(12) PATENT **(11)** Application No. **AU 199949469 B2**
(19) AUSTRALIAN PATENT OFFICE **(10)** Patent No. **753274**

(54) Title
Device, method and application in connection with a dental prosthesis arrangement in the jaw

(51)[7] International Patent Classification(s)
A61C 008/00

(21) Application No: **199949469** (22) Application Date: **1999.06.29**

(87) WIPO No: **WO00/02495**

(30) Priority Data

(31) Number	(32) Date	(33) Country
9802495	**1998.07.10**	**SE**

(43) Publication Date : **2000.02.01**
(43) Publication Journal Date : **2000.04.13**
(44) Accepted Journal Date : **2002.10.10**

(71) Applicant(s)
Nobel Biocare AB (publ)

(72) Inventor(s)
Halvar Hanssen

(74) Agent/Attorney
WATERMARK PATENT and TRADEMARK ATTORNEYS,Locked Bag 5,HAWTHORN VIC 3122

(56) Related Art
US 4758161
US 5312255

49469/99.

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A61C 8/00 — A1

(11) International Publication Number: **WO 00/02495**

(43) International Publication Date: 20 January 2000 (20.01.00)

(21) International Application Number: PCT/SE99/01171

(22) International Filing Date: 29 June 1999 (29.06.99)

(30) Priority Data:
9802495-3 10 July 1998 (10.07.98) SE

(71) Applicant *(for all designated States except US)*: NOBEL BIOCARE AB (publ) [SE/SE]; Box 5190, S-402 26 Göteborg (SE).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: HANSSEN, Halvar [NO/SE]; Runslingan 115, S-423 47 Göteborg (SE).

(74) Agent: OLSSON, Gunnar; Nobel Biocare AB (publ), P.O. Box 5190, S-402 26 Göteborg (SE).

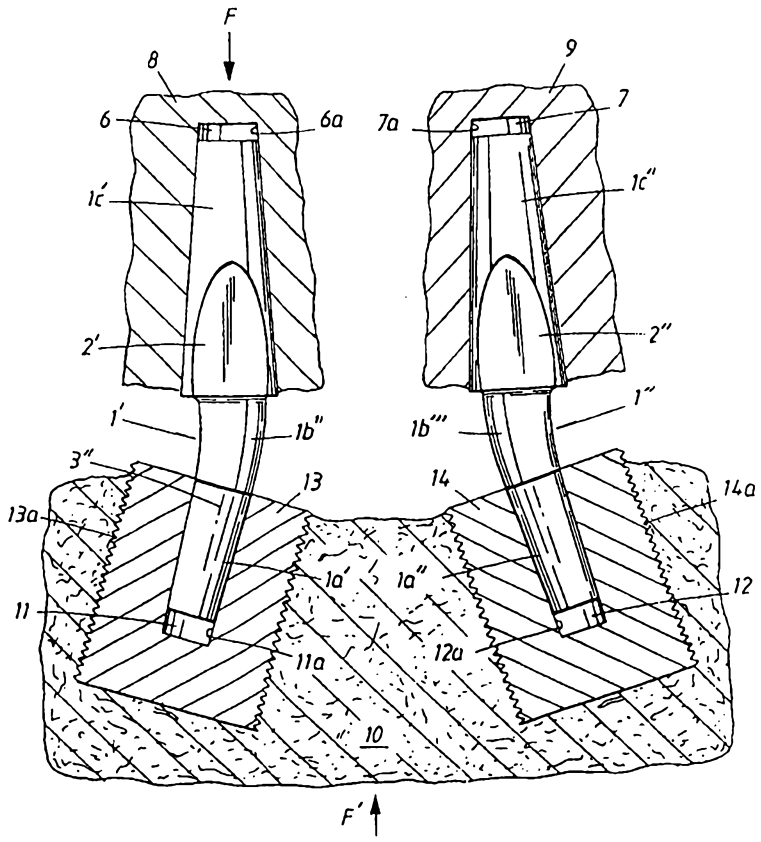
(81) Designated States: AU, CA, JP, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: DEVICE, METHOD AND APPLICATION IN CONNECTION WITH A DENTAL PROSTHESIS ARRANGEMENT IN THE JAW

(57) Abstract

A dental prosthesis arrangement incorporates one or more implant(s) (13, 14) and one or more attachment part(s) (8, 9) which can be fitted thereto by a joint. At least a first joint between implant and attachment part, alternatively between attachment parts, consists only of a truncated cone or other conically tapered body which is arranged on the implant or attachment part or on the one attachment part and which is guided or guidable in wedging mechanical interaction with a corresponding recess (6) in the attachment part or implant concerned, and a section (1b) connecting to the said truncated cone or other conically tapered body, which section is bendable in order to achieve a common insertion direction for the dental prosthesis arrangement.



TITLE

Device, method and application in connection with a dental prosthesis arrangement in the jaw

TECHNICAL FIELD

The present invention relates to a device for or in connection with a dental prosthesis arrangement, which comprises one or more implant(s) and one or more attachment part(s), e.g. one or more spacer(s), one or more bridge(s), parts of spacers or bridges, etc., fitted to the said implant(s) by a joint. The invention also relates to a method for realizing a joint in a dental prosthesis which comprises one or more implant(s) and one or more attachment part(s) fitted to the said implant(s). The invention additionally relates to a specific application of a truncated cone arrangement and a recess or recesses corresponding to the said cones.

PRIOR ART

By virtue of American Patent Application 4 645 453, it is previously known to use cemented joints in dental prostheses which comprise an implant and attachment parts. The patent describes, inter alia, the use of a bendable section by means of which the part or parts supporting the dental prosthesis can be angularly orientated in relation to the slant of the implant in the jawbone.

It is also previously known to use an implant with bendable part for its head or upper part. The implant is screwed into the dentine and in the screwed-in position the bendable part is actuated into the desired vertical extension position in relation to the slanted position of the implant in the dentine. Reference can here be made, inter alia, to the K.S.I.-Bauer-Screw system sold

on the market, which is supplied by "Keramisches Dental-Labor, GmbH/DE".

It is also previously known to use an implant having conical joints, see, for example, American Patent Application 4 772 204. In this case, the spacing element has a conical section which passes at the bottom onto a threaded, cylindrical part. Spacing elements of this type are however not designed to be bent and, because of the threaded part, difficulties arise with the orientation even if bending were to be possible. The spacing elements are therefore impossible to use in combination with angular orientation.

TECHNICAL PROBLEMS

In the prior art, there is a need for dental contexts to be able to use technically simple and unambiguous components (screws, spacers, bridges, sleeves, etc.) which are easy to combine in dental prosthesis attachments and nevertheless give reliable joints which are durable over a long period in the patient. An embodiment of an aspect of the present invention aims to solve this problem, inter alia.

In the prior art, there is a also a need to be able to establish temporary dental prosthesis systems which shall be able to be implemented in the jaw or jaws of a patient during the time when patients are undergoing restoration (e.g. extensive restoration) by means of a permanent dental prosthesis system. An embodiment of an aspect of the present invention solves this set of problems also.

According to an embodiment of an aspect of the present inventive idea, use is made of the discovery that so-called Morse cones have a high mechanical wedging effect. There is here a need for the cones in question and corresponding recesses to be arranged such that necessary strong mechanical joints are obtained between components concerned. In addition, the arrangement shall be such that chewing and biting motions of the patient, and corresponding external effects, reinforce or do not weaken the joint. An embodiment of an aspect of the present invention solves this problem also.

In temporary and permanent dental prosthesis systems in the prior art, there is a need for those parts in the system which support the dental prosthesis to be able to be arranged and angularly orientated such that a common insertion direction for the dental prosthesis is possible despite the fact that an implant has

been arranged at a slant in the dentine owing to poor condition of the latter. In case of non-parallelism between two or more spacing elements exceeding the cone angle for the second cone, fitting is impossible in practice. An embodiment of an aspect of the present invention is of the type which uses a bendable section or bendable zone which, under the influence of bending, can be redirected in relation to the implant screw or implant body. It is in this case important that the bending function can be effected outside the jaw of the patient so that the patient's dentine is not subjected to bending forces which cause discomfort and pain in the patient. Bending of an implant in the patient can lead moreover to the implant breaking loose from its position, especially if it is placed in bone of poor quality, i.e. low-density bone. An embodiment of an aspect of the present invention solves this problem also.

In connection with the exercising of the bending function, the attachment parts connected to the implants (spacers, bridges, sleeves, etc.) shall be able to be angularly orientated such that the respective attachment part acquires the correct position extending in the vertical direction (in the direction of the tooth) despite the fact that the bending function is effected outside the mouth of the patient. An embodiment of an aspect of the present invention solves this problem also and proposes a simple method for assessing (pointing out) the angular position, for effecting the bending outside the mouth and for returning the element having the bent zone such that the previous angularly orientated position is obtained.

It is also important not to need to use cement or glue in the joint, the biocompatible effects of which have not been established in long-term trials. An embodiment of an aspect of the invention solves this problem also.

SUMMARY OF INVENTION

An object of the present invention is to solve one or more problems mentioned in the prior art.

According to a first aspect of the invention, there is provided a device for a dental prosthesis arrangement, which comprises one or more implant(s) and one or more attachment part(s), e.g. spacer(s) or bridge(s), etc., fitted to the said implant(s) by a joint, and wherein at least a first joint between implant and attachment part, here referred to as the first case, alternatively between

attachment parts, here referred to as the second case, consists only of a truncated cone or other conically tapered body which is arranged on the implant or attachment part in the first case or on the one attachment part in the second case and which is guided or guidable in wedging mechanical interaction with a corresponding recess in the attachment part or implant in the first case or the second attachment part in the second case wherein the components, in the form of implant and attachment part or attachment parts, provided with truncated cone or body and recess, consist of titanium or other material with high friction coefficient so that said wedging mechanical interaction is effectuated by said high friction coefficients in the implant and the attachment part, respectively, as well as a great tolerance accuracy of the truncated cone or other conically tapered body and the corresponding recess, and wherein the implant supporting truncated cone or body, or the attachment part supporting the truncated cone or body, being arranged with a section connecting to the truncated cone or body, which section is bendable for the achievement of a levelling function in the dental prosthesis arrangement when the implant is arranged at a slant in the dentine, i.e. that the longitudinal axis of the implant which is congruent with the longitudinal axis of a third section of the implant or attachment part, respectively, is slanted in the dentine.

Preferably, the bendable section is essentially of uniform thickness in the unbent position and has essentially the same diameter or corresponding measure as the truncated cone or body exhibits at its base or wider end.

The truncated cone or body may form part, together with the bendable section, of a threaded implant.

In an embodiment of the invention, the truncated cone or body, here referred to as the first truncated cone or body, forms part, together with the bendable section and second truncated cone or body, of an element in which the first and second truncated cones or bodies are secured in the respective end of the bendable section.

Preferably, the truncated cone exhibits a cone angle of 2-4°, and/or the second truncated cone or body exhibits a cone angle of 6-10°.

The truncated cone may exhibit a cone angle of 3°.

The second truncated cone or body may exhibit a cone angle of 8°.

In an embodiment of the device, said components, in the form of implant and attachment part or attachment parts, provided with truncated cone or body and recess, of titanium or other material has a friction coefficient of 0.2-0.8.

In an embodiment of the device, said components, in the form of implant and attachment part or attachment parts, provided with truncated cone or body and recess, of titanium or other material has a friction coefficient of 0.5.

According to a second aspect of the present invention, there is provided a device for effecting a joint in a dental prosthesis arrangement, which comprises one or more implant(s) and one or more attachment part(s) which can be fitted to the said implant(s), wherein the respective implant or a first attachment part is arranged with a first section designed as a truncated cone or other conically tapered body, wherein a second attachment part or the implant in question is arranged with a recess corresponding to the truncated cone or body, and wherein the truncated cone or body and the corresponding recess are arranged to form part of a wedging mechanical interaction which alone, i.e. without cement, glue, etc., due to high friction coefficients in the material of the respective implant and the attachment part as well as a great tolerance accuracy of the truncated cone or other conically tapered body and the corresponding recess, realising the said mechanical joints.

According to a third aspect of the invention, there is provided a method for realising a joint in a dental prosthesis which comprises one or more implant(s) and one or more attachment part(s) fitted thereto, e.g. spacer or spacers, bridge or bridges, etc., wherein a truncated cone or other conically tapered body arrangement on a first section of an implant or first attachment part is guided in wedging mechanical interaction with a corresponding recess on the first attachment part or the implant or a second attachment part with the aim of attaining a cement-free or glue-free joint, a second section connected to the first section, when the implant is slanted in the dentine concerned, being assigned bending forces for levelling the upper part of the implant in relation to the slant.

Preferably, in an embodiment of the method, the truncated cone or body and recess of the first attachment part are guided to interaction with the recess and truncated cone or body respectively of the implant or of the second attachment part in an intermediate position in which the first attachment part is

separable from the implant and the second attachment part respectively, wherein the first attachment part is separated from the implant and the second attachment part respectively and hence bending forces are assigned to the second section, and wherein the first attachment part once again, following any intermediate adjustments, is guided in interaction with the implant and the second attachment part respectively into essentially the same angularly orientated position.

ADVANTAGES

In embodiments of the invention, the joint for a permanent or temporary dental prosthesis arrangement such as bridges, individual teeth, parts of bridges and teeth, etc., is obtained in simple manner through the use of Morse cones and recesses interacting therewith. In the fitting operation, the work of the dentist is substantially simplified by the fact that he/she can simply identify the rotation angle position for the element, which thereafter can be assigned bending forces outside the mouth and reinserted to an adjusted rotation angle position. The bending force can be assigned using a simple, e.g. tubular, tool. Dimensioning of parts of the element can be carried out such that weakening upon bending is minimal, thereby guaranteeing a durably effective joint, the wedging function of which is additionally reinforced with chewing and biting motions of the patient. Conventional joints with threads, screws and untested glue can be eliminated. The effectiveness of the Morse cone is enhanced by the use of material with high friction coefficients in the two joinable parts.

DESCRIPTION OF FIGURES

In order that the invention might be more fully understood, embodiments of the invention will be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows in vertical view an embodiment of an element which supports at its ends sections designed as truncated cones and which sections are combined with a section which acts as a bending zone,

Figure 2 shows in vertical view the element according to Figure 1, but rotated by 90°,

Figure 3 shows in end view of the element according to Figure 1,

Figure 4 shows in vertical view tubular tool parts applied to the element according to Figure 1, which tool parts are used to impart a bending upon the bending zone of the element,

Figure 5 shows in vertical view and in basic representation two elements which form part of a mechanical joint between implants screwed into a jaw and attachment part(s) fitted to the implants, and

Figures 6-6a show in vertical views and in partial cross section a further embodiment.

DETAILED EMBODIMENT

In Figure 1, a device or element according to an embodiment of the invention is denoted by 1. In the illustrative

embodiment, the device is designed as a pin or column and has first, second and third sections 1a, 1b and 1c. The first section has the form of a first truncated cone, the half cone angle α of which is in the order of magnitude of 0.75-3°, preferably ca. 1.5°, i.e. the cone angle 2α is 1.5-6°, preferably ca. 3°. At its widest part, the first truncated cone is provided with a diameter of 1.5-2.0 mm, preferably ca. 1.8 mm. The tolerance for the diameter is high and in the present case is chosen at 2/100 mm (0.02 mm). The first truncated cone has a length L of 3-5 mm and is preferably ca. 4 mm.

The first section 1a connects at its widest part to a cylindrical second section 1b, of a diameter which essentially corresponds to the said diameter D and has a length L1 of 2-5 mm, preferably ca. 3 mm. At its end facing away from the section 1a, the cylindrical section 1b passes into the third section 1c via a radius R of 0.1-0.3 mm, preferably ca. 0.2 mm. The third section 1c has the form of a second truncated cone which exhibits a cone angle β of 6-10°C, preferably ca. 8°, and a diameter D1 at its widest point of 2-4 mm, preferably ca. 3 mm, and the tolerance is here too ca. 2/100 mm. The length L2 is 6-10 mm, preferably ca. 8 mm. The section 1c is provided with a straight bevel 2, see also Figures 2 and 3. The surface of the bevel is situated at a distance A from the centre axis 3 of the element. In the illustrated case, the distance is chosen at within the range 1.0-1.4 mm and is preferably 1.2 mm with a tolerance accuracy of 3/100 mm. The total length of the element is preferably ca. 15 mm and the sections are preferably constructed in titanium or equivalent with a friction coefficient of ca. 0.5 mm.

According to Figure 4, the section 1b acts as a bending zone. By means of tubular tool parts 4 and 5, a slant γ between the longitudinal axes 3a and 3' respectively of the sections 1a and 1c can be simply realized. As a

result of the cylindrical form of the section 1b, the risks of the element breaking or becoming substantially weakened upon bending and during the subsequent application in the mouth of the patient, are averted.

In Figure 5, two connecting elements 1' and 1'' are bent in their bending zones 1b'' and 1b''' respectively according to Figure 4. The third sections 1c' and 1c'' are arranged in the recesses 6 and 7 respectively having conical walls 6a and 7a corresponding to the conical forms of the truncated conical form of the third section 1c' and 1c'' respectively. The recesses 6 and 7 are produced with identical or essentially the same accuracy as the conical form of the first section, so that a high wedging function is present on the part or parts 8, 9 supported by the recesses 6 and 7, a force F generated upon chewing or biting motions, or by external influence, is present relative to a jaw 10 shown in basic representation. The part or parts 8, 9 can comprise a bridge, sleeve, spacer, etc. or parts thereof.

The first sections 1a' and 1a'' are arranged in corresponding manner in recesses 11 and 12 respectively having conical walls 11a, 12a, the conical forms of which essentially correspond to the conical form of the respective first section. The accuracy for the conical forms of the recesses is as large or essentially as large as for the respective conical form for the conical form of the first section, so that here too the mechanical wedging force is strong or exceedingly large, since a force F' generated by external influence and/or by chewing or biting motions arises in the dentine 10 (relative to the force F). In the illustrated case, the other conical recesses 11 and 12 are arranged in implants 13, 14, which can be constituted by a type which is known per se and which are screwed in place by means of threads 13a, 14a in the dentine 10.

The parts 8, 9 and the implants 13, 14 can be constituted in titanium or corresponding material with a high friction coefficient which can be in the order of magnitude of 0.5. The bevels 2', 2'' can form rotation-angle-orientated markings for the dentist or equivalent. In one embodiment, the sections 1a' and 1a'' are applied in the recesses 11 and 12 respectively with relatively low friction force F'. Any bending of the zone 1b'' and 1b''' is assessed and the element(s) 1', 1'' is/are removed and bending effected according to Figure 4 or in some other way. The bevels 2' and 2'' can form part of the angle orientation upon renewed application of the sections 1a' and 1a'' in the recesses 11 and 12 respectively. Following possible further bending adjustments when the described process is repeated, the sections are pressed tight (wedged) in the recesses 11 and 12 in the rotation positions defined by means of the bevels 2', 2''. The sections 1c' and 1c'' thereupon assume essentially parallel directions congruent with the vertical direction of the tooth attachment in question. The attachment part or attachment parts 8, 9 can thereafter be pressed onto the sections 1c, 1c'' by way of their recesses 6 and 7. The effected mechanical wedging can be of temporary or permanent nature. Naturally there are cases in which bending of the bending zone does not need to be carried out, in which case the bending operation is omitted. The bevels 2', 2'' can constitute rotation angle fixing in the respective implant 13, 14, the implant being constructed with a surface 15 opposed to the bevel, see line in Figure 2. The cone angles 2α and β can be varied and related, e.g. to the friction coefficient in the respective used material. The respective implant or attachment part can be provided with fixedly arranged elements or columns which, at their free ends, are interactable with a corresponding conical recess or recesses in another attachment part or the implant. Known Morse cones can thus be used as a joint between

implant and attachment part or attachment parts, or between attachment parts.

The respective section constructed as a truncated cone can be replaced by another type of conically tapered body and can have the form, for example, of a truncated pyramid, pentagon or hexagon, etc. The slant of the respective implant in Figure 5 is identified by the fact that the longitudinal axis 3'' for the implant part 1a' in question is angled in relation to the longitudinal axis for the element part 1c'. The parts 1c' and 1c'' are arranged such that they are essentially congruent with the direction of insertion of the dental prosthesis or are mutually levelled so that the one element part does not substantially jut above the second element part.

The invention is not limited to the embodiment shown by way of example above but can be subject to modifications within the scope of subsequent patent claims and the inventive concept. Thus, for example, according to Figures 6 and 6a, an implant can be constructed having a conical recess 12' with a half cone angle of corresponding size (e.g. 1.5°) to the cone angle for 1a''' (see Figure 1). A diameter D for the recess 12' falls in line with the size D of the section 1a'''. The angle and diameter measurements are mutually matched with great accuracy (as is the case for Morse cones) so that sought-after wedging forces are attained when the section 1a''' is applied in the recess 12'. The section 1c (see Figure 1) can then interact with an attachment part and the bevel 2 can here be used as rotation angle fixing. A device according to the invention can thus also additionally or separately be characterized in that it has the form of an implant which has a conical recess for connection only by means of cones of an attachment part or equivalent to the implant, which cones wedge mechanically one into the other.

The terms "comprise", "comprises", "comprised" and "comprising" when used in this specification are taken to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

Discussion or mention of any piece of prior art in this specification is not to be taken as an admission that the prior art is part of the common general knowledge of the skilled addressee of the specification.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Device for a dental prosthesis arrangement, which comprises one or more implant(s) and one or more attachment part(s), e.g. spacer(s) or bridge(s), etc., fitted to the said implant(s) by a joint, and wherein at least a first joint between implant and attachment part, here referred to as the first case, alternatively between attachment parts, here referred to as the second case, consists only of a truncated cone or other conically tapered body which is arranged on the implant or attachment part in the first case or on the one attachment part in the second case and which is guided or guidable in wedging mechanical interaction with a corresponding recess in the attachment part or implant in the first case or the second attachment part in the second case wherein the components, in the form of implant and attachment part or attachment parts, provided with truncated cone or body and recess, consist of titanium or other material with high friction coefficient so that said wedging mechanical interaction is effectuated by said high friction coefficients in the implant and the attachment part, respectively, as well as a great tolerance accuracy of the truncated cone or other conically tapered body and the corresponding recess, and wherein the implant supporting truncated cone or body, or the attachment part supporting the truncated cone or body, being arranged with a section connecting to the truncated cone or body, which section is bendable for the achievement of a levelling function in the dental prosthesis arrangement when the implant is arranged at a slant in the dentine, i.e. that the longitudinal axis of the implant which is congruent with the longitudinal axis of a third section of the implant or attachment part, respectively, is slanted in the dentine.

2. Device according to claim 1 wherein the bendable section is essentially of uniform thickness in the unbent position and has essentially the same diameter or corresponding measure as the truncated cone or body exhibits at its base or wider end.

3. Device according to claim 1 or 2 wherein the truncated cone or body forms part, together with the bendable section, of a threaded implant.

4. Device according to claim 1 or 2 wherein the truncated cone or body, here referred to as the first truncated cone or body, forms part, together with the bendable section and second truncated cone or body, of an element in which the first and second truncated cones or bodies are secured in the respective end of the bendable section.

5. Device according to any one of the preceding claims wherein the truncated cone exhibits a cone angle of 2-4°, and/or the second truncated cone or body exhibits a cone angle of 6-10°.

6. Device according to claim 5 wherein the truncated cone exhibits a cone angle of 3°.

7. Device according to claim 5 wherein the second truncated cone or body exhibits a cone angle of 8°.

8. Device according to any one of the preceding claims wherein said components, in the form of implant and attachment part or attachment parts, provided with truncated cone or body and recess, of titanium or other material has a friction coefficient of 0.2-0.8.

9. Device according to claim 8 wherein said components, in the form of implant and attachment part or attachment parts, provided with truncated cone or body and recess, of titanium or other material has a friction coefficient of 0.5.

10. Device for effecting a joint in a dental prosthesis arrangement, which comprises one or more implant(s) and one or more attachment part(s) which can be fitted to the said implant(s), wherein the respective implant or a first attachment part is arranged with a first section designed as a truncated cone or other conically tapered body, wherein a second attachment part or the implant in question is arranged with a recess corresponding to the truncated cone or body, and wherein the truncated cone or body and the corresponding recess are arranged to form part of a wedging mechanical interaction which alone, i.e. without cement, glue, etc., due to high friction coefficients in the material of the

respective implant and the attachment part as well as a great tolerance accuracy of the truncated cone or other conically tapered body and the corresponding recess, realising the said mechanical joints.

11. Method for realising a joint in a dental prosthesis which comprises one or more implant(s) and one or more attachment part(s) fitted thereto, e.g. spacer or spacers, bridge or bridges, etc., wherein a truncated cone or other conically tapered body arrangement on a first section of an implant or first attachment part is guided in wedging mechanical interaction with a corresponding recess on the first attachment part or the implant or a second attachment part with the aim of attaining a cement-free or glue-free joint, a second section connected to the first section, when the implant is slanted in the dentine concerned, being assigned bending forces for levelling the upper part of the implant in relation to the slant.

12. Method according to claim 11 wherein the truncated cone or body and recess of the first attachment part are guided to interaction with the recess and truncated cone or body respectively of the implant or of the second attachment part in an intermediate position in which the first attachment part is separable from the implant and the second attachment part respectively, wherein the first attachment part is separated from the implant and the second attachment part respectively and hence bending forces are assigned to the second section, and wherein the first attachment part once again, following any intermediate adjustments, is guided in interaction with the implant and the second attachment part respectively into essentially the same angularly orientated position.

13. Device for a dental prosthesis arrangement substantially in accordance with any one of the embodiments hereinbefore described and illustrated with reference in the accompanying drawings.

14. Device for effecting a joint in a dental prosthesis arrangement substantially in accordance with any one of the embodiments hereinbefore described and illustrated with reference in the accompanying drawings.

15. Method for realising a joint in a dental prosthesis substantially in accordance with any one of the embodiments hereinbefore described and illustrated with reference in the accompanying drawings.

DATED this 7th day of August 2002

NOBEL BIOCARE AB (PUBL)

WATERMARK PATENT & TRADE MARK ATTORNEYS
290 BURWOOD ROAD
HAWTHORN VICTORIA 3122
AUSTRALIA

KJS/RJS/MEH P18813AU00

Fig. 1

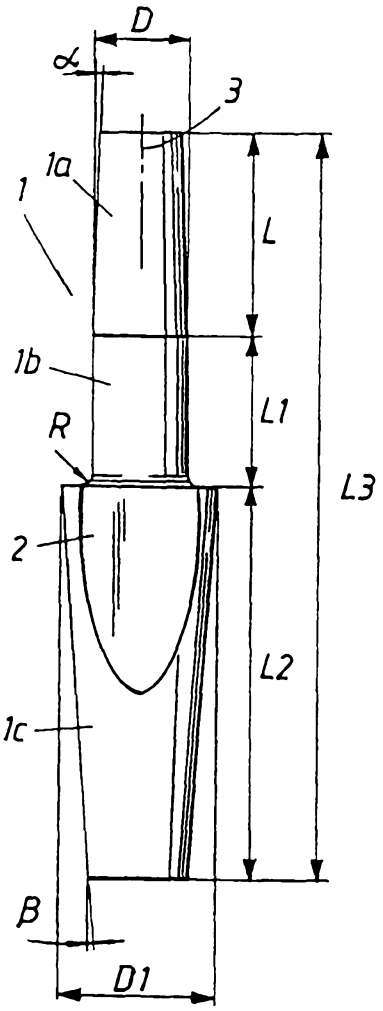


Fig. 2

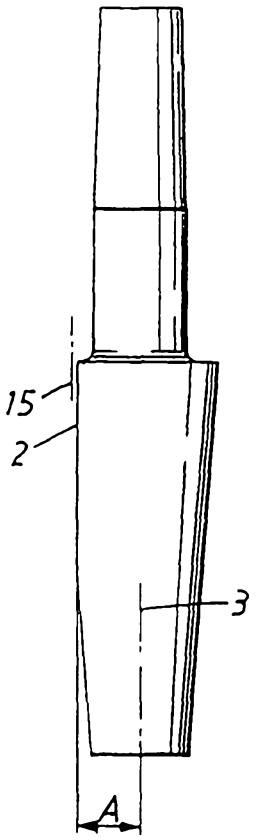


Fig. 4

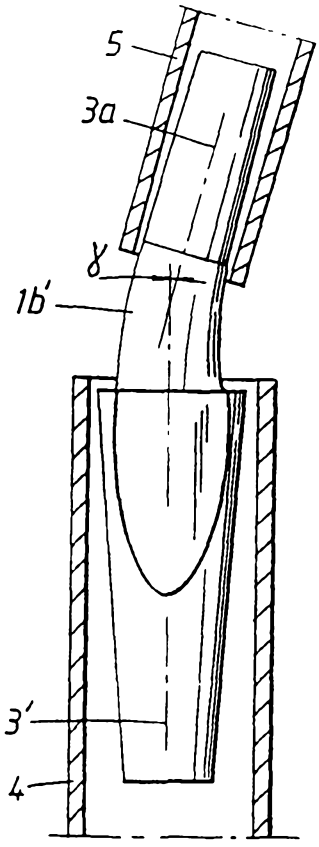


Fig. 3

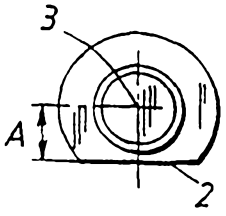


Fig. 5

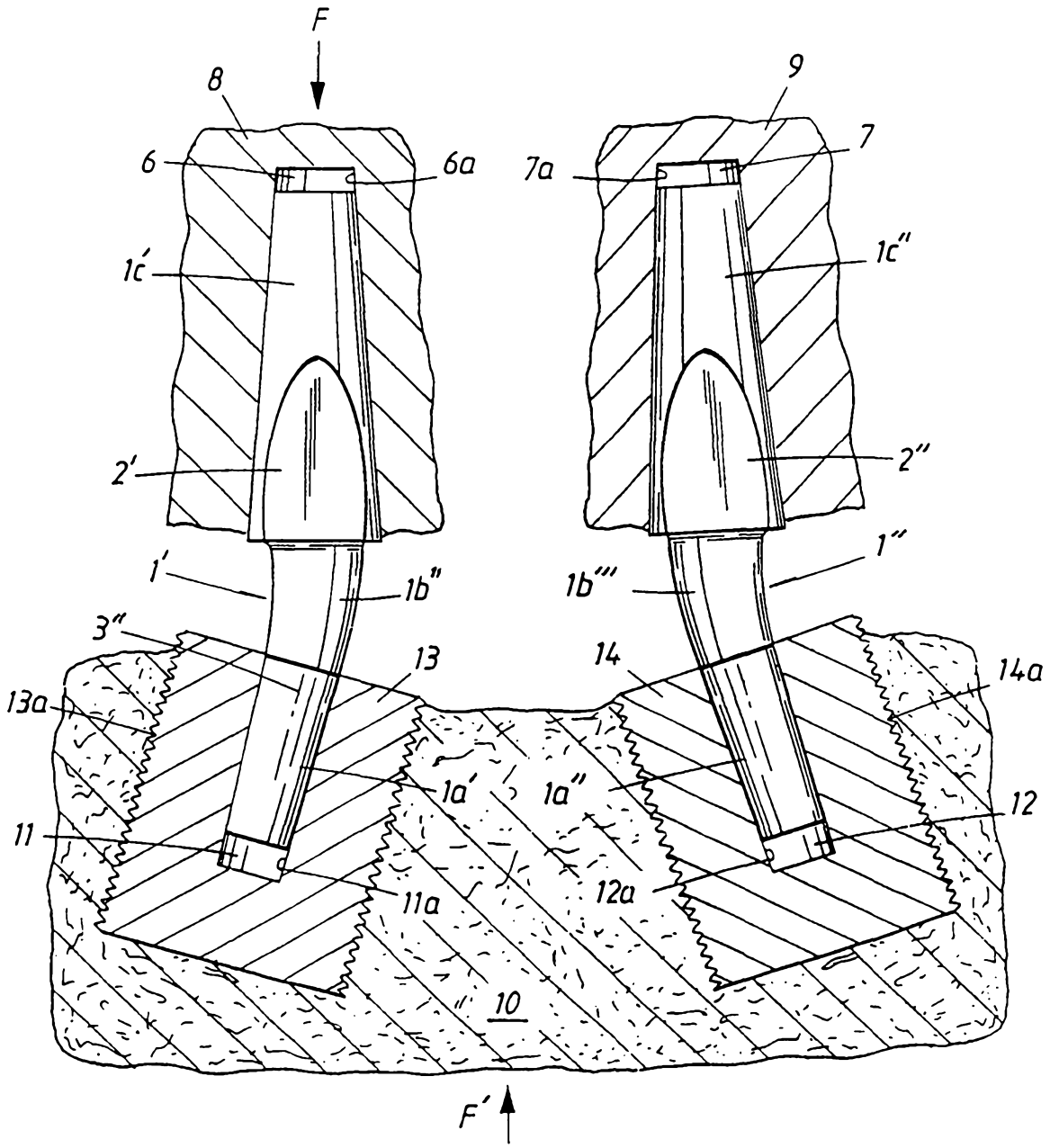


Fig. 6

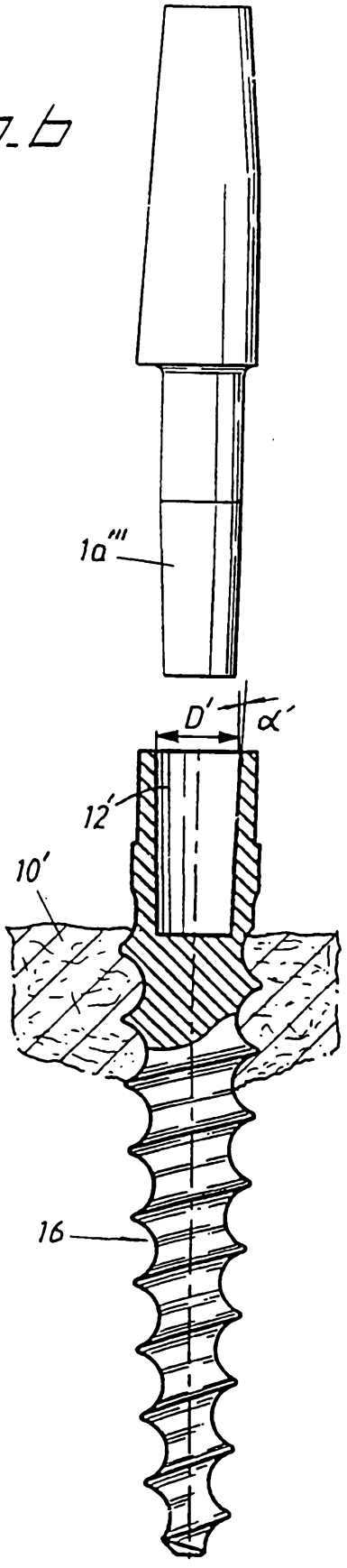


Fig. 6a