der Gewindehülse 103 ein. Die Kopfschraube 106 kann z. B. aus Stahl, Titan, einem Kunststoff oder einem Keramikmaterial bestehen.

Die Gewindehülse 103 weist im proximalen Bereich eine Mehrzahl von Zungen 140 auf, die
10 durch parallel zur Längsachse geführte Einschnitte in der Gewindehülse 103 voneinander beabstandet sind. Als eigentliche Verriegelungsmittel dienen Radialrippen 104 die im proximalen Bereich der Zungen 140 radial nach aussen gerichtet sind und in eine korrespondierende Radialnut 123 am Grunde der Implantatkörperinnenbohrung 121 eingreifen können. In der Ausführungsform gemäss den Figuren 15 bis 17 ist das
15 Verriegelungsmittel als einstückig mit der Gewindehülse 103 verbundene Mehrzahl von Verriegelungsrippen 104 ausgebildet. Das Verriegelungsmittel 104 ist durch eine flexible Lagerung auf den Zungen 140 in Radialrichtung beweglich ausgebildet. Die Gewindehülse 103 mit den Verriegelungsrippen 104 ist so beschaffen, dass in einem Einführzustand, in dem sie in die Implantatkörperinnenbohrung 21 eingeführt wird, seine maximale radiale
20 Ausdehnung der Rippen kleiner ist als ein Durchmesser der Implantatkörperinnenbohrung, so dass es durch eine obere (distale) Öffnung 122 in die Implantatkörperinnenbohrung 121 eingeführt werden kann. In einem Endzustand, der in den Figuren 17(a) und 17(b) gezeigt ist, greifen die Verriegelungsrippen 104 mit einer maximalen radialen Ausdehnung, die grösser ist als der Durchmesser der Implantatkörperinnenbohrung 121 in die Ringnut 123
25 ein. So kommt ein Formschluss und allenfalls auch ein Kraftschluss zwischen der Verriegelung 104 der Gewindehülse 103 und der Ringnut 123 zustande.

Nachfolgend wird das Einsetzen, d. h. das Einführen und das Befestigen des Abutments 105 im bereits inserierten Implantatkörper 102 beschrieben. Die Kopfschraube 106 wird von oben in die Abutmentinnenbohrung 151 eingeführt, so dass ihr unterer Gewindeteil 161 aus einer unteren (proximalen) Öffnung aus dem Abutment 105 herausragt. Von unten wird
5 die Gewindehülse 103 mittels Formschlussmitteln 150 verdrehsicher auf den Abutmentstamm 154 aufgesteckt und teilweise auf den Gewindeteil 162 aufgeschraubt. Die Kopfschraube 6 wird soweit in die Gewindehülse eingeschraubt, dass der proximale Bereich mit den Zungen frei, respektive in seinem Einführzustand bleibt. Die so zusammengehaltenen Elemente 103, 105 und 106 werden nun von oben in die
10 Implantatkörperinnenbohrung 121 eingeführt, wobei die Rippen auf den flexiblen Zungen radial nach innen federn können. Wenn sie ihre Endlage in der Implantatkörperinnenbohrung 121 erreicht haben, wird die Kopfschraube 106 komplett eingedreht und fest angezogen. Dadurch dringt das Gewindeteil 162 zwischen die Zungen ein und fixiert diese und damit die Rippen in der Verriegelungsstellung. Je nach
15 Ausgestaltung der Zungen können diese auch zusätzlich von der Schraube nach aussen in die Ringnut 123 gespreizt werden. Der verriegelte Endzustand ist im Längsschnitt gemäss Figur 17(b) dargestellt.

Die Gewindehülse 103 mit ihren Rippen 104 greift in die Ringnut 123 ein und verankert sich in der Implantatkörperinnenbohrung 121. Das Abutment 105 wird mit einer durch das
20 Anziehen der Kopfschraube 106 definierten axialen Kraft gegen einen oberen Rand 124 des Implantatkörpers 102 und gegen die im Implantatkörper 102 abgestützte Gewindehülse gezogen.

Bei Kenntnis der Erfindung ist der Fachmann imstande, weitere Ausführungsformen abzuleiten, die ebenfalls zur vorliegenden Erfindung gehören.

Patentansprüche

1. Zahnersatzanordnung (1, 100), umfassend einen enossalen Implantatkörper (2, 102) zur Verankerung der Zahnersatzanordnung (1, 102) in einem Kieferknochen, wobei
5 der Implantatkörper (2, 102) eine Innenbohrung (21, 121) aufweist, eine in der Implantatkörperinnenbohrung (21, 121) verankerte Gewindehülse (3, 103), ein Abutment (5, 105) zur Aufnahme einer Suprakonstruktion, welches Abutment (5, 105) eine Abutmentinnenbohrung (51, 151) aufweist, und eine Kopfschraube (6, 106) zur Verbindung des Abutments (5, 105) mit dem Implantatkörper (2, 102), wobei ein
10 Kopf (61, 161) der Kopfschraube (6, 106) formschlüssig in der Abutmentinnenbohrung (51, 151) abgestützt ist und ein Gewindeteil (62, 162) der Kopfschraube (6, 106) in die Gewindehülse (3, 103) eingreift, dadurch gekennzeichnet, dass die Gewindehülse (3, 103) Verriegelungsmittel (4, 104) in der Implantatkörperinnenbohrung (21, 121) formschlüssig verankerbar ist.
15
2. Zahnersatzanordnung (1, 100) nach Anspruch 1, wobei die Verriegelungsmittel (4, 104) in eine Ringnut (23, 123) eingreifen und in dieser abgestützt sind, die in einer Wand der Implantatkörperinnenbohrung (21, 121) angebracht ist.
3. Zahnersatzanordnung (1) nach Anspruch 2, wobei die Verriegelungsmittel als ein in
20 radialer Richtung nach aussen spreizbares Verriegelungsbauteil (4) ausgebildet sind, welches in einem ungespreizten Zustand in die Implantatkörperinnenbohrung (21) einführbar ist und in einem gespreizten Zustand in die Ringnut (23) eingreift.
4. Zahnersatzanordnung (1) nach Anspruch 3, wobei das Verriegelungsbauteil (4) mindestens zwei flügelartige, in einer zu einer Längsachse (10) senkrechten Ebene

angeordnete Sektoren (42.1-42.3) beinhaltet, die durch dehnbare, vorzugsweise elastische Verbindungsmittel (43) miteinander verbunden sind.

5. Zahnersatzanordnung (1) nach Anspruch 3 oder 4, wobei das Verriegelungsbauteil (4) eine Bohrung (41) aufweist, in welche ein konusförmiges Ende (32) der Gewindehülse (3) eindringt, um das Verriegelungsbauteil (4) nach aussen zu spreizen.
5
6. Zahnersatzanordnung (1) nach einem der vorangehenden Ansprüche, wobei die Implantatkörperinnenbohrung (21), eine Aussenwand der Gewindehülse (3), die Verriegelungsmittel (4) und/oder ein in die Implantatkörperinnenbohrung (21) eingreifendes Ende (54) des Abutments (5) um eine Längsachse (10) dreh-symmetrisch ausgeführt sind und der Drehsymmetriewinkel vorzugsweise 120° oder 60° beträgt.
10
7. Zahnersatzanordnung (100) nach Anspruch 2, wobei eine Mehrzahl von Verriegelungsmitteln, als Abschnitte einer nach aussen stehenden Radialrippe (104) auf jeweils einzelnen voneinander beabstandeten flexiblen Zungen (140) im proximalen Bereich der Gewindehülse (103) angeordnet sind.
- 15 8. Zahnersatzanordnung (1, 100) nach einem der vorangehenden Ansprüche, wobei der Implantatkörper (2, 102) aus einem Keramikmaterial oder einem biokompatiblen Metall wie Titan, die Gewindehülse (3, 103) Stahl, Titan, einem Kunststoff oder einem Keramikmaterial, die Verriegelungsmittel (4, 104) aus Stahl, Titan, Kunststoff oder einem Keramikmaterial, das Abutment (5, 105) aus einer Zirkonoxidkeramik und/oder die Kopfschraube (6, 106) aus Stahl, Titan, einem Kunststoff oder einem
20 Keramikmaterial besteht.
9. Verriegelungsbauteil (4) für eine Zahnersatzanordnung (1) nach Anspruch 2, dadurch gekennzeichnet, dass es von einem Einführzustand, in dem es eine erste seitliche

Ausdehnung hat, in einen Endzustand überführbar ist, in dem es eine zweite seitliche Ausdehnung hat, die grösser ist als die erste seitliche Ausdehnung.

10. Verriegelungsbauteil (4) nach Anspruch 9, wobei das Verriegelungsbauteil (4) mindestens zwei flügelartige, in einer zu einer Längsachse (10) senkrechten Ebene angeordnete Sektoren (42.1-42.3) beinhaltet, die durch dehnbare, vorzugsweise elastische Verbindungsmittel (43) miteinander verbunden sind.
11. Verriegelungsbauteil (4) nach Anspruch 9 oder 10, wobei das Verriegelungsbauteil (4) eine Bohrung (41) aufweist und infolge eines Eindringens eines konusförmigen Gegenstandes (32) in die Bohrung (41) nach aussen spreizbar ist.
12. Verfahren zum Aufbau einer Zahnersatzanordnung (1) nach Anspruch 6, wobei die Kopfschraube (6) von einer distalen Seite her in die Abutmentinnenbohrung (51) eingeführt wird, so dass ihr Gewindeteil (62) auf einer proximalen Seite aus dem Abutment (5) herausragt, das Verriegelungsbauteil (4) mit seiner Bohrung (41) auf den Gewindeteil (62) aufgesetzt und mit der Gewindehülse (3) gesichert wird, die so zusammengehaltenen Elemente (3-6) in die Implantatkörperinnenbohrung (21) eingeführt werden, die Kopfschraube (6) fester angezogen wird, so dass das konusförmige Ende (32) der Gewindehülse (3) in die Verriegelungsbauteilbohrung (41) gedrückt wird, und das Verriegelungsbauteil (4) durch das Eindringen des konusförmigen Endes (32) der Gewindehülse (3) nach aussen in die Ringnut (23) gespreizt wird.

1/11

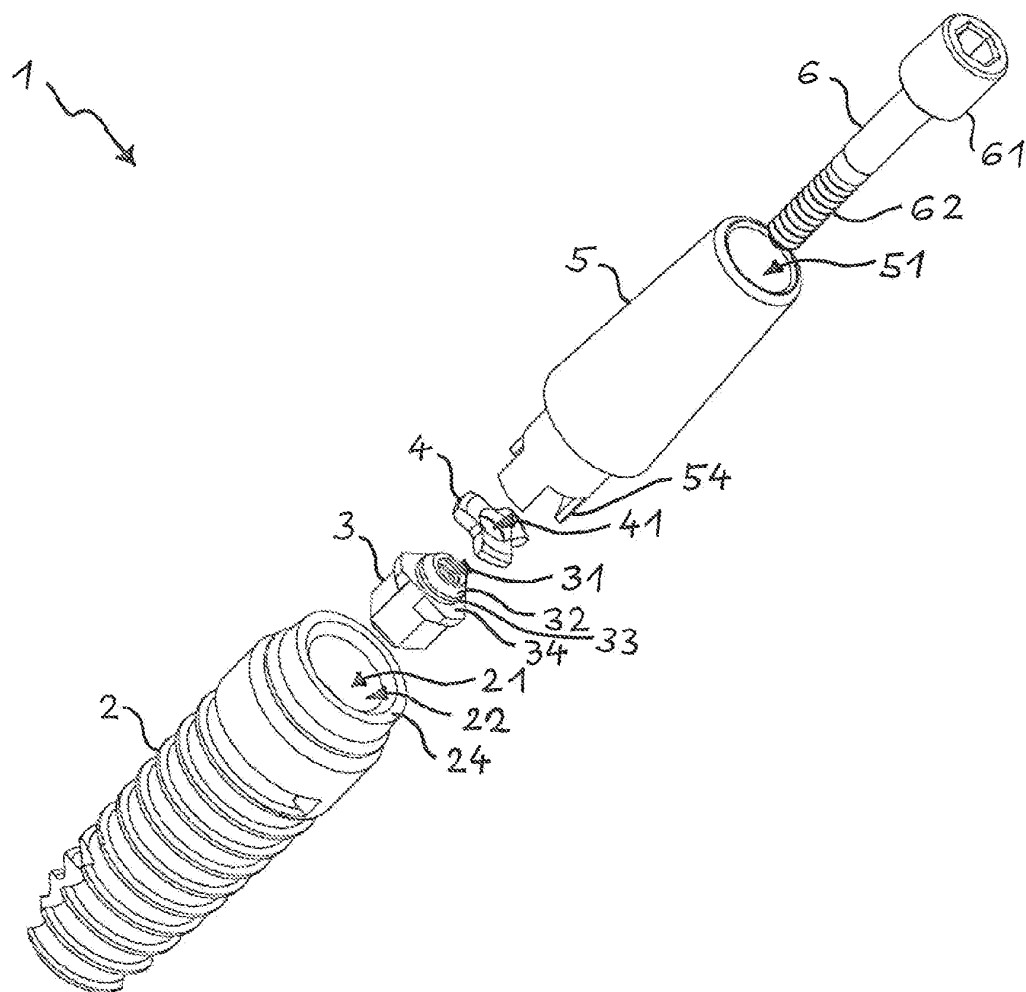


Fig. 1

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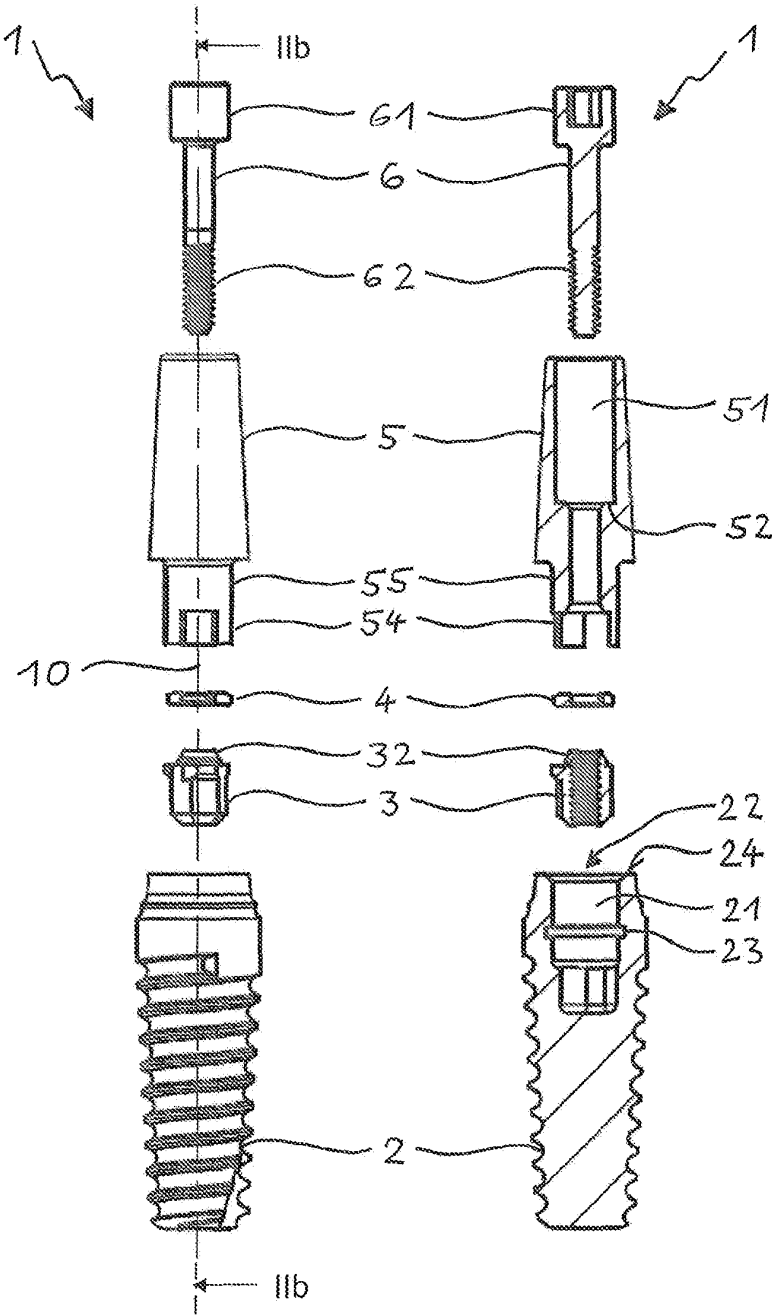


Fig. 2(a)

Fig. 2(b)

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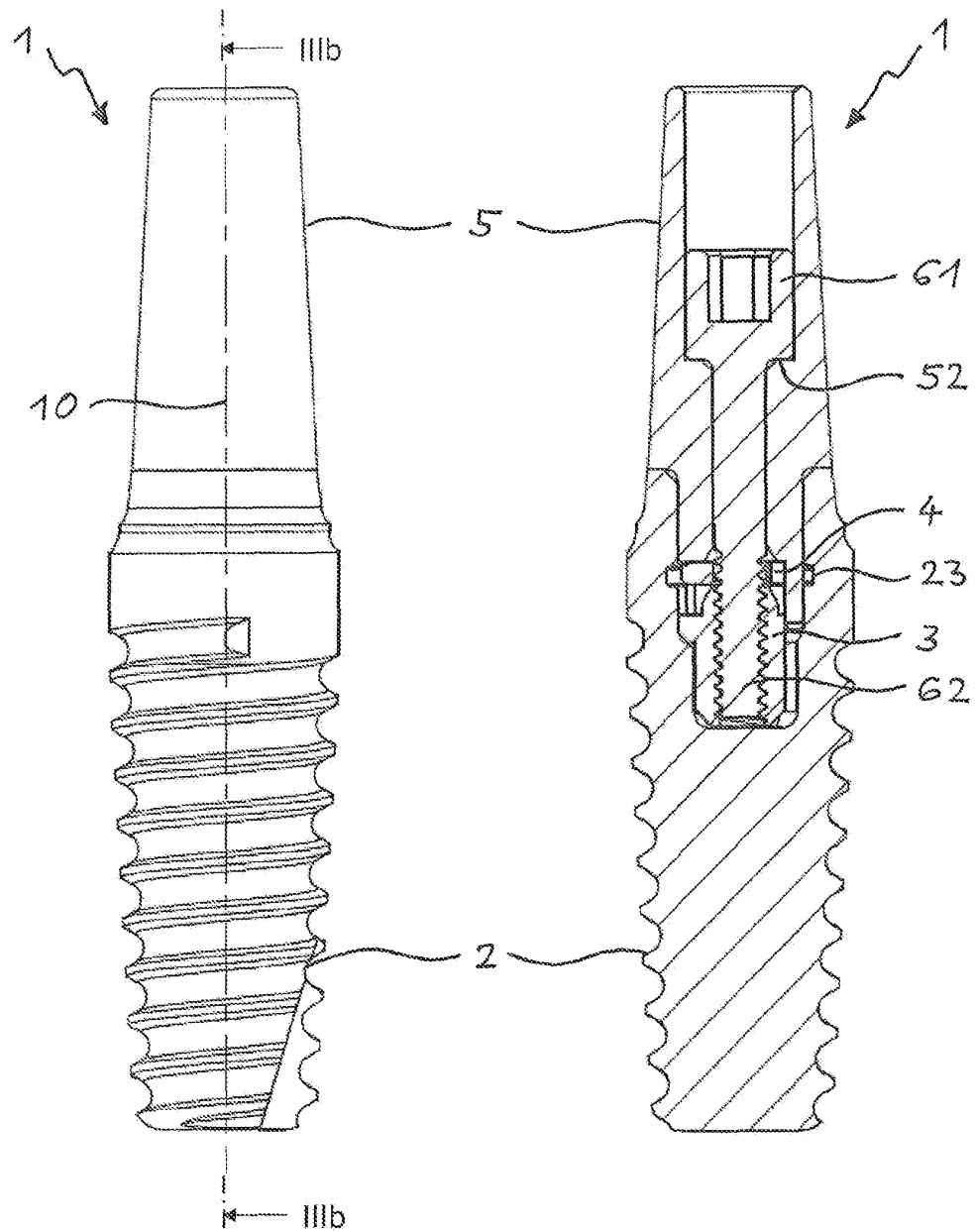


Fig. 3(a)

Fig. 3(b)

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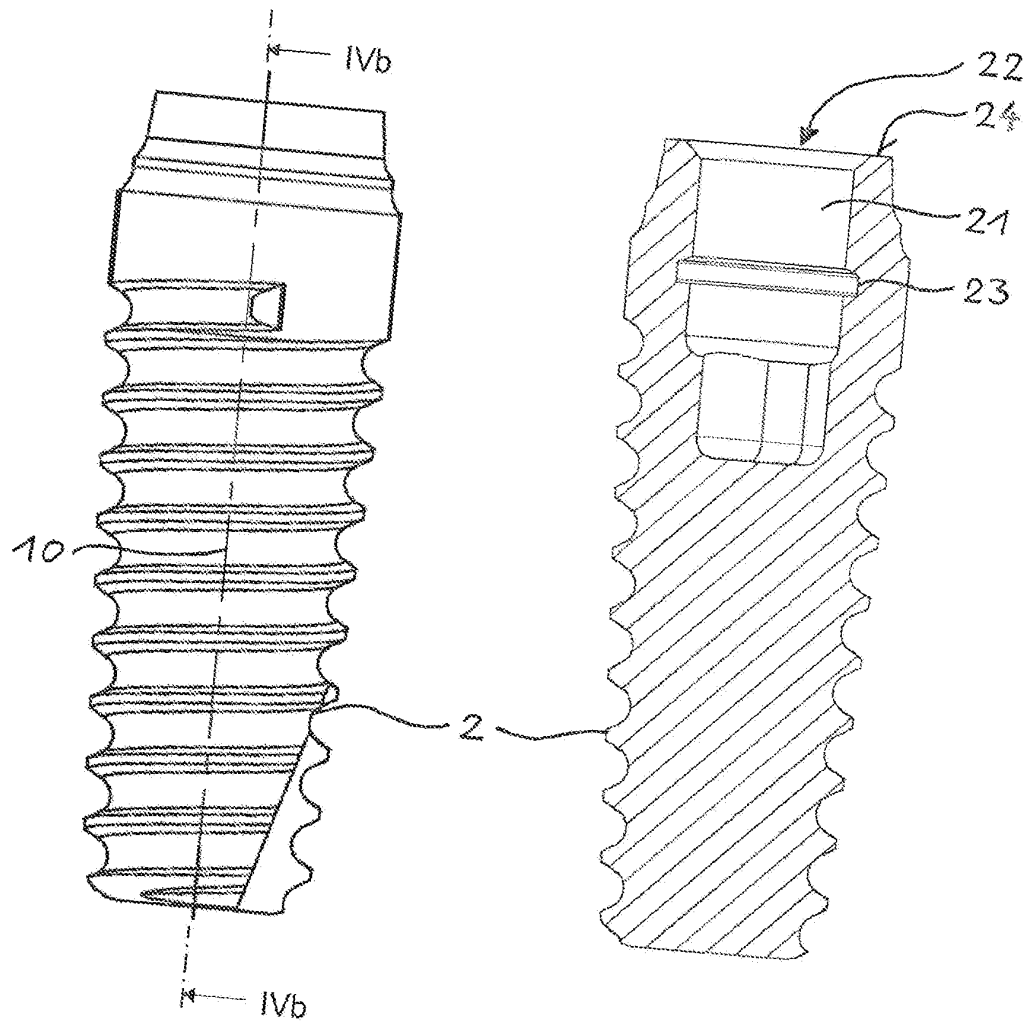


Fig. 4(a)

Fig. 4(b)

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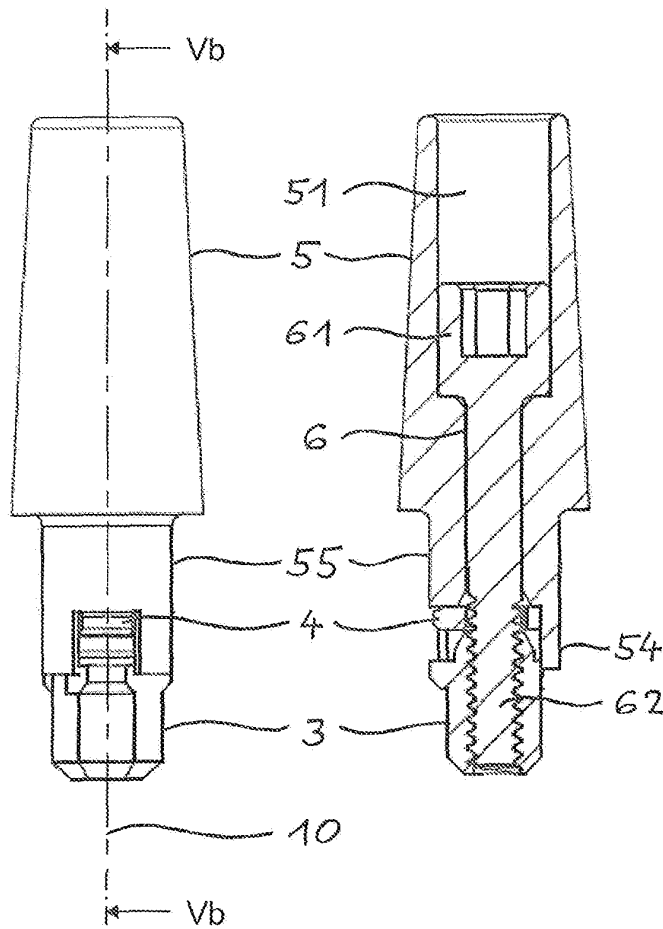


Fig. 5(a)

Fig. 5(b)

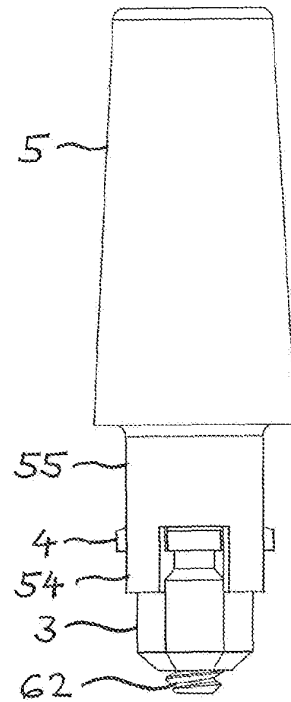


Fig. 6

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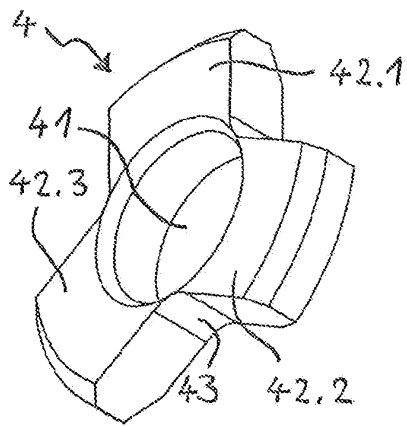


Fig. 7(a)

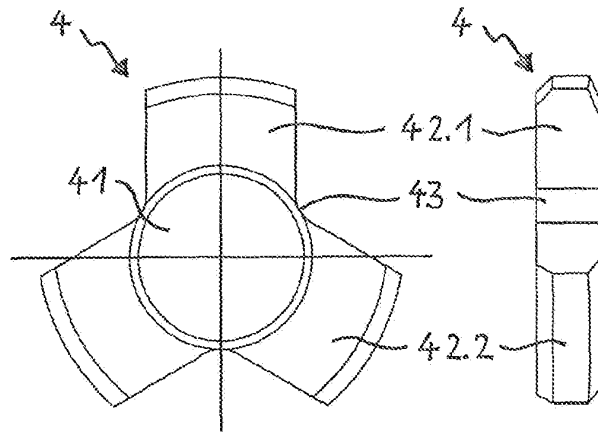


Fig. 7(b)



Fig. 7(c)

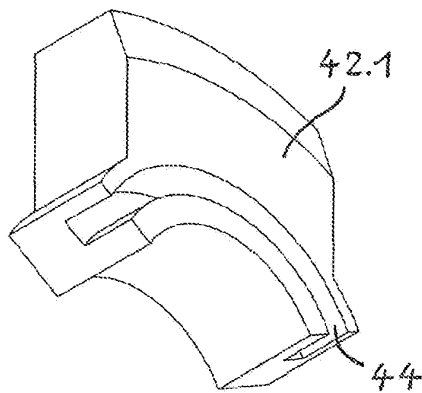


Fig. 8(a)

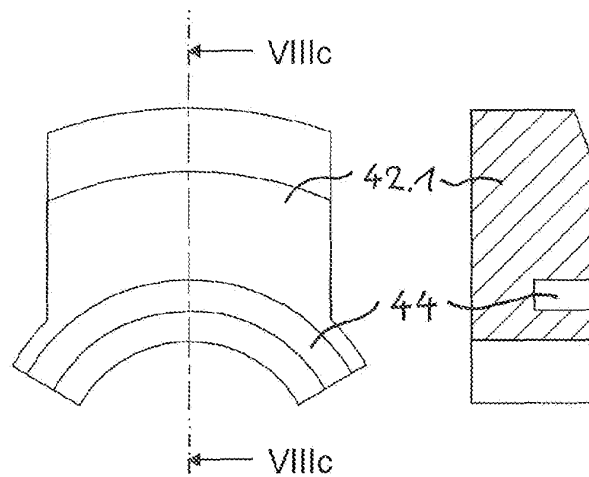


Fig. 8(b)



Fig. 8(c)

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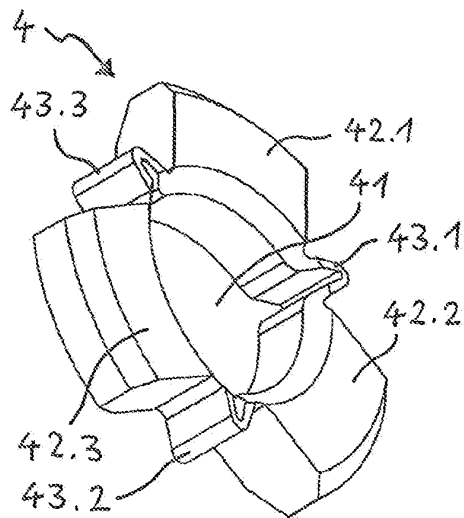


Fig. 9(a)

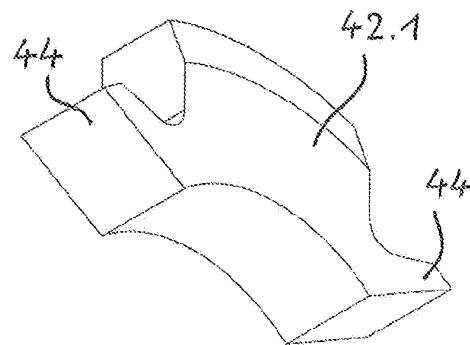


Fig. 10(a)

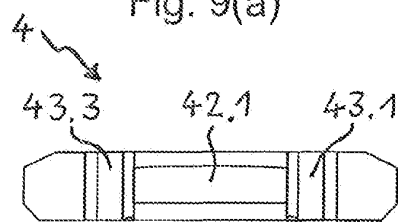


Fig. 9(c)

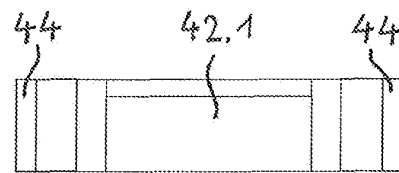


Fig. 10(c)

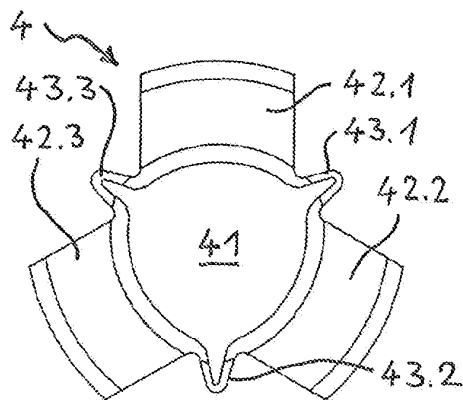


Fig. 9(b)

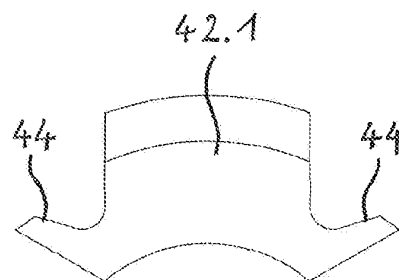


Fig. 10(b)

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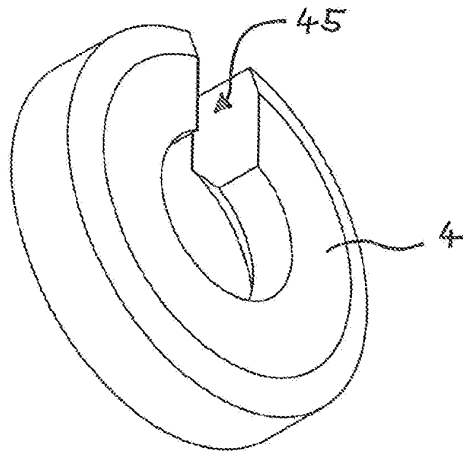


Fig. 11(a)

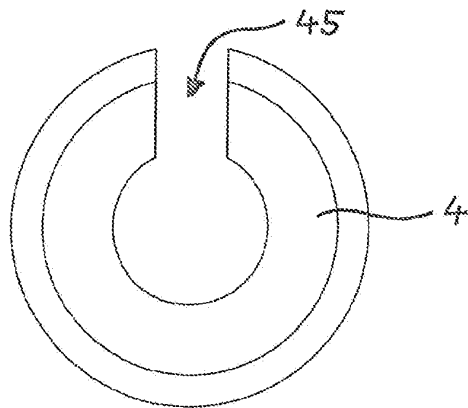


Fig. 11(b)

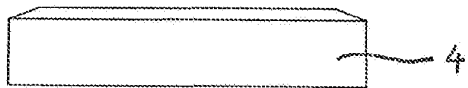
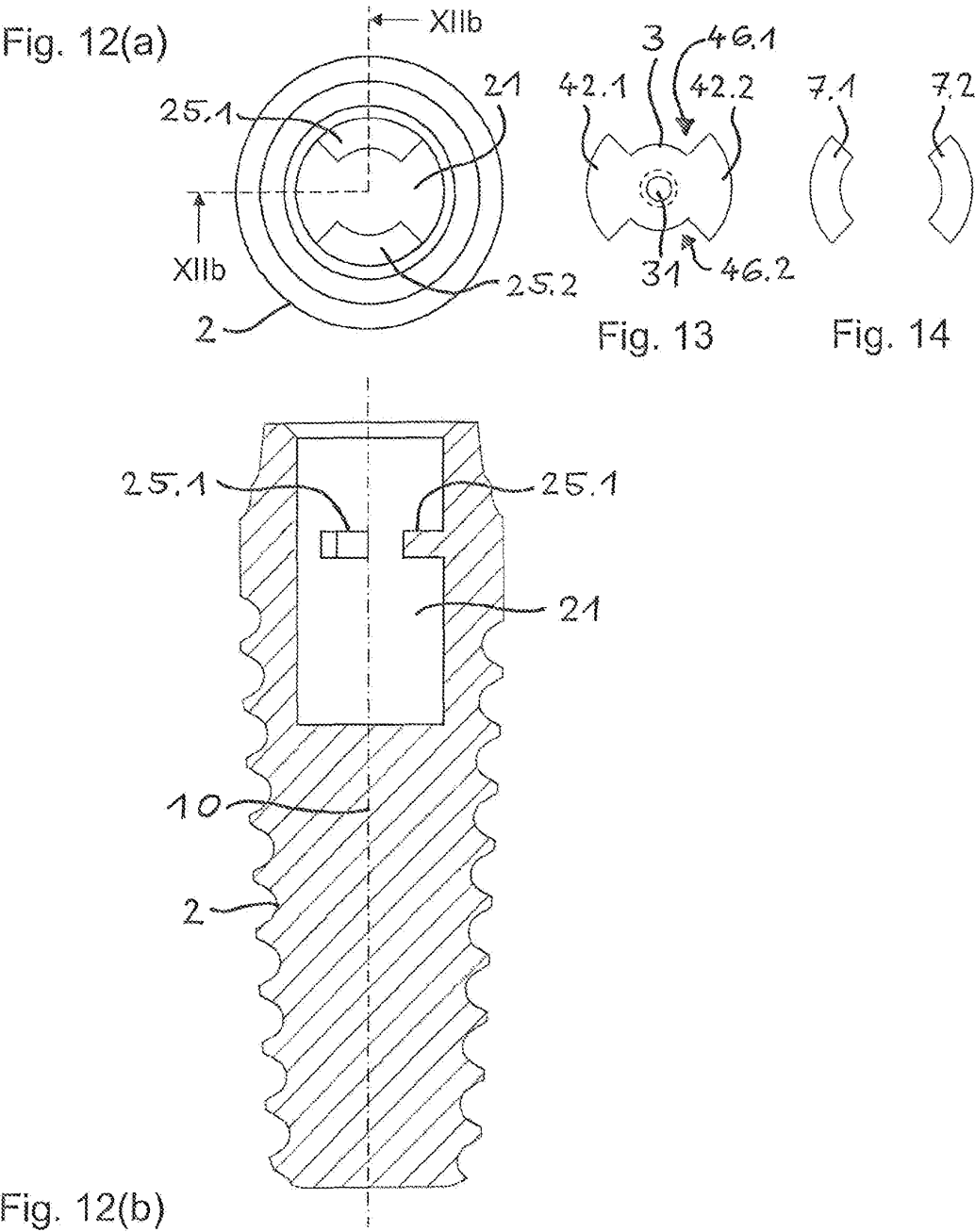


Fig. 11(c)

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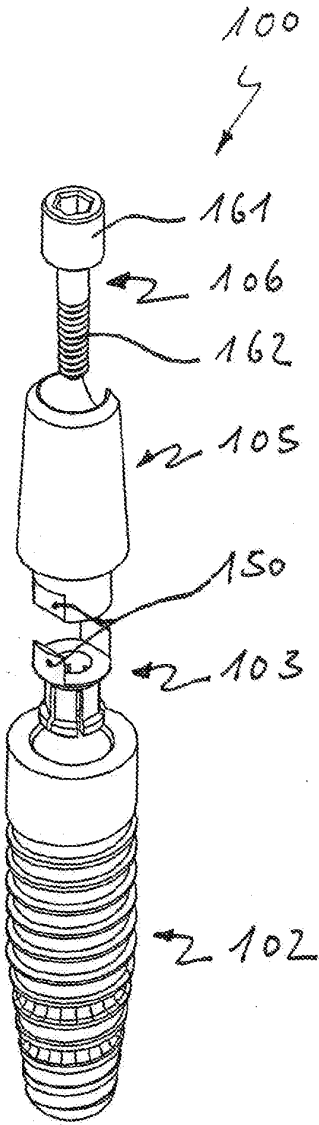


Fig. 15

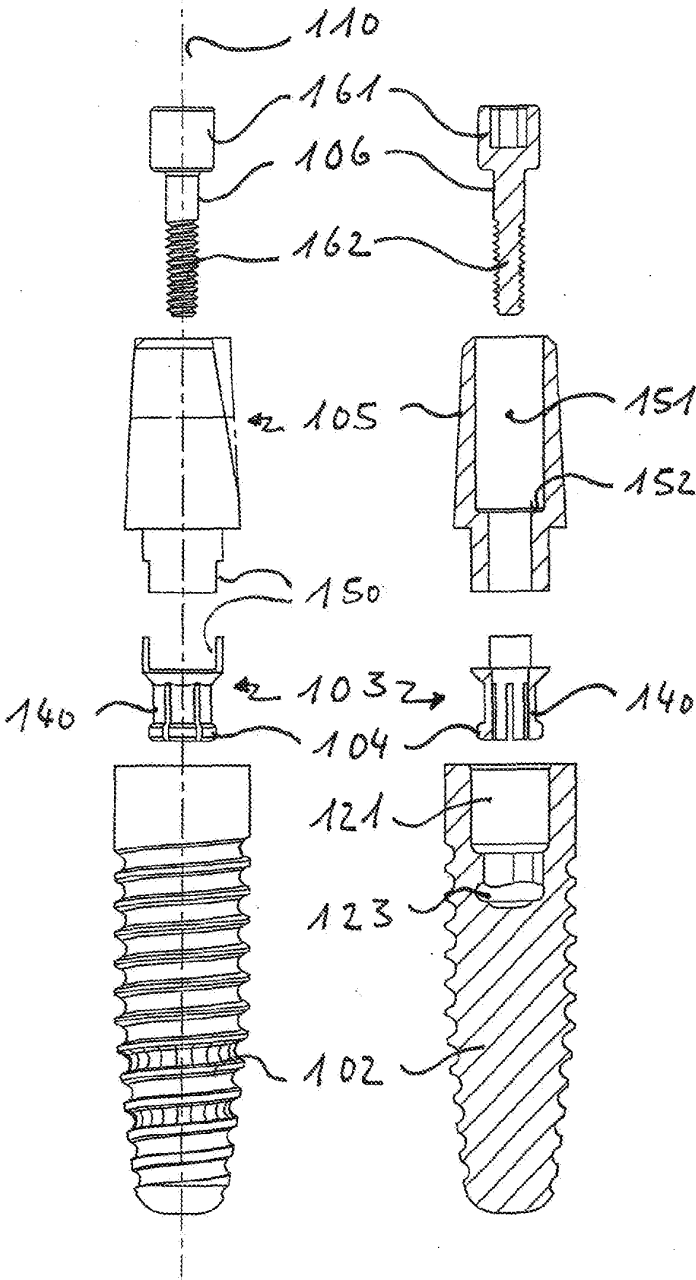


Fig. 16(a)

Fig. 16(b)

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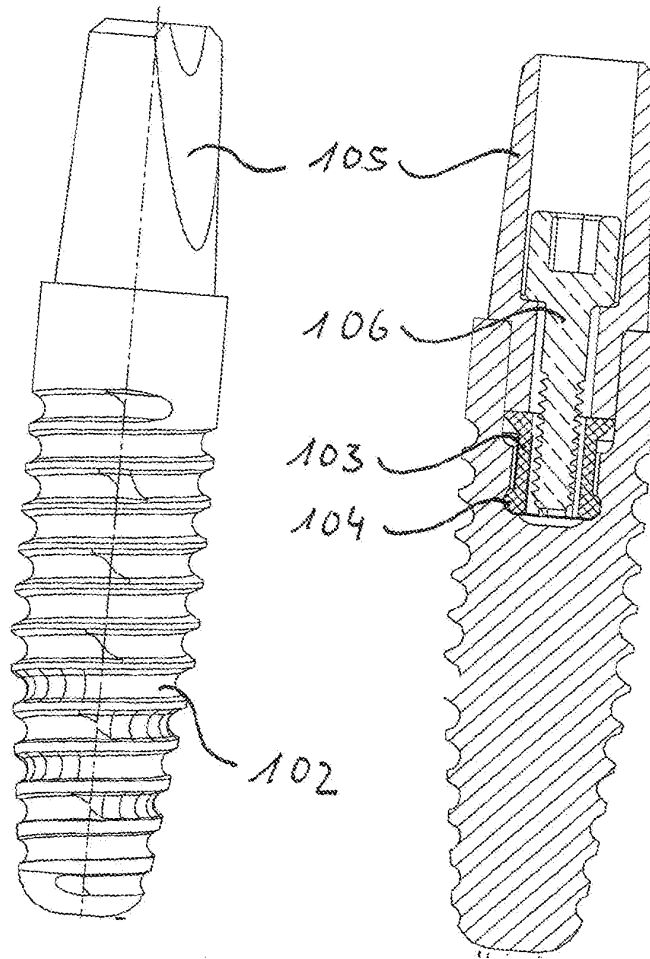


Fig. 17(a)

Fig. 17(b)

Dental prosthesis

The invention relates to a tooth replacement arrangement, a locking component for the same, and a method for constructing a dental prosthesis arrangement according to the preambles of the independent patent claims.

Among the terms. Dental implants "or dental implant" have been offered on the market for years and, in part, have been very successfully used. The tooth replacement arrangements used today are mostly multi-part because they offer several possible combinations and can avoid a load during the unit phase. Typical multi-part tooth replacement arrangements include an endosseous implant body for anchoring the arrangement in the jawbone and an abutment (also called connecting part or implant post) for receiving the superstructure, for example a crown or a bridge. The implant body and the abutment are glued and/or screwed together, and the superstructure is glued onto the abutment

Implant bodies made of metal can be provided with an internal thread into which a screw fixing the abutment can be screwed. Such a screw connection between the implant body and the abutment has the advantage of being detachable if necessary. For this purpose, metallic implant bodies have other disadvantages. If, after a longer carrying period of the dental implant, the jaw mucosa returns, the implant body becomes visible and, on account of its dark coloration, is also visually perceptible, which is aesthetically unsatisfactory. Furthermore, many metallic materials are recognized as foreign bodies and do not heal into the jawbone. In addition, it is not excluded that certain amounts of metal are released from the implant body in the long term, reach the body and have a detrimental effect there. For these aesthetic and medical reasons, implant bodies made of ceramic would be preferred. However, these have the disadvantage that they cannot enter into a direct screw connection with the abutment. Instead, the abutment in the implant body is permanently fixed with an adhesive or a cement, so that the abutment cannot be detached from the implant body in a non-destructive manner at a later point in time. In addition, it is not excluded that the adhesive or cement used is absorbed by the body and has undesirable effects therein

DE -103'40'059 A1 discloses a dental implant which allows a releasable screw connection between a ceramic implant body and the abutment. The implant body has an inner bore which extends coaxially to its central axis and completely penetrates the implant body and has an upper (coronal) and a lower opening. The abutment can be inserted through the upper opening with its own abutment internal bore extending to its central axis. A threaded sleeve can be inserted through the lower opening into the internal bore of the implant body. The abutment

can be fixed in the implant body by means of a head screw which can be inserted into the abutment internal bore, wherein the head screw can be fixed in the threaded sleeve. The implant body can be made of a ceramic material, the thread strokes can be made of a metallic material such as titanium. A problem with this solution is the fixing of the axial position of the inserted threaded sleeve, its anti-rotation lock and the termination of the lower opening.

Generic dental prosthesis arrangements are also known from three publications of the applicant of the present protective right, which are discussed below.

WO 2009/009909 A1 proposes a dental prosthesis system having an implant body and an abutment, in which a cleaning groove is provided in the contact region between the crown and the implant body. The cleaning groove serves for receiving and subsequently cleaning over-liquid adhesive which emerges when the crown is adhesively attached

According to WO 2009/009910 A1, an abutment strain, including a fitting cylinder, can be fitted into a corresponding cylindrical fitting seat of a receiving opening in the implant body. As a result, an optimized introduction of force from the abutment into the implant body is ensured and full freedom in the selection of materials is permitted. The implant body and the abutment can be produced from titanium or ceramic, and both components can be used in all possible combinations of materials. As a result, the adhesive bonding of ceramic abutments in implant bodies made of titanium oxide or other metallic materials is made possible

WO 2009/009911 A1 discloses a dental prosthesis system in which the abutment can be positioned in at least two radial angular positions by the positive interaction of locking means on a proximal abutment base and at least one inner wall of the proximal portion of a receiving opening in the implant body. The locking means pairs are preferably based on regular multi-edges. As a result of the simple production possibilities, there is full freedom in the selection of materials, so that both components can be used in all possible combinations of materials in this dental prosthesis system.

It is an object of the present invention to provide a dental prosthesis arrangement which combines the advantages of an implant body made of ceramic and a detachable screw connection between the implant body and the abutment, but avoids the aforementioned disadvantages of DE -103 ' 40 ' 059 A1, but in particular the abutment should be secured against displacements in the axial direction and against rotations about the longitudinal axis. The installation and the fixing of the abutment in the implant body should nevertheless be simple.

These and other objects are achieved by the dental prosthesis arrangement according to the invention as defined in the first patent claim. Advantageous embodiments are specified in the dependent claims.

The basic idea of the invention is to provide locking means by means of which a threaded sleeve is anchored in a form-fitting manner in an implant body inner bore. The abutment can then be fastened to the implant body in a manner known per se by means of a screw engaging in the threaded sleeve, preferably a head screw. This arrangement is made without adhesive or cement, even if material-bonded compounds according to the invention are not excluded. Thus, the abutment can be released from the implant body in a non-destructive manner if required.

The dental prosthesis arrangement according to the invention comprises an endosseous implant body for anchoring the dental prosthesis arrangement in a jawbone. The implant body has an inner bore. A threaded sleeve can be anchored in the implant body inner bore in a form-fitting and/or force-fitting manner. An abutment which serves to receive a superstructure has an abutment internal bore. A screw, preferably a head screw, is used to connect the abutment to the implant body, wherein a form-fitting means, preferably the head of the head screw, is positively supported in the abutment inner bore and a threaded part of the head screw engages in the threaded sleeve by means of locking means. The locking means are operatively connected to the threaded sleeve and attached to the latter in one piece therewith or attached in the implant body inner bore

In a preferred embodiment, the locking means are supported in an annular groove which is mounted in a wall of the inner bore hole of the implant body. The locking means can act as a radially outwardly expandable locking means

For this purpose, the locking component can include at least two wing-like sectors which are arranged in a plane perpendicular to a longitudinal axis and which are connected to one another by stretchable, preferably elastic connecting means. The locking component can have a bore into which a conical end of the threaded sleeve penetrates in order to spread the locking component outwards.

The locking component according to the invention for a dental prosthesis arrangement according to the invention can be transferred from an insertion state in which it has a first lateral extent into an end state in which it has a second lateral extent which is greater than the first lateral extent.

In a preferred embodiment, the locking component comprises at least two wing-like sectors which are arranged in a plane perpendicular to a longitudinal axis and which are connected to one another by stretchable, preferably elastic connecting means. The locking component can have a bore and, as a result of the penetration of a conical object into the bore, can be spread outwards.

In a more preferred embodiment, the threaded sleeve and the locking means are formed in one piece. The form-fitting anchoring in an annular groove running around in the inner bore of the

locking body is achieved by a plurality of locking means which are arranged as portions of an outwardly projecting radial rib on respective individual flexible tongues spaced apart from one another in the proximal region of the threaded sleeve. When the threaded sleeve is inserted into the inner bore of the implant body, the flexible tongues allow the radial ribs to be pressed together and snap into their outer radial position when the annular groove is reached substantially in a plane perpendicular to a longitudinal axis and de

Locking the threaded sleeve. By screwing in the head screw, on the one hand, the abutment is connected to the implant body, and on the other hand the length of the screw is dimensioned such that it penetrates deep enough into the threaded sleeve in order to prevent radial compression of the flexible tongues against the inside. In order to remove the abutment, the screw is released and partially screwed out as soon as the proximal region of the threaded sleeve is released with the flexible tongues, the latter can be pulled out of the implant body inner bore by corresponding pulling on the screw, since the tongues can now be pressed inwards. In order to facilitate the insertion and withdrawal of the threaded sleeve, the locking means are preferably rounded or at least beveled in the axial direction. The threaded sleeve can be designed in such a way that the proximal ends of the tongues are inclined towards the longitudinal axis in the rest position and are only spread outwardly by the screwing-in of the screw.

In the method according to the invention for the construction of a tooth replacement arrangement according to the invention, the head screw is inserted from a distal side into the abutment internal bore so that its threaded part protrudes from the abutment on a proximal side, according to one embodiment, the locking component is placed with its bore on the threaded part and secured with the threaded sleeve. The elements held together in this way are tightened into the implant body inner bore, so that the conical end of the threaded sleeve is pressed into the locking component bore. The locking component is spread outwardly into the annular groove by the penetration of the conical end of the threaded sleeve

The main advantage of the dental prosthesis arrangement according to the invention is the possibility of reversible connection between the implant body and the abutment. Nevertheless, the implant base body can be made completely metal-free, for example from a ceramic material. The abutment can also be embodied in a completely metal-free manner, for example from "brain" (ie with the isostatic hot pressing method, not isostatic pressing, abbreviated HIP, produced) ceramic material. The structure of the dental prosthesis arrangement according to the invention is ceramic-compatible and in particular stress-free. Its mechanical strength satisfies the requirements. The angular position of the abutment can be selected during installation, for example from six positioning possibilities. The dental prosthesis arrangement can be produced comparatively cost-effectively.

The implant bodies required for the dental prosthesis arrangement according to the invention are essentially identical to the already known and proven implant bodies. The implant body of the dental prosthesis arrangement according to the invention can be used outside the present invention for an integrally bonded connection to an abutment. This usability of the implant body both in and outside the dental prosthesis arrangement according to the invention increases the economy because, thanks to the different possibilities of use, larger numbers can be produced and thus the production costs can be reduced. In addition, storage is simplified in the retailer and in practice, since a single implant type can be used both for screw connections and also for adhesive connections of the abutments

Preferred embodiments of the invention will be explained in detail below with reference to the accompanying drawings, in which:

FIG. 1 shows an exploded drawing of a first embodiment of the dental prosthesis arrangement according to the invention.

FIG. 2 shows essential parts of the dental prosthesis arrangement of FIG. 1 (a) in a frontal view and (b) in a longitudinal section

FIG. 3 shows the composite tooth replacement arrangement of FIG. 1 (a) in a frontal view and (b) in a longitudinal section

FIG. 4 shows an implant body of the dental prosthesis arrangement of FIG. 1 (a) in a frontal view and (b) in a longitudinal section.

FIG. 5 shows an abutment and further elements of the dental prosthesis arrangement of FIG. 1 in an insertion state (a) in a frontal view and (b) in a longitudinal section.

FIG. 6 shows the abutment of FIG. 6 in an end state in which the locking means is spread

FIG. 7 shows a first embodiment of a locking means for the dental prosthesis arrangement (a) according to the invention in a perspective view, (b) in a plan view and (c) in a side view

FIG. 8 shows a part of a second embodiment of a locking means for the dental prosthesis arrangement (a) according to the invention in a perspective view (b) in a plan view and (c) in a cross section

FIG. 9 shows a third embodiment of a locking means for the dental prosthesis arrangement (a) according to the invention in a perspective view (b) in a rear view and (c) in a plan view

FIG. 10 shows a perspective view of a part of a fourth embodiment of a locking means for the dental prosthesis arrangement (a) according to the invention

(b) in a rear view and (c) in a plan view

FIG. 11 shows a fifth embodiment of a locking means for the dental prosthesis arrangement (a) according to the invention in a perspective view, (b) in a plan view and (c) in a frontal view

FIG. 12 shows an implant body of a second embodiment of the dental prosthesis arrangement (a) according to the invention in a plan view and (b) in a longitudinal section

FIG. 13 shows an abutment of the embodiment according to FIG. 12 in a plan view

FIG. 14 shows two filling elements of the embodiment according to FIG. 12 in a plan view

FIG. 15 shows an exploded drawing of a further embodiment of the dental prosthesis arrangement according to the invention.

FIG. 16 shows essential parts of the dental prosthesis arrangement of FIG. 15 (a) in a frontal view and (b) in a longitudinal section

FIG. 17 shows the composite tooth replacement arrangement of FIG. 15 (a) in a frontal view and (b) in a longitudinal section

A first embodiment of the dental prosthesis arrangement 1 according to the invention or parts thereof are shown in FIGS. 1-6 in various views and sectional drawings, corresponding locking means 4 in FIGS. 7-11.

The dental prosthesis arrangement 1 includes an endosseous implant body 2 for anchoring the dental prosthesis arrangement 1 in a jaw bone (not shown here). In its upper (distal) region, the implant body 2 has a non-continuous inner bore 21, which runs substantially coaxially with a longitudinal axis 10 of the implant body 2 or of the dental prosthesis arrangement 1. The implant body 2 preferably consists of a ceramic material (eg ZERAMEX *) or a biocompatible metal such as titanium. Thus, the implant body 2 in large parts corresponds to the proven implant bodies known from the prior art.

The inner bore 21 of the implant body serves to anchor a threaded sleeve 3, the function of which will be discussed below. The thread strokes 3 can consist, for example, of steel, titanium, a plastic or a ceramic material.

Furthermore, the dental prosthesis arrangement 1 includes an abutment 5 for receiving a superstructure (not shown here), for example a crown or a bridge. The abutment 5 can consist, for example, of a zirconium oxide ceramic. It has a continuous inner bore 51, which runs substantially coaxially with the longitudinal axis 10 of the abutment or tooth replacement arrangement 1

The abutment inner bore 51 receives a head screw 6 for connecting the abutment 5 to the implant body 2. A head 61 of the head screw 6 is supported in a form-fitting manner in the abutment inner bore 51, for example, on a circumferential shoulder 52 mounted in the interior

of the abutment inner bore 51. A threaded part 62 of the head screw 6 with an external thread engages in a corresponding internal thread 31 of the threaded sleeve 3. The head screw 6 can be made of steel, for example. titanium, a plastic or a ceramic material.

The threaded sleeve 3 is anchored in the implant body inner bore 21 by means of a locking means 4 supported in the implant body inner bore 21 in a form-fitting manner in the implant body inner bore 21. In the first embodiment of FIGS. 1-11, the locking means 4 is formed as a separate locking component 4 and is supported in an annular groove 23 which is introduced into a wall of the implant body inner bore 21, the maximum radial extent of which is smaller than a diameter of the implant body inner bore 21, so that it can be inserted through an upper (distal) opening 22 into the implant body inner bore 21. This insertion state is shown in FIG. 5. In an end state, which is shown in FIGS. 3 and 6, on the other hand, the locking component 4 has a radial extent which is greater than the diameter of the implant body inner bore 21 and just still fits into the annular groove 23, thus resulting in a form fit between the locking component 4 and the annular groove 23.

The insertion, ie the insertion and the fastening of the abutment 5 in the already inserted implant body 2, is described below. The head screw 6 is inserted from above into the abutment inner bore 61 so that its lower threaded part 62 protrudes from a lower (proximal) opening out of the abutment 5. From below, the locking component 4 is placed with its bore 41 onto the threaded part 62 and secured with the threaded sleeve 3. The head screw 6 is tightened, but only so that the locking component 4 remains in its insertion state (see FIG. 5). The elements 3-6 held together in this way are now introduced from above into the implant body inner bore 21. When they have reached their end position in the inner bore 21 of the implant body, the head screw 6 is tightened more firmly. As a result, a conical upper end 32 of the threaded sleeve 3 is pressed into the locking component bore 41 upon penetration of the conical end 32 of the threaded sleeve 3, the axial force is converted by the wedge effect into a radial force which spreads the locking component 4 outwardly into the annular groove 23. The spread end state is shown in FIG. 6.

The final state is shown in FIG. 3. The spread locking component 4 is supported in the annular groove 23 and thus anchors the threaded sleeve 3 in the implant body inner bore 21. The abutment 5 is pressed against an upper edge 24 of the implant body 2 by an axial force defined by the attraction of the head screw 6 and against the locking component 4 supported in the implant body 2. The locking component 4 is held in position by a cylindrical part 33 at the upper end of the threaded sleeve 3 and is firmly clamped between the abutment 5 and supporting flanks 34 of the threaded sleeve 3. This makes it possible to remove the metallic head screw 6 after installation of the abutment 5 and to replace it with a securing screw (not shown) made of