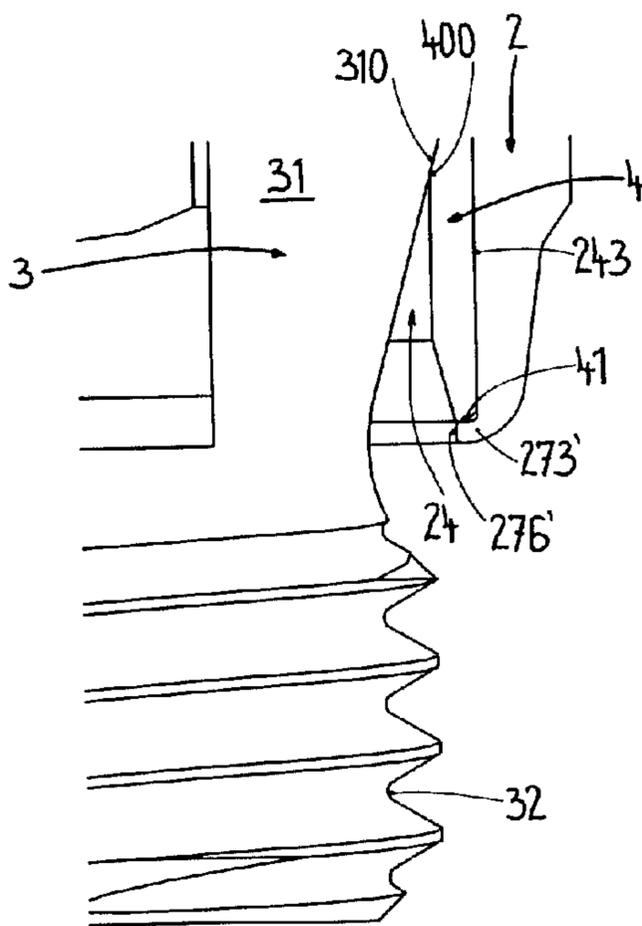




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(57) **Abrégé/Abstract:**

The invention relates to a connection between a known dental implant (1) and a straight or angular abutment (2) which can be established by means of a base screw (3) and a support ring (4). The support ring (4) is fixedly introduced into the inlet of the abutment (2) near the lower edge of same, Preferably by welding or by bending over of the lower edge of the abutment (2). Before insertion of the support ring (4) the base screw (3) is introduced head first into the inlet (24) from the side of the root part of the abutment (2). The base screw is held in the abutment (2) by the support ring (4) on which the base screw (3) rests, The threaded shank (32) of the base screw (3) engages the inner thread (14) provided for in the implant (1) and draws the abutment (2) into the receiving hole (12) of the implant (1). An angled surface of the base screw (3) and a beveled surface of the support ring (4) contact each other so that the welding seam or bent over lower edge of the abutment (2) are relieved of axial stress. The above connection system is designed especially for implants (1) with a conical receiving hole (12) and internal polygon as well as abutments (2) having a complementary external conical shape and external polygon.

(57) Abstract

The invention relates to a connection between a known dental implant (1) and a straight or angular abutment (2) which can be established by means of a base screw (3) and a support ring (4). The support ring (4) is fixedly introduced into the inlet of the abutment (2) near the lower edge of same, preferably by welding or by bending over of the lower edge of the abutment (2). Before insertion of the support ring (4) the base screw (3) is introduced head first into the inlet (24) from the side of the root part of the abutment (2). The base screw is held in the abutment (2) by the support ring (4) on which the base screw (3) rests. The threaded shank (32) of the base screw (3) engages the inner thread (14) provided for in the implant (1) and draws the abutment (2) into the receiving hole (12) of the implant (1). An angled surface of the base screw (3) and a beveled surface of the support ring (4) contact each other so that the welding seam or bent over lower edge of the abutment (2) are relieved of axial stress. The above connection system is designed especially for implants (1) with a conical receiving hole (12) and internal polygon as well as abutments (2) having a complementary external conical shape and external polygon.

Connection arrangement between a dental implant and an abutment

Field of application of the invention

5 The present invention relates to a connection arrangement which comprises a dental implant known per se, which can be inserted into the jaw bone, and an abutment to be fixed on the implant. At the top, on the head of the implant, an axial, downwardly extending receiving hole, which is preferably widened conically upward, opens out within an encircling implant shoulder. The lower root part of the
10 abutment, which, when there is a conical inner configuration of the receiving hole, has a complementary conical outer contour, can be inserted into the receiving hole. For the reproducible positioning of the abutment, a non-rotationally-symmetrical receiving contour may be advantageously provided in the receiving hole and have relating to it a corresponding, non-rotationally-symmetrical outer
15 mating contour on the root part of the abutment. The non-rotationally-symmetrical contours complementing one another likewise represent a rotational securement for the inserted abutment, the rotational securement in fact already being brought about by the cone-cone connection between the inner cone of the implant and the conical root part on the abutment.

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From the bottom of the receiving hole there extends further downward a coaxial internally threaded hole for the engagement of a base screw disposed axially in the abutment, so that the abutment is fixed on the implant by screwing in of the base screw. The base screw is introduced into the abutment, the head of the base
25 screw being supported in the abutment, while the threaded shank of the base screw protrudes out of the abutment at the bottom and engages in the internally threaded hole in the implant. Connection arrangements of this type are used both for straight abutments and for angled abutments. The base screw secures the abutment axially on the implant and – if the implant and abutment have non-
30 rotationally-symmetrical contours engaging in one another – also against rotation in addition to the cone-cone connection. The selectable rotational positions in which the abutment can be fixed are limited by the shaping of the non-rotationally-symmetrical contours, for example the number of corners of polygons used.

35 Prior art

The basic structure of the implant – but still without a non-rotationally-symmetrical receiving contour, preferably an internal polygon – is known for example from the monograph by SCHROEDER/SUTTER/BUSER/KREKELER: Oral Implantology, Georg Thieme Verlag Stuttgart, 2nd edition 1996, page 127. Such an implant has

the implant head at the top and the shank part at the bottom, the implant head terminating at the very top with the radially encircling implant shoulder and it being possible, depending on the type of implant, for there to be an external thread on the shank part. The implant shoulder surrounds the mouth of the receiving hole
5 conically narrowing axially downward, whereby the inner cone is produced. At the bottom of the hole, the receiving hole merges into a coaxial internally threaded hole of reduced diameter, which extends apically into the shank part and has the internal thread.

10 WO 94/09717 and WO 97/14371 disclose implants of the type described above which have within the receiving hole an internal polygon arranged at a distance from the implant shoulder. Complementing this, there are external polygons on the respective abutments. The internal polygon in the implant brings with it consider-
15 able advantages as a positioning aid for the reproducible positioning of the inserted abutment in conjunction with the superstructures which are adapted by the prosthetist or dental technician, and possibly as rotational securement. The angle of rotation with respect to the longitudinal axis of an inserted abutment whose neck part protruding above the implant shoulder is not rotationally symmetrical must be transferred to a dental model in relation to the anatomy surrounding the implanta-
20 tion site. In the case of the implant according to US 4,960,381, the internal polygon is additionally used beforehand for screwing into the bone, in that a socket wrench is inserted into the internal polygon.

WO 97/14371 discloses a connection arrangement between an implant with an
25 internal polygon in the conical receiving hole and an abutment with a corresponding, apically extending root part. In the case of this design, there is in the root part of the abutment, close to the lower outlet of the passage, a radial groove for receiving a spreading ring. The spreading ring is pushed onto the shank piece of the base screw and comes to lie under the screw head. The base screw can then be
30 pushed with the screw head first into the root part, until the spreading ring slides into the radial groove. The abutment preassembled to this extent with the base screw and the spreading ring is inserted into the receiving hole of the implant. In the case of a straight abutment, the passage is axial. In the case of an angled abutment, the passage is likewise angled and may have an additional vertically
35 oriented lateral opening for the perpendicular insertion of the screwing implement. The screwing implement is inserted through the passage or the lateral opening and the threaded shank of the base screw is thus screwed into the internally threaded hole of the implant. The screw head of the base screw presses on the

spreading ring, which introduces the tensile force into the abutment, so that the latter is drawn into the receiving hole.

The connection arrangement according to WO 97/14371 has the major advantage
5 that the screw head of the base screw does not have to be introduced from above into the passage of the abutment. This allows the passage at the coronal end, in which an internal thread for an occlusal screw may be provided, to be shaped such that it is dimensioned smaller than the diameter of the screw head of the base screw. The space available on the superstructure, for example on the artificial
10 tooth crown, limits the size of the insertable occlusal screw. In the interests of the strength of the screw connection, however, a base screw which is not reduced in diameter in relation to the occlusal screw but has the same diameter may be used. The main resultant advantage is that screws of the same diameter as the base screw and as the occlusal screw that can be screwed into the coronal end can be
15 used; i.e. the internally threaded hole in the implant and the internally threaded hole in the coronal part of the abutment have the same diameter. This serves for the reliability of the screw connections and simplifies the system which forms the implants of various configuration with the variety of structural parts and the set of implements.

20

With the connection arrangement according to WO 97/14371, significant progress was achieved in comparison with the previously applicable state of the art. The forming of the internal radial groove in the abutment and the use of the spreading ring disposed on the base screw and received in the radial groove cannot, how-
25 ever, be regarded as the ultimate, complete solution. The mechanical working of the radial groove in the abutment and a radial groove on the shank of the base screw in which the spreading ring is seated during the pushing of the base screw into the abutment must take place with high precision and altogether requires a not inconsiderable outlay in terms of working and inspection. Bearing in mind the rela-
30 tively small dimensions of the connection arrangement, the relatively high forces to be absorbed under alternating loading and the enormous requirements for reliability, there is the need to retain the basic advantages of the connection arrangement but to lower the production outlay and, in particular, further increase the reliability. The head of the base screw presses on the relatively narrow annular surface at
35 the top of the spreading ring and the spreading ring is for its part seated in a pressing manner on a likewise narrow horizontal annular surface within the radial groove.

Object of the invention

In view of the need to improve the functional reliability of the previously known connection arrangement and at the same time lower the production outlay, the invention is based on the object of proposing a perfected connection arrangement. A connection arrangement between an implant and a straight or angled abutment that is distinguished by extremely high reliability is to be provided. The abutment must at the same time allow itself to be fixed in a practical way on the implant and must not be loosened even as a result of micro-movements. Moreover, the connection arrangement is to comprise a small number of uncomplicated parts and consequently be inexpensive to produce. The parts of the connection arrangement should have a system character and consequently be able to be used for different variants of the connection arrangement – i.e. for combination with various abutments. The main advantages of a connection arrangement where the base screw is inserted with the screw head first into the root part of the abutment are to be retained. An additional objective here is that the flexurally greatly stressed base screw should have a small longitudinal force and a loosening moment that is as high as possible.

Summary of the invention

Provided in the abutment is an inlet, which could be an axial passage. From the side of the root part, a base screw can be pushed with its screw head first into this inlet, as far as a head zone. The threaded shank of the base screw, which is reduced in diameter with respect to the screw head and, in the inserted state, protrudes from the root part of the abutment, is intended for engagement in the axially extending internally threaded hole in the implant. After insertion of the base screw into the abutment, a support ring is pushed over the threaded shank of the base screw into the mouth of the inlet and is fixed in its intended position. Fixing takes place by radial welding to the lower edge of the abutment. An alternative possibility is for the support ring to be adhesively bonded to the inner wall of the abutment, for which purpose a biocompatible and officially approved cement or adhesive is used. A further alternative for the fixing of an inserted support ring is to provide that the lower edge of the abutment is extended in order to bend said lower edge around inward after the pushing in of the support ring, i.e. gripping under the lower edge of the support ring. The base screw then rests in each case on the fixed support ring.

It has proven to be favorable to provide the support ring on its upper and lower edges with an internal beveled surface and to shape the part of the screw neck situated beneath the screw head such that it widens conically toward the screw

head. Consequently, in the screwed state, a sloping surface of the screw neck presses against the internal beveled surface of the support ring. With the support ring having an identical contour at the upper and lower edges, it does not matter which edge of the support ring is at the top. To give it elasticity, the support ring could have a penetrating vertical slit or partial slits. In a special configuration, the support ring has an internal thread complementing the threaded shank of the base screw, so that the support ring must be screwed on when it is fitted onto the base screw.

10 The connection arrangement comprising the abutment with the inserted base screw, which is held by the introduced support ring, and the implant is put together in the following way. The abutment is brought with the threaded shank of the base screw first up to the receiving hole of the implant, so that the threaded shank is above the internally threaded hole of the implant. If there is a non-rotationally-symmetrical receiving contour – for example an internal polygon – in the implant and a complementary outer mating contour on the abutment, it must be ensured that the two contours are in a congruent position when they are brought into place. A suitable screwing implement is used to reach through the penetrating axial passage in the abutment or a provided lateral opening into the engagement contour of the base screw and screw the latter into the internally threaded hole. Consequently, the abutment is drawn increasingly deeper and more firmly into the receiving hole, the screw neck pressing onto the support ring fixed in the abutment.

25 Then the further superstructure can be fitted onto the abutment, the method by which it is fastened depending on the design of the abutment respectively used. If the abutment has an internally threaded hole, a method which comes into consideration is a screw connection with an occlusal screw, which is advantageously of the same diameter as the base screw. In the anterior tooth area, or if the implant is in a slanted position, where occlusal screw connection is not possible, an abutment with a lateral hole will be used for the transversal screw connection of the fitted-on crown cap. In the case of solid abutments, the superstructure is cemented onto the abutment.

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According to a broad aspect of the invention, there is provided a connection arrangement comprising a dental implant and an abutment to be fixed on it, in which:

a) the implant has an implant head and a downwardly extending shank part; b) provided in the implant head is a receiving hole, which opens out at the top, which is surrounded by an implant shoulder, and at the bottom ends at the bottom of the hole in the form of a blind hole, from which there extends an axial, downwardly facing internally threaded hole; c) the abutment has an upper neck part and a lower root part, which ends at a lower edge, and the neck part protrudes out of the implant, while the root part is disposed in the receiving hole; d) a base screw having a screw head and a threaded shank, connects the abutment to the implant, and the threaded shank of the base screw engages in the internally threaded hole; e) the abutment has an inlet, which begins at the lower edge and arranged in which there is a support ring, through which the base screw protrudes; wherein f) the support ring is firmly inserted in the inlet; g) before the insertion of the support ring, the base screw is introduced into the inlet with the screw head first, from the side of the root part; and h) the base screw is held in the abutment and the screw head rests on the support ring.

According to another broad aspect of the invention, there is provided an abutment with a base screw and support ring for the fixing of a dental implant, in which: a) the abutment has: aa) an upper neck part; and ab) a lower root part, which ends at a lower edge, and is intended for insertion in a receiving hole provided in the implant; ac) the lower edge is where an inlet begins; b) the base screw has: ba) a screw head; and bb) a threaded shank, which is intended for engagement in an internally threaded

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-5b-

hole, which is provided in the implant; c) the support ring is arranged in the inlet; and d) the base screw protrudes through the support ring, wherein e) the support ring is firmly inserted in the inlet, f) before the insertion of the support ring, the base screw is introduced into the inlet with the screw head first, from the side of the root part; and g) the base screw is held in the abutment, and the screw head rests on the support ring.

The invention is responsible for providing a connection arrangement between an implant and an abutment which is distinguished by very high functional reliability - i.e. being held together in a stable and precise manner in the fitted state - and advantageous fitting and removal properties. The connection arrangement according to the invention can be produced at efficient production costs and is suitable in particular for implants with a non-rotationally-symmetrical receiving contour in

combination with straight or angled abutments with a corresponding non-rotationally-symmetrical outer mating contour.

Brief description of the attached drawings

5 In the drawings:

Figure 1 shows an implant with an internal octagon in the implant head as a partial section;

10 Figure 2A shows a straight abutment of a *first configuration* with an external octagon at the root part and an external octagon at the neck part as a partial section;

Figure 2B shows an angled abutment of a *second embodiment* with an external octagon at the root part, a conical neck part and a lateral opening;

15 Figure 2C shows the abutment according to Figure 2B from below as a perspective view;

Figure 2D shows the abutment according to Figure 2B, with offsetting of the external octagon at the root part by 22.5°, from below as a perspective view;

20 Figure 2E shows a straight abutment of a *third embodiment* with an external octagon at the root part, a conical neck part and two lateral openings;

Figure 3A shows a base screw of a *first embodiment* with a conically constricted neck;

25 Figure 3B shows the base screw of a second embodiment with a conically cylindrical neck;

Figure 4A shows a support ring of a *first embodiment*;

Figure 4B shows a support ring of a *second embodiment* with a penetrating vertical slit;

30 Figure 4C shows a support ring of a *third embodiment* with four expansion slits;

Figure 4D shows a support ring of a *fourth embodiment* with an internal thread and a penetrating vertical slit;

35 Figure 5A shows the abutment according to Figure 2A, the support ring according to Figure 4A and the base screw according to Figure 3B in combination as a partial section;

Figure 5B shows the abutment according to Figure 2B, the support ring according to Figure 4A and the base screw according to Figure 3B in combination as a partial section;

Figure 5C shows the abutment according to Figure 2E, the support ring according to Figure 4A and the base screw according to Figure 3B in combination as a partial section;

5 Figure 6A shows a connection arrangement with the implant according to Figure 1, the abutment according to Figure 2A, the support ring according to Figure 4A and the base screw according to Figure 3B as a partial section;

10 Figure 6B shows the connection arrangement according to Figure 6A with a fitted-on gold cap and occlusal screw as a partial section;

15 Figure 6C shows a connection arrangement with the implant according to Figure 1, the abutment according to Figure 2E, the support ring according to Figure 4A, the base screw according to Figure 3B and a screw-connected transversal cap as a partial section;

Figure 7A shows the straight abutment according to Figure 2A with an axially extended lower edge, inserted support ring according to Figure 4A and inserted base screw according to Figure 3A as a partial section;

Figure 7B shows the detail X from Figure 7A as an enlargement;

20 Figure 7C shows the arrangement according to Figure 7A with the lower edge bent around, fixing the support ring; and

Figure 7D shows the detail Y from Figure 7C as an enlargement.

Exemplary embodiments

25 The detailed description of exemplary embodiments of the connection arrangement according to the invention on the basis of the attached drawings follows.

30 The following statement applies to the entire further description. If reference numerals are included in a figure for the purpose of elucidating the drawing, but are not explained in the directly associated text of the description, you are referred to where they are mentioned in the descriptions of previous figures. In the interests of overall clarity, components are not usually denoted again in the subsequent figures, provided that it is clear from the drawing that they are "recurrent" components.

35

Figure 1

The implant 1 used in the connection arrangement is of a construction known per se. The implant 1 has at the top the implant head 10 and at the bottom the shank part 19, the implant head 10 terminating at the very top with the radially encircling

implant shoulder 11 and it being possible, depending on the type of implant, for there to be an external thread 190 on the shank part 19. The implant shoulder 11 surrounds the mouth of the receiving hole 12, conically narrowing axially downward. At the bottom 13 of the hole, the receiving hole 12 merges into a coaxial internally threaded hole 14 of reduced diameter, which extends into the shank part 19.

Formed inside the receiving hole 12 as a non-rotationally-symmetrical receiving contour there is here, by way of example, a radially encircling internal octagon 15. Beneath the internal octagon 15 lies a circular annular groove 16, which is recommendable for the machining of the internal octagon 15. The internal octagon 15 finishes in the upward direction in parabolic tips. The internal octagon 15 preferably lies within the receiving hole 12 in such a way that uninterrupted, mutually aligned cone portions 120,121 of the receiving hole 12 are retained beneath it. The implant 1 represented is a solid-screw implant; however, the connection arrangement may equally be constructed with a hollow-screw, hollow-body and solid-body implant of a straight or angled version.

Figure 2A

This straight abutment 2 of a *first embodiment* has at the top the neck part 20 and the downwardly adjoining root part 29, which is conical in certain portions. Said root part is intended for insertion into the receiving hole 12 of the implant 1, while the neck part 20 protrudes above the implant shoulder 11. The neck part 20 is divided into three segments, to be specific the polygonal segment 21 directly adjoining the root part 29 – here an external octagon –, the cylindrical guiding segment 23 at the very top and the cone segment 22 lying between the polygonal segment 21 and the guiding segment 23. The polygonal segment 21 is useful for reproducible positioning when taking impressions and making models and also for possible rotational securement of the fitted-on superstructure. The guiding segment 23 contributes to the centering and guiding of the fitted-on crown cap.

On the root part 29 there is a mating contour complementing the receiving contour 15 in the implant 1, consequently here an external octagon 28. Above the external octagon 28 lies a cone portion 270, which is adjacent to the polygonal segment 21, and beneath the external octagon 28 lies the cone portion 271, with which the abutment 2 ends at the lower edge 272. The two cone portions 270,271 are in alignment with one another, so that in the inserted state the upper and lower cone portions 120,270;121,271 respectively of the implant 1 and of the abutment 2 come to lie against one another. The plane faces of the polygonal segment 21 and

of the external octagon 28 are preferably in alignment with one another.

Through the abutment 2 there extends an inlet 24, here in the form of an axial passage, which is divided into a plurality of zones. In the region of the guiding segment and cone segment 23, 22, an internal thread 240 is provided for receiving an occlusal screw. The internal thread 240 preferably has the same diameter as the internally threaded hole 14 in the implant 1. Beneath the internal thread 240 there lies, after a shoulder surface 244, a head zone 241, which is widened in diameter with respect to the internal thread 240 and extends approximately over the region of the polygonal segment 21 and upper cone portion 270. With a circular shoulder surface 242, the head zone 241 merges downward toward the mouth of the inlet 24 into a radial widening 243. The widening 243 has a greater internal diameter than the head zone 241 and is intended for receiving a support ring, the depth of insertion of which is limited by the shoulder surface 242.

15

Figures 2B and 2C

The abutment 2 represented, of a *second embodiment*, has in comparison with the *first embodiment* a modified neck part 20, which obliquely adjoins the unchanged root part 29 and, toward the free, upper end, is conically tapered as a whole. At the bottom, the abutment 2 ends with the lower edge 272. The inlet 24 is now angled, again being provided internally with the internal thread 240 and – all not visible – the head zone 241, the shoulder surface 242 and the widening 243. For the engagement of a screwing implement, the abutment 2 has on the neck part 20 a perpendicularly oriented lateral opening 200. The external octagon 28 on the root part 29 is aligned in such a way that two mutually parallel plane faces 280 of the external octagon 28 are aligned perpendicularly with respect to the inclination of the neck part 20. For better adaptation to the respective anatomical situation, various inclinations, for example 15° and 20°, may be provided within a system.

30 Figure 2D

In a variant of the angled abutment 2, the external octagon 28 has at the root part 29 an offset of 22.5°, so that all the plane faces 280 of the external octagon 28 are aligned peripherally with respect to the inclination of the neck part 20. The tips formed by the point of intersection of two neighboring plane faces 280 then lie perpendicularly with respect to the inclination of the neck part 20. With the two variants according to Figures 2C and 2D, 16 rotational positions respectively with an offset of 22.5° are then available.

35

Figure 2E

The abutment **2** of the *third embodiment* has a conical neck part **20**, which adjoins the unchanged root part **29** in a straight manner and advantageously terminates at the very top with a cylindrical guiding segment **23**. On the neck part **20** there are
5 two lateral openings **201** for transversal screw connection with a fitted-on crown cap. The lateral openings **201** are preferably offset from alignment with respect to one another by 22.5° . Consequently, 16 rotational positions of a transversal cap **7** fitted onto the implant **1** and the abutment **2** are available (see Figure 6C). This makes better adaptation to the anatomical conditions encountered possible, which
10 is relevant in particular when replacing an individual tooth.

Figure 3A

For the construction of the connection arrangement according to the invention on the implant **1**, alternatively one of the embodiments described above of the abutment **2** – the neck part **20** could have further modifications – and a base screw **3**
15 are required. Considered in the downward direction, the base screw **3** comprises the basically cylindrical screw head **30**, the conically constricted screw neck **31** adjoining it and the lower threaded shank **32**. Provided on the upper side of the screw head **30** is an engagement contour **300** for the screwing implement. The
20 screw neck **31**, which is conical at the top, continues steplessly beneath the screw head **30** with an initially tapering sloping surface **310** and then, in a constricted form, merges into the threaded shank **32**, in a thickening form. The harmonious transitions between the screw head **30**, screw neck **31** and threaded shank **32** serve for reducing concentrations of stress. In the interests of a lowest possible
25 longitudinal screw force of the base screw **3**, the surface of the threaded shank **32** should be relatively smooth and, to achieve a high loosening moment, the sloping surface **310** on the other hand should be made rougher.

Figure 3B

30 The only difference from the base screw **3** described above of the first embodiment is in the geometry of the screw neck **31**, which here in the second embodiment is conical-cylindrical. The sloping surface **310** in turn follows on beneath the screw head **30** without any step. The transitions are advantageously rounded.

Figures 4A to 4D

35 In the first, simplest form (Figure 4A), the support ring **4** comprises a tubular neck piece and has at its upper edge **40** an internal beveled surface **400** for providing support for the sloping surface **310** of the base screw **3**. The lower edge **41** is preferably also provided with a beveled surface **400**, so that during production the

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support ring 4 can be inserted into the abutment 2 without it mattering with which edge 40,41 first the support ring 4 is introduced. In the case of the *second embodiment* (Figure 4B), the support ring 4 has a penetrating vertical slit 42 and is consequently open. In the *third embodiment* (Figure 4C), a plurality of systematically distributed expansion slits 43 are provided. These expansion slits 43 run from the upper edge 40 vertically toward the lower edge 41 and extend over part of the height of the support ring 4. The beveled surface 400 is consequently repeatedly interrupted by the expansion slits 43. In the case of the *fourth embodiment* (Figure 4D), the support ring 4 is open as a result of a vertical slit 42, and an internal thread 44 passes through the support ring 4. The internal thread 44 matches the thread on the threaded shank 32, so that, during preassembly, the support ring 4 can be screwed onto the base screw 3 by means of the threaded shank 32. This form of the support ring 4 is more complex to produce, but a widened beveled surface 400 is thereby obtained for the supported base screw 3.

15

Figure 5A

A base screw 3, which is held by a support ring 4, is inserted into a straight abutment 2, having a polygonal segment 21, cone segment 22 and guiding segment 23, as a structural unit. Two largely similar working methods seem appropriate for the assembly of this structural unit.

20

First working method

1st step: Introduction of the screw head 30 of the base screw 3 from below into the inlet 24 of the abutment 2, so that the screw head 30 comes to lie inside the head zone 241.

25

2nd step: Guiding of the support ring 4 over the threaded shank 32 and insertion of the support ring 4 into the widening 243 in the abutment 2. The support ring 4 and the widening 243 together form a press fit in the upper portion.

30

3rd step: Fixing of the support ring 4, seated in the widening 243, by adhesively bonding or cementing in place on the widening 243 or welding at its lower edge 41 to the lower edge 272 of the abutment 2. The sloping surface 310 of the base screw 3 rests on the internal beveled surface 400 in the support ring 4.

35

Second working method

1st step: Guiding of the support ring 4 over the threaded shank 32 of the base screw 3.

2nd step: Introduction of the screw head **30** of the base screw **3** from below into the inlet **24** of the abutment **2** and insertion of the support ring **4** into the widening **243** in the abutment **2**.

3rd step: Fixing of the support ring **4** seated in the widening **243**.

5

The structural unit can be sold in this preassembled combination of the abutment **2** and base screw **3** held by the support ring **4**.

Figures 5B and 5C

10 In the same way, a structural unit can be produced from an angled abutment **2** with the lateral opening **200** or a straight abutment **2** for transversal screw connection with the lateral openings **201** and the base screws **3** held by the support rings **4**.

15 Figure 6A

In the completed connection arrangement, the root part **29** of the abutment **2** is seated in the receiving hole **12** of the implant **1**, while the neck part **20** of the abutment **2** protrudes above the implant shoulder **11**. The base screw **3** has been screwed with its threaded shank **32** into the internally threaded hole **14** of the im-
 20 plant **1** and the sloping surface **310** of the base screw **3** presses on the beveled surface **400** of the support ring **4** seated firmly in the abutment **2**. The forces acting on the support ring **4** via the sloping surface **310** and the beveled surface **400** have the effect that major force components are directed transversely onto the support ring **4** or the abutment **2**, so that the fastening of the support ring **4** is not
 25 subjected as much to being pressed out axially. This is significant in particular if the fixing of the support ring **4** in the abutment **2** is realized by welding its lower edge **41** to the lower edge **272** of the abutment **2**. In this way, the weld seam is relieved of the axial forces acting. The shoulder surface **244** is positioned such that it bounds the head zone **241** in such a way that, when the base screw **3** is un-
 30 screwed, its screw head **30** bears with its upper end face against the shoulder surface **244**, before the threaded shank **32** of the base screw **3** fully disengages from the internal thread **14** in the implant **1**. As a result, when the base screw **3** is unscrewed further, the abutment **2** is ejected from the cone portions **120,121** in the implant **1**.

35

Figure 6B

Here, the connection arrangement according to the previous figure is supplemented by a sleeve-shaped crown cap **5**, known per se, which has been fitted onto the abutment **2** and is held by a conventional occlusal screw **6**, engaging in the

internal thread **240** in the abutment **2**. The occlusal screw **6** and base screw **3** are of the same cross-sectional dimension. The screw head **60** of the occlusal screw **6** lies in a screw seat **50**, which is located at the top internally in the crown cap **5**. For supporting on the implant shoulder **11**, the crown cap **5** has a flange-like rim **51** complementing the implant shoulder **11**.

Figure 6C

This connection arrangement comprises an implant **1**, an abutment **2** and a transversal cap **7**, known per se, which has been fitted onto the abutment **2** and screw-connected transversely to the abutment **2** by means of a conventional clamping screw **8**. The root part **29** of the abutment **2** is in turn seated in the receiving hole **12** of the implant **1** and the neck part **20** of the abutment **2** protrudes above the implant shoulder **11**. The threaded shank **32** of the base screw **3** engages in the internally threaded hole **14** of the implant **1**, the base screw **3** pressing in the way described above the beveled surface **400** of the support ring **4** seated in the abutment **2**. At the very bottom of the transversal cap **7** there is a conical supporting surface **71** and a lug **70** protruding away laterally, with a transversal threaded hole **72**, into which a clamping screw **8** has been screwed. The clamping screw **8** is directed at one of the two lateral openings **201**, so that the tip **80** of the clamping screw protrudes into the lateral opening **201**, is supported at the top against the lateral openings **201** and, as a result, presses the transversal cap **7** with the supporting surface **71** onto the implant shoulder **11**.

Figures 7A and 7B

Shown here is a further embodiment for the fixing of the support ring **4** inserted into the straight abutment **2**, on the beveled surface **400** of which ring the sloping surface **310** of the screw neck **31** of the base screw **3** is seated. The screw head **30** is in turn located in the internal head zone **241** in the abutment **2**. The initially not yet fixed support ring **4** lies in the widening **243** within the inlet **24**. The abutment **2** is provided with an axially lower-lying lower edge **272'**, which protrudes as bending zone **273'** apically in the downward direction beyond the lower edge **41** of the, to this extent positioned, support ring **4**. With regard to the two alternative working methods, for the 1st and 2nd working steps of the preassembly of the base screw **3** and support ring **4** you are referred to the description relating to Figure 5A.

To enhance the flow behavior of the bending zone **273'** during the bending-around operation and to achieve optimum contouring after the bending-around operation, the bending zone **273'** has an outer, radially encircling narrowing **274'** with respect

to the wall of the abutment 2 lying above the narrowing 274'. The transition into the narrowing 274' is formed by a concave curvature 275' and the lower edge 272' has an inwardly facing, apically open conical surface 276'.

5 Figures 7C and 7D

In the case of the arrangement formed and preassembled according to Figures 7A and 7B, for the permanent fixing of the support ring 4, the extended lower edge 272' is bent around in the inward-facing direction, i.e. in the direction of the screw neck 31. After the bending-around operation, the deformed bending zone 273' of
10 the abutment 2 grips under the lower edge 41 of the support ring 4, so that the latter is now fixed in its seating in the widening 243. The narrowing 274' of the bending zone 273' now provides a rounding, running harmoniously under the support ring 4, and the previous conical surface 276' provides an axially extending edge. The base screw 3 rests on the fixed support ring 4, i.e. the configuration of
15 the sloping surface 310 on the screw neck, which presses on the beveled surface 400 at the upper edge 40 of the support ring 4 when the base screw 3 is tightened, causes the force to be introduced essentially laterally into the abutment 2. Remaining axial force components act on the bent-around lower edge 272' to a relatively slight extent.

20

In the case of this embodiment of the connection arrangement, there is no need for the apparatus for laser welding and the corresponding specific inspection outlay, which can be replaced by a mechanical bending-around device with adequate quality control.

25

Further structural modifications can be realized with respect to the exemplary embodiments described above. The following are expressly mentioned here:

- 30 – The receiving hole 12 in the implant 1 could be of a cylindrical form. It is possible to dispense with the internal octagon 15 and its positioning within the receiving hole 12 is freely selectable.
- In principle, the abutment 2 must have a root part 29 complementing the receiving hole 12 of the implant 1. If the implant 1 has an internal octagon 15, abutments 2 with and without an external octagon 28 can be used in it.
35
- The outer contour of the neck part 20 of the abutment 2 may be fully conical or fully cylindrical or have combinations of conical and cylindrical segments.

- 15 -

- 5 – The polygonal segment **21** on the abutment **2** could be replaced by some other non-rotationally-symmetrical outer contour, which may lie at the very top of the abutment **2** or between two segments of the neck part **20**. In further alternatives, the non-rotationally-symmetrical outer contour could extend – for example as a flattening – over a plurality of segments of the neck part **20** or over the entire neck part **20**.
- 10 – The internal thread **240** in the abutment **2** may also have a smaller or slightly larger diameter than the internal thread **14** in the implant **1**.
- For a person skilled in the art, it goes without saying that the inner contour of the crown cap **5** and of the transversal cap **7** must be adapted to a modified outer contour of the abutment **2** and of the implant shoulder **11**.

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CLAIMS:

1. A connection arrangement comprising a dental implant and an abutment to be fixed on it, in which:
- a) the implant has an implant head and a
5 downwardly extending shank part;
 - b) provided in the implant head is a receiving hole, which opens out at the top, which is surrounded by an implant shoulder, and at the bottom ends at the bottom of the hole in the form of a blind hole, from which there
10 extends an axial, downwardly facing internally threaded hole;
 - c) the abutment has an upper neck part and a lower root part, which ends at a lower edge, and the neck part protrudes out of the implant, while the root part is
15 disposed in the receiving hole;
 - d) a base screw, having a screw head and a threaded shank, connects the abutment to the implant, and the threaded shank of the base screw engages in the internally threaded hole;
 - 20 e) the abutment has an inlet, which begins at the lower edge and arranged in which there is a support ring, through which the base screw protrudes; wherein
 - f) the support ring is firmly inserted in the inlet;
 - 25 g) before the insertion of the support ring, the base screw is introduced into the inlet with the screw head first, from the side of the root part; and
 - h) the base screw is held in the abutment and the screw head rests on the support ring.

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2. The connection arrangement as claimed in claim 1,
wherein

a) the support ring has an upper edge and a lower
edge; and

5 b) the lower edge of the support ring is welded to
the lower edge of the abutment.

3. The connection arrangement as claimed in claim 1,
wherein

10 a) the support ring has an upper edge and a lower
edge;

b) the abutment has an apically extending bending
zone which extends axially beneath the lower edge of the
inserted support ring and terminates at the very bottom with
a lower edge; and

15 c) once the bending-around operation has been
performed, this bending zone grips around and under the
lower edge of the support ring.

4. The connection arrangement as claimed in claim 3,
wherein, to enhance the flow behavior of the bending zone
20 during the bending-around operation and to achieve optimum
contouring after the bending-around operation,

a) the bending zone has an outer, radially
encircling narrowing with respect to the wall of the
abutment lying above the narrowing;

25 b) the transition into the narrowing is formed by
a concave curvature; and

c) the lower edge has an inwardly facing, apically
open conical surface.

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5. The connection arrangement as claimed in any one of claims 1 to 4, wherein

a) the support ring has at the upper edge a radially encircling beveled surface, which widens conically
5 toward the upper edge;

b) on the base screw there is above the threaded shank a downwardly tapering sloping surface;

c) the sloping surface of the base screw rests on the beveled surface of the support ring; and

10 d) the screw head has an engagement contour for the placing of a screwing implement.

6. The connection arrangement as claimed in any one of claims 1 to 4, wherein

a) the neck part of the abutment adjoins the root
15 part of the latter in a straight or angled form;

b) in the case of a straight abutment, the inlet passes right through and allows a screwing implement to be used to reach into the base screw from the side of the neck part;

20 c) in the case of an angled abutment, the neck part has a vertically oriented lateral opening to allow a screwing implement to be used to reach into the base screw;

d) in the case of an abutment for a superstructure which can be screwed on transversally, the neck part has at
25 least one transversally oriented lateral opening.

7. The connection arrangement as claimed in claim 1, wherein

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a) in the neck part of the abutment there is an internal thread for the engagement of an occlusal screw for the fixing of a superstructure; and

5 b) the internally threaded hole in the implant and the internal thread in the neck part of the abutment are of the same diameter.

8. The connection arrangement as claimed in claim 1, wherein

10 a) in the implant, the receiving hole widens conically upward and has a non-rotationally-symmetrical receiving contour; and

b) on the root part of the abutment there are complementing the conical receiving hole and the receiving contour an outer conical part and an outer mating contour.

15 9. The connection arrangement as claimed in claim 8, wherein

20 a) on the implant, the non-rotationally-symmetrical receiving contour is an internal polygon, above and beneath which there is respectively an uninterrupted cone portion, the two cone portions being in alignment with one another; and

25 b) on the abutment, the mating contour is an external polygon, which divides the cone part into a cone portion lying above it and a cone portion lying beneath it, the two of which are in alignment with one another.

10. The connection arrangement as claimed in claim 5, wherein the support ring

a) also has at the lower edge a radially encircling beveled surface, which widens conically toward

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the lower edge, whereby the support ring is of the same design at the upper and lower edges; and

b) can be shaped in an open form by means of a penetrating vertical slit, or has partially cut-in expansion
5 slits.

11. The connection arrangement as claimed in claim 5 or 10, wherein, for widening the beveled surface, the support ring has an internal thread, which complements the threaded shank of the base screw and allows screwing on of
10 the support ring via the threaded shank.

12. The connection arrangement as claimed in claim 1 or 5, wherein the base screw

a) has a screw neck between its screw head and threaded shank;

15 b) the sloping surface on the screw neck is located near the screw head;

c) the screw neck is conically constricted or conically cylindrical, the screw neck widening conically toward the screw head; and

20 d) the sloping surface having greater roughness than the threaded shank, in order to achieve a great loosening moment within the connection arrangement for the base screw.

13. The connection arrangement as claimed in any one
25 of claims 1 to 12, wherein the abutment

a) has in the inlet a widening, which begins at the lower edge and extends internally in the abutment upward adequately with respect to the height of the support ring as far as a shoulder surface;

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b) the widening has a greater clear diameter than the head zone lying above it, which is intended for receiving the screw head of the inserted base screw;

c) together with the support ring, the widening
5 forms a press fit, preferably in the upper portion, in the coronal direction;

d) the head zone has a greater clear diameter than the region of the inlet remaining above it; and

e) the head zone ends in the upward direction at a
10 constricting shoulder surface, which is positioned in a defined manner, whereby, when the base screw is unscrewed, its screw head bears with its upper end face against the shoulder surface, before the threaded shank of the base
15 screw fully disengages from the internal thread in the implant, and, when the base screw is unscrewed further, the abutment is ejected from the cone portions in the implant.

14. The connection arrangement as claimed in claim 6, wherein

a) in the implant, the receiving hole widens
20 conically upward and has a non-rotationally-symmetrical receiving contour, the receiving contour is an internal octagon;

b) on the root part of the abutment, there are, complementing the conical receiving hole and the receiving
25 contour, an outer conical part and an outer mating contour, the complementary mating contour is an external octagon with eight plane faces;

c) on an abutment with a neck part adjoining the root part in an angled manner, the external octagon is
30 positioned such that either

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ca) two plane faces lying parallel opposite one another lie perpendicular to the inclination of the neck part; or

5 cb) the external octagon is offset by 22.5° ,
whereby the edges formed at the point of intersection of two neighboring plane faces lie perpendicular to the inclination of the neck part.

15. The connection arrangement as claimed in claim 6, wherein

10 a) in the case of an abutment for a superstructure which can be transversally connected, the neck part has a first and a second transversally oriented lateral opening;

 b) the second lateral opening is offset in relation to the first lateral opening from alignment with
15 respect to one another by 22.5° .

16. The connection arrangement as claimed in claim 1, wherein on the neck part of the abutment there is an outer polygonal segment, the plane faces of which are preferably in alignment with the plane faces of the external octagon on
20 the root part.

17. The connection arrangement as claimed in claim 16, wherein

 a) the polygonal segment is an external octagon adjacent to the root part;

25 b) an upwardly tapering cone segment lies above the polygonal segment; and

 c) a terminating cylindrical guiding segment may lie above the cone segment.

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18. An abutment with a base screw and support ring for the fixing of a dental implant, in which:

a) the abutment has:

aa) an upper neck part; and

5 ab) a lower root part, which ends at a lower edge, and is intended for insertion in a receiving hole provided in the implant;

ac) the lower edge is where an inlet begins;

b) the base screw has:

10 ba) a screw head; and

bb) a threaded shank, which is intended for engagement in an internally threaded hole, which is provided in the implant;

c) the support ring is arranged in the inlet; and

15 d) the base screw protrudes through the support ring, wherein

e) the support ring is firmly inserted in the inlet,

20 f) before the insertion of the support ring, the base screw is introduced into the inlet with the screw head first, from the side of the root part; and

g) the base screw is held in the abutment, and the screw head rests on the support ring.

19. The abutment as claimed in claim 18, wherein

25 a) the support ring has an upper edge and a lower edge; and

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b) the lower edge of the support ring is welded to the lower edge of the abutment.

20. The abutment as claimed in claim 18, wherein

5 a) the support ring has an upper edge and a lower edge;

b) the abutment has an apically extending bending zone which extends axially beneath the lower edge of the inserted support ring and terminates at the very bottom with a lower edge; and

10 c) once the bending-around operation has been performed, this bending zone grips around and under the lower edge of the support ring.

21. The abutment as claimed in claim 20, wherein, to enhance the flow behavior of the bending zone during the bending-around operation and to achieve optimum contouring after the bending-around operation,

a) the bending zone has an outer, radially encircling narrowing with respect to the wall of the abutment lying above the narrowing;

20 b) the transition into the narrowing is formed by a concave curvature; and

c) the lower edge has an inwardly facing, apically open conical surface.

22. The abutment as claimed in any one of claims 18 to 21, wherein

25 a) the support ring has at the upper edge a radially encircling beveled surface, which widens conically toward the upper edge;

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b) on the base screw there is above the threaded shank a downwardly tapering sloping surface;

c) the sloping surface of the base screw rests on the beveled surface of the support ring; and

5 d) the screw head has an engagement contour for the placing of a screwing implement.

23. The abutment as claimed in any one of claims 18 to 22, wherein

10 a) the neck part of the abutment adjoins the root part of the latter in a straight or angled form;

b) in the case of a straight abutment, the inlet passes right through and allows a screwing implement to be used to reach into the base screw from the side of the neck part;

15 c) in the case of an angled abutment, the neck part has a vertically oriented lateral opening to allow a screwing implement to be used to reach into the base screw;

20 d) in the case of an abutment for a superstructure which can be screwed on transversally, the neck part has at least one transversally oriented lateral opening.

24. The abutment as claimed in claim 18, wherein

a) in the neck part of the abutment there is an internal thread for the engagement of an occlusal screw for the fixing of a superstructure; and

25 b) the internal thread in the neck part is of the same diameter as the internally threaded hole in the implant.

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25. The abutment as claimed in claim 18, wherein

a) on the root part of the abutment there are an outer cone part and an outer mating contour; with

b) the cone part complementing the receiving hole
5 widening conically upward in the implant; and

c) the mating contour complementing a non-rotationally-symmetrical receiving contour provided in the receiving hole.

26. The abutment as claimed in claim 25, wherein the
10 mating contour is an external octagon, which divides the cone part into a cone portion lying above it and a cone portion lying beneath it, the two of which are in alignment with one another.

27. The abutment as claimed in claim 22, wherein the
15 support ring

a) also has at the lower edge a radially encircling beveled surface, which widens conically toward the lower edge, whereby the support ring is of the same design at the upper and lower edges; and

20 b) can be shaped in an open form by means of a penetrating vertical slit, or has partially cut-in expansion slits.

28. The abutment as claimed in claim 22 or 27, wherein, for widening the beveled surface, the support ring
25 has an internal thread, which complements the threaded shank of the base screw and allows screwing on of the support ring via the threaded shank.

29. The abutment as claimed in claim 18 or 22, wherein the base screw

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a) has a screw neck between its screw head and threaded shank;

b) the sloping surface on the screw neck is located near the screw head;

5 c) the screw neck is conically constricted or conically cylindrical, the screw neck widening conically toward the screw head; and

d) the sloping surface having greater roughness than the threaded shank, in order to achieve a great
10 loosening moment within the connection arrangement for the base screw.

30. The abutment as claimed in any one of claims 18 to 29, wherein the abutment

a) has in the inlet a widening, which begins at
15 the lower edge and extends internally in the abutment upward adequately with respect to the height of the support ring as far as a shoulder surface;

b) the widening has a greater clear diameter than the head zone lying above it, which is intended for
20 receiving the screw head of the inserted base screw;

c) together with the support ring, the widening forms a press fit, preferably in the upper portion, in the coronal direction;

d) the head zone has a greater clear diameter than
25 the region of the inlet remaining above it; and

e) the head zone ends in the upward direction at a constricting shoulder surface, which is positioned in a defined manner, whereby, when the base screw is unscrewed, its screw head bears with its upper end face against the

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shoulder surface, before the threaded shank of the base screw fully disengages from the internal thread in the implant, and, when the base screw is unscrewed further, the abutment is ejected from the cone portions in the implant.

5 31. The abutment as claimed in claim 25, wherein

a) the neck part of the abutment adjoins the root part of the latter in a straight or angled form;

b) in the case of a straight abutment, the inlet passes right through and allows a screwing implement to be
10 used to reach into the base screw from the side of the neck part;

c) in the case of an angled abutment, the neck part has a vertically oriented lateral opening to allow a screwing implement to be used to reach into the base screw;

d) in the case of an abutment for a superstructure
15 which can be screwed on transversally, the neck part has at least one transversally oriented lateral opening;

e) on the root part of the abutment, the complementary mating contour is an external octagon with
20 eight plane faces;

f) on an abutment with a neck part adjoining the root part in an angled manner, the external octagon is positioned such that either

fa) two plane faces lying parallel opposite one
25 another lie perpendicular to the inclination of the neck part; or

fb) the external octagon is offset by 22.5° , whereby the edges formed at the point of intersection of two

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neighboring plane faces lie perpendicular to the inclination of the neck part.

32. The abutment as claimed in claim 23, wherein

a) in the case of an abutment for a superstructure
5 which can be transversally screw-connected, the neck part has a first and a second transversally oriented lateral opening;

b) the second lateral opening is offset in
relation to the first lateral opening from alignment with
10 respect to one another by 22.5°.

33. The abutment as claimed in claim 18, wherein on the neck part of the abutment there is an outer polygonal segment, the plane faces of which are preferably in alignment with the plane faces of the external octagon on
15 the root part.

34. The abutment as claimed in claim 33, wherein

a) the polygonal segment is an external octagon adjacent to the root part;

b) an upwardly tapering cone segment lies above
20 the polygonal segment; and

c) a terminating cylindrical guiding segment may lie above the cone segment.

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PATENT AGENTS

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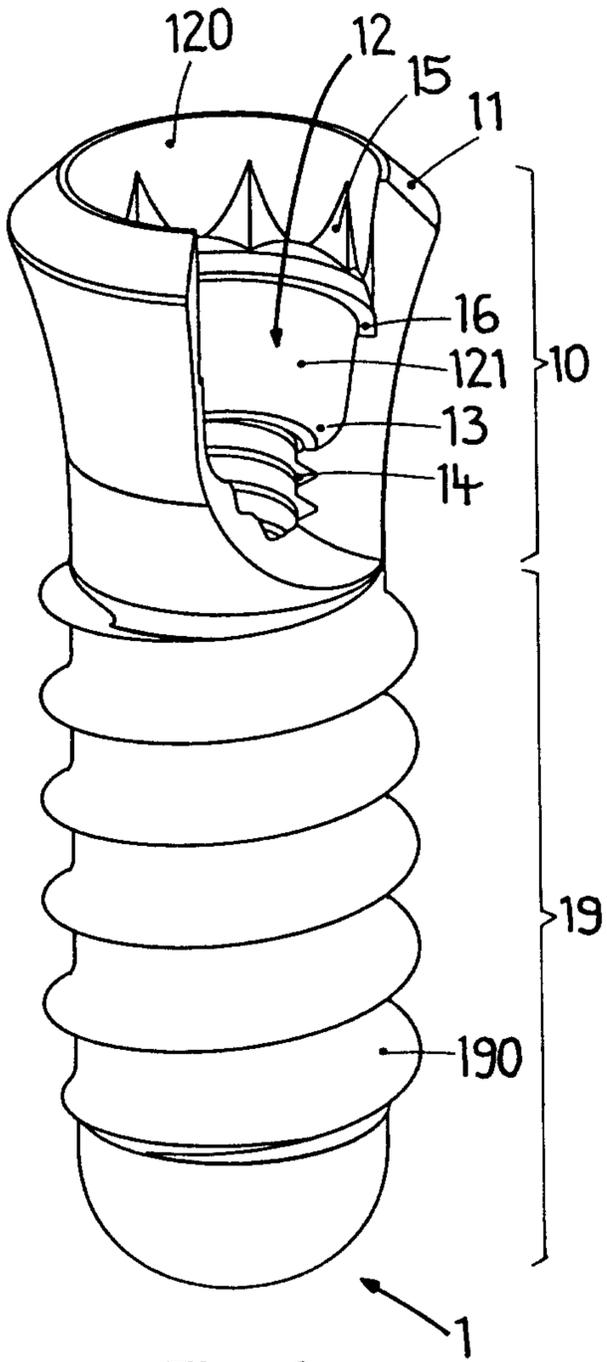


Fig. 1

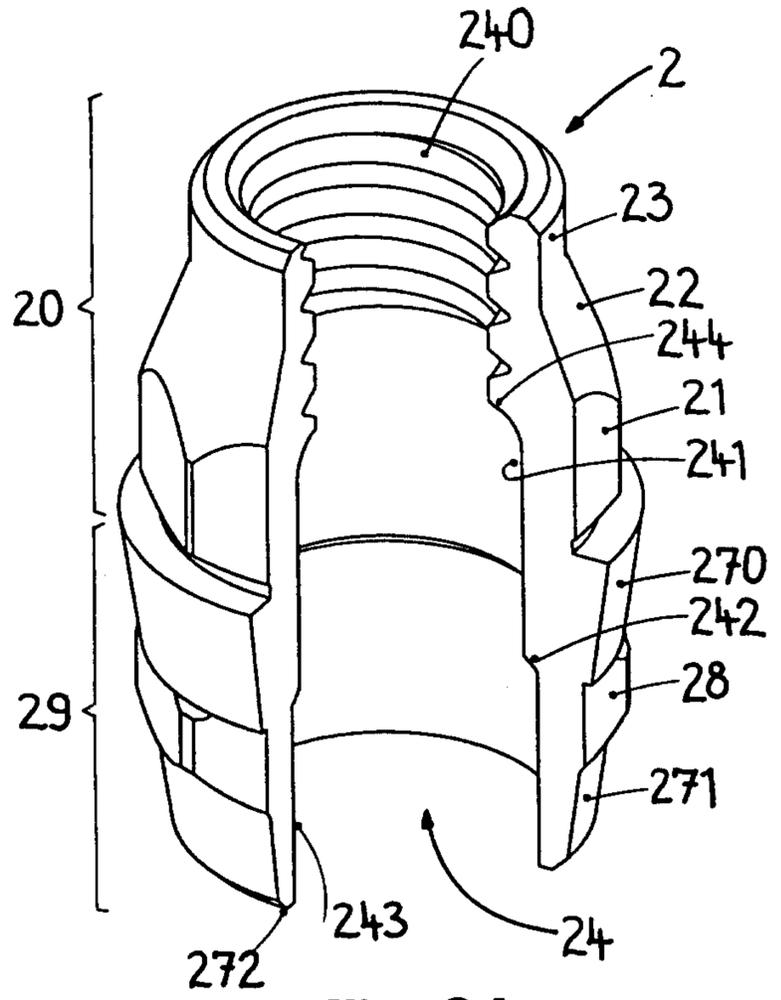


Fig. 2A

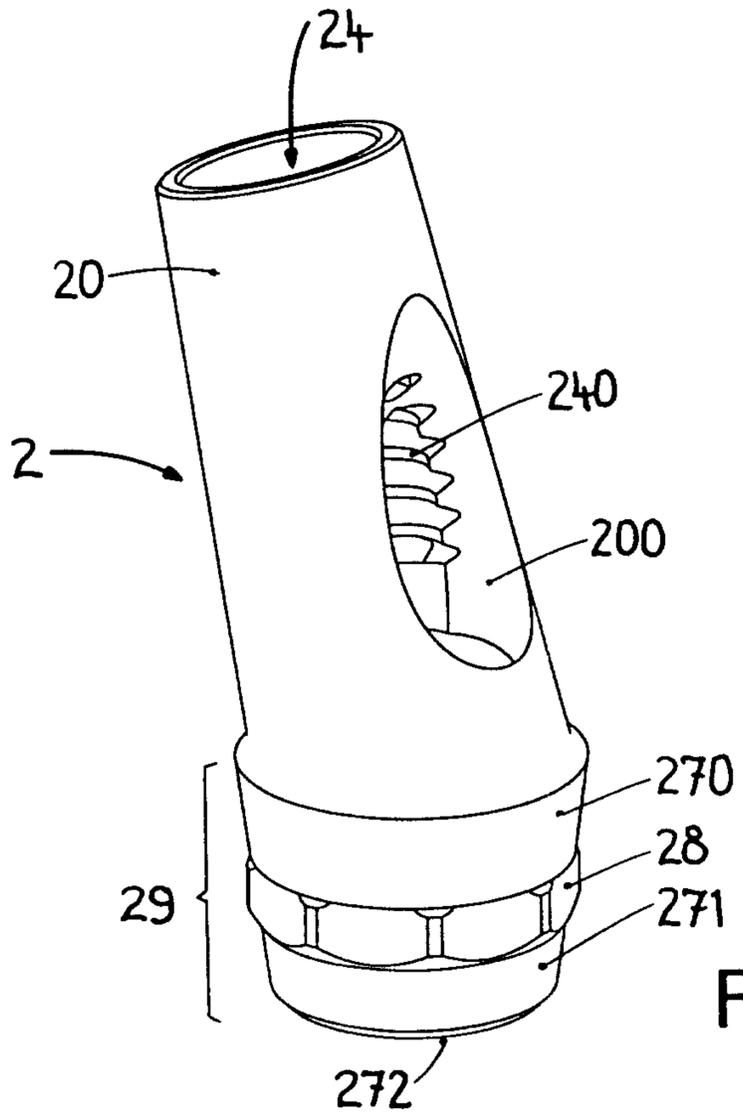


Fig. 2B

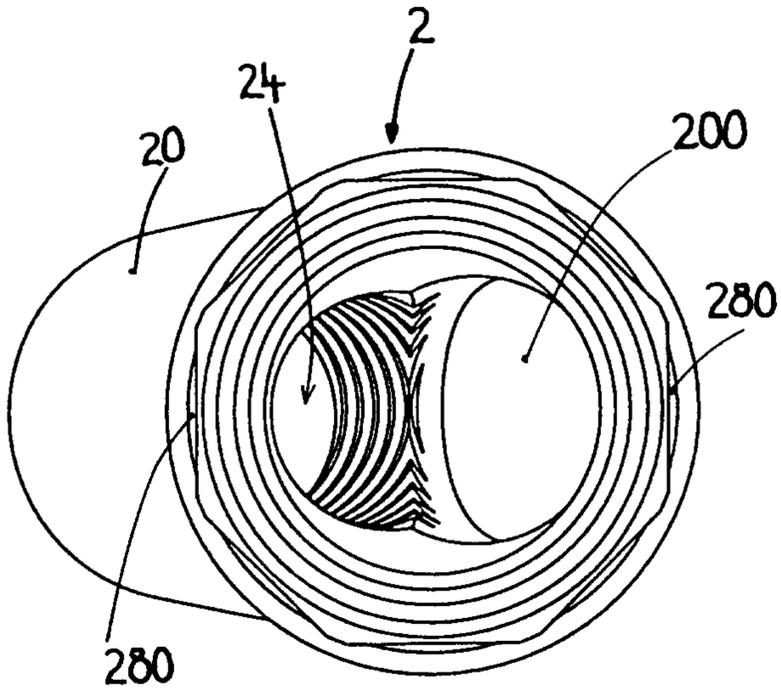


Fig. 2C

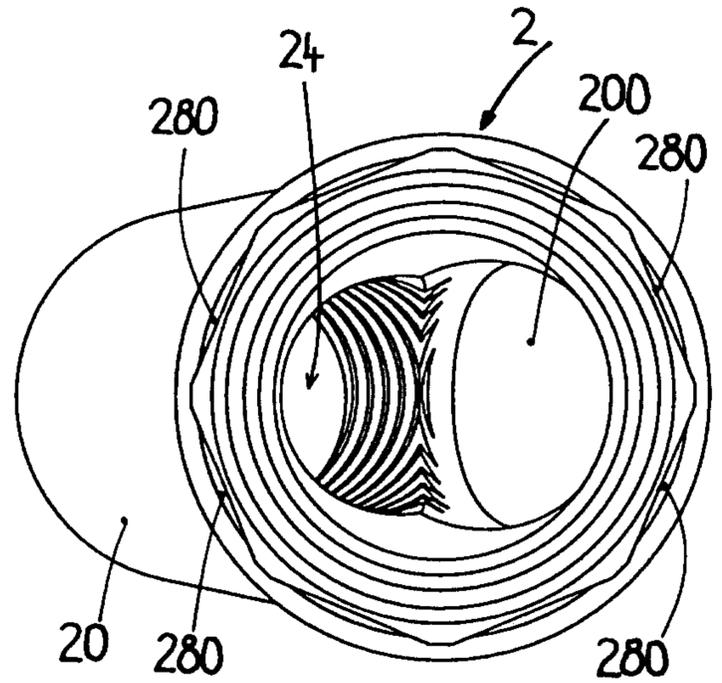


Fig. 2D

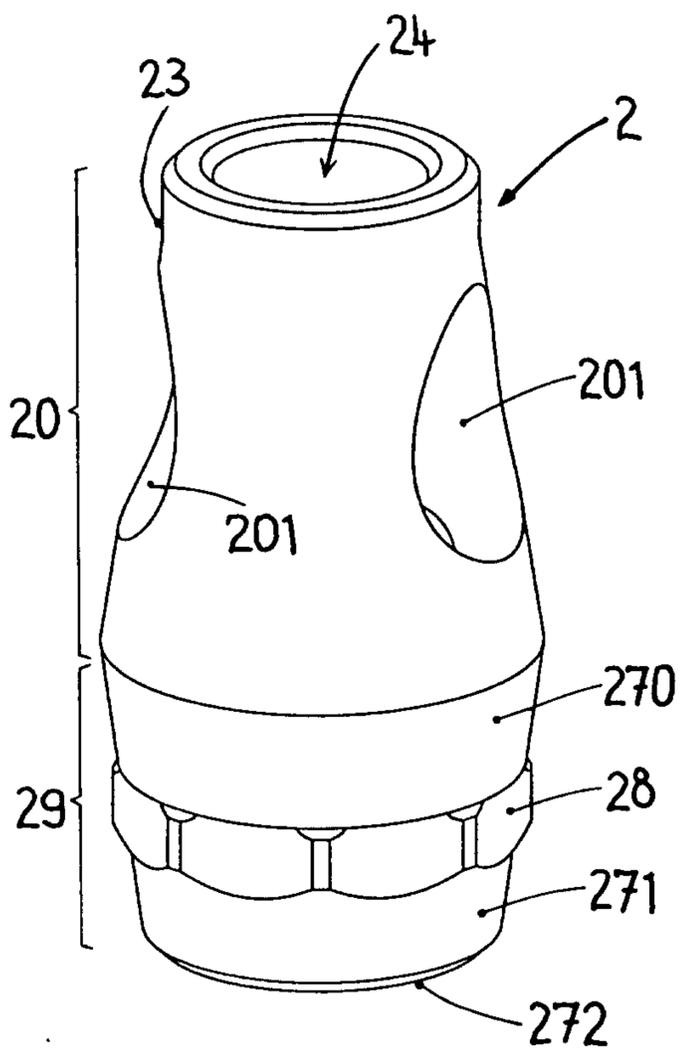


Fig. 2E

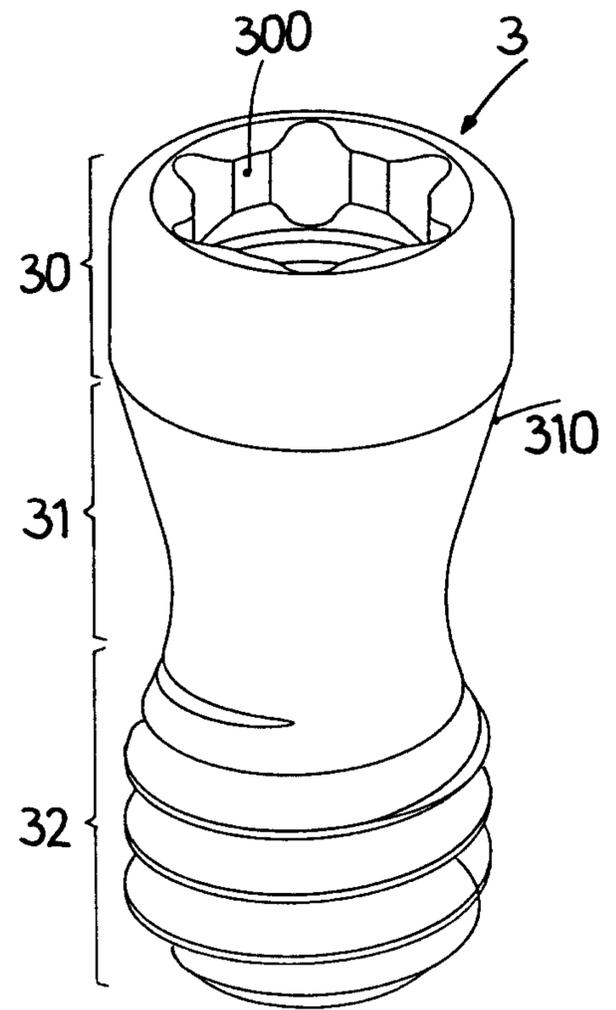


Fig. 3A

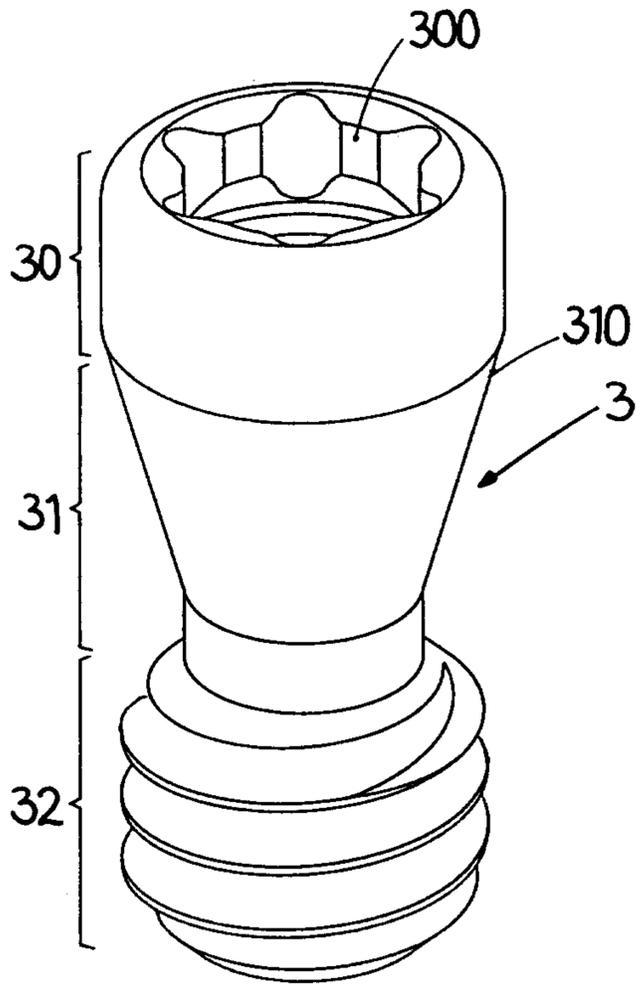


Fig. 3B

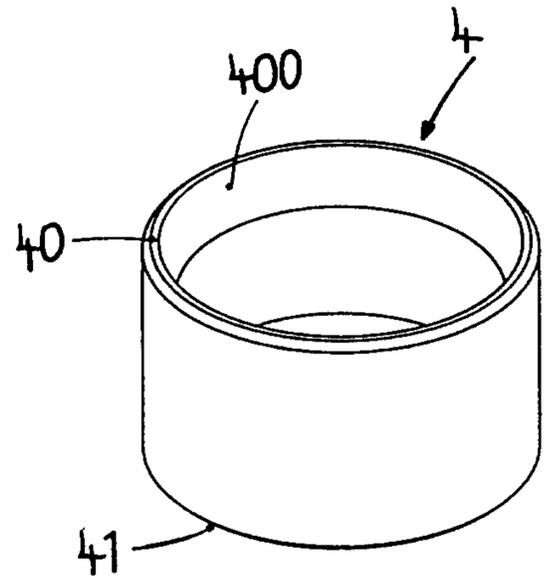


Fig. 4A

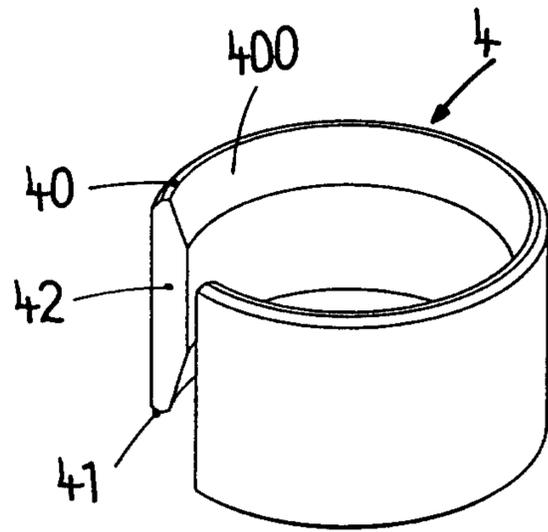


Fig. 4B

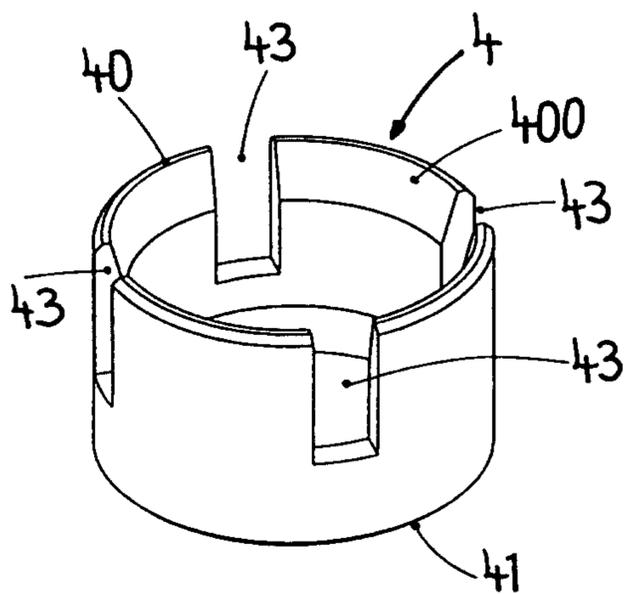


Fig. 4C

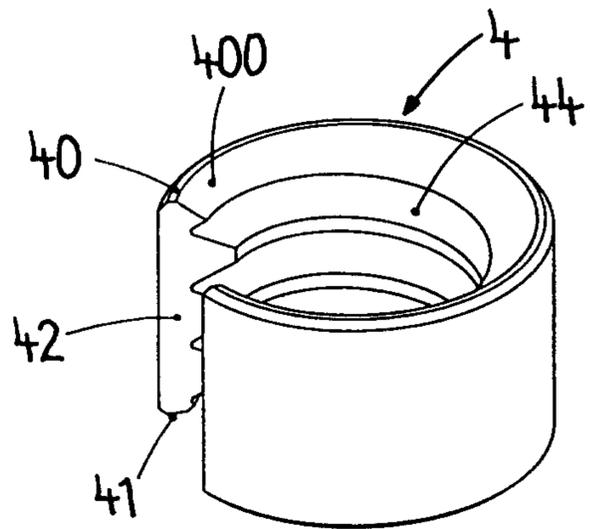


Fig. 4D

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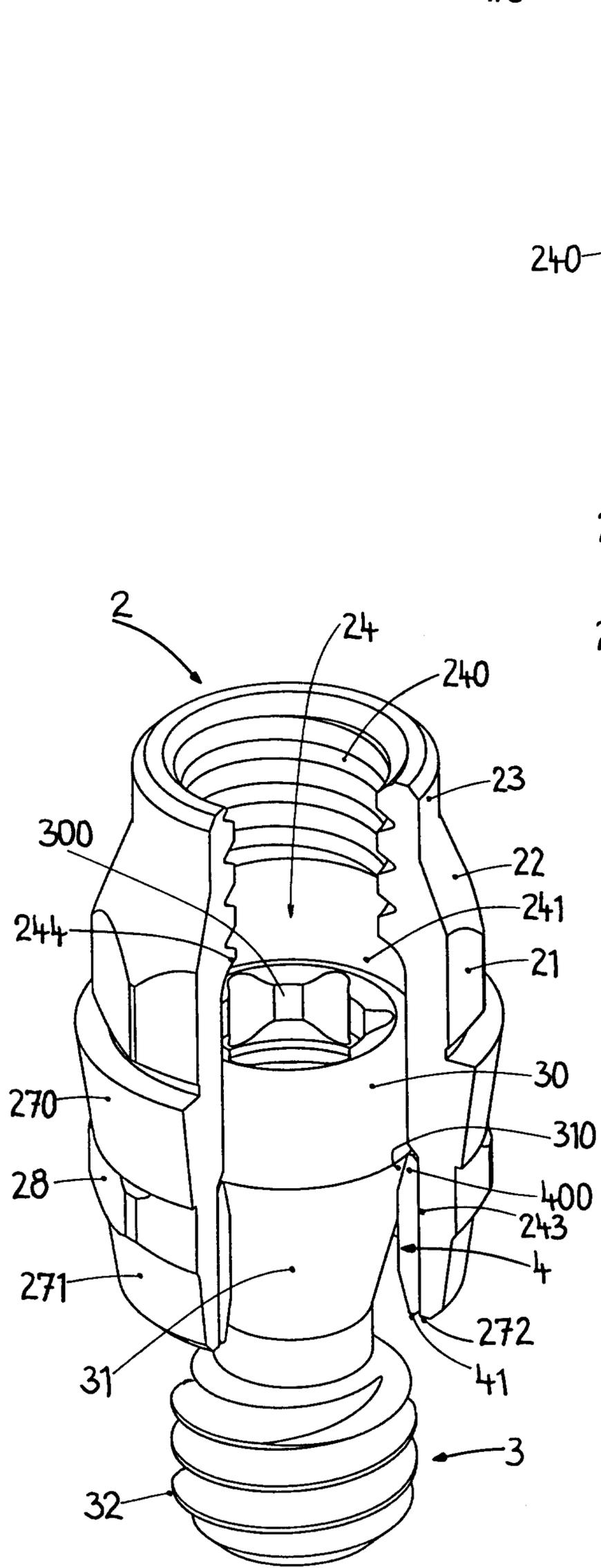


Fig. 5A

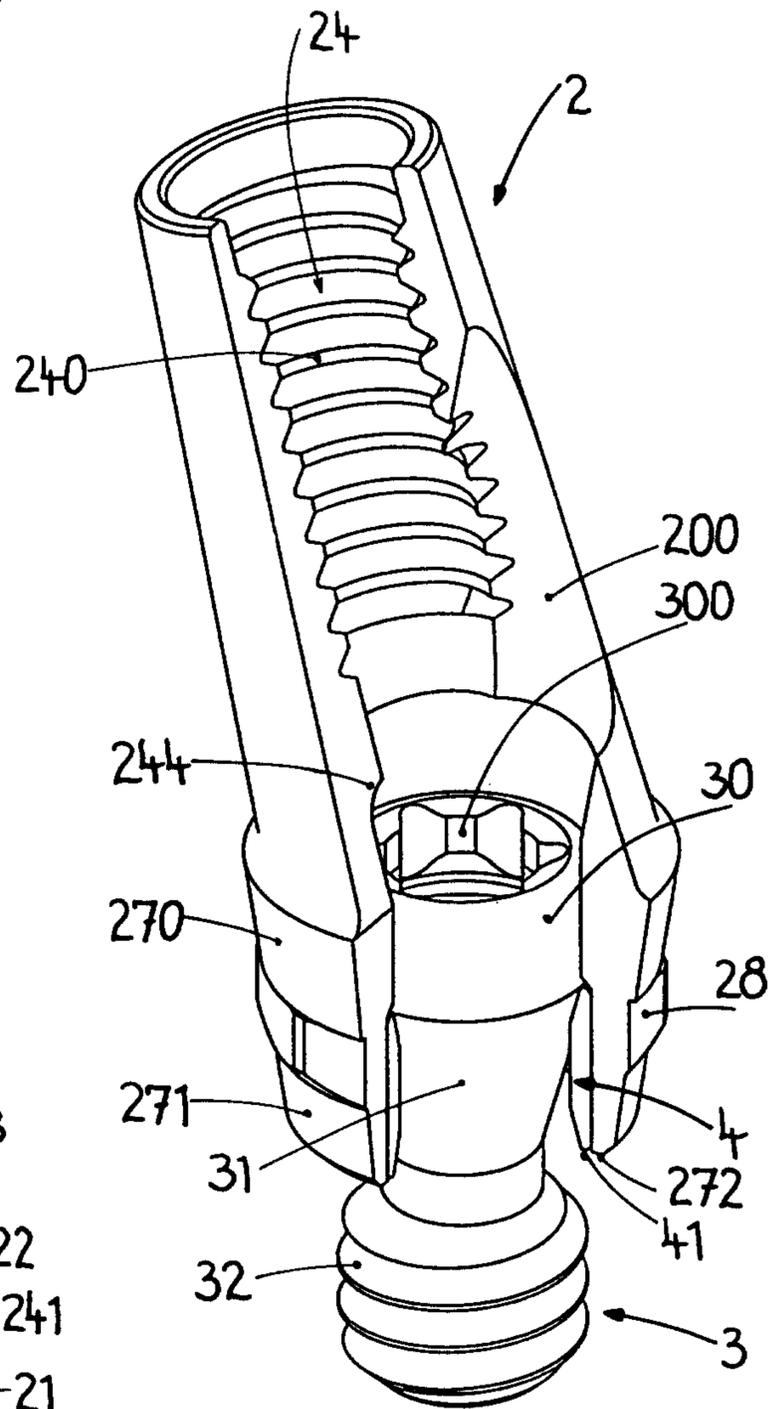


Fig. 5B

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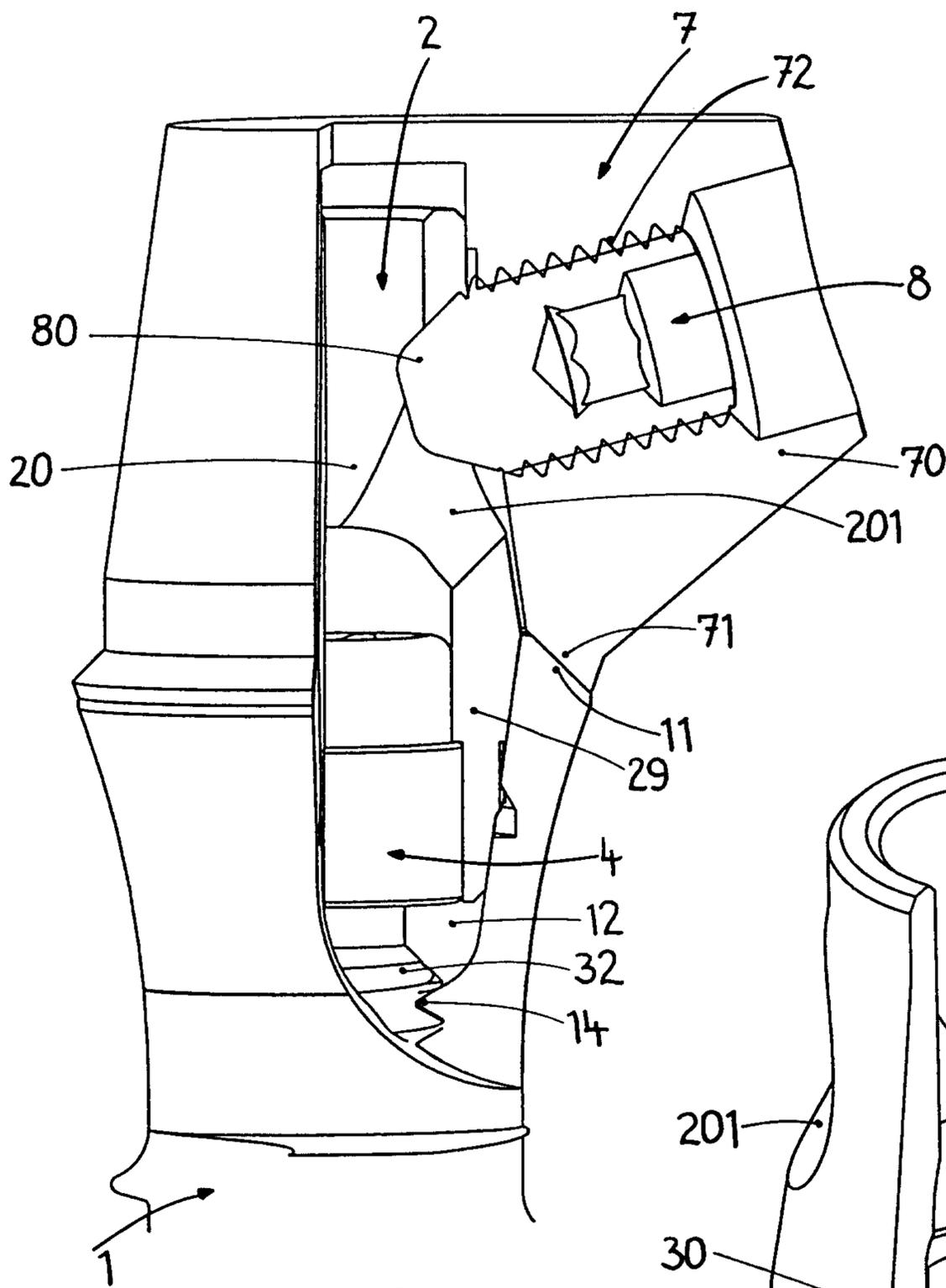


Fig. 6C

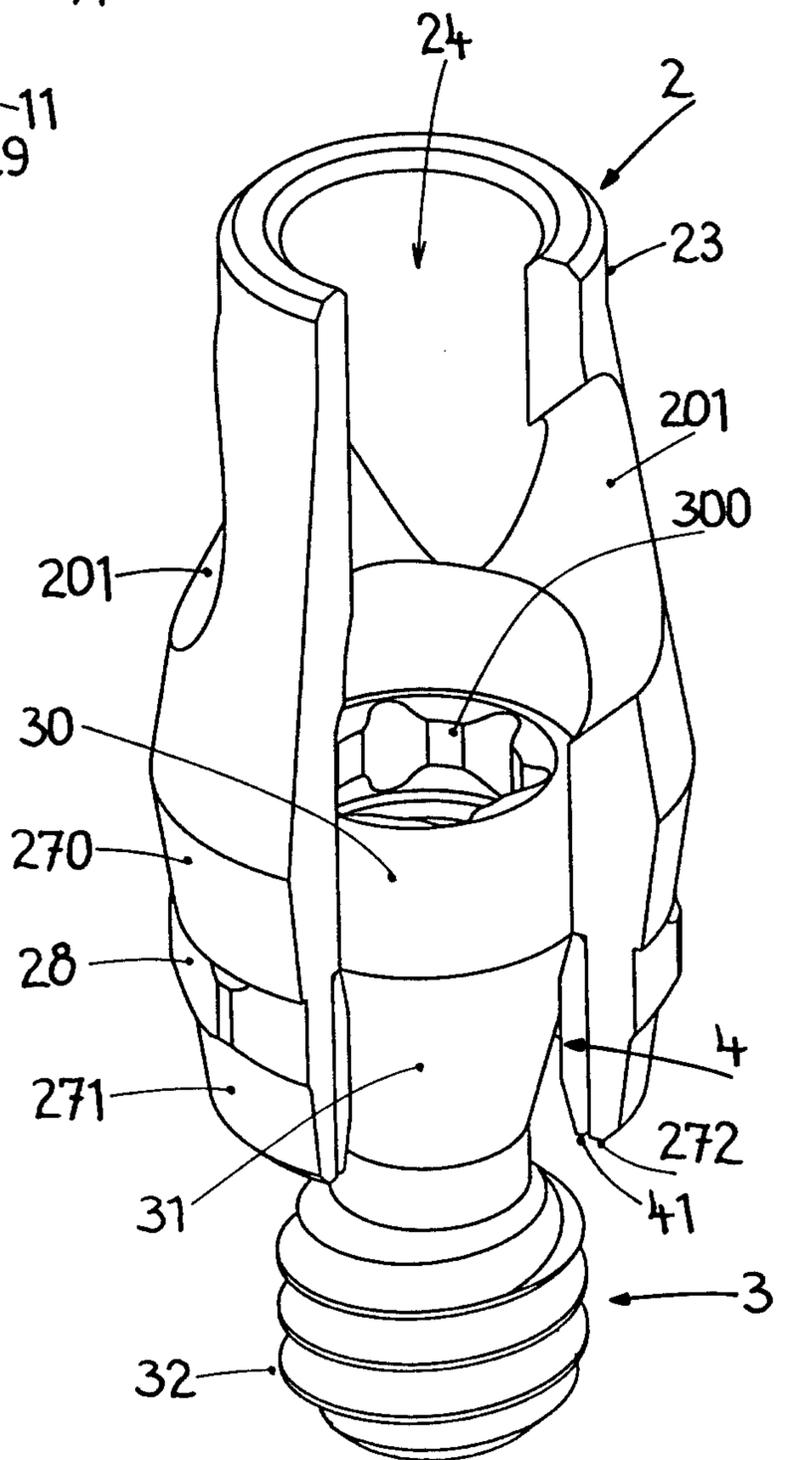


Fig. 5C

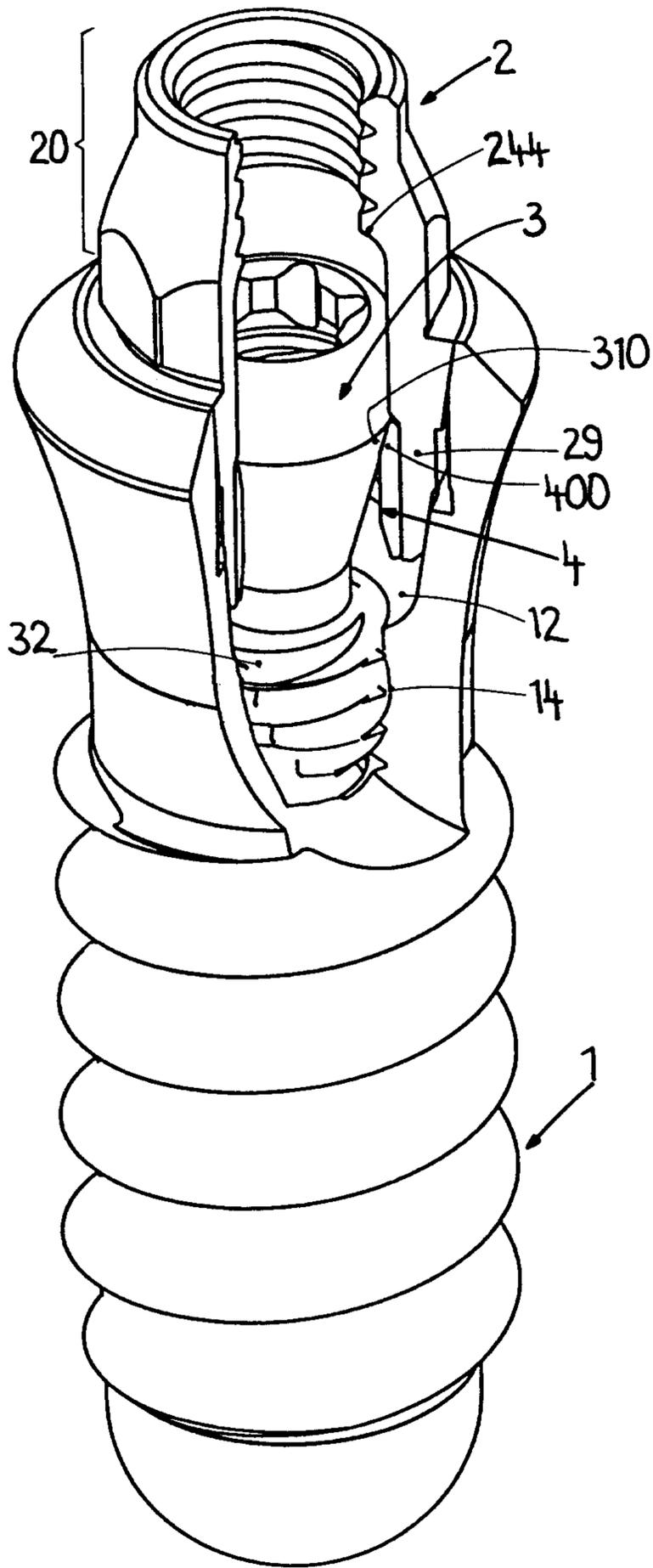


Fig. 6A

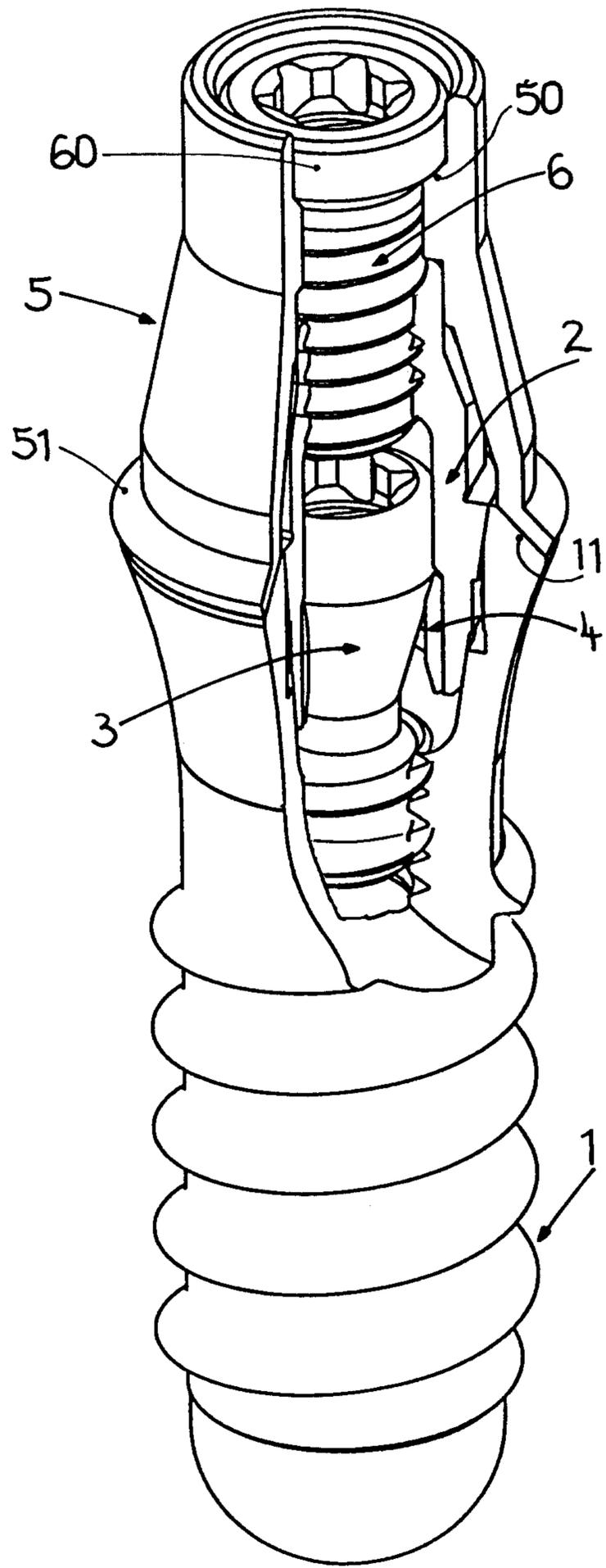


Fig. 6B

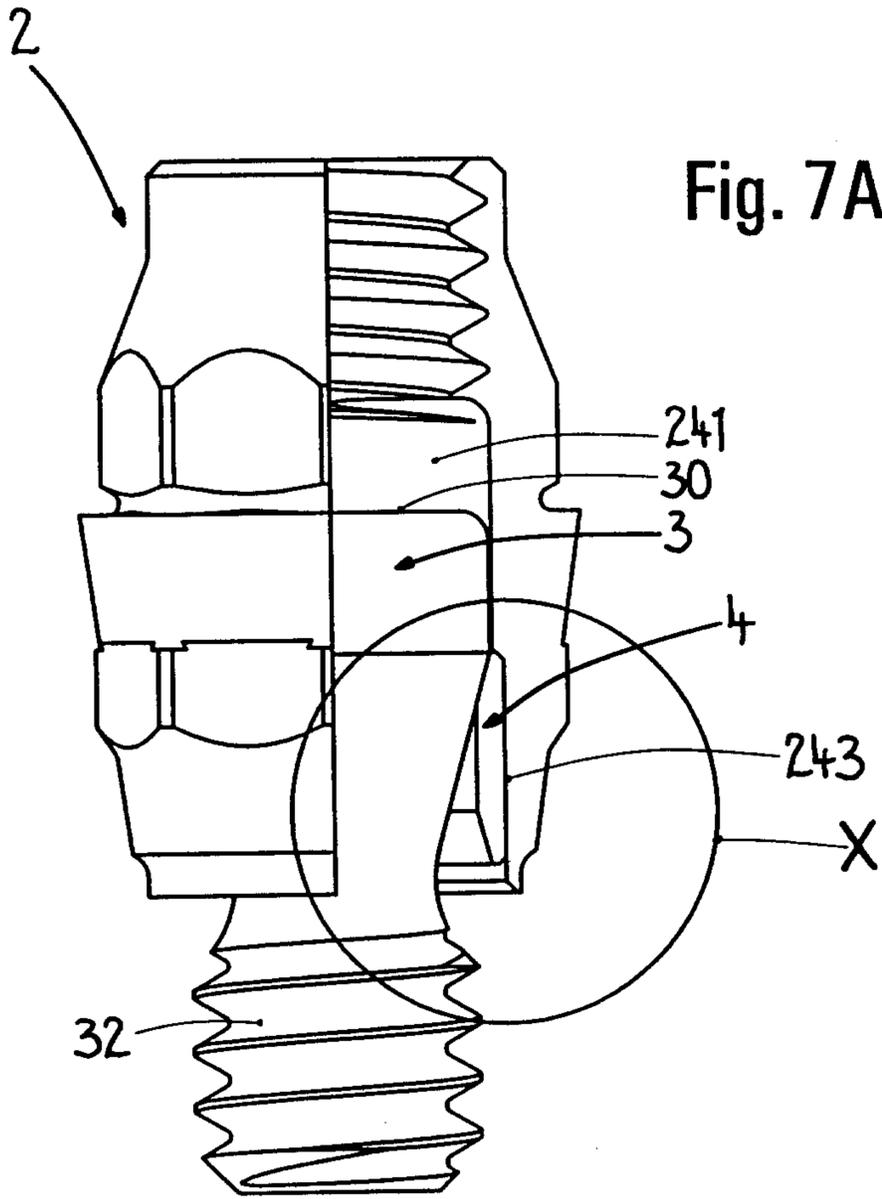


Fig. 7A

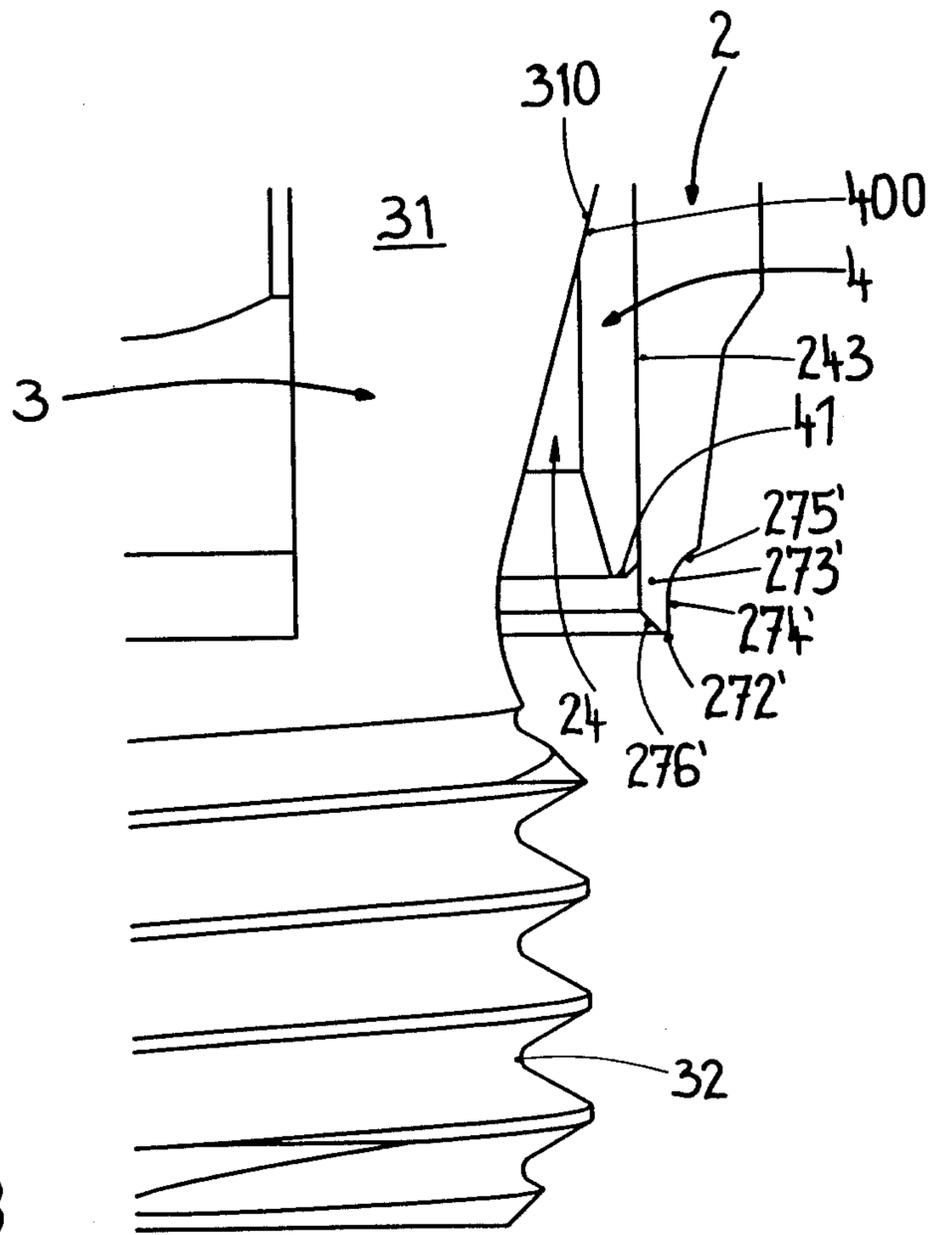


Fig. 7B

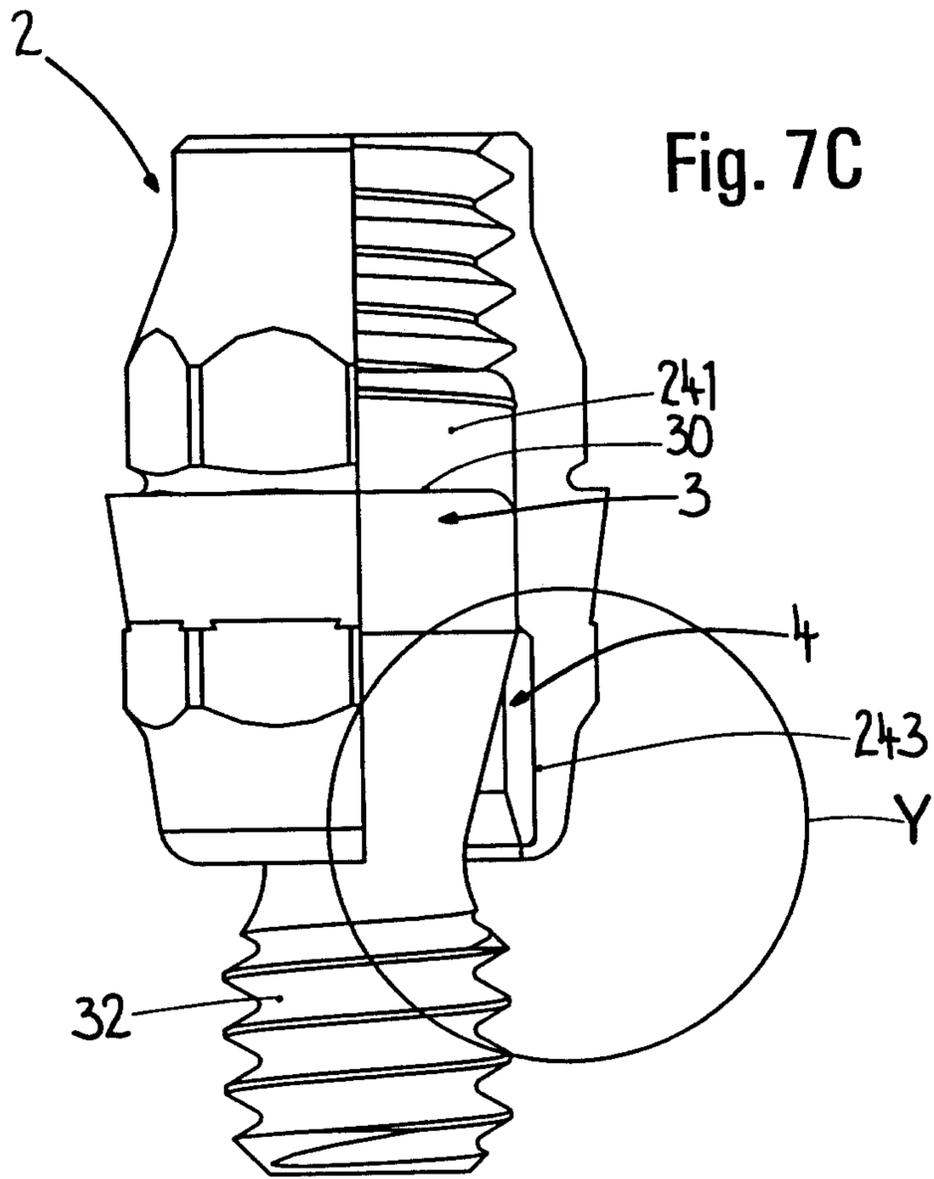


Fig. 7C

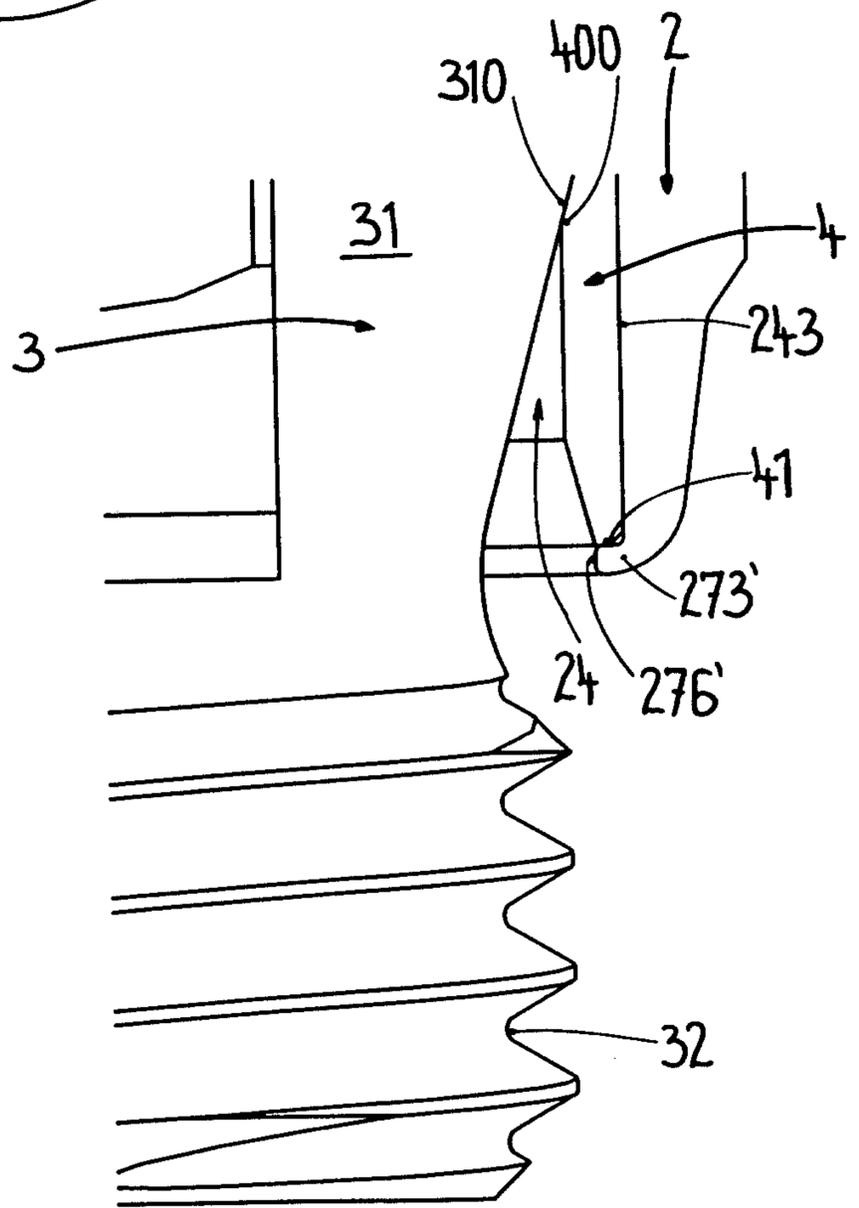


Fig. 7D

