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(54) Title: A DENTAL IMPLANT

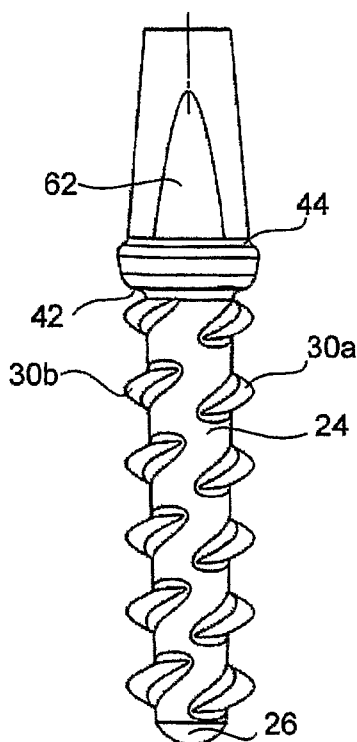


FIG. 2

(57) Abstract: A screw type dental implant is disclosed. The dental implant comprises a root portion and an upper portion. The root portion comprises a central elongated body having a main longitudinal axis and a plurality of wings extending outwardly from the peripheral surface of the central body. The plurality of wings is helically arranged around two or more axes that are not coincident with the main longitudinal axis of the central body.



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MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM,

TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,

ML, MR, NE, SN, TD, TG).

— *with international search report (Art. 21(3))*

A DENTAL IMPLANT

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

5 The present invention generally relates to dental implant systems. More specifically the invention relates to an intraosseous dental implant of a novel root design that provides enhanced stability and anchorage and that can be placed in areas of limited bone width.

10 DISCUSSION OF THE RELATED ART

A dental implant is an artificial support planted into a jawbone to serve as an artificial root for supporting a dental prosthesis or other dental items. Present dental implants are typically intraosseous implants designed to be placed within an opening in the jaw bone, the osteotomy site, in direct contact with the bone. The
15 fixation of an intraosseous implant is achieved by osseointegration, namely the proliferation and differentiation of bone cells growth on and into the surface of the implant. Intraosseous implants are made of bio-compatible ossiointegratable material, typically titanium, or a titanium alloy, where a structural and functional connection between the living bone and the implant is formed. An osteotomy or
20 precision hole is drilled, or otherwise prepared, in the jawbone and the implant is then inserted into the osteotomy. As long as the bone has not formed, the implant is not held in place correctly.

Dental implant may assume various shapes. Of particular relevance to the present invention are dental implants of the self tapping screw type, which are placed into the osteotomy site by screwing. Known dental implants of the screw type can include one or more threads located on the outer surface of the body. The thread can include flanks located around a core body. The thread can be present as extended faces between and/or above and/or beneath the flanks. Further, the dental implant can include grooves or cavities formed on the face and/or on the body for receiving the bone tissue that is chipped off when the screw is threaded into the bone.

The available ridge width and the quality of the bone at the site of potential implantation dictate the complexity of the surgery required before an osteotomy site can be prepared. It also dictates which implant, if any, should be used. In particular, the reconstruction of bone losses in the upper maxilla constitutes a major problem in maxillofacial surgery, especially in cases of osseous atrophy of the upper maxilla in edentulous patients who are candidates for dental implants. In order to fit an implant-supported prosthesis to a patient with upper maxilla bone losses, it is usually necessary to proceed in different stages spread over a period of approximately one year or even more. The first stage is fitting a bone graft by sinus lift or by apposition. The next stage is placing the implant which is followed by a healing period. The final stage is the fitting of the implant-supported structure (the dental prosthesis).

In view of the above, there is still a continuous need for improved structures of dental implants with enhanced anchorage and stability that will allow placement in narrow and/or shallow bone with reduced surgical intervention prior to placement.

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SUMMARY OF THE PRESENT INVENTION

It is the object of the present invention to provide a dental implant of improved anchorage and stability that minimises surgical intervention while
10 ensuring a rapid formation of bone and that allows placement in areas of limited bone width.

These and other objects of the invention will be apparent to those skilled in the art from the following description.

The dental implant comprises a root portion and an upper portion. The root portion comprises a central elongated body and a plurality of wings that extend outwardly from the peripheral surface of the ventral body that are helically arranged around two or more axes that are not coincident with the main longitudinal axis of the body. The central elongated body may be a parallel-walled cylinder or a tapered cylinder.

Preferably, the two or more axes are arranged around the main longitudinal axis of the main body in a symmetrical concentric manner. The two

or more axes may be parallel to the longitudinal axis of the main body or may lie on a conical surface coaxial with said longitudinal axis of the main body.

Preferably, the plurality of wings comprises two or more sets of longitudinally aligned wings. The two or more axes are parallel to said longitudinal axis of the main body. The wings may be truncated at their outermost lateral edges to conform to a general envelope of a predetermined shape.

The dental implant of the invention may further comprise an abutment part configured as linking and retaining means for an installation tool or a dental item and a collar portion interposed between and connecting the root portion and the abutment part. In accordance with a preferred embodiment of the invention, the dental implant is a one piece structure comprising the root, collar and abutments parts.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description taken in conjunction with the drawings in

5 which:

Fig. 1 is a side view of a dental implant in accordance with an embodiment of the invention;

Fig. 2 is another side view of the implant of Fig. 1 rotated by approximately 90° with respect to Fig. 1;

10 Fig. 3 is a perspective view of the implant of Fig. 1;

Fig. 4 is another perspective view of the implant of Fig. 1;

Fig. 5 is a top view of the implant of Fig. 1;

Fig. 6 is a bottom isometric view of the implant of Fig. 1;

Fig. 7 is a schematic illustration showing a helical span of one set of

5 wings;

Fig. 8 is a partial view illustrating a single wing;

Fig. 9 is side view of another embodiment of the present invention;

Fig. 10 is a perspective view of the implant of Fig. 9;

Fig. 11 is a bottom isometric view of the implant of Fig. 9;

10 Fig. 12 illustrates a further embodiment of the invention; and

Fig. 13 is a bottom isometric view of the implant of Fig. 11.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention provides a dental implant which is especially designed for dental purposes or dental prosthesis. The invention provides for a dental implant of a novel thread design which provides enhanced stability and anchorage of the dental implant in the bone and permits installation of the dental implant in a narrow and/or a shallow bone. The implant of the invention is designed to facilitate bone osseointegration and to minimize surgical intervention procedures that are required to modify the volume and shape of the bone prior to implantation.

In accordance with the invention, the implant has a unique thread that provides the implant with a self-tapping ability and sufficient primary stability during its osseointegration. The thread comprises a plurality of blades, or wings, extending from the outer surface of a main central body from one end of the root portion to its second end that are designed to thread into the walls of the ostetomy site and to condense bone material therebetween. The main body has a generally circular cross-section in the direction perpendicular to its longitudinal axis and may be a paralleled walls or tapered walls cylinder. The blades are spaced from each other and are positioned in a pattern spanning from the first end to the second end of the root. Unlike known implant threads, the wings according to the present invention are helically arranged not about the central axis of the main body but around multiple axes that do not coincide with the main body axis. The multiple axes may be parallel or non-parallel to each other and to the main body axis.

Preferably, the multiple axes are arranged around the axis of the main body in a symmetrical concentric manner, i.e., they lie on a cylindrical or conical surface around the central axis of the main body at $360^\circ/n$ from each other, where n is the number of multiple axes ($n \geq 2$). Thus, in accordance with the invention, the wings
5 comprise two or more sets of wings, each of which follows a different helical path around its respective axis. The sets of wings are arranged such that each set consists of longitudinally aligned wings while the wings of one set are located between the wings of the other sets in the longitudinal dimension.

To put it differently, the screw of the invention may be considered as a
10 superposition of a cylindrical body and multiple identical screws of the conveyer type (also known as Archimedes' screw) having their helical axes confined within the cylindrical body and concentrically arranged about its longitudinal axis such that only the outer portions of the screws are extending outwardly from the cylinder surface while the inner portions are confined within, and therefore merge
15 with, the cylindrical body. Such a combination will result with longitudinally aligned sets of wings, each set belongs to a different helical path. Thus, according to this description, each wing consists of the outer section of one revolution of the screw that extends outwardly from the surface of the central body. The helical paths may be of a varied pitch/radius ratio along their length and of symmetrical or
20 asymmetrical revolutions on a cylinder or cone.

The general outline of the implant may be of a cylindrical or a tapered cylindrical shape. It will be realized that the root portion of the implant of the

invention has an n -fold symmetry about its main longitudinal axis, where n is the number of the multiple eccentric axes and corresponding sets of aligned wings. Accordingly, the root portion has a non-circular cross section in the direction perpendicular the main longitudinal axis of the implant. Thus, with respect to the
5 implant of the invention, the terms cylindrical or tapered cylindrical outline relates generally to the overall outline of the root portion, namely whether the cross section decreases toward its lower end, and does not implies circular cross section. As mentioned above, the main central body (shaft) itself may be a cylinder or a tapered cylinder. Additionally, the multiple axes of the wings may be parallel to
10 the main axis or may converge toward the lower end and the wings themselves may be formed on a circular or conic helical path. In accordance with certain embodiments of the invention, the wings may be truncated to conform to a cylindrical or conical envelope independently of the main body shape and/or the helix on which they were formed.

15 Preferably the implants of the invention have a diameter (including the wings) of 2.8, 3.6 and 4.2 mm and a length in the range of 10 to 15 mm. However, the implants may assume other dimensions as well. The diameter and length of the implants, as well as the number n of wing sets and their pitch, are selected according to the bone width and bone quality at the site of implantation.

20 The implants of the invention may be fabricated from any ossiointegratable material known in the art, or a combination of such materials, preferably from titanium or titanium alloy. Preferably, the implants are fabricated

by the 'milling and turning' technology. However, other technologies of material processing may be employed. For example the implants may be fabricated by electro-erosion technology.

In the context of the present invention the terms 'wings' and 'blades' are
5 used interchangeably.

Turning to the drawings, Figs. 1 through 6 illustrate a first embodiment of a dental implant of the invention, generally designated 100. Dental implant 100 is characterized by a longitudinal axis 10. Dental implant 100 comprises a root
10 part 20 designed to be screwed into the bone; an abutment part 60 designed to extend above the ossetomy site for receiving and carrying the dental prosthesis; and a collar part 40 interposed and connecting between parts 20 and 40. Preferably parts 20, 40 and 60 are formed as one integral piece. Collar part 40 comprises shoulder 42 that functions as a stopper when viewed from the osseous
15 end of the implant while the upper surface 44 of collar 40 functions as the prosthetic shoulder for abutment 60. In accordance with the one-piece embodiment 100, abutment 60 serves both as the linking means for an installation tool and once implant 10 is implanted, as the supporting means for carrying a dental item, e.g., a healing cap or the dental prosthesis. Abutment 60 is generally of a conical shape
20 having two opposite flat sides 62 to engage with the tool or with a dental item and to provide a non-rotational feature that prevents rotation of the dental item against the implant. Abutment 60 further comprises a bore hole 64 extending downwardly

from top 66 for receiving a post of the dental item. The floor 68 of bore 64 serves as a stopper for a dental post. As best seen in Fig. 5, in the embodiment shown here, bore 64 has an oval cross section. However it will be realized that bore 64 may assume any other form, including a circle, since flat sides 62 are sufficient for rendering abutment 60 anti rotational feature for both retaining the dental items and for serving as guides for positioning the dental prosthesis in the right angular orientation. It will be also realized that abutment 60 is not limited to the specific design shown here but may assume any other form known to those skilled in the art as long as it includes at least one non-round element. Of course, the tool and the dental items should have complementary matching structure for engaging with the abutment.

The structure of root portion 20, hereinafter referred to as $\Omega 2$ (omega 2) structure, comprises a central elongated body, or shaft, 22 and a span of wings 30 extending from the outer surface 24 of body 22. In the embodiment shown here central body 22 is a tapered cylinder terminating with a dome 26. In accordance with other embodiments, body 22 may be a paralleled-wall cylinder and may terminate with a flat bottom. As best seen in Figs. 3, 4 and 6, wings 30 comprise two identical sets 30a and 30b, of longitudinally aligned wings, each set having an axis 35a and 35b, respectively, denoted by the black circles in Fig. 6. Axes 35 are symmetrical with respect to main axis 10. In the embodiment shown here, axes 35 are also parallel to main axis 10. However in other embodiments of the invention,

the axes may be angled with respect to main axis 10 such that the distance between the axes diminishes toward the bottom end of the implant.

Fig. 7 is a schematic illustration demonstrating the helical span of a wing set around a cylindrical body 22. As can be seen wings 30 are spanned along a helix path 15. Helix path 15 may be of a fixed or variable pitch. For simplicity sake only one set of wings is shown. However, it will be understood that the implant of the invention comprises at least two such sets, each of which comprises a plurality of wings spanned about a respective helical path. The helical paths relate to each other such that the wings of one set are arranged between the wings of the other sets. Fig. 8 is a fragmentary illustration of single wing 30 extending from surface 24 of main body 22. Wing 30 has a general form of an elongated arched ridge 32 surrounded by margins 34 of lesser slope which smoothly merge into surface 24. The angle formed between the wing and a plane perpendicular to the longitudinal axis of body 22 is preferably in the range of 0 to 45°. In the direction traverse to the helical path, wing 30 has a tapered cross section having its base in contact with surface 24 and tapering outwardly (i.e., away from the main body) to form the outermost edge of the wing. Preferably, the wing is symmetric with respect to the plane that connects the outermost edge of the wing to the centerline of the wing base. The cross section in the direction traverse to the helical path diminishes in both its dimensions toward ends 33 of the wing where it merges with the main body. Preferably the wing does not comprise any abrupt edges or corners but only graduated smooth slopes and rounded corners to

facilitate bone condensation rather than bone cutting when the implant is inserted into the bone.

As best seen in Fig. 6, root part 20 has a cross section which significantly deviates from a circular shape and varies between a minimum dimension r and maximum dimension R . This unique feature of the screw allows positioning the implant in different, non-equivalent, orientations with respect to the bone ridge. In particular it allows placing the implant in areas of narrow width without compromising stability. Thus, if inserted correctly in a narrow bone the wing span is aligned such as to avoid extra pressure on the bicortical parts of the jawbone and at the cervical part.

Figs. 9 through 11 illustrate another embodiment of the invention, referred to as $\Omega 3$ (omega 3), according to which the root portion has a three-fold symmetry. Dental implant 200 comprises a root portion 120, an abutment 160 and a collar 140. Preferably parts 120, 140 and 160 are integrally formed as a one-piece implant. Collar 140 and abutment 160 have a similar structure as of corresponding parts 40 and 60 of embodiment 100 described above. However, as explained above in association with embodiment 100, the collar part and the abutment part may assume other forms. Root portion 120 comprises a central cylindrical body 122 and a span of wings 130 extending from peripheral surface of body 122. Wings 130 comprise three sets of longitudinally wings 130a, 130b and 130c, each arranged around a respective axis, 135a, 135b and 135c, respectively, as best seen in Fig. 11. Axes 135 are symmetrically arranged around the

longitudinal axis of body at 120° from each other. In accordance with embodiment 200, axes 135 are parallel to each other and to the main axis of body 120. A modified three-winged embodiment 300 according to which the multiple axes are not parallel as in embodiment 200 illustrated in Figs. 12 and 13.

5 According to this embodiment, axes 235a, 235b and 235c of wing sets 230a, 230b and 230c converge toward the main axis 210 such that the distance between the axes decreases toward the bottom end of the implant. Further in accordance with embodiment 300, the outermost lateral edges of the wings are truncated to conform to a cylindrical envelope in order to render the implant a generally
10 cylindrical shape. As can be seen in Fig. 12, the truncated area t decreases toward the bottom end of implant 300 from the uppermost wings 230_i to the bottommost wings 230_v . It will be appreciated that according to other embodiments of the invention the wings may be cut to conform to other envelope shape, such as for example a tapered cylinder or a cone.

15 The implants of the invention are placed in a similar way to the conventional screw implants by threading it into a cavity in the bone (the osteotomy site) drilled, or otherwise prepared, beforehand. Traditionally, the periosteal mucosa is cleared away and a series of drill bits creates a trans-osseous channel. However, it will be appreciated that using the implant of the present
20 invention significantly reduces the diameter of the cavity that needs to be drilled prior to the insertion of the implant, when compared to known screw implants of a similar size. While the pre-prepared cavity that is required for conventional

implants is of a diameter only slightly smaller than the external diameter of the implant, the cavity required for the implant of the present invention may be reduced to about 50% of the implant's external diameter. This not only reduces surgical intervention but also offers the advantages of narrow alveolar processes especially in the molar and premolar areas or in the case of a soft or porous bone.

It will be appreciated that the number of the wing sets is not limited to two or three but may be up to six or even more. Likewise it will be appreciated that the features illustrated in association with a certain embodiment are not limited to that specific embodiment but may be implemented in different embodiment with appropriate modifications, if necessary.

It will be further appreciated that the various embodiment of the invention that has been illustrated and described has been given as a non-restrictive illustrative examples of the invention and that various modifications may be made by those skilled in the art without departing from the spirit of the invention. For example, the root and collar portions may be a one-piece structure while the abutment part may consist of a separate part that is configured to be engaged with the root part after or before its implantation.

Thus, it will be appreciated by persons skilled in the art that the present invention is not limited to what has been particularly shown and described hereinabove. Rather the scope of the present invention is defined only by the claims which follow.

CLAIMS

1. A dental implant comprising a root portion and an upper portion, wherein the root portion comprises a central elongated body having a main longitudinal axis and a peripheral surface; and a plurality of wings extending outwardly from said peripheral surface, wherein said plurality of wings are helically arranged around two or more axes that are not coincident with said main longitudinal axis.
2. The dental implant of claim 1 wherein said two or more axes are arranged around said main longitudinal axis of the main body in a symmetrical concentric manner.
3. The dental implant of claim 1 wherein said plurality of wings comprises two or more sets of longitudinally aligned wings.
4. The dental implant of claim 1 wherein said central elongated body is a parallel-walled cylinder or a tapered cylinder.
5. The dental implant of claim 1 wherein said two or more axes are parallel to said longitudinal axis of the main body.
6. The dental implant of claim 1 wherein said two or more axes lie on a conical surface coaxial with said longitudinal axis of the main body.
7. The dental implant of claim 1 wherein the wings are truncated at their outermost lateral edges to conform to a general envelope of a predetermined shape.

8. The dental implant of claim 1 wherein the upper portion comprises a collar part.
9. The dental implant of claim 1 wherein the upper portion comprises a collar part and an abutment part, the abutment part configured as linking and retaining means for an installation tool or a dental item.
10. The dental implant of claim 9 wherein the abutment part is integrally formed on the collar part.
11. The dental implant of claim 9 wherein the dental implant is a one piece structure.

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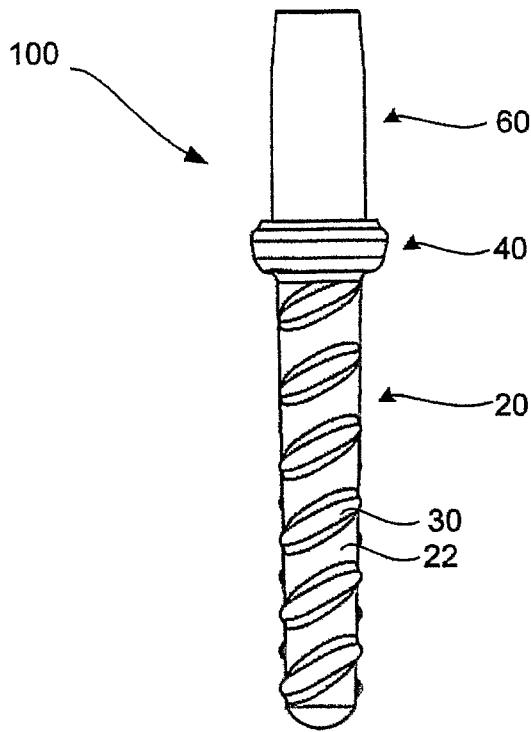


FIG. 1

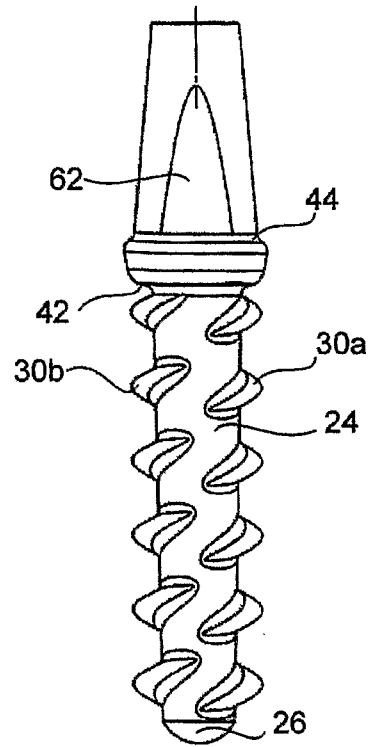


FIG. 2

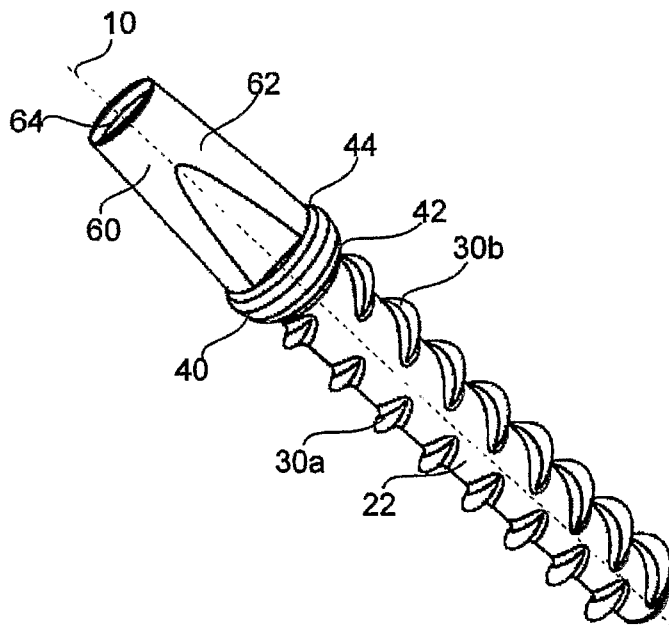


FIG. 3

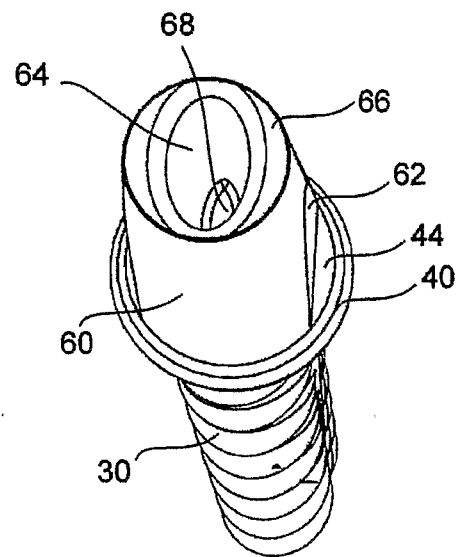


FIG. 4

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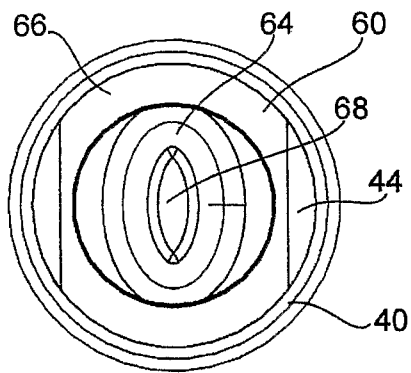


FIG. 5

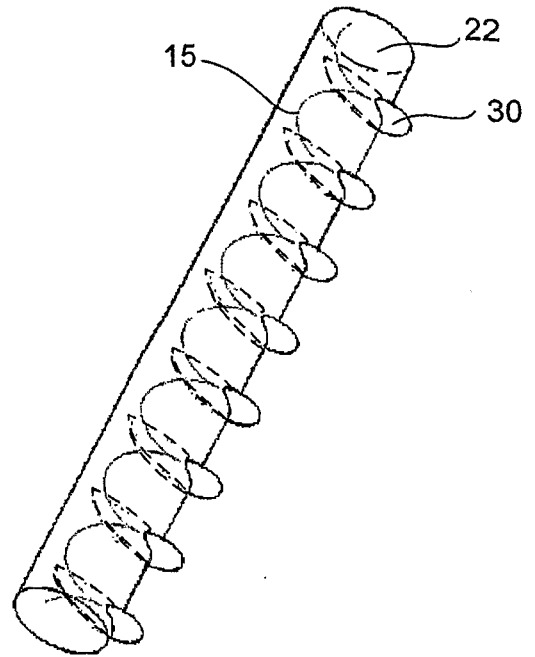


FIG. 7

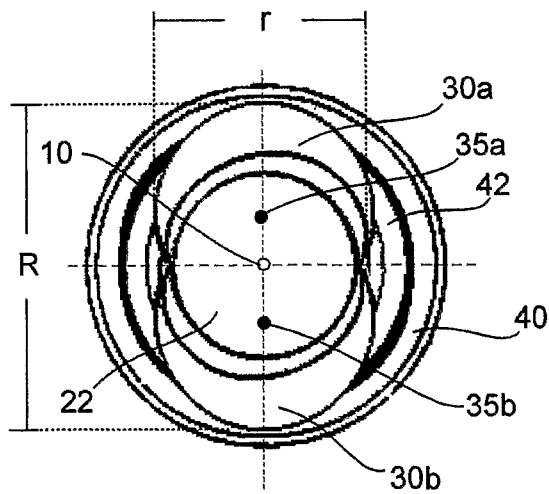


FIG. 6

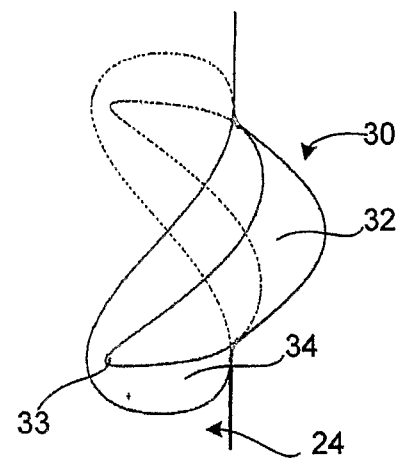


FIG. 8

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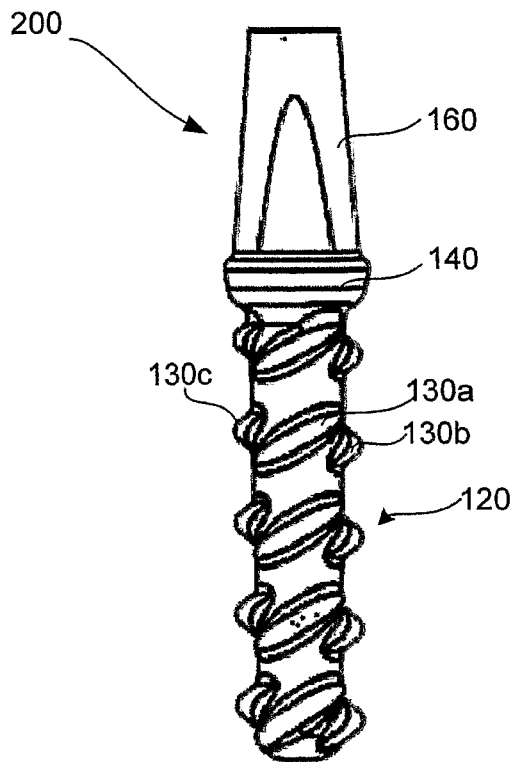


FIG. 9

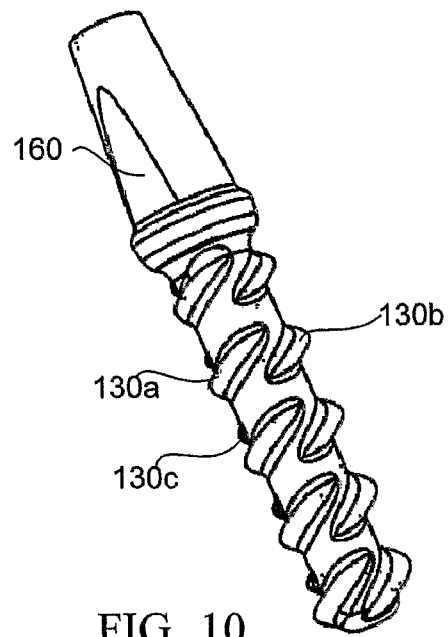


FIG. 10

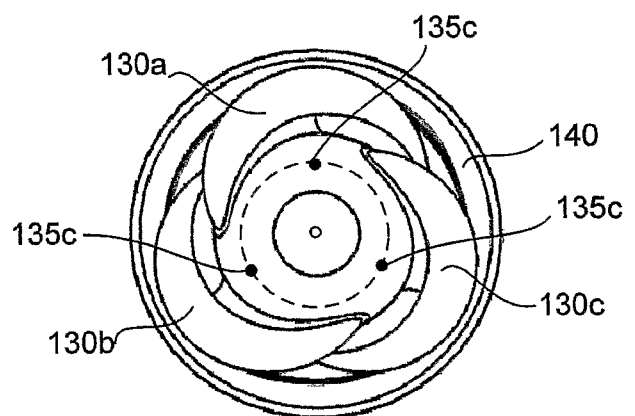


FIG. 11

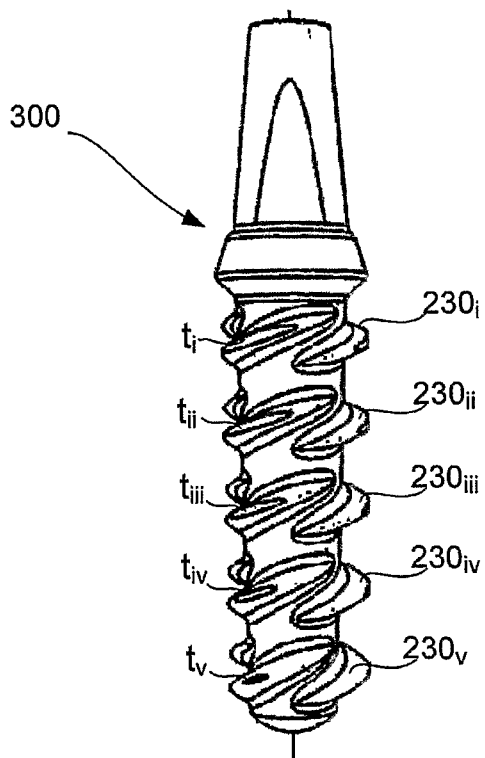


FIG. 12

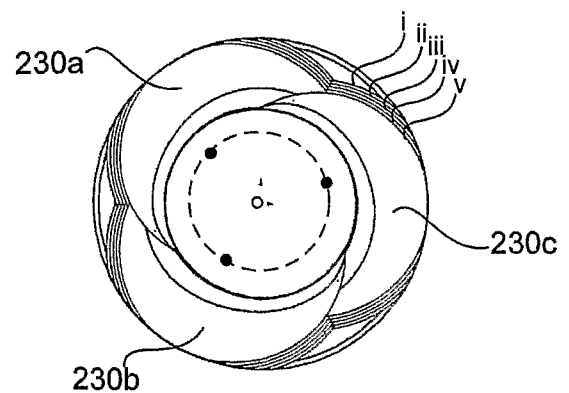


FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL2009/000870

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A61C 8/00 (2009.01)

USPC - 433/173

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) - A61C 8/00 (2009.01)

USPC - 433/172-176

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

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

PatBase

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/0261175 A1 (HURSON) 23 October 2008 (23.10.2008) entire document	1-11
A	US 6,273,722 B1 (PHILLIPS) 14 August 2001 (14.08.2001) entire document	1-11
A	EP 0 592 701 A1 (KRIVOV) 20 April 1994 (20.04.1994) entire document	1-11

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


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Date of the actual completion of the international search

11 December 2009

Date of mailing of the international search report

22 DEC 2009

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