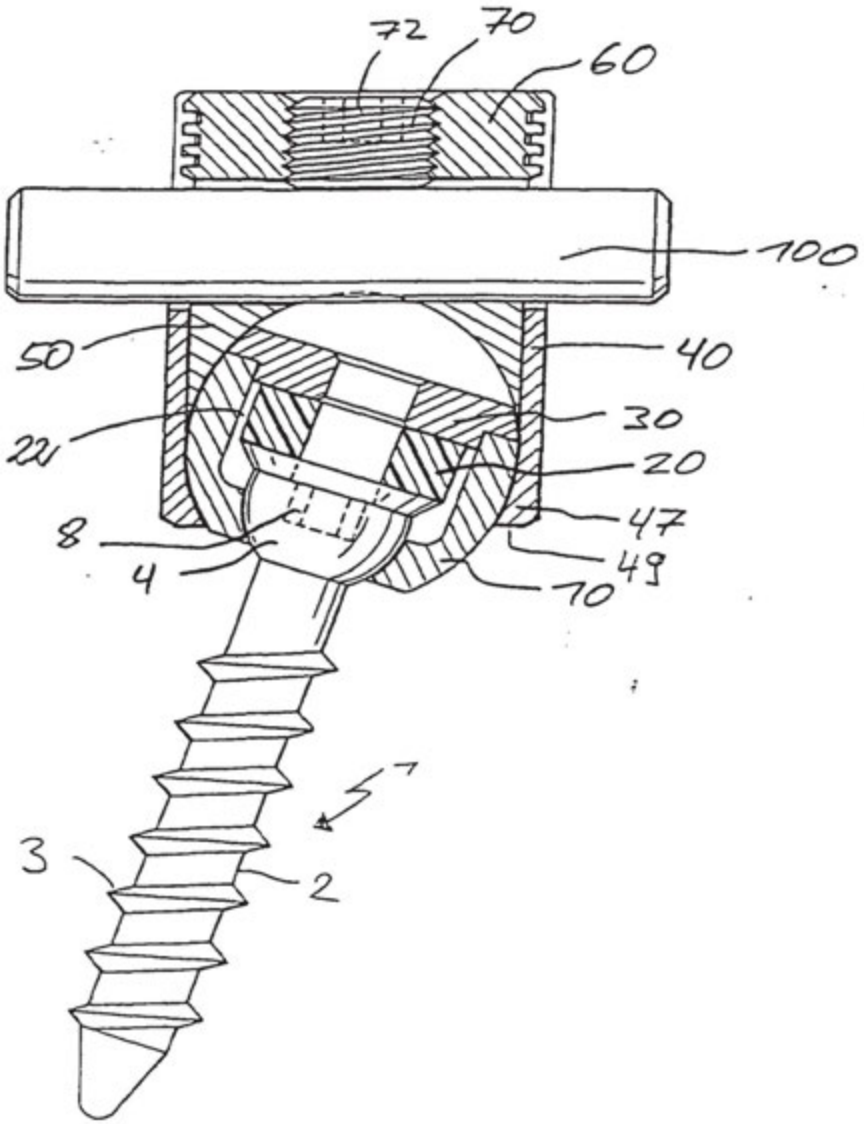
15. Dispositif de stabilisation comprenant un premier élément d'ancrage osseux et un deuxième élément d'ancrage osseux, et une barre (100) ou une plaque (200) reliant ceux-ci, **caractérisé en ce qu'**au moins l'un des éléments d'ancrage osseux est réalisé selon l'une des revendications 1 à 14.

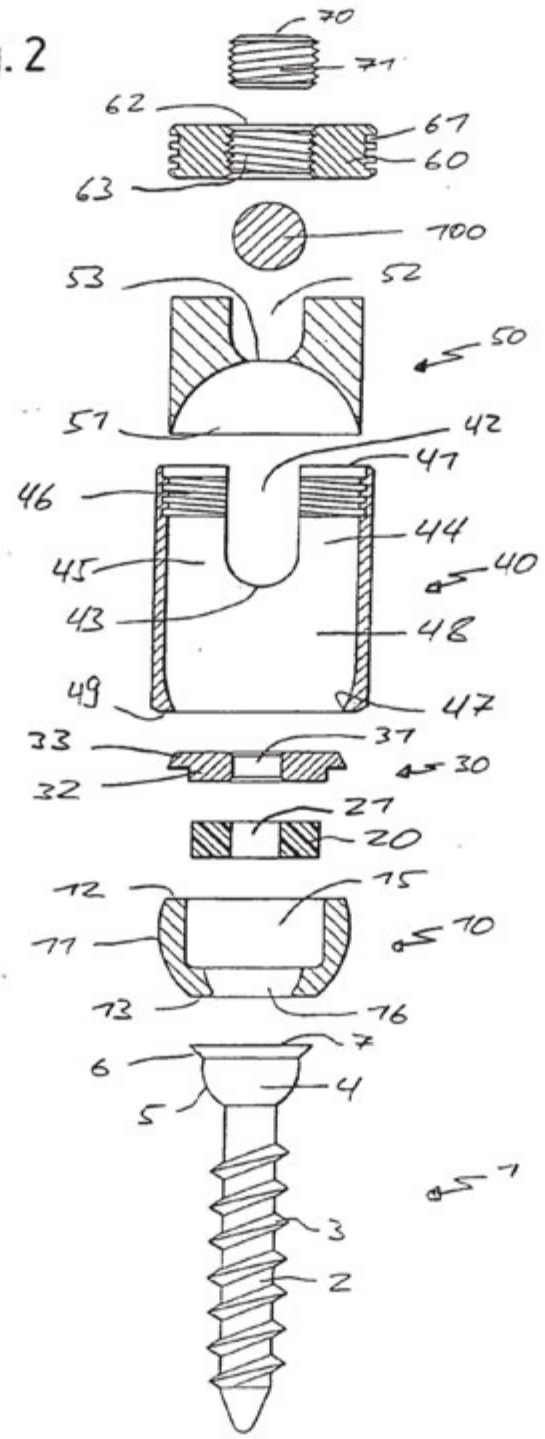
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Fig. 1



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Fig. 2



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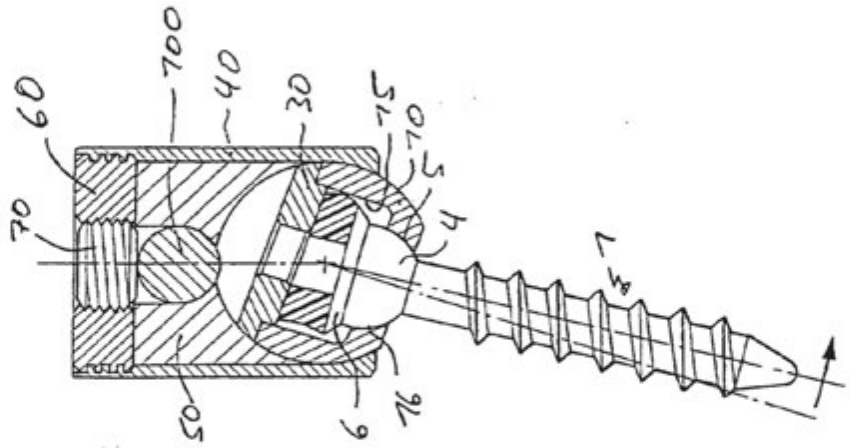


Fig. 3c

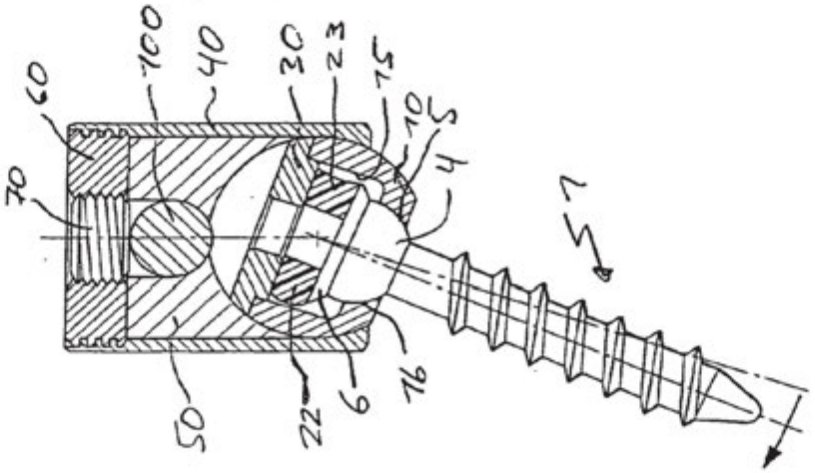


Fig. 3b

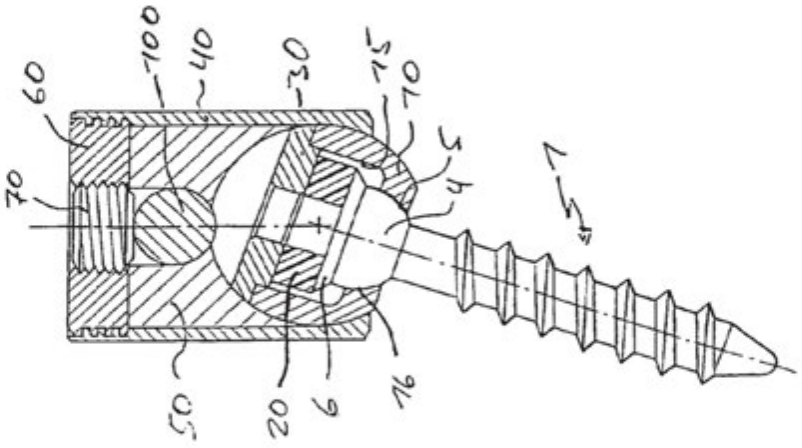
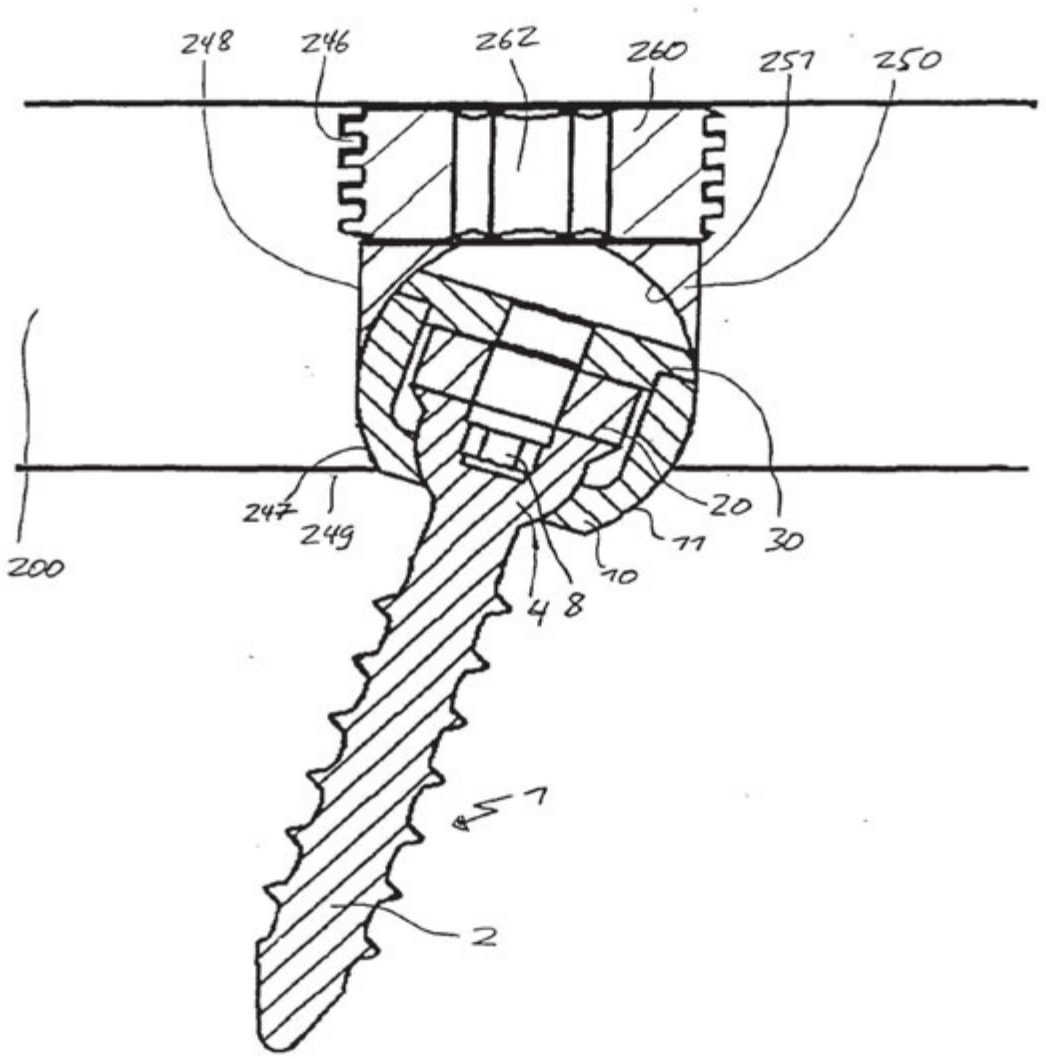


Fig. 3a

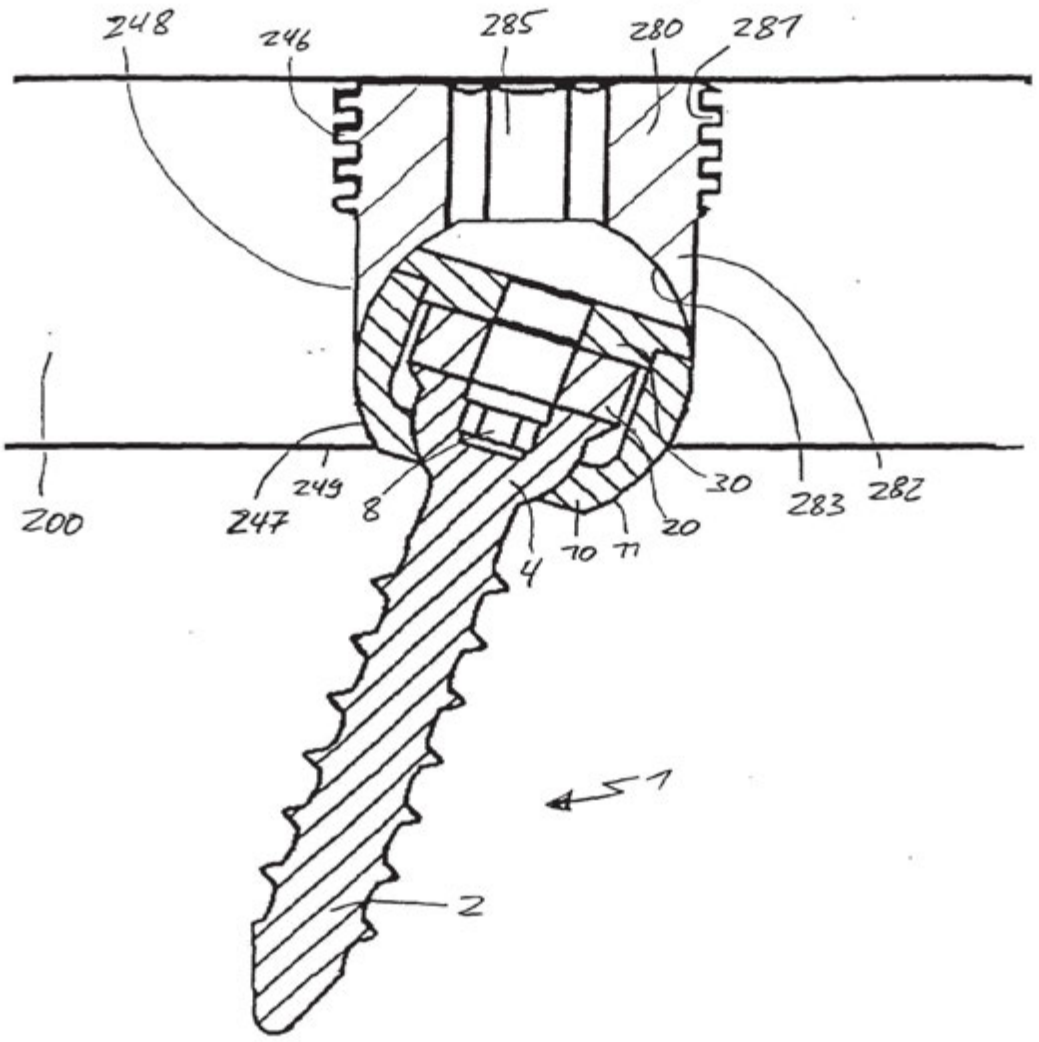
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Fig. 4



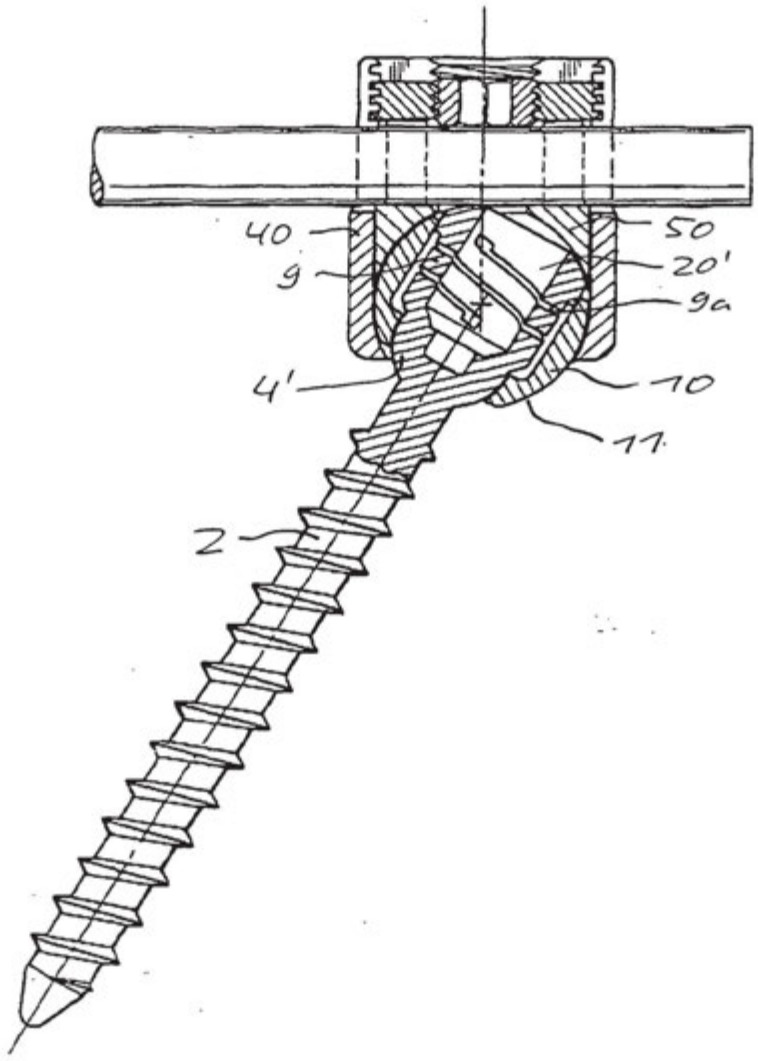
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Fig. 5



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Fig. 6



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F16B 31/02

(52) Domestic classification
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U1S 2055 F2H

(56) Documents cited

GB 1564237	GB 1387969
GB 1559040	GB 1357875
GB 1517657	GB 1330320
GB 1411151	GB 1298095
GB 1398180	GB 0898026

(58) Field of search
F2H

(54) Shear head screws or bolts, or shear head adaptor

(57) A shear head screw 10 (Fig. 3) comprises a first (screw) head 14A and a second head 14B coupled by a shear neck 16 so that the screw can be tightened by the first head 14A until the screw shears at the neck 16 leaving the second head 14B and a threaded stem 12 tightened to a predetermined torque determined by the shear force. The screw thus applied can subsequently be loosened by the second head 14B.

A shear head adaptor 108 (Fig. 19) comprises a socket 112 drivingly engageable with the screw head 106, and a drive head 114 coupled by a shear neck 116 to the socket 112.

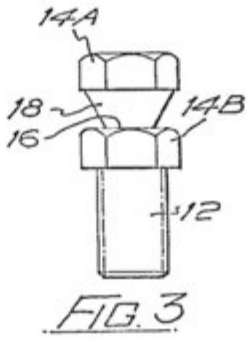


FIG. 3

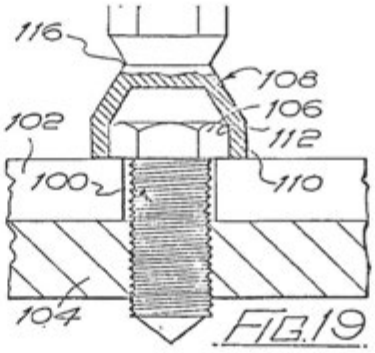


FIG. 19

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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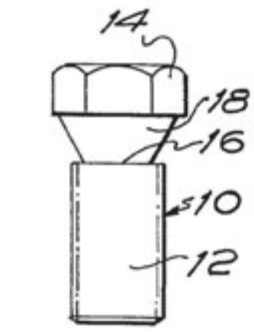


FIG. 1

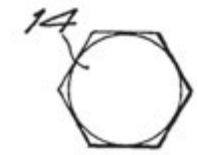


FIG. 2

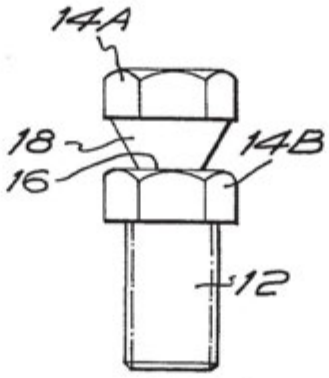


FIG. 3



FIG. 4

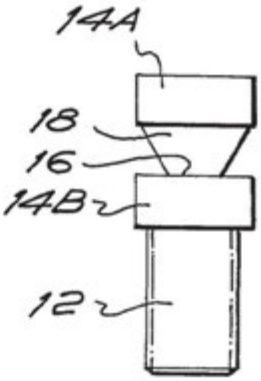


FIG. 5



FIG. 6

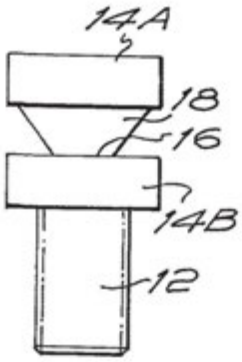


FIG. 7

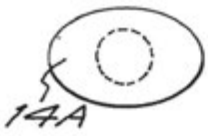


FIG. 8

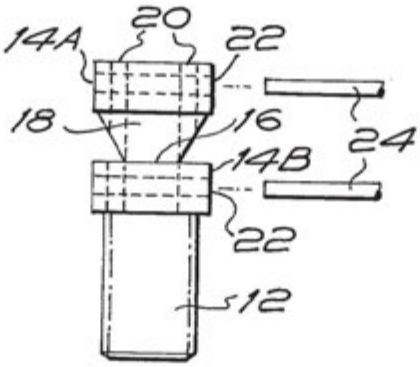


FIG. 9



FIG. 10

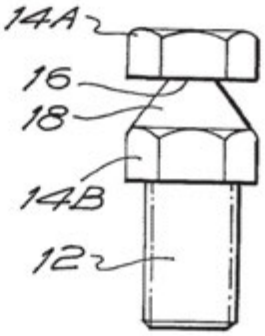


FIG. 11

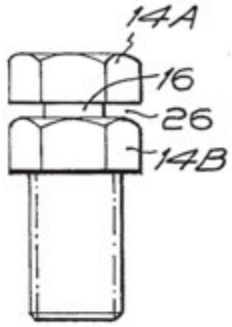


FIG.12

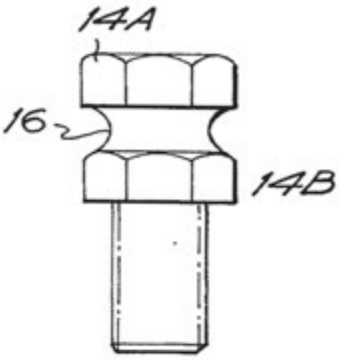


FIG.13

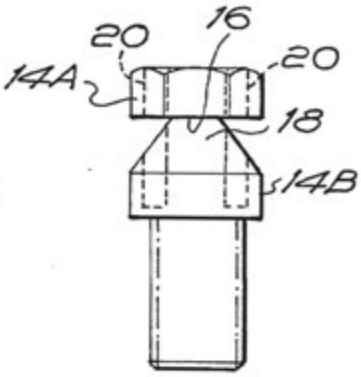


FIG.14

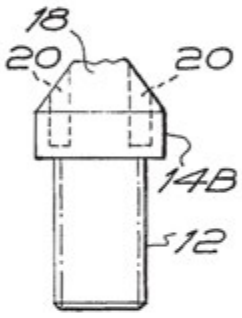


FIG.15

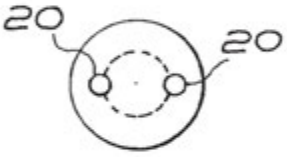


FIG.16

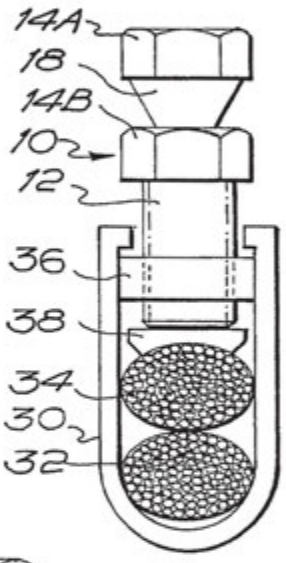


FIG.17

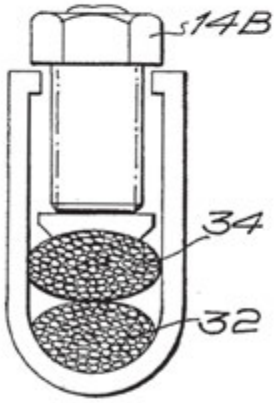


FIG.18

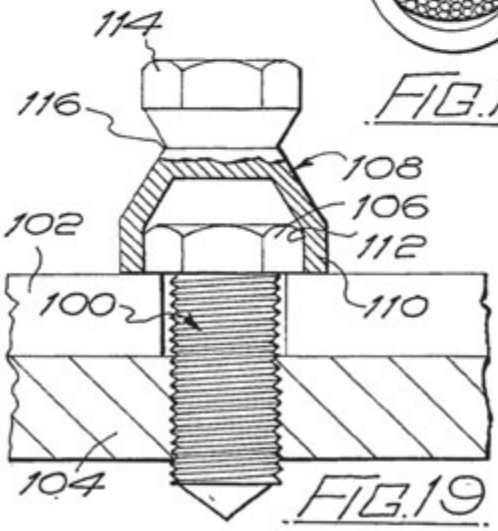


FIG.19

SPECIFICATION

Improvements relating to shear head screws or bolts

This invention relates to shear head screws or bolts, referred to hereinafter simply as shear head screws for convenience, or adaptors therefor, and concerns a novel form of shear head screw or adaptor to provide functionality not heretofore conceived in connection with shear head screws.

Essentially, shear head screws are utilised in circumstances where it is desired to turn a screw, in the tightening of same, to a torque of a predetermined value or lying within a predetermined range, the principle being that the screw is tightened until such times as the head thereof shears from the threaded portion of the screw in a predetermined region, the said region in relation to the screw thread pitch and diameter being designed so that shearing will take place at the predetermined torque.

These shear head screws have a wide application in electrical connectors for the connecting of electrical distribution cables, because in such connectors it is important that the torque applied to the screw which performs the clamping of the connector to another connector or to a connector body should be tightened to a predetermined torque reliably without the use of a torque meter. It is necessary in such application to have a predetermined torque which is neither too high nor too low, because if the torque is too high or too low then the electrical performance of the connector will be reduced unacceptably.

The disadvantage of a shear head screw is that when the head has been sheared from the threaded portion of the screw, it is difficult subsequently to remove the screw. This is not a problem in connection with many electrical connectors of the type referred to above, because such connectors are invariably included in shells or casing which are in any event filled with an encapsulating material such as a synthetic resin, and there is rarely if ever a requirement to disconnect an electrical connector once coupled.

However, the possibility of providing a shear head screw of a type which can be unscrewed represents a significant step forward in certain electrical connectors which are known as terminal connectors which couple supply cables to distribution boards, parts of which require replacement from time to time, but in any event a shear head screw which is capable of being unscrewed represents a considerable advantage in general engineering, because then the screw can be designed to shear at a particular torque, but the shearing of the head does not mean that the screw cannot subsequently be removed. A particularly suitable application for such screws is in internal combustion engines where such screws could be used with good effect for the connecting of the engine cylinder head to the cylinder block.

There is furthermore the general application that if a screw is a shear head screw but is capable of subsequently being unscrewed, then in all engineering applications the screw can be designed so that the head will shear before the threads shear, and this will prevent the application of screws to more than a predetermined design torque. In many instances in engineering and industry, fitters overtighten screws, causing stripping of the thread, or shearing of the head, with the consequent difficulties of screw removal.

The shear head screw in accordance with the present invention comprises a threaded stem, and at one end of the stem, there are two tool engaging sections for the turning of the screw, the said two sections being an outer section and an inner section as regards their relationship with the threaded stem, such sections being separated by a shear throat designed so that when the screw is turned, the outer section will shear from the remainder of the screw including the second section and threaded stem in the throat area before failure of the screw threaded stem, leaving the screw to be unscrewed by means of a suitable tool which can engage the second section.

Preferably, the said throat will be a reduced diameter region between the first and second sections.

The form of tool to be used in connection with the turning of the screw by engagement of the first and second sections may be any suitable, such as a spanner or socket wrench, and the said sections may be designed so that different tools are required to turn the screw by engagement of the first and second sections.

To achieve any predetermined shear torque at which the first section will shear from the remainder of the screw, will depend upon a number of factors including the material from which the screw is produced, the pitch and diameter of the thread of the threaded portion, and the cross sectional area of the shear throat. Particular screws will of course be designed for particular applications.

The principle of the invention as applied to screws as mentioned above, can also be applied to adaptors, in that an adaptor is drivably coupleable to a screw head, and has another portion which is adapted to be engaged by a tool, and between these portions is a shear area, so that turning of the screw through the medium of the adaptor transmits the torque across the shear area of the adaptor, so that the adaptor will shear at such area when the predetermined torque has been applied to the screw. This means that adaptors can be used with conventional screws, and can tighten same to predetermined torques. In this arrangement, adaptors can be made of different material from the screw being tightened.

Various embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, wherein:-

Figures 1 and *2* are a side elevation and plan of a shear head screw which is used extensively in electrical connectors;

Figures 3 and *4* are views similar to Figures 1 and 2 showing a first embodiment of the invention;

Figures 5 and *6*, *Figures 7* and *8*, and *Figures 9* and *10* show respectively three further embodiments of a shear head screw according to the invention, in a manner similar to Figures 3 and 4;

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Figure 11 is a side elevation of a shear head screw according to another embodiment of the invention, showing an alternative formation;

Figures 12 and *13* respectively show, in two further embodiments of the invention, how the throat formation can be modified;

Figure 14 shows a side elevation of a screw according to yet another embodiment of the invention;

Figure 15 shows the screen of Figure 14 after shearing of same;

Figure 16 is a plan view of the shear head screw portion shown in Figure 15;

Figure 17 is a side elevation of an electrical connector showing how the screw according to Figures 3 and 4 is utilised;

Figure 18 shows the connector of Figure 17 after tightening of the screw and shearing of same; and

Figure 19 is a sectional elevation showing an adaptor according to the invention.

Referring to the drawings, where appropriate the same reference numerals, or the same reference numerals with suffix letters have been used throughout.

In Figure 1 there is shown a screw 10 which is of the shear head type in that it is provided with a threaded stem 12, a hexagonal head 14 and a reduced dimension throat 16 forming the shear area of the screw. The throat 16 connects the top of the threaded stem 12 to the head 14 by a frusto-conical section 18. The dimension of the throat 16 is smaller than at least the outer diameter of the thread of stem 12, and will usually be less than the inner diameter of the thread, to ensure that when the screw is tightened, the head 14 will shear from the stem 12 along the shear area 16, at a predetermined torque, which is related to the material of the screw, the diameter and pitch of the thread of stem 12, and the dimension of the throat 16, all of which can be calculated depending upon the application.

Figure 2 shows that the largest cross section of the screw is the head 14, and the screw can be produced from hexagonal bar of the dimension of the head 14.

Screws as shown in Figures 1 and 2 are widely used in electrical connectors as described herein.

The disadvantage of the screw shown in Figures 1 and 2 is that when the head has sheared from the threaded stem, the threaded stem cannot be unscrewed without considerable difficulty. The shear head screws of the present invention are such as to be capable of being unscrewed after the initial shearing has taken place.

In the embodiment of the invention shown in Figure 3, there are two sections 14A and 14B by which the screw can be turned, and the sections 14A and 14B are connected by frusto-conical portion 18 leading from the shear throat 16 located at one side of the section 14B. Figure 4 shows that the screw can be made from hexagonal bar stock. One use of the screw shown in Figures 3 and 4 will be described when referring to Figures 17 and 18.

Figures 5 and 6 show in a manner similar to Figures 3 and 4, a further embodiment of the invention, and illustrate that the sections 14A and 14B can be square instead of hexagonal, whilst Figures 7 and 8 show that the sections 14A and 14B may be oval, in which case a special tool may be required to turn the stem 12 by engaging either the section 14A or the section 14B. Figures 9 and 10 show that the sections 14A and 14B can in fact be circular, in which case the screw may be provided with axial holes 20 passing through both sections 14A and 14B, whereby turning of the screw to shear the section 14A would be by means of a special tool having two pins for engaging the holes 20. Figure 9 also shows that the sections 14A and 14B may be provided with radial holes 22 so that the screw can be turned by engaging either of the holes 22 with tommy bars 24.

In the arrangement of Figure 11, the only difference between this embodiment and the Figures 3 and 4 embodiment is that the section 18 is inverted, so that the shear throat 16 is adjacent to section 14A.

In the arrangement of Figure 12, the throat is defined by a radial slot 26, instead of a frusto-conical section 18, and in the arrangement of Figure 13, the shear section 16 is defined by waisting the section connecting sections 14A and 14B.

In each of the examples described, the shear head screw is applied initially by driving through the section 14A, until the section 14A shears from the remainder at the shear area 16, whereby the screw is tightened to a predetermined torque as indicated herein, and for the removal of the screw, a suitable tool is engaged with the section 14B, and the screw is unscrewed thereby.

As regards the arrangement shown in Figures 14 to 16, the screw illustrated has the first drive section 14A adapted for driving engagement by a tool of a first configuration, whilst the section 14B is such as to require a driving tool of a different configuration for the unscrewing of the screw, and indeed the section 14B is designed so that only a custom built tool will be capable of unscrewing the screw. This embodiment of the invention therefore is particularly effective for security applications where only possessors of the custom built tool can unscrew the screw. Specifically, the section 14A is hexagonal, whilst the section 14B is circular and the frusto-conical section 18 narrows from section 14B to section 14A defining the throat 16 adjacent section 14A. Axial holes 20 extend through the section 14A, the frusto-conical portion 18 and the section 14B as shown, and therefore when the section 14A has been sheared from the remainder as shown in Figure 15, only a tool with a frusto-conical cavity with appropriate drive pins therein can be used for unscrewing of the screw.

Figures 17 and 18 illustrate a typical application of the screw shown in Figures 3 and 4. In Figures 17 and 18, reference 30 indicates a rigid U-shaped, metal yoke, containing two stranded electrical conductors 32 and 34 which are to be electrically connected. The conductor wires are bared and placed in contact as shown, and a screw 10 as shown in Figures 3 and 4 is threaded in a bridge piece 36 and the lower end of the threaded stem 12 engages a pressure pad 38 of the same material as the yoke. To complete the connection, the screw is driven by the section 14A and thereby compressing the stranded

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conductors as shown in Figure 18, until the section 14A and the frusto-conical section 18 shear from the remainder of the screw as shown in Figure 18, at the predetermined torque giving a pre-calculated compression between the conductors 32 and 34. To unscrew the screw, it is simply a matter of driving same by the remaining section 14B using the same tool.

When driving a screw of the invention by the outer section 14A, it may be necessary to locate a member around the section 14B, preventing driving engagement between the driving tool and section 14B, to ensure that the tightening torque will be applied through the shear throat area 16.

Shear head screws according to the present invention will have many applications.

Referring now to Figure 19, in this drawing a conventional screw 100 is shown as connecting two components 102 and 104, and mounted on the head 106 of the screw is an adaptor 108 having a socket portion 110 of which a hexagonal socket 112 drivingly engages the head 106 of the screw, and the socket furthermore has a hexagonal drive head 114, the said headed socket being connected by a reduced dimension throat region 116, which forms a shear area enabling the tightening of the screw 100 to a predetermined torque. As will be understood, the adaptor, which is a rigid metallic member, operates in that the screw 106 is tightened by the head 114, using a suitable tool, until such times as the adaptor shears at throat 116, the shearing torque being designed to give predetermined tightening of the screw 100. Other forms of adaptor can be devised, and the advantage of using an adaptor is that it can be made in a different or perhaps cheaper materials, and adaptors can for example be moulded in multiple cavity moulds, whereas screws such as screw 100, or screws 10 of previous embodiments, tend to require machining.

The screws and adaptors according to the invention will normally be fabricated in metal, but the invention is not to be considered limited to such material, as other materials, such as plastics materials can be used.

CLAIMS

1. A shear head screw comprising a threaded stem, and at one end of the stem, there are two tool engaging sections for the turning of the screw, the said two sections being an outer section and an inner section as regards their relationship with the threaded stem, such sections being separated by a shear throat designed so that when the screw is turned, the outer section will shear from the remainder of the screw including the second section and threaded stem in the throat area before failure of the screw threaded stem, leaving the screw to be unscrewed by means of a suitable tool which can engage the second section.

2. A screw according to Claim 1, wherein the throat is a reduced diameter region between the first and second sections.

3. A screw according to Claim 1 or 2, wherein the first and second sections are of hexagonal cross section and are adapted to be turned by suitable spanners.

4. A screw according to Claim 1, 2 or 3, wherein the throat is defined by the end of a tapered conical section between said inner and outer sections.

5. A screw according to Claim 4, wherein the conical section tapers towards the second section.

6. A shear head adaptor for tightening a screw comprising a first portion which is adapted to be engaged by a tool, and a coupling portion adapted to be coupled drivingly to a screw head, and between these portions is a shear area, so that turning of the screw through the medium of the adaptor transmits the torque across the shear area of the adaptor, so that the adaptor will shear at such area when the predetermined torque has been applied to the screw.

7. An adaptor according to Claim 6, wherein the section which is adapted to be coupled drivingly to a screw head comprises a hexagonal socket for receiving the screw head, and said portion adapted to be turned by a suitable tool comprises a hexagonal sectioned portion.

8. A shear head screw substantially as any of the embodiments described with reference to the accompanying drawings Figures 1 to 18.

9. An adaptor for tightening the screw substantially as hereinbefore described with reference to Figure 19 of the accompanying drawings.

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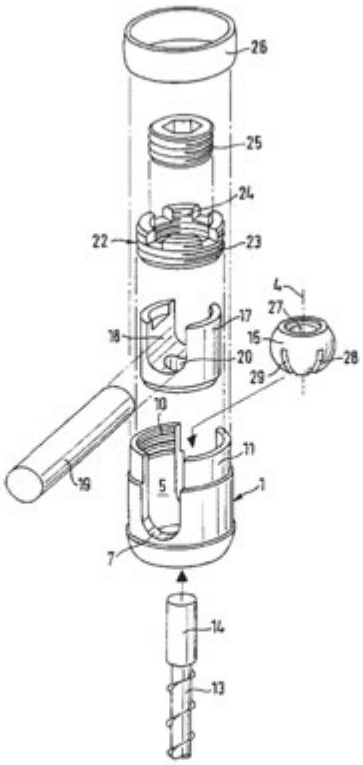
(81) Bestimmungsstaaten *(national)*: JP, KR.

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[Fortsetzung auf der nächsten Seite]

(54) Title: ANCHOR ELEMENT

(54) Bezeichnung: VERANKERUNGSELEMENT



(57) Abstract: An anchor element with a screw (12), comprising a threaded section (13) and a head (15), in the form of a segment of a sphere and a housing piece (1), for connecting the screw (12) to a bar (19) is disclosed. The housing piece (1) comprises a first end (2) and an opposing second end (3), with a longitudinal axis (4) running through both ends (2, 3). The housing piece further comprises a drilling (5) coaxial to the longitudinal axis (4), a first region adjacent to the first end (2), having an essentially U-shaped cross-section (18), with two free sides (8, 9), comprising a thread for housing the bar (19) to be fitted, a region adjacent to the other end (3) for housing the head (15) and an element for exerting pressure on the bar (19) and the head (15). The threaded section (13) and the head (15) are embodied as separate pieces, such that the screw may be used in situations with varying lengths.

(57) Zusammenfassung: Es wird ein Verankerungselement mit einer einen Gewindeabschnitt (13) und einen als kugelsegmentförmigen Abschnitt ausgebildeten Kopf (15) aufweisenden Schraube (12) und einem Aufnahmeteil (1) zum Verbinden der Schraube (12) mit einem Stab (19) geschaffen. Das Aufnahmeteil (1) weist ein erstes Ende (2) und ein diesem gegenüberliegendes zweites Ende (3) und eine durch die beiden Enden (2, 3) gehende Längsachse (4) koaxiale Bohrung (5), einen in einem an das erste Ende (2) angrenzenden ersten Bereich mit einem im wesentlichen U-förmigen Querschnitt (18) mit zwei freien, ein Gewinde aufweisenden Schenkeln (8, 9) zur Aufnahme des einzusetzenden Stabes (19), einen an das andere Ende (3) angrenzenden Bereich zur Aufnahme des Kopfes (15) und ein auf den Stab (19) bzw. den Kopf (15) Druck ausübendes Element auf. Damit die Schrauben vor Ort für verschiedenste Längen verwendbar sind, sind der Gewindeabschnitt (13) und der Kopf (15) als separate Teile ausgebildet.

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Erklärungen gemäß Regel 4.17:

- *hinsichtlich der Berechtigung des Anmelders, ein Patent zu beantragen und zu erhalten (Regel 4.17 Ziffer ii) für die folgenden Bestimmungsstaaten JP, KR, europäisches Patent (AT, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR)*
- *Erfindererklärung (Regel 4.17 Ziffer iv) nur für US*

Veröffentlicht:

- *mit internationalem Recherchenbericht*
- *vor Ablauf der für Änderungen der Ansprüche geltenden Frist; Veröffentlichung wird wiederholt, falls Änderungen eintreffen*

Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

Verankerungselement

Die Erfindung betrifft ein Verankerungselement mit einer einen Gewindeabschnitt und einen als kugelsegmentförmigen Abschnitt ausgebildeten Kopf aufweisenden Schraube und einem Aufnahmeteil zum Verbinden der Schraube mit einem Stab nach dem Oberbegriff des Patentanspruches 1. Ein derartiges Verankerungselement wird insbesondere in der Wirbelsäulenchirurgie, aber auch in der Unfallchirurgie bei anderen Knochen eingesetzt.

Ein solches Verankerungselement ist beispielsweise aus der DE 43 07 576 C1 bekannt. Bei derartigen bekannten Verankerungselementen und Schrauben sind der Gewindeabschnitt der Schraube und ihr Kopf einstückig ausgebildet. Da der Chirurg verschiedenste Längen der Schrauben benötigt, muß er immer verschiedene Sätze solcher Schrauben vorrätig haben. Das macht ein erhebliches Vorratslager notwendig mit der Folge erheblicher Kosten.

Aufgabe der Erfindung ist es, diesen Nachteil zu beseitigen.

Diese Aufgabe wird durch das in Patentanspruch 1 gekennzeichnete Verankerungselement gelöst. Dadurch wird es möglich, daß der Chirurg bei der Anwendung den Gewindeabschnitt vor oder nach dem Implantieren auf eine gewünschte Länge kürzt und dann diesen mit dem Kopf und dem Aufnahmeteil verbindet. Auf diese Weise wird die Vorratshaltung wesentlich verkleinert, und gleichzeitig erhöhen sich die Möglichkeiten für den Chirurgen, feinere Justierungen vorzunehmen, da die Schrauben auf jedes Längenmaß kürzbar sind.

Weiterbildungen der Erfindung sind in den Unteransprüchen gekennzeichnet.

Weitere Merkmale und Zweckmäßigkeiten der Erfindung ergeben sich aus der Beschreibung von Ausführungsbeispielen anhand der Figuren.

Von den Figuren zeigen:

Fig. 1 eine Seitenansicht einer ersten Ausführungsform in geschnittener Darstellung;

Fig. 2 die in Fig. 1 gezeigte Ausführungsform in Explosionsdarstellung;

Fig. 3 eine entsprechende Explosionsdarstellung einer zweiten Ausführungsform;

Fig. 4 eine Seitenansicht der ersten in den beiden Ausführungsformen verwendeten Knochenschraube;

Fig. 5 eine Draufsicht auf die Knochenschraube in Fig. 4;

Fig. 6 eine Seitenansicht einer zweiten Ausführungsform der in den ersten beiden Ausführungsbeispielen verwendeten Knochenschraube;

Fig. 7 eine Draufsicht auf die in Fig. 6 gezeigte Knochenschraube;

Fig. 8 eine Seitenansicht einer dritten Ausführungsform einer in den ersten beiden Ausführungsbeispielen gezeigten Knochenschraube;

Fig. 9 eine Seitenansicht einer weiteren Ausführungsform in Schnittdarstellung;

Fig. 10 eine Seitenansicht einer weiteren Ausführungsform in Schnittdarstellung; und

Fig. 11 eine vergrößerte Darstellung des Details X von Fig. 10.

Bei der in den Fig. 1 und 2 gezeigten ersten Ausführungsform weist das Verankerungselement ein zylindrisch ausgebildetes Aufnahmeteil 1 mit einem ersten Ende 2 und einem gegenüberliegenden zweiten Ende 3 auf. Die beiden Enden erstrecken sich senkrecht zu einer Symmetrie- bzw. Längsachse 4. Koaxial zu der Längsachse 4 ist eine von dem ersten Ende 2 aus sich erstreckende erste koaxiale Bohrung 5 vorgesehen, die sich bis zu einem vorbestimmten Abstand von dem zweiten Ende 3 hin erstreckt. An dem zweiten Ende 3 ist eine zweite Bohrung vorgesehen, deren Durchmesser kleiner als der Durchmesser der ersten Bohrung ist. In dem gezeigten Ausführungsbeispiel ist die zweite Bohrung als eine Öffnung ausgebildet, deren Rand

als hohlkugelsegementförmiger Abschnitt geformt ist, dessen Mittelpunkt zum ersten Ende 2 hin gerichtet ist.

Das Aufnahmeteil 1 weist ausgehend von dem ersten Ende 2 eine sich senkrecht zur Längsachse 3 erstreckende U-förmige Ausnehmung 7 auf mit zwei zum ersten Ende 2 hin endenden freien Schenkeln 8, 9. Angrenzend an das erste Ende 2 weisen die Schenkel ein Innengewinde 10 auf. Der Grund der U-förmigen Ausnehmung erstreckt sich bis zu einem vorgegebenen Abstand von dem zweiten Ende 3 hin. Angrenzend an das erste Ende 2 weisen die Schenkel 8, 9 außen einen Abschnitt 11 auf, dessen Außendurchmesser kleiner ist als der Außendurchmesser des angrenzenden Abschnittes des Aufnahmeteiles.

Die mit dem Aufnahmeteil 1 zusammenwirkende Schraube 12 weist einen als Knochenschraube ausgebildeten Gewindeabschnitt 13 und einen in der in Fig. 1 gezeigten montierten Darstellung damit verbundenen kugelsegmentförmigen Kopf 15 auf. Der Kopf weist einen Radius auf, der so bemessen ist, daß der Kopf bei der in Fig. 1 gezeigten Aufnahme des Kopfes 15 in der zweiten Bohrung 6 zu einem dort gebildeten hohlkugelsegementförmigen Wandabschnitt paßt, wobei der hohlkugelsegmentförmige Abschnitt so ausgebildet ist, daß der Mittelpunkt 16 der Kugel so weit zum ersten Ende 2 hin versetzt ist, daß der Abschnitt ein Widerlager bildet und die Kugel bzw. der Kopf 15 in dem hohlkugelsegmentförmigen Abschnitt der zweiten Bohrung 6 gehalten wird.

Es ist ferner ein Druckelement 17 vorgesehen, welches zylindrisch ausgebildet ist und einen Außendurchmesser aufweist, der gerade so groß ist, daß das Druckelement in die erste Bohrung 5 einführbar und in dieser in Axialrichtung hin- und herbewegbar ist. Auf seiner, dem zweiten Ende 3 zugewandten

Unterseite weist das Druckelement 17 einen zur Längsachse 4 symmetrisch ausgebildeten hohlkugelsegmentförmigen Abschnitt auf, dessen Radius dem Radius des Kopfes 5 entspricht. Das Druckelement weist eine sich quer zur Längsachse 4 erstreckende U-förmige Ausnehmung 18 auf, deren freie Schenkel sich zum ersten Ende 2 hin erstrecken. Der seitliche Durchmesser dieser U-förmigen Ausnehmung ist so gewählt, daß ein aufzunehmender Stab 19 in die Ausnehmung einsetzbar ist und in dieser seitlich geführt ist. Die Tiefe der hohlkugelsegmentförmigen Ausnehmung ist so gewählt, daß sie in einem Abstand von dem zweiten Ende 3 endet, der größer ist als der dem Radius des Kopfes 15 entsprechenden Abstandes von dem Mittelpunkt 16 zum ersten Ende 2 hin gesehen. Am Grund der U-förmigen Ausnehmung 18 schließt sich eine koaxiale Bohrung 20 an, deren Durchmesser kleiner als der Durchmesser des aufzunehmenden Stabes 19 ist.

Wie aus Fig. 1 ersichtlich ist, weist die U-förmige Ausnehmung 18 an ihrem zum ersten Ende 2 hin gerichteten Ende einen Abschnitt 21 auf, dessen innere Weite größer als der Durchmesser der U-förmigen Ausnehmung 18 ist.

Auf der dem ersten Ende 2 zugewandten Seite schließt sich an das Druckelement 17 eine Mutter 22 an, die ein zu dem Innengewinde 10 passendes Außengewinde 23 und zusätzlich ein Innengewinde 24 aufweist. Die Innenabmessung der Mutter 22 ist so gewählt, daß die innere Weite kleiner als der Durchmesser des Abschnittes 21 ist und größer als der Durchmesser des Stabes 19 und damit der U-förmigen Ausnehmung 18 ist. Ferner ist eine Innenmutter 25 mit einem zum Innengewinde 24 passenden Außengewinde vorgesehen. Schließlich ist eine das freie Ende angrenzend an das erste Ende 2 umfassende Hülse 26 vor-

gesehen, die im zusammengesetzten Zustand auf dem ringförmigen Abschnitt 11 aufsitzt, wie dieser in Fig. 1 gezeigt ist.

Wie am besten aus Fig. 2 zu ersehen ist, weist die Mutter 22 einen Schlitz und die Innenmutter 25 eine Sechskantöffnung zum jeweiligen getrennten Angreifen von Schraubendrehern auf.

Wie am besten aus Fig. 2 zu ersehen ist, ist der Kopf 15 als eine an ihrem dem ersten Ende 2 zuzuwendenden Ende abgeflachte Kugel ausgebildet und weist eine zu der Längsachse 4 koaxiale Bohrung 27 auf. Der Durchmesser der Bohrung 27 ist gleich dem Außendurchmesser des Schaftes 14 und so ausgebildet, daß der Schaft in die Bohrung reibschlüssig einschiebbar ist. Wie aus Fig. 2 ersichtlich ist, ist das so geformte hohlkugelsegmentförmige Element auf seiner dem abgeflachten Ende gegenüberliegenden Seite mit in Umfangsrichtung einen Abstand zueinander aufweisenden und sich parallel zur Längsachse 4 erstreckenden und bis zu dem der abgeflachten Seite gegenüberliegenden Ende reichenden Ausschnitten 28, 29 versehen. Dadurch wird erreicht, daß der dem ersten Ende 2 abgewandte Rand 30 zum Einführen des Schaftes 14 federnd nach außen nachgebbar ausgebildet ist.

Im Betrieb wird zunächst die Schraube 12 in den Knochen bzw. den Wirbel eingeschraubt. Zu diesem Zweck weist der Schaft 14 bekannte Eingriffsmöglichkeiten wie etwa einen Innensechskant auf. Dann kürzt der Operateur den Schaft 14 auf die gewünschte Länge und setzt zunächst das Aufnahmeteil mit der zweiten Bohrung auf den Schaft 14 und führt dann den Kopf von dem ersten Ende 2 her auf den Schaft 14, so daß der Schaft 14 vom federnd nachgebenden Rand 30 her in die Bohrung 27 eingeführt wird und der Kopf den Schaft in der in Fig. 1 gezeigten Weise einschließt. Der Kopf 15 und der Schaft 14 sind reib-

schlüssig miteinander verbunden. Anschließend wird das Druckelement 17 eingesetzt und durch Einschrauben der Mutter 22 so auf den Kopf 15 gedrückt, daß dieser eine gewünschte Drehstabilisierung erfährt. Die Hülse 26 wird aufgebracht und dann wird mit Hilfe der Innenmutter 25 der Stab 19 fixiert. Der Stab 19 übt über das Druckelement 17 einen zusätzlichen Druck auf den Kopf 15 aus.

Durch den vom ersten Ende 2 her gesehen ausgeübten Druck auf den Kopf 15 wird der geschlitzte Kopf 15 einerseits mit dem Schaft 14 bewegungsfest verbunden bzw. verklemmt, gleichzeitig wird der Kopf in seiner Drehstellung arretiert.

Die in Fig. 3 gezeigte zweite Ausführungsform unterscheidet sich von der zuvor beschriebenen Ausführungsform durch einen abgewandelten Kopf 31. Dieser weist wie bei der ersten Ausführungsform in Umfangsrichtung zueinander versetzte Ausschnitte 28 auf, die an dem dem ersten Ende abgewandten Rand 34 frei enden und einen Abstand von dem dem ersten Ende 2 zugewandten Rand 32 aufweisen. Es ist jedoch ein Ausschnitt 33 vorgesehen, der sich vollständig von dem Rand 32 bis zum gegenüberliegenden Rand 34 erstreckt, mit der Folge, daß das so gebildete Kugelsegment um ein durch die Breite des Ausschnittes 33 bestimmtes Ausmaß zusammendrückbar ist. Die Breite des so gebildeten Schlitzes 33 ist so gewählt, daß der Kopf 31 zunächst so weit zusammendrückbar ist, daß er in der in Fig. 3 gezeigten Richtung vom zweiten Ende 2 her in die erste Bohrung 5 hineindrückbar ist und daß dann der Schaft 14 in den Kopf in der gleichen Weise wie oben beschrieben einschiebbar ist und auf die gleiche Weise in verklemmter Position gehalten wird.

Der Schaft 14 der Schraube hat vorzugsweise die in den Fig. 4 und 5 gezeigte zylindrische Form oder auch eine in den Fig. 6 und 7 gezeigte mehreckige Form. In letzterer ist der Querschnitt achteckig ausgebildet. Eine weitere bevorzugte Ausführungsform ist in Fig. 8 gezeigt. Der Schaft ist hier zylindrisch ausgebildet und weist eine rauhe Oberfläche auf, die das Ineingriffbringen zwischen Kugel 15 und Schaft erleichtert.

Die in Fig. 9 gezeigte weitere Ausführungsform stimmt in allen Merkmalen, die das Aufnahmeteil 1, das Druckelement 17, den Stab 19 und die Schrauben 22 und 25 betreffen, mit den vorhergehenden Ausführungsbeispielen überein. Der einzige Unterschied besteht darin, daß der Kopf 15 als ein Kugelsegment ausgebildet ist, welches in seinen äußeren Abmessungen den beiden vorhergehenden Kugelsegmenten entspricht, jedoch keine Ausschnitte 28 oder 33 aufweist. Statt dessen weist das Kugelsegment auf der Innenseite seiner Bohrung 27 ein Innengewinde auf. Anstelle des Schaftes 14 ist ein Schaft 35 mit einem Gewinde vorgesehen, welches zu dem Innengewinde des Kopfes passend ausgebildet ist. Die Bohrung ist als eine Sackbohrung ausgebildet, die an dem dem freien Ende 2 zugewandten Ende endet oder dort einen Anschlag aufweist, so daß die Schraube nur so weit in die gezeigte Stellung einschraubbar ist, in der sie nicht aus dem Kugelsegment an dessen abgeflachter Seite heraussteht. Wie in Fig. 9 gezeigt ist, sind das Innengewinde des Kopfes 15 und das entsprechende Außengewinde des Schaftes 35 in der Richtung vorzugsweise entgegengesetzt zur Richtung des Gewindes des Gewindeabschnittes 13 der Knochenschraube ausgebildet.

Der Betrieb erfolgt in gleicher Weise wie bei dem zuerst beschriebenen Ausführungsbeispiel, wobei nach dem Kürzen des

Schaftes 35 der Kopf 15 vom ersten Ende 2 des Aufnahmeteils 1 her in die Bohrung 5 eingeführt und auf den vom zweiten Ende 3 her eingeführten Schaft 35 aufgeschraubt wird.

Die in den Figuren 10 und 11 gezeigte weitere Auführungsform stimmt in allen Merkmalen, die das Aufnahmeteil 1, das Druckelement 17, den Stab 19 und die Schrauben 22 und 25 betreffen, mit den vorhergehenden Ausführungsbeispielen überein. Anstelle des Schafts 35 und des Kopfes 15 der Ausführungsform nach Fig. 9, welche die zusammenwirkenden Gewinde aufweist, ist bei dieser Ausführungsform der Schaft 37 in einem Abschnitt angrenzend an das dem Knochengewindeabschnitt gegenüberliegenden Ende als Wellenstab ausgebildet. Die Außenfläche des Schaftes weist in Umfangsrichtung verlaufende Wellentäler 38 und dazwischenliegende Wellenkämme 39 auf. Die Wellentäler 38 haben in Umfangsrichtung gesehen einen kreisabschnittförmigen Querschnitt und ihr Durchmesser auf halber Höhe bzw. Tiefe ist deutlich größer als der entsprechende Durchmesser des Wellenbergs 39, so dass die Wellenberge 39 spitz sind im Verhältnis zu dem Grund der Wellentäler 38. Der Kopf 15 ist als ein Kugelsegment ausgebildet, welches in seinen äußeren Abmessungen den zuvor genannten Kugelsegmenten entspricht, das jedoch keine Ausschnitte 28 oder 33 aufweist. Auf der Innenseite seiner Bohrung 27 weist das Kugelsegment des Kopfes 15 in Umfangsrichtung verlaufende Wellen mit Wellentälern 40 und Wellenkämmen 41 auf, die jeweils den Wellenkämmen 39 bzw. den Wellentälern 38 des Schaftes 37 entsprechen. Zwischen den Wellentälern 38 und den Wellenkämmen 39 des Schaftes einerseits und den entsprechenden Wellenkämmen 40 und Wellentälern 41 andererseits ist ein kleiner Zwischenraum, so daß der Schaft in das Kugelsegment einführbar ist.

Der Betrieb erfolgt in ähnlicher Weise wie bei dem Ausführungsbeispiel gemäß Fig. 9. Das Kürzen des gewellten Schaftes 37 ist jedoch bei dieser Ausführungsform einfacher als das Kürzen des Schaftes 35 mit dem Gewinde gemäß Fig. 9, da die Wellentäler 38 ein leichtes Abschneiden ermöglichen, während bei dem Schaft 35 mit dem Gewinde gemäß Fig. 9 darauf geachtet werden muß, daß das Gewinde nicht zerstört wird. Nach dem Kürzen des Schaftes 37 wird der Kopf 15 von dem ersten Ende 2 des Aufnahmeteils 1 in die Bohrung 5 eingeführt und auf den Schaft 37 aufgedrückt. Dabei wirken die Wellen des Schaftes 37 und die entsprechenden der Bohrung 27 des Kopfes 15 zusammen, so daß der Schaft gehalten wird.

In den oben beschriebenen Ausführungsbeispielen wird der Kopf 15 jeweils durch einen mit dem Aufnahmeteil 1 einstückig ausgebildeten Rand gehalten. Ein solches Widerlager kann auch auf andere Weise gebildet werden, beispielsweise ist es möglich, die erste Bohrung 5 vollständig durch das Aufnahmeteil 1 hindurch zu bohren und dann angrenzend an das zweite Ende ein den Kopf 15 aufnehmendes Halteelement einzuspannen.

In den oben beschriebenen Ausführungsbeispielen weist das Aufnahmeteil stets die Mutter 22 und eine Innenmutter 25 sowie eine Hülse 26 auf. Diese Fixierung kann in bekannter Weise auch anders ausgebildet sein. Insbesondere kann gegebenenfalls auch lediglich eine Innenmutter vorgesehen sein.

Bei dem oben unter Bezugnahme auf Fig. 9 beschriebenen Ausführungsbeispiel weist der Kopf 15 keine Ausschnitte 28, 33 auf. In einer weiteren Ausführungsform weisen Kopf 15 und Schaft 35 wie bei der in Fig. 9 gezeigten Darstellung zueinander passende Gewinde auf. Der Kopf 15 weist jedoch zusätz-

lich den sich über die gesamte Länge erstreckenden Ausschnitt 33, so daß wie bei der in Fig. 3 gezeigten Ausführungsform der Kopf ohne eingeschraubten Schaft von dem Rand 3 aus durch Zusammendrücken in das Aufnahmeteil einschiebbar ist und dann auf den ebenfalls vom Ende 3 her einführbaren Schaft 35 durch Einschrauben aufnimmt und mit diesem verbunden wird. Der Schlitz führt beim Aufsetzen der Druckelemente bzw. beim Ausüben des Druckes auf den Kopf 15 dazu, daß gleichzeitig der Kopf und der Schaft 35 fester zusammengedrückt werden als ohne einen solchen Schlitz.

In einer weiteren Ausführungsform können zusätzlich noch Ausschnitte 28 in der in Fig. 3 gezeigten Weise vorgesehen sein, um so ein noch stärkeres Anpressen an den Gewindeschaft 35 zu bewirken.

Patentansprüche

1. Verankerungselement mit einer einen Gewindeabschnitt (13) und einen als kugelsegmentförmiger Abschnitt ausgebildeten Kopf (15) aufweisenden Schraube (12) und einem Aufnahmeteil (1) zum Verbinden der Schraube (12) mit einem Stab (19), wobei das Aufnahmeteil (1)
ein erstes Ende (2) und ein diesem gegenüberliegendes zweites Ende (3), eine durch die beiden Enden (2, 3) gehende Längsachse (4),
eine zur Längsachse (4) koaxiale Bohrung (5), einen in einem an das erste Ende (2) angrenzenden ersten Bereich mit einem im wesentlichen U-förmigen Querschnitt (7) mit zwei freien ein Gewinde aufweisenden Schenkeln (8, 9) zur Aufnahme des einzusetzenden Stabes (19), einen an das andere Ende (3) angrenzenden Bereich zur Aufnahme des Kopfes (15) und
ein auf den Stab (19) bzw. auf den Kopf (15) Druck ausübendes Element (22, 17) aufweist,
dadurch gekennzeichnet, daß
der Gewindeabschnitt (13) und der Kopf (15) als separate Teile ausgebildet sind.

2. Verankerungselement nach Anspruch 1, dadurch gekennzeichnet, daß der Gewindeabschnitt (13) an dem kopfseitigen Ende einen Schaft (14) aufweist.

3. Verankerungselement nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Kopf (15) auf seiner dem Gewindeabschnitt (13) zugewandten Seite einen federnd nachgebenden Rand aufweist.

4. Verankerungselement nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß der dem Gewindeabschnitt zugewandte Rand (34) eine oder mehrere zur Symmetrieachse (4) parallel gerichtete und umfangsmäßig verteilte Durchbrechungen bzw. Ausnehmungen (28, 29, 33) aufweist.

5. Verankerungselement nach Anspruch 4, dadurch gekennzeichnet, daß eine Durchbrechung (33) sich in Richtung parallel zur Symmetrieachse (4) gesehen über die gesamte Wandlänge erstreckt.

6. Verankerungselement nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß der Kopf (15) eine zur Symmetrieachse koaxiale Bohrung (27) aufweist.

7. Verankerungselement nach Anspruch 6, dadurch gekennzeichnet, daß die Bohrung (27) zylindrisch ausgebildet ist.

8. Verankerungselement nach einem der Ansprüche 2 bis 7, dadurch gekennzeichnet, daß der Schaft (14) eine rauhe Oberfläche aufweist.

9. Verankerungselement nach einem der Ansprüche 2 bis 8, dadurch gekennzeichnet, daß der Schaft (14) mehreckig ausgebildet ist.

10. Verankerungselement nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß der Kopf (15) in der Bohrung ein Innengewinde und der Schaft (35) ein dazu passendes Außengewinde aufweist.

11. Verankerungselement nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß der Kopf (15) in der Bohrung in Umfangsrichtung gewellt ausgebildet ist und der Schaft (37) an seiner Außenseite eine entsprechende Wellung aufweist.

FIG.2

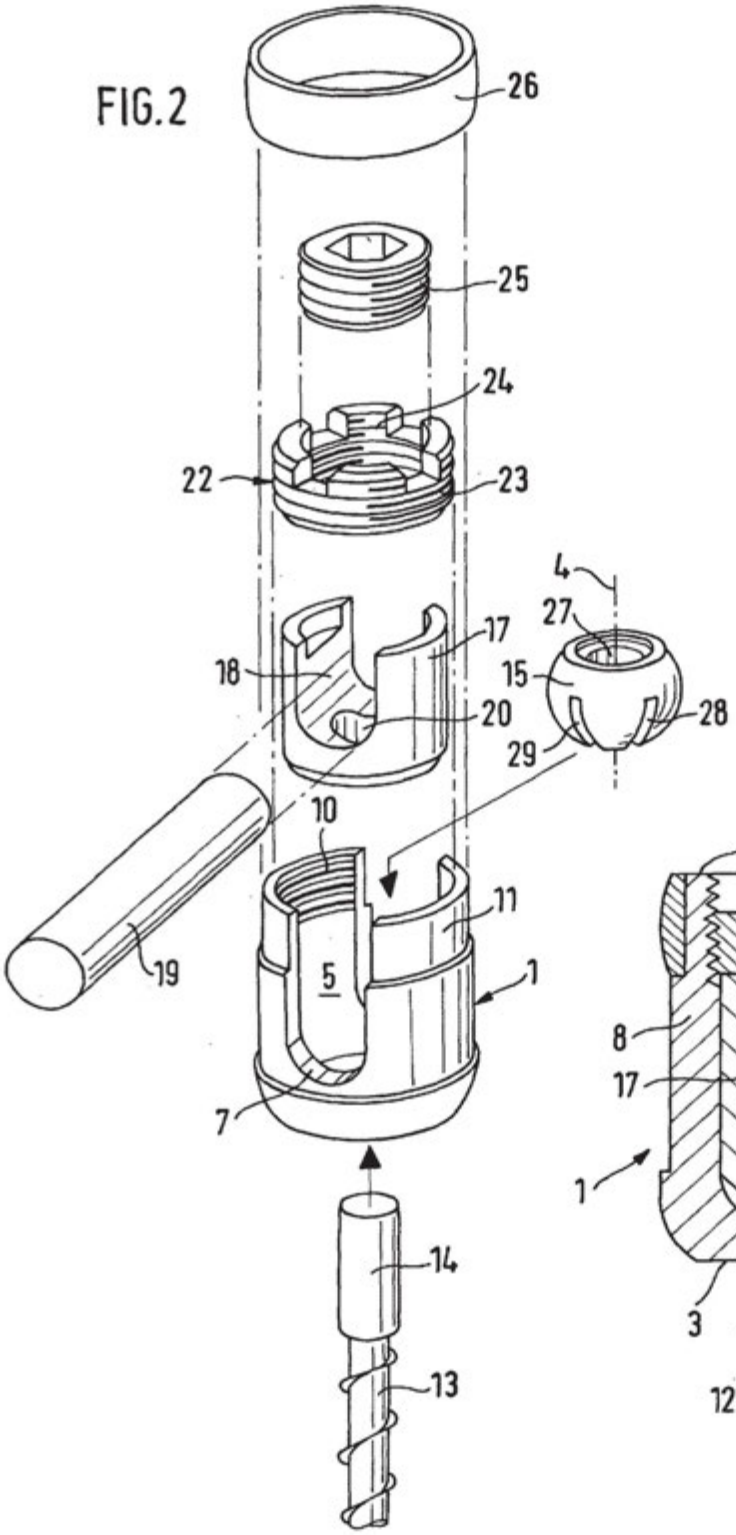
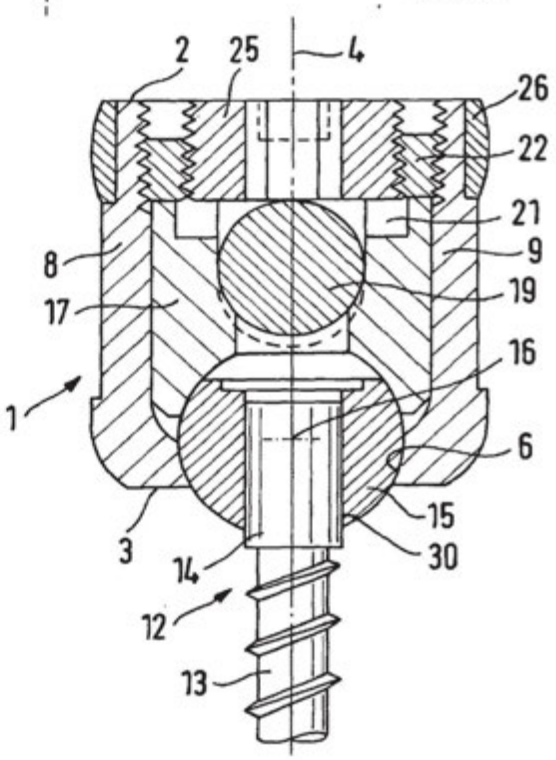


FIG.1



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FIG.3

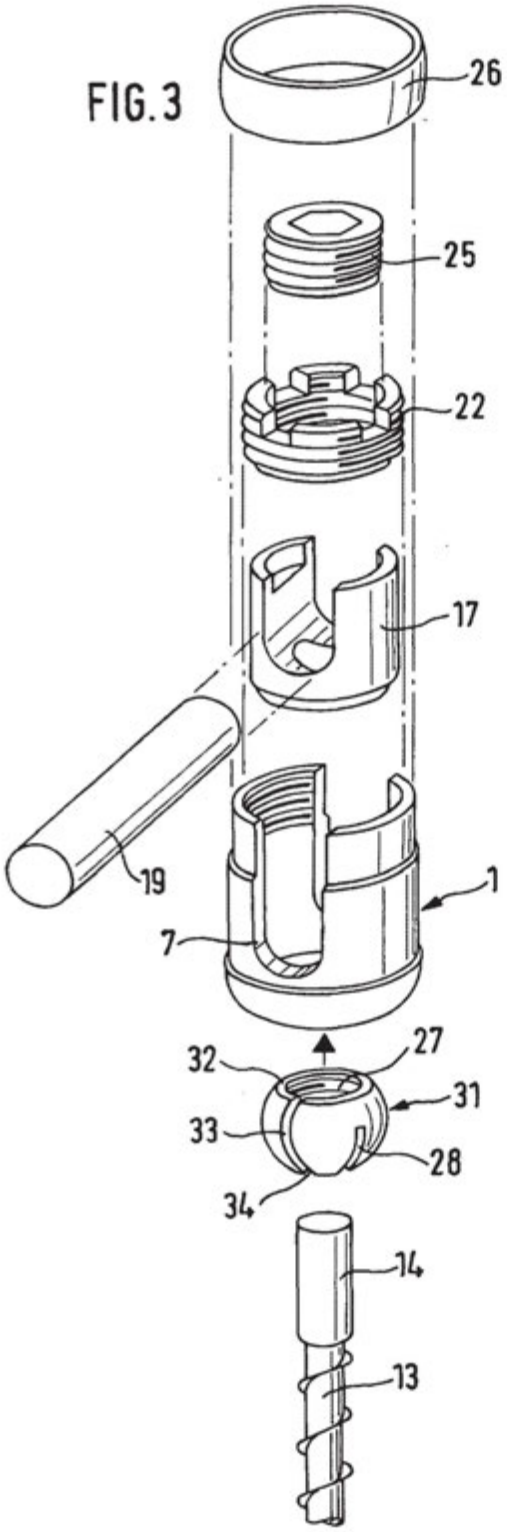
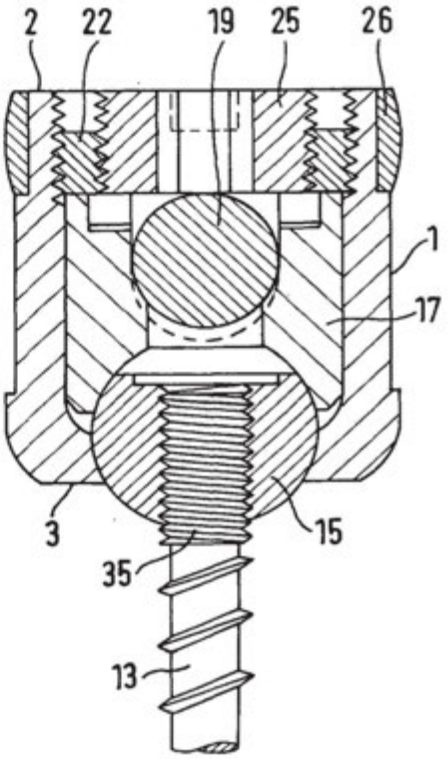


FIG.9



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FIG.4



FIG.5

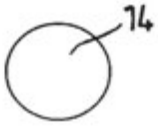


FIG.6



FIG.7

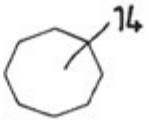
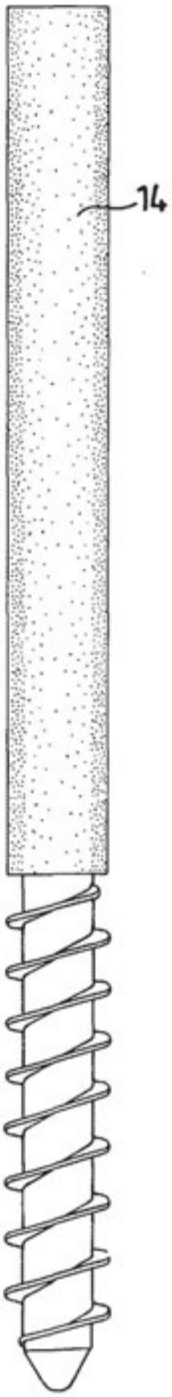


FIG.8



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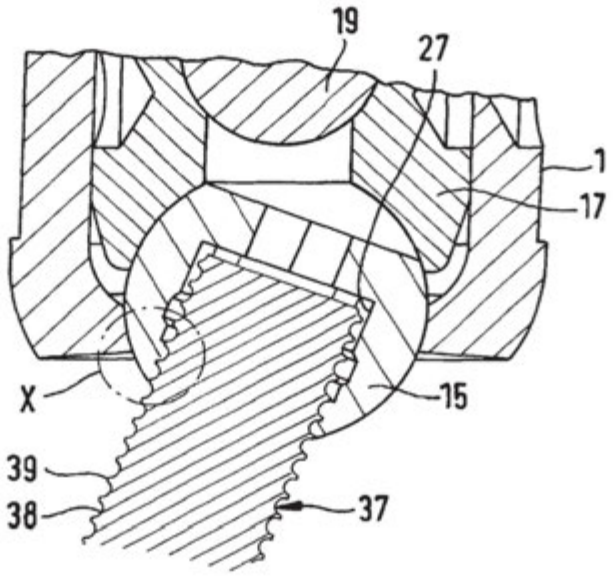


FIG.10

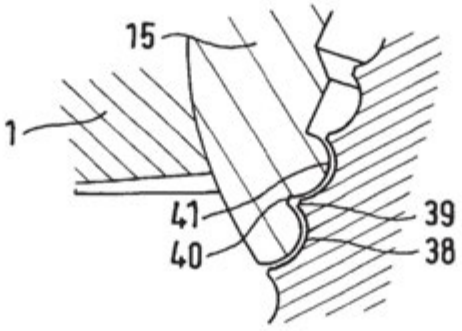


FIG.11

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 02/01284

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B17/70 A61B17/86

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 7 A61B

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01 03593 A (FERUS ROBERT ;FRIGG ROBERT (CH); SYNTHES AG (CH); SYNTHES USA (US)) 18 January 2001 (2001-01-18) abstract; claim 1; figure 6 ---	1,10,11
X	EP 0 933 065 A (SULZER ORTHOPAEDIE AG) 4 August 1999 (1999-08-04)	1
A	the whole document ---	2-11
A	WO 94 00066 A (HESS MARTIN ;SYNTHES AG (CH); SCHLAEPFER JOHANNES FRIDOLIN (CH)) 6 January 1994 (1994-01-06) abstract; figures 1,2 ---	1-11
A	FR 2 786 088 A (DIMSO SA) 26 May 2000 (2000-05-26) abstract; figure 3 ---	1,3-7
	-/--	

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Date of the actual completion of the international search	Date of mailing of the international search report
19 July 2002	29/07/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Hansen, S

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	FR 2 720 923 A (MIRONNEAU ANTOINE;REMOND JOEL; GALLAND OLIVIER; HUPPERT JEAN; SRA SARL) 15 December 1995 (1995-12-15) page 7, paragraph 1; figure 1 -----	1,2,8

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INTERNATIONAL SEARCH REPORT

formation on patent family members

International Application No
PCT/EP 02/01284

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0103593 A	18-01-2001	WO 0103593 A1	18-01-2001
		AU 4357399 A	30-01-2001
		EP 1191891 A1	03-04-2002
EP 0933065 A	04-08-1999	EP 0933065 A1	04-08-1999
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WO 9400066 A	06-01-1994	WO 9400066 A1	06-01-1994
		DE 59208301 D1	07-05-1997
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		JP 6509950 T	10-11-1994
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FR 2786088 A	26-05-2000	FR 2786088 A1	26-05-2000
FR 2720923 A	15-12-1995	FR 2720923 A1	15-12-1995

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INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
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A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 7 A61B17/70 A61B17/86

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C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X	WO 01 03593 A (FERUS ROBERT ;FRIGG ROBERT (CH); SYNTHES AG (CH); SYNTHES USA (US)) 18. Januar 2001 (2001-01-18) Zusammenfassung; Anspruch 1; Abbildung 6 ---	1,10,11
X	EP 0 933 065 A (SULZER ORTHOPAEDIE AG) 4. August 1999 (1999-08-04)	1
A	das ganze Dokument ---	2-11
A	WO 94 00066 A (HESS MARTIN ;SYNTHES AG (CH); SCHLAEPFER JOHANNES FRIDOLIN (CH)) 6. Januar 1994 (1994-01-06) Zusammenfassung; Abbildungen 1,2 ---	1-11
A	FR 2 786 088 A (DIMSO SA) 26. Mai 2000 (2000-05-26) Zusammenfassung; Abbildung 3 ---	1,3-7
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[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

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19. Juli 2002	29/07/2002

Name und Postanschrift der Internationalen Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Hansen, S

Formblatt PCT/ISA/210 (Blatt 2) (Juli 1992)

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/EP 02/01284

C.(Fortsetzung) ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie*	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	FR 2 720 923 A (MIRONNEAU ANTOINE;REMOND JOEL; GALLAND OLIVIER; HUPPERT JEAN; SRA SARL) 15. Dezember 1995 (1995-12-15) Seite 7, Absatz 1; Abbildung 1	1,2,8

Formblatt PCT/ISA/210 (Fortsetzung von Blatt 2) (Juli 1992)

INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentli[illegible]ı, die zur selben Patentfamilie gehören

Internationales Aktenzeichen
PCT/EP 02/01284

Im Recherchenbericht angeführtes Patentdokument		Datum der Veröffentlichung	Mitglied(er) der Patentfamilie		Datum der Veröffentlichung
WO 0103593	A	18-01-2001	WO	0103593 A1	18-01-2001
			AU	4357399 A	30-01-2001
			EP	1191891 A1	03-04-2002
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			EP	0938872 A1	01-09-1999
			JP	11253454 A	21-09-1999
			US	6146383 A	14-11-2000
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			DE	59208301 D1	07-05-1997
			EP	0599847 A1	08-06-1994
			JP	6509950 T	10-11-1994
			US	5501684 A	26-03-1996
FR 2786088	A	26-05-2000	FR	2786088 A1	26-05-2000
FR 2720923	A	15-12-1995	FR	2720923 A1	15-12-1995

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : **A61B 17/70, 17/88**	**A1**	**(11) International Publication Number:** **WO 95/13755** **(43) International Publication Date:** 26 May 1995 (26.05.95)

(21) International Application Number: PCT/US94/13317

(22) International Filing Date: 17 November 1994 (17.11.94)

(30) Priority Data:
08/155,430 19 November 1993 (19.11.93) US

(71) Applicant: CROSS MEDICAL PRODUCTS, INC. [US/US]; 4168 Fisher Road, Columbus, OH 43228-1024 (US).

(72) Inventors: PUNO, Rolando, M.; 11819 Lake Stone Way, Prospect, KY 40059 (US). MELLINGER, Philip, A.; 1094 Kirk Avenue, Worthington, OH 43085 (US). BYRD, J., Abbott, III; 3767 Oyster Point Qway, Virginia Beach, VI 23452 (US).

(74) Agents: SHUNK, Laura, F. et al.; Hudak & Shunk Co., L.P.A., Suite 808, 156 South Main Street, Akron, OH 44308-1304 (US).

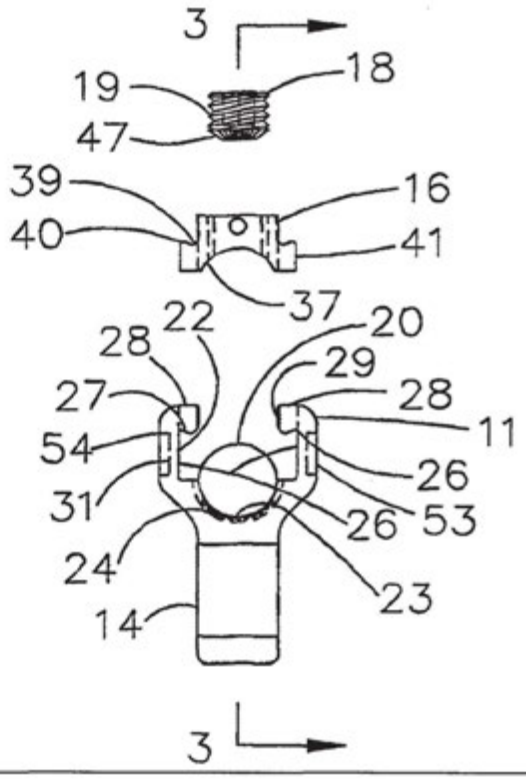
(81) Designated States: AU, BR, CA, JP, KR, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: ROD ANCHOR SEAT HAVING SLIDING CLOSURE MEMBER

(57) Abstract

A spinal implant assembly is provided having a top loading anchor (11) which is fixed to a spinal member by a hook (14). The anchor (11) includes a seat member (12) having a channel (22) to receive a stabilizer rod (20) and a sliding interconnecting closure member (16) which slides in a longitudinal direction relative to the seat member (12) to form an integral closed implant assembly. The closure member (16) includes retaining flanges (41) which dovetail relative to undercut retaining flanges (28) of the seat member (12) so as to prohibit the sliding closure member (16) from being dislodged from the seat channel (22), as well as inhibit the splaying of the seat member (12) in response to forces which may be imposed upon the seat member (12) during de-rotation of the spine. In addition, the seat member (12) includes a set screw (18) for locking the rod (20) in position relative to the anchor (11). An instrument (78) is provided which has a spring loaded ball plunger (89) for holding the closure member (16) during assembly to the seat member (12).



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ROD ANCHOR SEAT HAVING SLIDING CLOSURE MEMBER

FIELD OF INVENTION

This invention relates to orthopedic implants, and more particularly to a bone interface anchor for holding a stabilization rod. The anchor can be adjusted after implantation to receive a stabilizer, and is locked into position after assembly.

BACKGROUND

As surgical techniques have advanced, it has become increasingly common for surgeons to use specially designed hardware for the internal fixation of bones. A particular area of concentration for the recent development of this technology has been the spine. Internal fixation is used most frequently in the spine in conjunction with vertebral fusion, and also for the manipulation of the spine to correct spinal deformities such as scoliosis.

There are several important criteria for a hardware system which is used for internal fixation:

1. The implant should provide rigidity as is indicated, generally along the long axis of the patient's spine.

2. The system should be able to accommodate a broad variation in the size and shape of the spinal member with which it is used. For example, the surgeon may wish to use the implant on a variety of individuals. In addition, the difference in the area and size of the point of fixation is compounded by the change in the shape of the vertebrae over the length of the full spinal column. Since it is an advantage to allow the surgeon to master implanting a particular type of assembly, it is preferable if the same or similar anchoring means can be used for a variety of locations. This advantage results in cost efficiency of inventory as well as efficiencies with respect to minimizing the operating time.

3. The hardware must be able to apply and

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oppose considerable stresses and strains. Thus, the anchor means must be securely fixed to the bone, and the stabilizer must be securely fixed with regard to the anchor means. Moreover, it is desirable to have the integrity to resist breaking.

4. The system should be designed for ease of implantation and removal. Implant hardware is relatively small and therefore somewhat difficult to manipulate. Any difficulty with assembly is compounded by the fact that the assembly occurs during surgery and in a living being. Therefore, it is critical that the hardware is designed with the surgeon's convenience in mind, i.e., to limit the time required and the stress required to implant an assembly. Consequently, a fixation system should be designed to the extent possible for easy assembly while maintaining the option of removal where necessary.

SUMMARY OF THE INVENTION

The present invention relates to a top- loading rod anchor which has an interlocking sliding member to close the anchor about the rod. The anchor assembly in the present invention includes an anchor having a center slot to allow insertion of the sliding member from the center. The slot includes a lateral undercut which mates with the flanges on the sliding member.

Accordingly, it is an object of the present invention to provide a vertebral anchor means which is top-loading, but which converts to a two-piece closed anchor for derotation of the spine. Closed anchor refers to an anchor which at least substantially partially includes the rod so that the anchor means will withstand hoop stresses introduced by manipulating the rod within the anchor. It is a further object of the invention to provide a sliding interconnecting member which cooperates an said anchor seat means by an axially sliding and which has a positive stop which removably locks said sliding member into cooperation with said anchor means.

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BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is an exploded side view of the implant assembly in accordance with the present invention;

Figure 2 is an exploded front view of the implant assembly in accordance with the present invention;

Figure 3 is a cross-section of the assembled components of Figure 1 taken along line 3-3 of Figure 2;

Figure 4 is a cross-section of the assembled components taken along line 4-4 of Figure 1;

Figure 5 is a top view of the sliding interlocking seat closure member as shown in Figure 1;

Figure 6 is a cross-section of the closure member taken along line 6-6 of Figure 5;

Figure 7 is a cross-section of the sliding member taken along line 7-7 of Figure 5; and

Figure 8 is a top plan view of the anchor used with the implant assembly of Figure 1;

Figure 9 is a side cross-sectional view taken along line 9-9 of the anchor of Figure 8;

Figure 10 is a front cross-sectional view taken along line 10-10 of the anchor of Figure 8; and

Figure 11 is an instrument for the alignment and implantation of the sliding interconnecting rod closure member as shown in Figures 1-4.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 illustrates an exploded side view of the spinal implant assembly of the present invention. The implant assembly 10 comprises a stabilization means, i.e., rod 20, and an implant anchor 11. The anchor includes a seat 12 which is fixed to the spine by fixation means, in this case, a hook 14. However, the invention could also be practiced with other fixation means such as a bone screw. The seat 12 includes a recess 23 which receives the rod about its longitudinal axis and which is loaded from the top of the seat. The seat is closed by a sliding

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interconnecting closure member 16 which has a sliding interlocking engagement with seat member 12. More specifically, the closure member 16 is dropped into an engagement on the rod 20 and slid in a direction along the rods' longitudinal axis so as to form an interlocking engagement with the seat 12. A set screw 18 cooperates with the closure member to apply a compressive force on the rod and secure the rod relative to the seat member.

The seat 12 includes a channel 22 which has in its bottom a rod recess 23 which is contoured to accept the rod 20. Optionally, the rod recess 23 may include a surface interface so as to increase the compressive interface between the rod 20 and the seat, such as interrupted serrations.

The channel 22 includes in its upper portion a recess 26 which is formed on the inside of a seat shoulder 27. In addition, the flange members 28 which form the seat shoulder 27 include a slight protuberance 29 which mates with grooves 30 on the closure member 16 to bias the closure member 16 into position with regard to the seat member 12. The seat member includes a cutouts 43 in the flange members 28 which enables the sliding closure member 16 to be loaded into the seat 12 from a central position with a small sliding movement, in contrast to sliding the closure member along the entire length of the channel 22 from either direction.

The anchor 11 also includes a closure member 16 which acts with the seat 12 to present a closed anchor 11 which facilitates the manipulation and specifically, the derotation of the spine. Since the closure member has a dove-tailed relationship with the seat member 12 to allow a sliding interlocking engagement. The seat member 12 may be loaded from the top with the rod 20 and subsequently closed with the closure member 16 so as to fix the rod relative to the fixation means, but to allow rotation of the rod about its longitudinal axis. The closure member 16 includes projecting flanges 41 which have include a

recess 39 on their upper surface, and a sliding shoulder 40 outward from the recess 39. The shoulders 40 of the closure member 16 form a dove-tailed cooperation with the shoulders 27 of the seat member, which cooperation inhibits the sliding closure member from being pulled out of the channel 22 of the seat member 12, and further which inhibits the sides 53, 54 of the seat member which form the channel 22 from splaying in response to a rotational force applied to the rod and cap member, respectively.

The closure member further includes a curved or arched rod interface surface 37 which mates with the top surface of the rod 20. The closure member 16 includes a hole 33 which is threaded with internal threads 34 to receive a set screw 18 having external threads 19. Thus, the set screw 18 can be screwed down relative to the closure member 16 to form a compressive interface with the rod 20. It is a further advantage that the set screw 18 includes a bevel 47 having serrations 48 and a countersink 49 to inhibit the stripping of the set screw and seat threads, as well as improve the compressive grip of the set screw on the rod 20.

In addition, the sliding member has opposing cutout sections 42 corresponding to the cutout section 43 of the seat member to facilitate an intermediate loading of the sliding closure member 16 relative to the seat 12. The seat member 12 has multiple grooves 30 which receive the protuberance 29 of the seat to cause a friction lock between the closure member and the seat member, which lock can be overcome by sliding the closure member along the longitudinal axis of the rod. The closure member has opposing retaining dimples on its front and rear surface which facilitate the assembly of the closure member relative to the seat using an instrument 78 shown in Figure 8 of the present application. In addition, the set screw has a hex opening 46 to allow the set screw to be driven into engagement with the rod 20 using a hex driver.

An instrument 78 is shown for assembly of the

closure member relative to the seat member and includes a handle 80 an 82 shaft of a length appropriate to allow the surgeon access to the implant, and a pronged instrument head 84. The head 84 includes an opening 86 of a size appropriate to receive the closure member 16, which opening 86 is defined first and second arms 85. The first and second arms respectively include a boss 88 and a spring loaded plunger ball 89. The ball is held in engagement relative to the closure member 16 by biasing means 90.

While in accordance with the Patent Statutes, the best mode and preferred embodiment has been set forth, the scope of the invention is not limited thereto, but rather by the scope of the attached claims.

WHAT IS CLAIMED IS:

1. A retaining member for use with an elongated stabilizer for a spine, said holding means comprising:

a seat having a channel, said channel having an axis in a first direction, said channel receiving said elongated stabilizer so that the longitudinal axis of said stabilizer is aligned in said first direction, and a sliding closure member, said closure member having a sliding cooperation with said seat whereby said closure member may be slid in the first direction to engage said seat, and said seat including means to retain said closure member from disengagement from said channel.

2. A retaining member as set forth in claim 1, wherein said anchor closure member includes a rod interface surface which cooperates with less than all of the circumference of said rod.

3. An member as set forth in claim 2, wherein said closure member has a rod interface surface which extends through a range of less than about 270 degrees.

4. A member as set forth in claim 1, wherein said closure member has a dove-tailed cooperation with said seat.

5. A member as set forth in claim 4, wherein said seat includes first and second seat mating shoulders and said dove tail includes first and second mating shoulder members which mate with the seat mating shoulders inhibit the splaying of said seat means.

6. A member as set forth in claim 1, wherein said seat means includes a central opening to allow said sliding closure means to be engaged with said seat by loading said closure member through said opening and

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sliding it into a locked engagement.

7. An anchor member as set forth in claim 1, wherein said retaining means includes an interlocking biasing friction fit.

8. An anchor means for use with a stabilizer rod comprising a seat having a channel, said channel having a rod receiving recess and being open outwardly of said recess, said channel including a first sidewall and a second sidewall, said first and said second sidewalls terminating in opposing flanges; and

a sliding slide closure member having a rod receiving arch and including flanges which mate with said seat flanges to form a closed rod receiving channel.

9. An anchor means as set forth in claim 8, wherein said closure member includes a threaded bore substantially perpendicular to the longitudinal axis of said channel and said anchor means further includes at least one set screw received in said bore.

10. An anchor as set forth in claim 9, wherein said set screw includes a rod contacting terminus having a high friction surface.

11. An anchor as set forth in claim 8, wherein said mating flanges include means to inhibit splaying of said first and said second sidewalls.

12. An instrument for use with an anchor member, said anchor member securing an elongated stabilizer relative to a spine, and said anchor member having a channel to receive said stabilizer and a sliding closure means having a sliding cooperation with said seat means whereby said sliding closure means may be slid in the direction of the longitudinal axis of said stabilizer

to engage said seat means, said instrument comprising a handle portion, a shaft portion, and a head portion, said head portion receiving said closure means and having a biased releasable engagement with said closure means.

13. An instrument as set forth in claim 9, wherein said biased releasable engagement is provided by a spring loaded ball plunger.

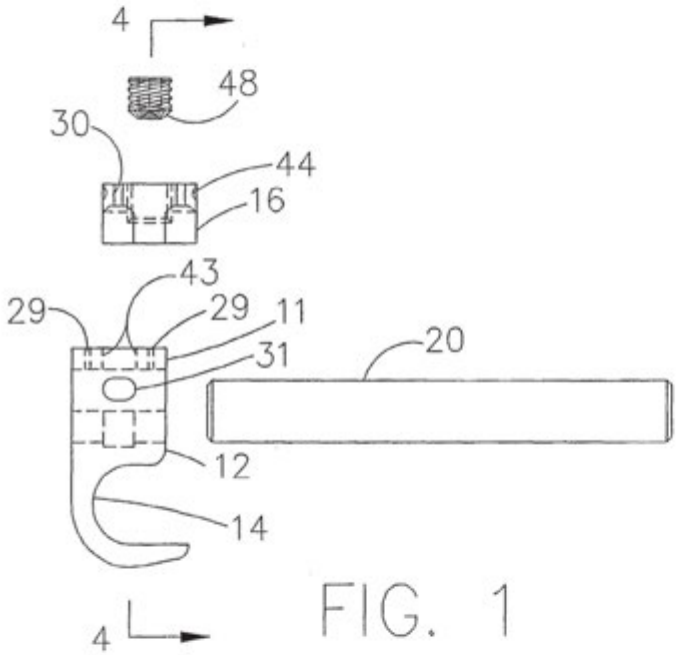


FIG. 1

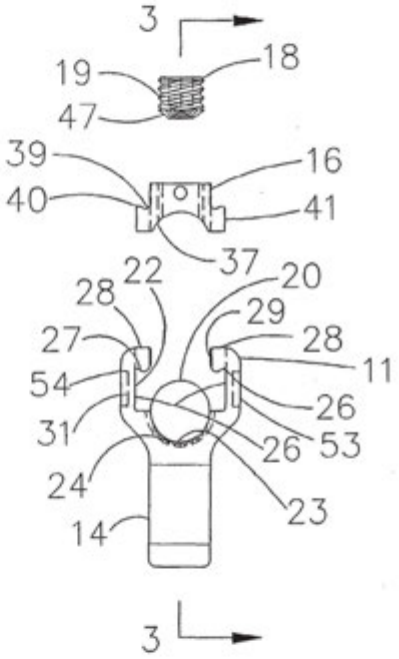


FIG. 2

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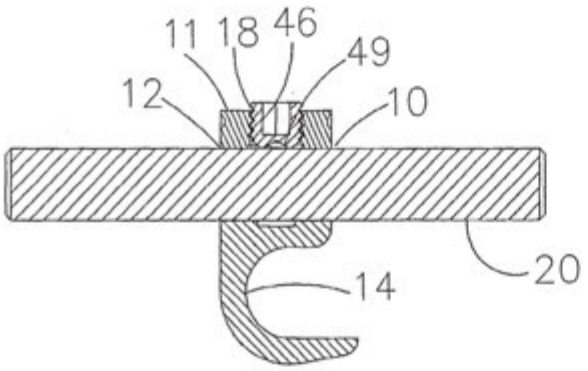


FIG. 3

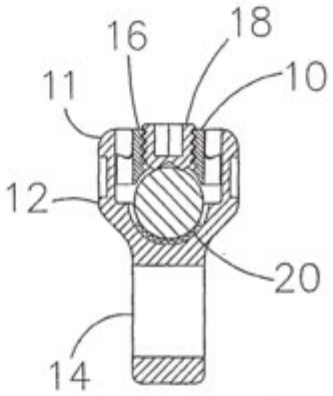


FIG. 4

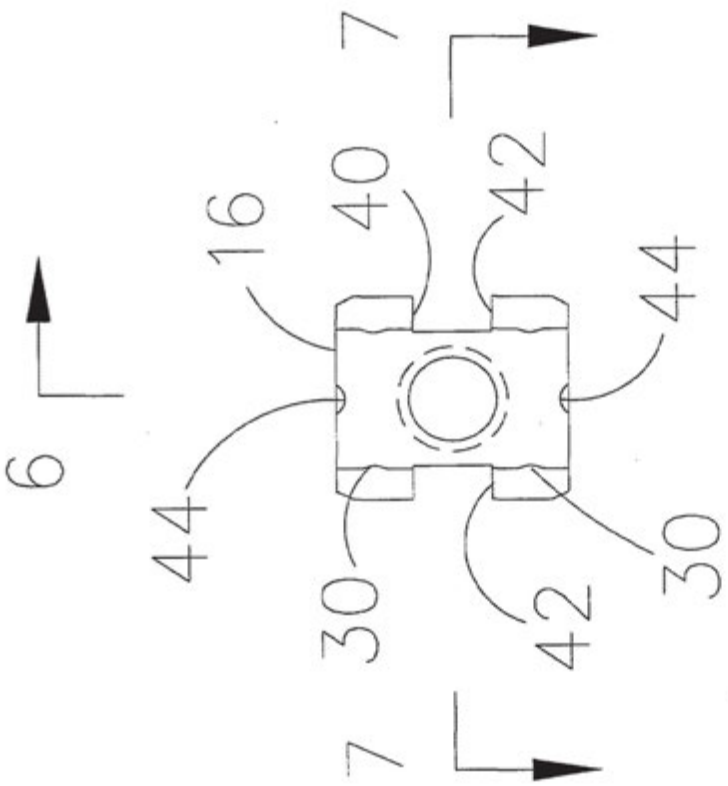


FIG. 5

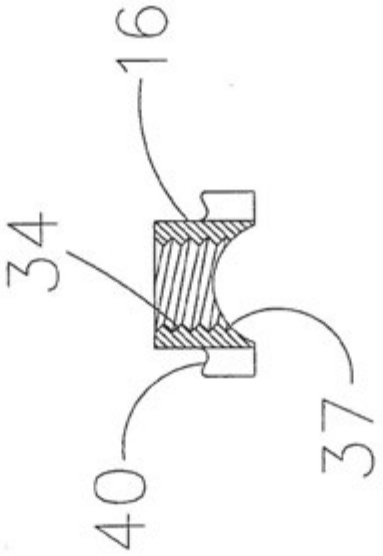


FIG. 7

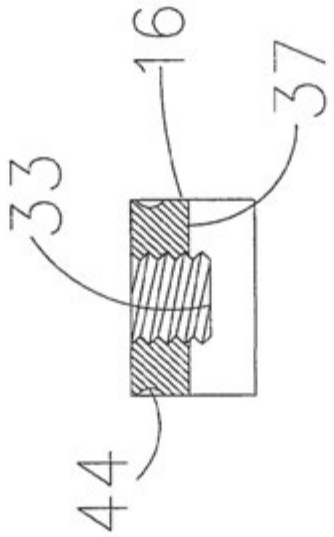


FIG. 6

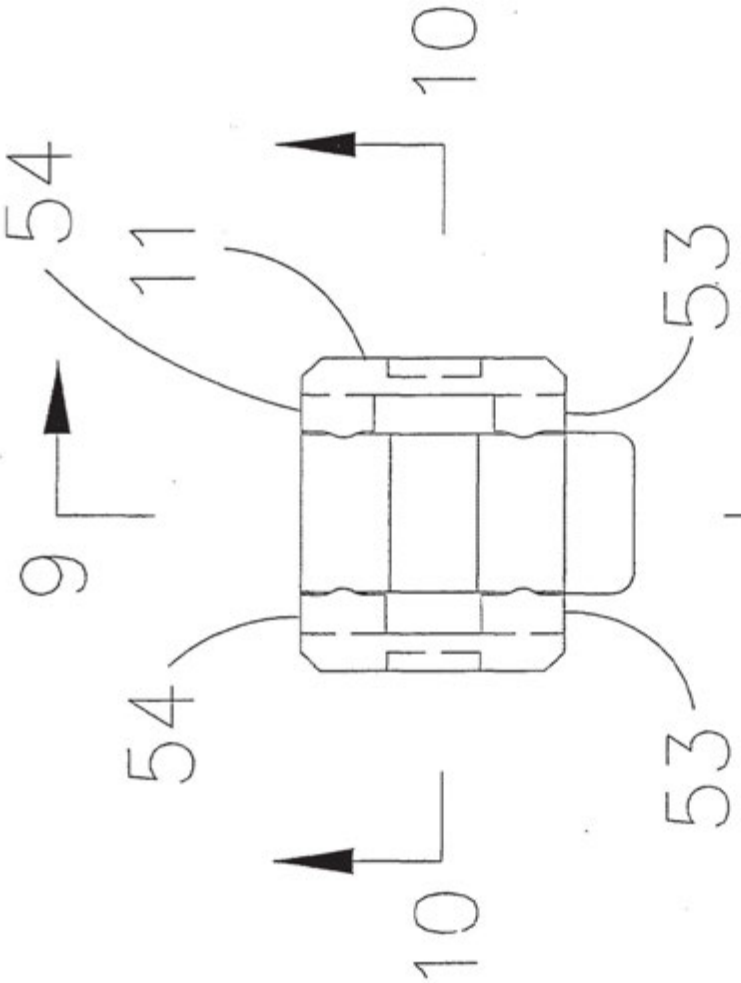


FIG. 8

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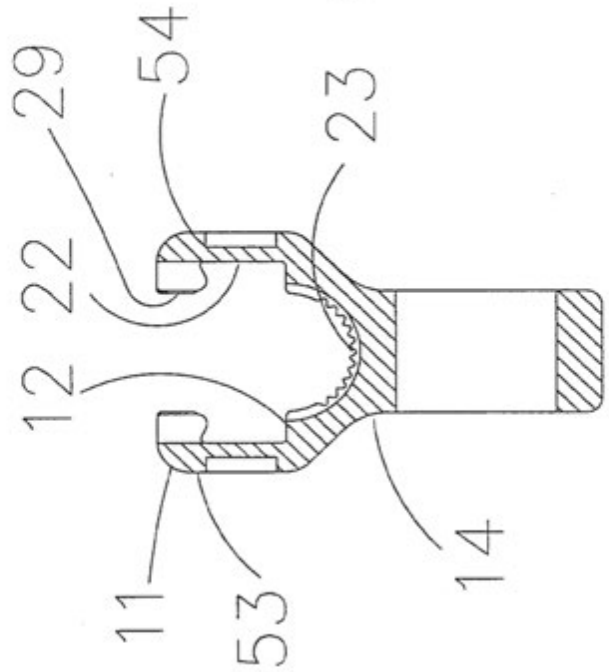


FIG. 10

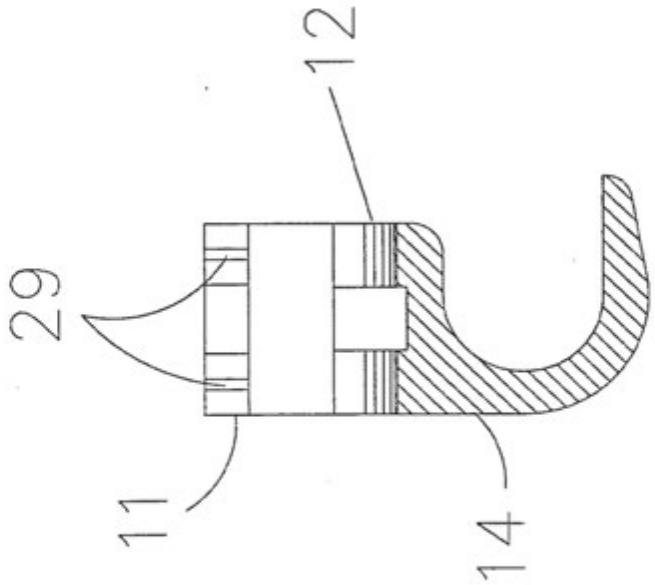


FIG. 9

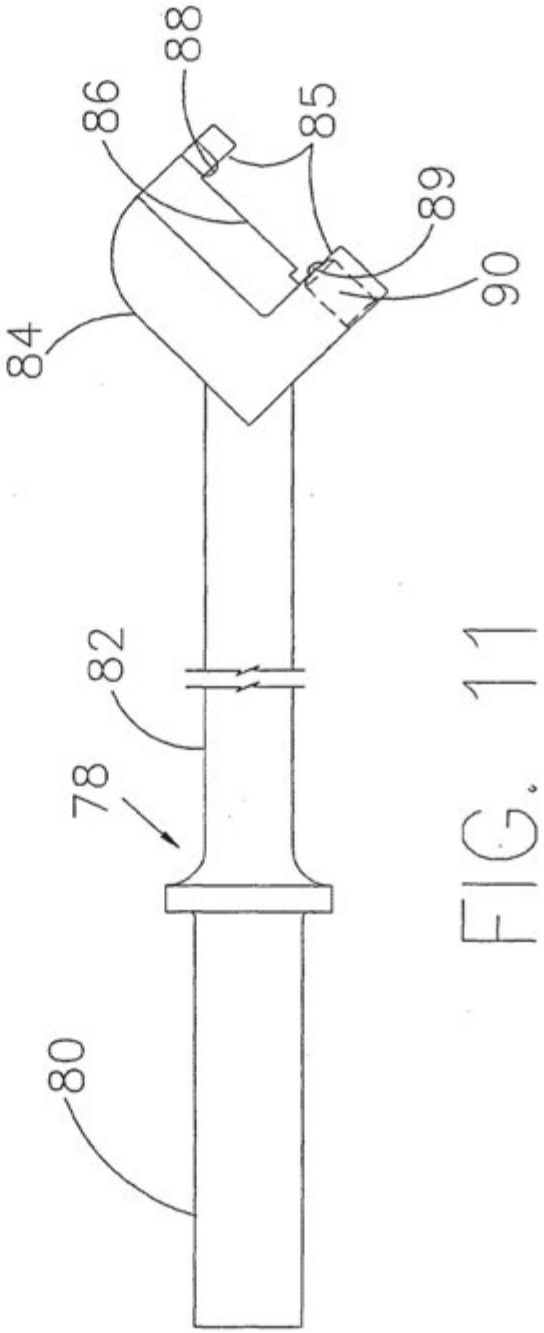


FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/13317

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A61B 17/70, 17/88
US CL :606/61, 99
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)

U.S. : 403/235, 331, 333, 381; 606/59-61, 72, 73, 99

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

NONE

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

NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 5,257,993, (ASHER ET AL.), 02 November 1993. See Figs. 20-22.	1-11
X	US, A, 4,347,845, (MAYFIELD), 07 September 1982. See element (24), and Figs. 1-3.	12, 13
X	US, A, 4,887,596, (SHERMAN), 19 December 1989. See whole document	1-11
X	DE, A, 4107480, (ULRICH H), 10 September 1992. See whole document	1-11

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 06 FEBRUARY 1995	Date of mailing of the international search report 10 MAR 1995
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer TAMARA L. GRAYSAY Telephone No. (703) 308-0858

Form PCT/ISA/210 (second sheet)(July 1992)*

SUBSTITUTE SPECIFICATION – MARKED-UP VERSION

MEDICAL IMPLANT RECEIVERS HAVING DUAL LEAD IN CLOSURE MATING THREAD FORMS AND CURVATE EXTENDING INSTRUMENT ENGAGING GROOVES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a continuation of U.S. Patent Application No. 15/964,502, filed April 27, 2018, now U.S. Patent No. 10,548,641, which is a continuation of U.S. Patent Application No. 15/469,076, filed March 24, 2017, now U.S. Patent No. 9,956,004, which is a continuation of U.S. Patent Application No. 14/566,356, filed December 10, 2014, now U.S. Patent No. 9,636,146, which is a continuation of U.S. Patent Application No. 13/694,849, filed January 10, 2013, now U.S. Patent No. 8,911,479, issued December 16, 2014, which claims the benefit of U.S. Provisional Application No. 61/631,746, filed January 10, 2012 and U.S. Provisional Application No. 61/634,361, filed February 28, 2012, all of which are incorporated by reference herein for all purposes.

BACKGROUND OF THE INVENTION

[0002] The present invention is directed to structure for joining together parts of a medical implant, in particular to closure mechanisms for use with open bone anchors in spinal surgery, and in some embodiments thereof, for use with spinal bone anchors such as polyaxial screws.

[0003] Bone anchors, such as bone screws and hooks are utilized in many types of spinal surgery in order to secure various implants to vertebrae along the spinal column for the purpose of stabilizing and/or adjusting spinal alignment. For example, the most common mechanism for providing vertebral support is to implant bone screws into certain bones which then in turn support a rod or are supported by the rod. Although both closed-ended and open-ended bone anchors are known, open-ended anchors are particularly well suited for connections to longitudinal connecting members such as hard, soft or deformable rods, dynamic or elastic connectors and connector arms, because such rods or other connector members do not need to be passed through a closed bore, but rather can be laid or urged into an open channel within a receiver or head of such a bone anchor. Generally, the anchors must be inserted into the bone as

an integral unit or a preassembled unit, in the form of a shank or hook and connected pivotal receiver. In some instances, a portion of such a preassembled unit, such as a shank of a polyaxial bone screw assembly, may be independently implanted into bone, followed by push- or pop-on assembly of a receiver portion of the unit.

[0004] Typical open-ended bone screws include a threaded shank with a head or receiver having a pair of parallel projecting branches or arms which form a yoke with a U-shaped slot or channel to receive a rod or other longitudinal connecting member. Hooks and other types of connectors, as are used in spinal fixation techniques, may also include similar open ends for receiving rods or portions of other fixation and stabilization structure. The open-ended head or rod receiver portion of such implants typically includes a pair of spaced arms forming a channel closed by a closure member after the rod or other longitudinal connecting member is placed in the channel. Known closures include slide-on types, twist-on varieties that are rotated ninety degrees to a locked in position, and a variety of single start helically wound guide and advancement structures including, for example, thread forms having v-thread, reverse-angle buttress or square thread forms, to name a few, as well as other non-threadlike helically wound forms. Sometimes threaded plugs are utilized with outer threaded nuts to prevent splaying of the receiver arms.

[0005] As indicated above, the force required to press a closure structure down onto a rod or other connector located between arms of an open implant is considerable. Even though a head or receiver portion of an open polyaxial bone anchor may be pivoted in a direction to make it easier for the arms of the open implant to receive a rod or other connector, spinal misalignments, irregularities and the placement of other surgical tools make it difficult to place the rod or other connector between the arms of the implant while a closure structure is mated with the open implant as well as used to push the rod or other connector downwardly into the implant. For example, when the closure is a cylindrical plug having a single start helically wound guide and advancement structure, such structure must be aligned with mating structure on one of the implant arms and then rotated until a portion of the structure is captured by mating guide and advancement structure on both arms of the implant, all the while the closure is being pressed down on the rod while other forces are pushing and pulling the rod back out of the implant. Integral or mono-axial open implants that cannot be pivoted to receive the rod are even more

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difficult to manipulate during the initial placement of the rod and initial mating rotation of a closure plug between the spaced, open arms of the implant. Therefore, extraordinary forces are placed on the implant and closure plug while the surgeon either pushes down on the rod or pulls up on the bone to get the rod in position between the implant arms and to initially push down upon the rod with the closure plug.

SUMMARY OF THE INVENTION

[0006] A closure structure, top or plug of the invention for insertion between spaced arms of an open medical implant includes one or more helically wound guide and advancement features, each feature having a start surface or structure located at or near a bottom surface of the closure plug, each start structure simultaneously engaging and being captured by each of the spaced arms of the open implant upon initial rotation of the closure structure with respect to the open implant arms. According to an aspect of the invention, a double-start closure is disclosed having two helically wound forms thereon, each form having a start structure for simultaneously engaging a mating helical form on a respective open implant arm. Each time the illustrated duel- or double-start closure plug is rotated one turn (three hundred sixty degrees) between the implant arms, the closure plug advances axially into the implant and toward the rod by a width of two helical forms. The helically wound forms of the multi-start closure spiral around a cylindrical plug body thereof to an extent that the closure rotates over ninety degrees to fully or substantially receive the entire closure plug between the arms of the open implant. The illustrated closure is sized for at least one complete rotation (three hundred sixty degrees) of the plug with respect to the open implant to substantially receive the plug between the implant arms. Multi-start closures of the invention may have two or more coarse or fine helical forms, resulting in fewer or greater forms per axial distance spiraling about the closure plug body and thus resulting in plugs that rotate less (when more coarse) or more (when thin or fine) than one complete rotation to be fully received between the implant arms, typically, at least a ninety-one degree rotation is preferred.

[0007] An illustrated multi-start closure and mating open implant is in the form of non-threaded, interlocking flange forms. Also disclosed are multi-start closure structures provided with helically wound forms of other geometry, including, but not limited to helically wound

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threads such as reverse angle, buttress, square and v-threads. The multi-start closure may be cannulated for minimally invasive surgical applications.

[0008] Another illustrated multi-start closure embodiment of the invention is shown with a bone screw assembly having an open receiver with a pair of opposed arms, each arm having guide and advancement structure for simultaneous mating engagement with a start of the helically wound multi-start closure. A further embodiment according to the invention includes an open bone anchor receiver having integral upwardly extending break-off tabs that also have the guide and advancement structure for mating with the multi-start closure. A further embodiment includes an attachable/detachable guide tool cooperating with such a multi-start open receiver, the tool having inner guide and advancement structures located near a bottom thereof for rotatably and matingly receiving the multi-start closure and being synchronized with the receiver guide and advancement structure for rotating and driving the multi-start closure downward from the guide tool to the receiver.

[0009] Objects of the invention further include providing apparatus and methods that are easy to use and especially adapted for the intended use thereof and wherein the tools are comparatively inexpensive to produce. Other objects and advantages of this invention will become apparent from the following description taken in conjunction with the accompanying drawings wherein are set forth, by way of illustration and example, certain embodiments of this invention.

[0010] The drawings constitute a part of this specification and include exemplary embodiments of the present invention and illustrate various objects and features thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 is a perspective view of an embodiment of a multi-start closure according to the invention.

[0012] FIG. 2 is another perspective view of the multi-start closure of FIG. 1.

[0013] FIG. 3 is a front elevational view of the closure of FIG. 1 shown with a portion of a receiver of a polyaxial bone screw according to FIG. 8, the receiver shown in partial front

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elevation with portions broken away to show the detail thereof, and further showing a rod being pressed upon by the closure, the rod also in partial front elevation with portions broken away to show the detail thereof.

[0014] FIG. 4 is a reduced top plan view of the closure of FIG. 1.

[0015] FIG. 5 is a reduced bottom plan view of the closure of FIG. 1.

[0016] FIG. 6 is an enlarged front elevational view of the closure of FIG. 1 with portions broken away to show the detail thereof.

[0017] FIG. 7 is a reduced cross-sectional view taken along the line 7-7 of FIG. 6.

[0018] FIG. 8 a partial front elevational view of an open bone screw assembly, with portions broken away to show the detail thereof, including a receiver, a shank, a compression insert and also shown in engagement with the closure top of FIG. 1 (in reduced view) and a longitudinal connecting member in the form of a hard rod.

[0019] FIG. 9 is a front elevational view of an alternative closure of an embodiment of the invention, similar to the closure of FIG. 1, but including a break-off head, the alternative closure shown with a portion of a receiver of the polyaxial bone screw of FIG. 8 shown in enlarged and partial front elevation with portions broken away to show the detail thereof, and further showing a rod being pressed upon by the alternative closure, the rod also in partial front elevation with portions broken away to show the detail thereof.

[0020] FIG. 10 is another front elevational view of the closure of FIG. 9 with portions broken away to show the detail thereof.

[0021] FIG. 11 is a front elevational view of an alternative square-thread closure of an embodiment of the invention with portions broken away to show the detail thereof, the closure shown with a portion of a receiver of the polyaxial bone screw of FIG. 8 shown in enlarged and partial front elevation with portions broken away to show the detail thereof, and further showing a rod being pressed upon by the alternative closure, the rod also in partial front elevation with portions broken away to show the detail thereof.

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[0022] FIG. 12 is a front elevational view of an alternative reverse angle closure of an embodiment of the invention with portions broken away to show the detail thereof, the closure shown with a portion of a receiver of the polyaxial bone screw of FIG. 8 shown in enlarged and partial front elevation with portions broken away to show the detail thereof, and further showing a rod being pressed upon by the alternative closure, the rod also in partial front elevation with portions broken away to show the detail thereof.

[0023] FIG. 13 is a front elevational view of an alternative v-thread closure embodiment of the invention with portions broken away to show the detail thereof, the closure shown with a portion of a receiver of the polyaxial bone screw of FIG. 8 shown in enlarged and partial front elevation with portions broken away to show the detail thereof, and further showing a rod being pressed upon by the alternative closure, the rod also in partial front elevation with portions broken away to show the detail thereof.

[0024] FIG. 14 is a front elevational view of an alternative buttress-thread closure embodiment of the invention with portions broken away to show the detail thereof, the closure shown with a portion of a receiver of the polyaxial bone screw of FIG. 8 shown in enlarged and partial front elevation with portions broken away to show the detail thereof, and further showing a rod being pressed upon by the alternative closure, the rod also in partial front elevation with portions broken away to show the detail thereof.

[0025] FIG. 15 is a partial front elevational view of an embodiment of a multi-start open bone anchor receiver of an embodiment of the invention with portions broken away to show the detail thereof, the receiver including break-off tabs.

[0026] FIG. 16 is an enlarged and partial front elevational view of the receiver of FIG. 15 with portions broken away to show the detail thereof.

[0027] FIG. 17 is a partial front elevational view of an embodiment of a bone anchor receiver having a guide and advancement structure that matingly cooperates with the multi-start closure of FIG. 1, also shown in front elevation, the receiver having portions broken away to show the detail thereof, and further shown with a guide tool, shown in phantom, the guide tool having a

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multi-start guide and advancement structure receiving inner surface synchronized with the bone anchor receiver guide and advancement structure.

[0028] FIG. 18 is an exploded perspective view of the polyaxial bone screw assembly of FIG. 8.

[0029] FIG. 19 is an enlarged perspective view of the receiver of FIG. 18.

[0030] FIG. 20 is a top plan view of the receiver of FIG. 19.

[0031] FIG. 21 is a bottom plan view of the receiver of FIG. 19.

[0032] FIG. 22 is a side elevational view of the receiver of FIG. 19.

[0033] FIG. 23 is an enlarged cross-sectional view taken along the line 23-23 of FIG. 20.

[0034] FIG. 24 is an enlarged cross-sectional view taken along the line 24-24 of FIG. 22.

[0035] FIG. 25 is an enlarged cross-sectional view taken along the line 25-25 of FIG. 20.

[0036] FIG. 26 is an enlarged perspective view of the retainer of FIG. 18.

[0037] FIG. 27 is a top plan view of the retainer of FIG. 16.

[0038] FIG. 28 is a bottom plan view of the retainer of FIG. 26.

[0039] FIG. 29 is an enlarged cross-sectional view taken along the line 29-29 of FIG. 27.

[0040] FIG. 30 is an enlarged perspective view of the compression insert of FIG. 18.

[0041] FIG. 31 is another perspective view of the insert of FIG. 30.

[0042] FIG. 32 is a top plan view of the insert of FIG. 30.

[0043] FIG. 33 is a bottom plan view of the insert of FIG. 30.

[0044] FIG. 34 is a reduced side elevational view of the insert of FIG. 30.

[0045] FIG. 35 is an enlarged cross-sectional view taken along the line 35-35 of FIG. 32.

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[0046] FIG. 36 is an enlarged cross-sectional view taken along the line 36-36 of FIG. 32.

[0047] FIG. 37 is an enlarged front elevational view of the receiver and retainer of FIG. 18 with portions of the receiver broken away to show the detail thereof and shown in an early stage of assembly with the retainer.

[0048] FIG. 38 is a front elevational view with portions broken away of the receiver and retainer, similar to FIG. 37, further showing the retainer and also the compression insert of FIG. 18 in a later stage of assembly, the compression insert shown in side elevation.

[0049] FIG. 39 is a reduced front elevational view with portions broken away, similar to FIG. 38, showing the insert in a stage of being rotated into a desired position within the receiver.

[0050] FIG. 40 is a reduced front elevational view with portions broken away, similar to FIG. 39 showing the insert being rotated into the desired position.

[0051] FIG. 41 is an enlarged and partial perspective view of the assembly as shown in FIG. 40, further showing portions of the receiver pressed or crimped toward the insert to prohibit further rotation of the insert with respect to the receiver.

[0052] FIG. 42 is an enlarged and partial, partially exploded front elevational view of the shank of FIG. 18 and also the receiver, retainer and compression insert of FIG. 18 as assembled as in FIG. 32, with portions broken away to show the detail thereof, the shank being shown implanted in a vertebra, shown in phantom, as the shank may be assembled with the receiver either before or after implantation.

[0053] FIG. 43 is a partial front elevational view, similar to FIG. 42, with portions broken away to show the detail thereof and showing the shank in a stage of assembly with the retainer.

[0054] FIG. 44 is an enlarged partial front elevational view, similar to FIG. 43, with portions broken away to show the detail thereof and showing the shank in a subsequent stage of assembly with the retainer wherein the retainer is at maximum expansion with the receiver cavity.

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[0055] FIG. 45 is a reduced and partial front elevational view, similar to FIG. 44, with portions broken away to show the detail thereof wherein the shank is fully assembled with the retainer.

[0056] FIG. 46 is a partial front elevational view, similar to FIG. 45, with portions broken away to show the detail thereof and showing the retainer dropped down to a seated position within the receiver.

[0057] FIG. 47 is an enlarged and partial front elevational view with portions broken away, similar to FIG. 46 and further showing the insert after being pressed downwardly into friction fit engagement with the shank.

[0058] FIG. 48 is an enlarged and partial front elevational view with portions broken away of the assembly of Fig. 18, shown with the closure top partially assembled as also shown in FIG. 3.

[0059] FIG. 49 is an enlarged and partial front elevational view with portions broken away, similar to FIG. 48 and further showing the closure fully assembled between arms of the receiver.

[0060] FIG. 50 a reduced and partial front elevational view with portions broken away of the assembly of FIG. 49, but with the rod and closure top thereof removed and replaced with an alternative deformable rod and an alternative multi-start closure of the invention, the insert remaining locked against the receiver and thus keeping the shank locked in place during removal and replacement of the rod and closure top.

[0061] FIG. 51 is a reduced and partial perspective view of the assembly of FIG. 49.

[0062] FIG. 52 is a partial perspective view, similar to FIG. 51, but showing the shank disposed at an eighteen degree angle (cephalic) with respect to the receiver.

[0063] FIG. 53 is a partial perspective view, similar to FIG. 52, but showing the shank disposed at an eighteen degree angle (caudal) with respect to the receiver.

[0064] FIG. 54 is a partial perspective view, similar to FIG. 53, but showing the shank disposed at an eighteen degree angle (lateral) with respect to the receiver.

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[0065] FIG. 55 is a partial perspective view, similar to FIG. 54, but showing the shank disposed at a forty-two degree (medial) by eight degree (cephalic) angle with respect to the receiver.

[0066] FIG. 56 is a partial perspective view, similar to FIG. 55, but showing the shank disposed at a forty-two degree (medial) angle with respect to the receiver.

[0067] FIG. 57 is a partial perspective view, similar to FIG. 56, but showing the shank disposed at a forty-two degree (medial) by eight degree (caudal) angle with respect to the receiver.

[0068] FIG. 58 is an enlarged front elevational view of the assembly of FIG. 57 with portions broken away to show the detail thereof.

DETAILED DESCRIPTION OF THE INVENTION

[0069] ~~[0028]~~ As required, detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention, which may be embodied in various forms. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention in virtually any appropriately detailed structure. It is also noted that any reference to the words top, bottom, up and down, and the like, in this application refers to the alignment shown in the various drawings, as well as the normal connotations applied to such devices, and is not intended to restrict positioning of the bone attachment structures in actual use.

[0070] ~~[0029]~~ Furthermore, the terms lead, pitch and start, as such terms are used to describe helically wound guide and advancement structures, are to be understood as follows: Lead is a distance along the axis of a closure plug that is covered by one complete rotation (360 degrees) of the closure plug with respect to a mating open implant. Pitch is the distance from a crest (or outer point or location) of one guide and advancement structure form to the next. For example in a single-start thread-form, such as a single start, helically wound v-thread closure plug, lead and pitch are the same. Single start means that there is only one ridge or helically wound form wrapped around a cylindrical core, or in the case of the present invention, wrapped around a

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cylindrical closure plug body and thus there is only one start structure or surface at a base or forward end of the closure body that initially engages a mating structure on the open implant. Each time a single start closure rotates one turn (360 degrees), the closure has advanced axially by a width of one ridge or one helical form. Double-start means that there are two ridges or forms wrapped around a core body and thus there are two starting surfaces or structures on the closure plug. Therefore, each time a double-start body rotates one turn (360 degrees), such a body has advanced axially by a width of two ridges or forms. Multi-start means that there are at least two and may be up to three or more of such ridges or forms wrapped around a core body.

[0071] ~~[0030]~~ With reference to FIGS. 1-8 and 18-58, and in particular to ~~FIG. 8~~ FIGS. 8 and 18, the reference number 1 generally represents an open implant in the form of a polyaxial bone screw apparatus or assembly that includes a shank 4, that further includes a body 6 integral with an upwardly extending upper portion or capture structure 8; a receiver 10; a retaining structure or retainer 12, a compression or pressure insert 14, and a multi-start closure structure or plug 18 of the invention in the form of a cylindrical plug having a double start helically wound flange-form. ~~cooperates with an illustrated closure structure 18 embodiment of the invention. The bone screw assembly 1 is described in detail in U.S. Provisional Patent Application No. 61/631,746 filed Jan. 10, 2012 and incorporated by reference herein (hereafter the '746 application) and therefore will not be described in great detail herein. The description set forth in the '746 application includes a more detailed explanation of all the components referenced in FIG. 8.~~ It is noted that multi-start closure embodiments of the invention, such as the closure 18 may be used with a variety of open implants including, but not limited to a wide variety of polyaxial screws, mono-axial or fixed screws, hooks and other types of open implants requiring a plug or closure mechanism to fix a rod or other implant member to a vertebra or other bone. Thus, the assembly 1 is only one example of how multi-start closures of the invention may be used.

[0072] ~~[0031] Briefly, the illustrated assembly 1 includes a shank 4 with an upwardly extending upper portion or capture structure 8; an open receiver 10; a retaining structure or retainer (not shown) that pivots with the shank 4, a compression or pressure insert 14 and the multi-start closure structure or plug 18 in the form of a cylindrical plug having a double-start helically wound flange form.~~ The closure structure 18 presses against and captures a longitudinal connecting member, for example, a rod 21 which in turn engages the compression insert 14 that

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presses against the shank upper portion 8 that is attached to the retaining structure that in turn presses against an inner surface of the receiver 10, so as to capture and fix the longitudinal connecting member 21 within the receiver 10 and thus fix the member 21 relative to a vertebra (not shown). The illustrated receiver 10 and the shank 4 cooperate in such a manner that the receiver 10 and the shank 4 can be secured at any of a plurality of angles, articulations or rotational alignments relative to one another and within a selected range of angles both from side to side and from front to rear, to enable flexible or articulated engagement of the receiver 10 with the shank 4 until both are locked or fixed relative to each other near the end of an implantation procedure.

[0073] ~~[0032]~~ The illustrated rod 21 is hard, stiff, non-elastic and cylindrical, having an outer cylindrical surface 22. However, in other embodiments, the rod 21 may be elastic, deformable and/or of a different cross-sectional geometry. The rod 21 may be made from a variety of metals, metal alloys and deformable and less compressible plastics, including, but not limited to rods made of elastomeric, polyetheretherketone (PEEK) and other types of materials, such as polycarbonate urethanes (PCU) and polyethylenes. Furthermore, in lieu of a rod, longitudinal connecting members for use with the assembly 1 may take a variety of shapes, and/or may include a tensioned cord as described in greater detail ~~in the '746 application that is incorporated by reference~~ herein.

[0074] ~~[0033]~~ It is noted that the receiver 10 includes guide and advancement structures 168 that are shown as interlocking flange forms described in greater detail in applicant's U.S. Pat. No. 6,726,689, also incorporated by reference herein. Alternately, when the closure structure includes a different helical form, the receiver cooperating structures (e.g., 168) must also be of a cooperating, mating geometry, such as a square-shaped thread receiving form, a buttress thread receiving form, a reverse angle thread receiving form or other thread-like or non-thread-like helically wound discontinuous advancement structure receiving forms for operably guiding under rotation and advancing a multi-start closure structure downward between the receiver arms 160, as well as eventual ~~torquing~~ torqueing when the closure structure abuts against the rod 21 or other connecting member.

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[0075] ~~[0034]~~ With particular reference to FIGS. 1-7, the illustrated multi-start closure structure 18 is a double start closure having a substantially cylindrical plug body 40 having an axis of rotation that is the same as that of the receiver 10 and including a helically wound guide and advancement structure in the form of a pair of helically wound forms 42 and 43, each illustrated as an interlocking flange form that operably joins with mating flange form guide and advancement structures 168 disposed on the arms of the receiver 10. The form 42 includes a start surface or structure 46 and the form 43 includes a start surface or structure 47. Each helically wound form 42 and 43 may take a variety of forms and geometries, including those described in Applicant's U.S. Pat. No. 6,726,689, which is incorporated by reference herein. It is noted (and also described in greater detail subsequently herein) that each of the closure structure guide and advancement structures or forms 42 and 43 could alternatively be in the form of a buttress thread, a square thread, a reverse angle thread, a v-thread or other thread like or non-thread like helically wound advancement structures, for operably guiding under rotation and advancing the closure structure downward between the arms of the receive 10 and preferably having such a nature as to resist splaying of the receiver arms when the closure structure 18 is advanced into the receiver channel. The specific flange forms 42 and 43 illustrated in FIGS. 1-7, as well as acceptable alternative locking forms, are described in detail in Applicant's U.S. Pat. No. 6,726,689, incorporated by reference herein, and thus shall not be discussed further herein. Such interlocking flange forms are preferred as the added strength provided thereby beneficially cooperate with and counter any reduction in strength caused by the any reduced profile of the receiver 10 that may more advantageously engage longitudinal connecting member components.

[0076] ~~[0035]~~ The illustrated closure structure 18 also includes a top surface 54 with an internal drive 56 in the form of an aperture that is illustrated as a star-shaped internal drive such as that sold under the trademark TORX, or may be, for example, a hex drive, or other internal drives such as slotted, tri-wing, spanner, two or more apertures of various shapes, and the like. A driving tool (not shown) sized and shaped for engagement with the internal drive 56 is used for both rotatable engagement and, if needed, disengagement of the closure 18 from the receiver 10 at arms 160. It is also foreseen that the closure structure 18 may alternatively include a break-off head designed to allow such a head to break from a base of the closure at a preselected torque, for example, 70 to 140 inch pounds. Such a closure structure would also include a body surface having an internal drive to be used for closure removal. A base or bottom surface 58 of the

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closure is planar and further includes a rim 60 for engagement and penetration into the surface 22 of the rod 21 in certain embodiments of the invention. The closure top 18 further includes a cannulation through bore 62 extending along a central axis thereof and through a drive base surface 63 and the bottom surface 58 thereof. Such a through bore provides a passage through the closure 18 interior for a length of wire (not shown) inserted therein to provide a guide for insertion of the closure top into the receiver arms 160.

[0077] ~~[0036]~~ The closure structure 18 helically wound flange form start structures 46 and 47 of the respective forms 42 and 43 are located on opposite sides of the closure plug body 40 and are both located adjacent the bottom surface 58. As illustrated in FIG. 3, for example, when the closure structure 18 is rotated into the receiver 10 between receiver arms 160, each having a guide and advancement structure 168, the start 46 engages mating guide and advancement structure 168 on one arm 160 and the start 47 simultaneously engages guide and advancement structure 168 on the opposing arm 160, both forms 42 and 43 being simultaneously captured by the mating forms 168 on the opposed arms 160. As the structure 18 is rotated, the structure advances axially downwardly between the arms 160 and presses evenly down upon the captured rod 21. Each time the illustrated duel- or double-start closure plug 18 is rotated one complete turn or pass (three hundred sixty degrees) between the implant arms, the closure plug 18 advances axially into the implant and toward the rod by a width of two helical flange forms. The illustrated closure 18 is sized for at least one complete rotation (three hundred sixty degree) of the plug 18 with respect to the receiver 10 open arms 160 to substantially receive the plug between the implant arms. Each of the start structures 46 and 47 includes a leading face having at least one curvate surface. The at least one curvate surface includes at least one radius of curvature. In one embodiment, the at least one curvate surface is both concave and convex. Multi-start closures of the invention may have two or more coarse or fine helical forms, resulting in fewer or greater forms per axial distance spiraling about the closure plug body and thus resulting in plugs that rotate less or more than one complete rotation to be fully received between the implant arms. Preferably, helically wound forms of the multi-start closure of the invention are sized so as to spiral around a cylindrical plug body thereof to an extent that the closure rotates at least ninety-one degrees to fully or substantially receive the closure plug between the arms of the bone screw receiver or other open implant. Particularly preferred guide and advancement structures are sized for at least one complete turn or pass (three-hundred sixty

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degree) of the closure between the receiver 10 arms and as many as two to three rotations to be fully received between implant arms.

[0078] An alternative closure top, such as the top 18' shown in FIG. 50 for use with a deformable rod, such as a PEEK rod 21', for example, includes a bottom surface 58' that has a domed portion 66' with a central nub 68' in lieu of the flat and rimmed surfaces of the closure top 18. Otherwise, the closure top 18' includes a guide and advancement structures 42' and 43', a top surface 54' and an internal drive feature 56' the same or substantially similar to the respective guide and advancement structures 42 and 43, top surface 54 and internal drive feature 56 of the closure top 18.

[0079] The shank 4, best illustrated in FIGS. 18 and 42-49, is elongate, with the shank body 6 having a helically wound bone implantable thread 124 (single or dual lead thread form) extending from near a neck 126 located adjacent to the upper portion or capture structure 8, to a tip 128 of the body 6 and extending radially outwardly therefrom. During use, the body 6 utilizing the thread 124 for gripping and advancement is implanted into the vertebra 17 leading with the tip 128 and driven down into the vertebra with an installation or driving tool (not shown), so as to be implanted in the vertebra to near the neck 126, as more fully described in the paragraphs below. The shank 4 has an elongate axis of rotation generally identified by the reference letter A.

[0080] The neck 126 extends axially upward from the shank body 6. The neck 126 may be of the same or is typically of a slightly reduced radius as compared to an adjacent upper end or top 132 of the body 6 where the thread 124 terminates. Further extending axially and outwardly from the neck 126 is the shank upper portion 8 that provides a connective or capture apparatus disposed at a distance from the upper end 132 and thus at a distance from the vertebra 17 when the body 6 is implanted in such vertebra.

[0081] The shank upper portion 8 is configured for a pivotable connection between the shank 4 (with attached retainer 12) and the receiver 10 prior to fixing of the shank 4 in a desired position with respect to the receiver 10. The shank upper portion 8 has an outer, convex and substantially spherical lower surface 134 that extends outwardly and upwardly from the neck 126 and terminates at a substantially planar ledge or shelf 136 that is annular and disposed

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perpendicular to the shank axis A. The spherical lower surface 134 has an outer radius that is the same or substantially similar to an outer radius of the retainer 12 as will be described in greater detail below, the surface 134 as well as the retainer 12 outer surface participating in the ball and socket joint formed by the shank 4 and attached retainer 12 within the partially spherical surface defining an inner cavity of the receiver 10. Extending upwardly from the ledge 136 is a cylindrical surface 138, the surface 138 having a radius that is smaller than the radius of the lower spherical surface 134. Extending outwardly from the cylindrical surface 138 is another annular surface or upper ledge 140 that faces toward the ledge 136 and is also substantially perpendicular to the axis A. As will be discussed in greater detail below, the lower ledge 136, cylindrical surface 138 and upper ledge 140 cooperate to capture and fix the resilient open retainer 12 to the shank upper portion 8, prohibiting movement of the retainer 12 along the axis A once the retainer 12 is located between the ledges 136 and 140. Extending upwardly from the upper ledge 140 is a cylindrical surface 142 having a radius smaller than the radius of the spherical surface 134 but larger than the radius of the cylindrical surface 138. Extending upwardly from the surface 142 is an upper partially spherical or domed surface 144. The spherical surface 144 has an outer radius configured for sliding cooperation and ultimate frictional mating with a substantially spherical concave surface of the compression insert 14 that has the same or substantially similar radius as the surface 144. The radius of the surface 144 is smaller than the radius of the lower spherical surface 134. Located near or adjacent to the surface 144 is an annular top surface 146. In the illustrated embodiment a bevel 147 extends about the spherical surface 144 and is located between the spherical surface 144 and the annular planar top surface 146.

[0082] A counter sunk substantially planar base or seating surface 149 partially defines an internal drive feature or imprint 150. The illustrated internal drive feature 150 is an aperture formed in the top surface 146 and has a multi-lobular or star-shaped aperture, such as those sold under the trademark TORX, the aperture designed to receive a tool (not shown)of an Allen wrench type, into the aperture for rotating and driving the bone screw shank 4. It is foreseen that such an internal tool engagement structure may take a variety of tool-engaging forms and may include one or more apertures of various shapes, such as a pair of spaced apart apertures or hex shape, or other geometric shape. The seat or base 149 of the drive feature 150 is disposed perpendicular to the axis A with the drive feature 150 otherwise being coaxial with the axis A. In

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operation, a driving tool is received in the internal drive feature 150, being seated at the base 149 and engaging the faces of the drive feature 150 for both driving and rotating the shank body 6 into the vertebra 17, either before the shank 4 is attached to the receiver 10 as shown in FIG. 42 or after the shank 4 is attached to the receiver 10, with the shank body 6 being driven into the vertebra 17 with the driving tool extending into the receiver 10.

[0083] The shank 4 shown in the drawings is cannulated, having a small central bore 151 extending an entire length of the shank 4 along the axis A. The bore 151 is defined by an inner cylindrical wall of the shank 4 and has a circular opening at the shank tip 128 and an upper opening communicating with the internal drive 150 at the surface 149. The bore 151 is coaxial with the threaded body 6 and the upper portion 8. The bore 151 provides a passage through the shank 4 interior for a length of wire (not shown) inserted into the vertebra 17 prior to the insertion of the shank body 6, the wire providing a guide for insertion of the shank body 6 into the vertebra 17.

[0084] To provide a biologically active interface with the bone, the threaded shank body 6 may be coated, perforated, made porous or otherwise treated. The treatment may include, but is not limited to a plasma spray coating or other type of coating of a metal or, for example, a calcium phosphate; or a roughening, perforation or indentation in the shank surface, such as by sputtering, sand blasting or acid etching, that allows for bony ingrowth or ongrowth. Certain metal coatings act as a scaffold for bone ingrowth. Bio-ceramic calcium phosphate coatings include, but are not limited to: alpha-tri-calcium phosphate and beta-tri-calcium phosphate ($Ca_3(PO_4)_2$), tetra-calcium phosphate ($Ca_4P_2O_9$), amorphous calcium phosphate and hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$). Coating with hydroxyapatite, for example, is desirable as hydroxyapatite is chemically similar to bone with respect to mineral content and has been identified as being bioactive and thus not only supportive of bone ingrowth, but actively taking part in bone bonding.

[0085] With particular reference to FIGS. 18-25, the receiver 10 has a generally U-shaped appearance with a partially discontinuous substantially cylindrical inner profile and a partially cylindrical and partially faceted outer profile. The receiver 10 has an axis of rotation B that is shown in FIG. 18 as being aligned with and the same as the axis of rotation A of the shank 4,

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such orientation being desirable, but not required during assembly of the receiver 10 with the shank 4. After the receiver 10 is pivotally attached to the shank 4, either before or after the shank 4 is implanted in a vertebra 17, the axis B is typically disposed at an angle with respect to the axis A, as shown, for example, in FIGS. 54-58.

[0086] The receiver 10 includes a substantially cylindrical base 158 integral with a pair of opposed upstanding arms 160. A cavity, generally 161, is located within the base 158. The arms 160 form a cradle and define a U-shaped channel 162 with an upper opening, generally 163, and a U-shaped lower seat 164, the channel 162 having a width for operably snugly receiving the rod 21 between the arms 160. The channel 164 communicates with the base cavity 161. Each of the arms 160 has an interior surface, generally 166 that has a cylindrical profile and further includes a partial helically wound guide and advancement structure 168 extending radially inwardly from the surface 166 and located adjacent top surfaces 169 of each of the arms 160. In the illustrated embodiment, the guide and advancement structures 168 are each in the form of a partial helically wound interlocking flange form configured to mate under rotation with the dual start closure structure 18. Thus, unlike single start advancement structures, the helical forms 168 on the opposing arm surfaces 166 that are configured to mate with the dual start closure top 18 are reverse or flipped images of one another, the structures 168 on each arm 160 being aligned with respect to the receiver axis B, so that each closure structure start and are simultaneously engaged and captured at each arm 160 at the same time.

[0087] The arms 160 further include an opposed pair of vertically extending outer grooves, generally 174, running substantially parallel to the receiver axis B that are centrally formed in outer curved (illustrated as faceted, both curved and planar) surfaces 176. Each groove 174 runs centrally from the respective arm top surface 169 and terminates at a through aperture 177. Each aperture 177 extends through the respective arm surface 176 and also through the respective interior arm surface 166 and is located spaced from the receiver base 158. Each groove 174 has an upper opening partially defined by a pair of opposed surfaces 179 and a substantially planar outer wall surface 181 extending between the surfaces 179. The planar wall surface 181 terminates at the top arm surface 169 and at a lower surface 182 partially defining the aperture 177. The illustrated opposed surfaces 179 are parallel and extend below the lower surface 182, partially defining the through aperture 177. The opposed surfaces 179 are sized to receive

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portions of an elongate tool (not shown) for locking and unlocking the insert 14 with respect to the receiver as will be described in greater detail below. In some embodiments, the surfaces 179 may be disposed at a slight angle with respect to each other, forming a dovetail-like space for maintaining a close relationship between an elongate tool (not shown) that enters into the groove 174 at the arm top surface 169 and is slidingly received between the surfaces 179. The surfaces 179 terminate at a lower surface 183 that also partially defines the through aperture 177. The surface 183 is substantially perpendicular to the surfaces 179. Thus, the illustrated through aperture 177 located below each of the grooves 174 is substantially the same width as the groove 174 there-above, resulting in the aperture 177 having a substantially rectangular profile. The through apertures 177 are sized and shaped for receiving tooling and portions of the compression insert 14 as will be described in greater detail below.

[0088] With particular reference to FIGS. 19, 22, 24, and 41, formed in the arm surfaces 176 and located on either side of the through apertures 177 are lateral crimping apertures 186. The four crimping apertures 186 are substantially circular in profile and do not extend completely through the respective arms 160, but rather terminate at a location between the arm outer surface 176 and the interior surface 166 to provide a crimping portion or wall 187. The crimping portions or walls 187 are sized and shaped for pressing or crimping some or all of the wall material inwardly onto front and rear surfaces of the insert 14 to prohibit rotation and misalignment of the insert 14 with respect to the receiver 10 as will be described in greater detail below.

[0089] The receiver 10 is a one-piece or integral structure and is devoid of any spring tabs or collet-like structures. Preferably the insert and/or receiver are configured with structure for blocking rotation of the insert with respect to the receiver, such as the crimp walls 187, but allowing some up and down movement of the insert with respect to the receiver during the assembly and implant procedure. Also formed in each outer arm surface 176 near the top surface 169 is an undercut tool receiving and engaging groove 189. Some or all of the apertures and grooves described herein, including, but not limited to grooves 174, apertures 177, and grooves 189 may be used for holding the receiver 10 during assembly with the insert 14, the retainer 12 and the shank 4; during the implantation of the shank body 6 into a vertebra when the shank is pre-assembled with the receiver 10; during assembly of the bone anchor assembly 1 with the rod

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21 and the closure structure 18; and during lock and release adjustment of inserts according to the invention with respect to the receiver 10, either into or out of frictional engagement with the inner surfaces of the receiver 10 as will be described in greater detail below. It is foreseen that tool receiving grooves or apertures may be configured in a variety of shapes and sizes and be disposed at other locations on the receiver arm 160 outer surfaces 176 and/or inner surfaces 166 as well as surfaces defining the base 158.

[0090] Returning to the interior arm surfaces, generally 166, of the receiver arms 160, located below the discontinuous guide and advancement structure 168 is a discontinuous cylindrical surface 190 partially defining a run-out feature for the guide and advancement structure 168. Adjacent to and above the surface 190 is a discontinuous upper annular ceiling surface 191. The upper annular surface 191 includes the surface 182 that partially defines the aperture 177 and also includes bottom surfaces of the guide and advancement structure 168. Also adjacent to and below the surface 190 is a discontinuous annular surface or step 192 that in turn is adjacent to a discontinuous frusto-conical surface 193 that extends from the surface 192 inwardly toward the receiver central axis B. Adjacent the surface 193 is another substantially cylindrical discontinuous surface 194 that may in some embodiments run frusto-conical either toward or away from the axis B, depending upon, for example, clearance requirements for the top loading of assembly components, such as the retainer and a compression insert or inserts and also modifying (enlarging or reducing) a thickness for the crimping walls 187, if desired. In the current embodiment, the surface 194 terminates at a small discontinuous ledge or lip 195 directed inwardly toward the axis B. The through apertures 177 extend through both the cylindrical surfaces 190 and the surfaces 193 and 194. A cylindrical surface 196 is adjacent to and runs downwardly from the lip 195 towards the base cavity 161. A lower portion of the cylindrical surface 196 is continuous and thus partially defines the base cavity 61. The cylindrical surface 196 has a diameter smaller than a diameter of the cylindrical surface 190, but larger than a diameter of the surface 194. The receiver inner arm surfaces 166 may further include other sloped, stepped or chamfered surfaces between the cylindrical surfaces 190, 194, and 196 as desired for ease in assembly of the other top loaded components.

[0091] With particular reference to FIGS. 23-25, the continuous portion of the inner cylindrical surface 96 terminates at a downwardly sloping, annular ledge surface 197 that

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extends from the surface 196 and runs inwardly toward the receiver axis B. The surface 197 terminates at a substantially cylindrical surface 198. The surface 198 terminates at another annular surface 199 that faces a lower portion of the receiver cavity 161. The surfaces 197, 198, and 199 form an abutment or ceiling stop for the retainer 12 as will be described in greater detail below. The ceiling surface 199 runs substantially perpendicular to the axis B. Cut or otherwise formed into the surfaces 197, 198, and 199 under one of the arms 160 is a curved c-shaped notch, creating a substantially cylindrical surface 200 having a radius greater than a radius of the surface 198, the opening partially defined by the surface 200 providing clearance within the assembly 1, allowing the retainer 12 to move above the surface 197 when the shank 4 and attached retainer 12 are pivoted at a favored angle, for example, as shown in FIG. 58 and discussed in more detail below.

[0092] As stated above, the surface 199 is substantially annular and defines an upper ceiling or stop of a retainer 12 expansion portion or chamber of the inner cavity 161 that is further defined by a substantially spherical surface 202 that is adjacent to the surface 199. The surface 202 partially defines a recess that is sized and shaped to receive the retainer 12 as it expands around the shank upper portion 8 as the shank 8 is moved upwardly toward the channel 162 during assembly. Located below and adjacent to the spherical surface 202 is another curved surface 203 extending downwardly and inwardly toward the axis B. The surface 203 is illustrated as spherical, but in some embodiments the surface may be frusto-conical. The surface 203 is a seating surface for the retainer 12, the surface 203 slidingly receiving the retainer 12 until the retainer is frictionally locked against the surface 203 when downward pressure is placed on the shank 4 by the insert 14. A cylindrical surface 204 is adjacent the spherical surface 203 and an outwardly flaring surface 205, illustrated as frusto-conical, spans between the cylindrical surface 204 and a bottom surface 206 of the receiver 10. The surface 205 communicating with the bottom surface 206 to define a lower opening, generally 207 into the receiver base inner cavity 161. The cylindrical surface 204, as well as the frusto-conical surface 203 are sized and shaped to be smaller than an upper outer radial dimension of the retainer 12 when the retainer 12 is fixed to the shank upper portion 8, so as to form a restriction to prevent the structure 12 and attached shank portion 8 from passing through the cavity 161 and out the lower exterior 206 of the receiver 10 during operation thereof.

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[0093] In various embodiments of the invention, a cut-out or aperture made of one or more notches or curved, cupped or stepped surfaces may be cut into or otherwise formed in a portion of the base surface 206, as well as in portions of the surfaces 202, 203, 204, and 205, the cupped or stepped surfaces being typically located substantially centrally and directly below one of the arm 160. Such a cupped or stepped surface or surfaces may be sized and shaped for providing clearance for an increased angle of articulation between the shank 4 and the receiver 10 in a particular or desired direction. In the present embodiment, one such arrangement of stepped surfaces, generally 208 is illustrated. In particular, the cut-out portion 208 includes a plurality of graduated, partially annular surfaces 209 connecting with a plurality of graduated partially planar and partially curved surfaces 210, the surfaces 209 and 210 defining edges for gripping the shank 4 as shown, for example in FIG. 58. The cut-out 208 is located directly below the cut-out portion 200 that provides clearance for the retainer 12 during such a favored angle pivoting of the shank 4 and attached retainer 12.

[0094] With particular reference to FIGS. 18 and 26-29, the open retainer 12 that operates to capture the shank upper portion 8 within the receiver 10 has a central axis C that is operationally the same as the axis A associated with the shank 4 when the shank upper portion 8 and the retainer 12 are installed within the receiver 10. The retainer 12 is made from a resilient material, such as a stainless steel or titanium alloy, so that the retainer 12 may be expanded during assembly as will be described in greater detail below. However, because there is little or no need to compress the retainer 12 during assembly, the opening or slit that allows for expansion of the retainer 12 is designed to be very narrow, advantageously providing substantial or almost full surface contact between the retainer and the shank upper portion 8 and also between the retainer and the receiver seating surface 203.

[0095] The retainer 12 has a central channel or hollow through bore, generally 221, that passes entirely through the structure 12 from a top surface 222 to a bottom surface 224 thereof. The bore 221 is primarily defined by a discontinuous inner cylindrical surface 225 that runs from the top surface 222 to the bottom surface 224. In some embodiments of the invention, notches or grooves may be formed in the inner and/or bottom surfaces to more evenly distribute stress across the entire retainer during expansion thereof. The retainer 12 further includes an outer substantially spherical surface 227 running between the top surface 222 and the bottom surface

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224, the surface 227 has an identical or substantially similar radius as the receiver seating surface 203 and also the shank lower spherical surface 134. The resilient retainer 12 further includes first and second end surfaces, 230 and 231 disposed in spaced relation to one another when the retainer is in a neutral state. Both end surfaces 230 and 231 are disposed substantially perpendicular to the top surface 222 and the bottom surface 224. The embodiment shown in FIGS. 26-29 illustrates the surfaces 230 and 231 as substantially parallel, however, it is foreseen that it may be desirable to orient the surfaces obliquely or at a slight angle to the top and bottom surfaces.

[0096] With particular reference to FIGS. 18 and 30-36, the locking compression insert 14 is illustrated that is sized and shaped to be received by and down-loaded into the receiver 10 at the upper opening 166. The compression insert 14 has an operational central axis that is the same as the central axis B of the receiver 10. In operation, the insert advantageously frictionally engages the bone screw shank upper portion 8 as well as engaging the receiver 10 in an interference fit engagement, locking the shank 4 in a desired angular position with respect to the receiver 10 that remains in such locked position even if, for example, a rod and closure top are later removed and the rod is replaced with another rod or other longitudinal connecting member or member component, such as a sleeve of a tensioned cord connecting member. Such locked position may also be released by the surgeon if desired with insert engaging tools (not shown). In some embodiments of the invention, an alternative insert is provided that does not have the receiver interference fit feature, but is otherwise substantially similar to the insert 14. Such an insert includes outer surfaces that are slidingly received along the receiver 10 surfaces defining the arms 160 and the cavity 161. The locking insert 14 (as well as the non-locking alternative insert not shown) is preferably made from a solid resilient material, such as a stainless steel or titanium alloy, so that portions of the insert 14 may be grasped, pinched or pressed, if necessary, and un-wedged from the receiver 10 with a release tool (not shown).

[0097] The locking compression insert 14 includes a body 256.with cylindrical surfaces of a variety of diameters as well as planar surfaces and chamfers and cut-outs to provide clearance between the insert 14 and the retainer 12 during various steps of assembly as well as when the assembly 1 is in a final locked position. The body 256 is integral with a pair of upstanding arms 257. Located between the arms 257, the body 256 has an outer partial cylindrical surface 258.

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Each arm outer surface is substantially cylindrical in profile but is made from a variety of facets or faces as well as cut-outs to provide for clearance with other components of the assembly 1. Located on the body 256 below each upstanding arm 257 is a substantially cylindrical interference fit surface or band 159 that extends outwardly from and between an upper cylindrical surface 260 and a lower cylindrical surface 261. The lower surface 261 is adjacent to an annular bottom surface 264 of the insert 14. Each upper cylindrical surface 260 partially defines one of the insert arms 257. The interference fit band 159 runs substantially parallel to the bottom surface 264. A diameter of the insert 14 measured at the band surface 259 is larger than a diameter measured at surfaces 260 or 261. As best shown in FIG. 36, in the illustrated embodiment, the bottom surface 264 is disposed at an angle with respect to the lower surface 261, but may be perpendicular to the lower surface 261 in other embodiments. The insert 14 further includes substantially planar arm top surfaces 265 located opposite the bottom surface 264. The arms 257 are each further defined by substantially planar front and rear surfaces 266 that run from the top surfaces 265 to the bottom surface 264. At the bottom surface 264, the front and rear surfaces 266 are narrow due to clearance cut-outs 267 located at each corner of the insert 14. Each arm 257 also includes an outwardly extending wing, generally 268 located centrally on and extending outwardly from an upper cylindrical surface 269 of the arm 257, the surface 269 being adjacent to the arm top surface 265. Each arm top surface 265 also extends along the respective wing 268 to a substantially cylindrical outer surface 270. Each wing is also defined by a lower surface 271 and opposed planar side surfaces 272, the upper surfaces 265 and the lower surfaces 271 being substantially parallel to one another. The juncture between the planar side surfaces 272 and the cylindrical surface 270 may include one or more chamfered, planed, or otherwise angled or curved surface to aid in rotational assembly of the insert 14 within the receiver 10. The opposed side surfaces 272 generally span between top and bottom surfaces 265 and 271 respectively, of each wing 268, the side surfaces 272 being substantially perpendicular to adjacent top and bottom surfaces 265 and 271. The cylindrical surfaces 270 are sized and shaped for sliding rotation within the receiver arm cylindrical surfaces 190 during assembly of the insert 14 with the receiver 10 as will be described in greater detail below. The illustrated wings 268 include indicator stripes 273 that provide a surgical staff with an indication of the location of the insert 14 with respect to the receiver 10 during surgery. For example, the location of the stripe 273 with respect to the receiver 10 indicates whether the insert 14 is in a

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non-floppy, but movable, frictional engagement with the shank head 8 or whether the insert 14 is fully locked down on the shank head 8. The indicator stripes 273 are conveniently located on the wing cylindrical surface 270 that is visible when the wings 268 are extending through the receiver apertures 177.

[0098] Returning to the inner surfaces of the insert 14, a through bore, generally 275, is disposed primarily within and through the body 256 and communicates with a generally U-shaped through channel formed by a saddle surface 278 that is substantially defined by the upstanding arms 257. Near the top surfaces 265, the saddle surface 278 is substantially planar. The saddle 278 has a curved lower seat 279 sized and shaped to closely, snugly engage the rod 21 or other longitudinal connecting member. It is foreseen that an alternative embodiment may be configured to include planar holding surfaces that closely hold a square or rectangular bar as well as hold a cylindrical rod-shaped, cord, or sleeved tensioned cord longitudinal connecting member. A pair of opposed, inwardly facing grooves or apertures 280 are located in the saddle 278 beginning near a juncture of the substantially planar upper portion of the saddle 278 and extending toward the curved lower seat 279. The grooves 280 are sized and shaped to receive tooling for rotation, locking, unlocking and other manipulation of the insert 14.

[0099] The bore, generally 275, is substantially defined at the body 256 by an inner cylindrical surface 282 that communicates with the seat 279 and also communicates with a lower concave, radiused or otherwise curved portion 284, that in some embodiments may include shank gripping surfaces or ridges, the surface portion 284 generally having a radius for closely mating with the surface 144 of the shank upper portion 8. The portion 284 terminates at the base surface 264. It is foreseen that the lower shank engaging portion 284 may additionally or alternatively include a roughened or textured surface or surface finish, or may be scored, knurled, or the like, for enhancing frictional engagement with the shank upper portion 8. Formed in a portion of the surface 284 and in a portion of the bottom surface 264 is a notch 286 sized and shaped to receive a portion of the retainer 12 when the shank 4 and attached retainer 12 are pivoted into a favored angle position as shown, for example, in FIG. 58. The notch 286 is located directly beneath one of the arms 257 and has a geometry for receiving a portion of the top 222 and outer spherical surface 227 of the retainer 12 when the shank upper portion 8 is fully locked into place by the insert surface 284 and the shank 4 is pivoted toward the receiver cut-out 208.

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[0100] The compression insert 14 through bore 275 is sized and shaped to receive a driving tool (not shown) therethrough that engages the shank drive feature 146 when the shank body 6 is driven into bone with the receiver 10 attached. Also, in some locking embodiments of the invention, the bore receives a manipulation tool (not shown) used for releasing the insert 14 from a locked position with the receiver 10, the tool pressing down on the shank head 8 and also gripping the insert 14 at the apertures 280, or with other tool engaging features. Each of the arms 257 and the insert body 256 may include more surface features, such as cut-outs notches, bevels, etc. to provide adequate clearance for inserting the insert 14 into the receiver and cooperating with the retainer 12 during the different assembly steps as will be described in greater detail below.

[0101] The insert body 256 cylindrical surface 258 has a diameter slightly smaller than a diameter between crests of the guide and advancement structure 168 of the receiver 10, allowing for top loading of the compression insert 14 into the receiver opening 163, with the arms 257 of the insert 14 being located between the receiver arms 160 during insertion of the insert 14 into the receiver 10 as shown, for example, in FIG. 38. Once the arms 257 of the insert 14 are generally located beneath the guide and advancement structure 168, the insert 14 is rotated into place about the receiver axis B with the wings 268 entering the receiver groove formed by the cylindrical surface 190, the adjacent upper annular surface 191 and the adjacent lower annular surface 192 until the wings 268 are located in the apertures 177 as will be described in greater detail below.

[0102] With reference to FIGS. 18 and 48-50, the illustrated elongate rod or longitudinal connecting member 21 (of which only a portion has been shown) can be any of a variety of implants utilized in reconstructive spinal surgery, but is typically a cylindrical, elongate structure having the outer substantially smooth, cylindrical surface 22 of uniform diameter. The rod 21 may be made from a variety of metals, metal alloys and deformable and less compressible plastics, including, but not limited to rods made of elastomeric, polyetheretherketone (PEEK) and other types of materials, such as polycarbonate urethanes (PCU) and polyethylenes.

[0103] Longitudinal connecting members for use with the assembly 1 may take a variety of shapes, including but not limited to rods or bars of oval, rectangular or other curved or polygonal

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cross-section. The shape of the insert 14 may be modified so as to closely hold the particular longitudinal connecting member used in the assembly 1. Some embodiments of the assembly 1 may also be used with a tensioned cord. Such a cord may be made from a variety of materials, including polyester or other plastic fibers, strands or threads, such as polyethylene-terephthalate. Furthermore, the longitudinal connector may be a component of a longer overall dynamic stabilization connecting member, with cylindrical or bar-shaped portions sized and shaped for being received by the compression insert 14 of the receiver having a U-shaped, rectangular- or other- shaped channel, for closely receiving the longitudinal connecting member. The longitudinal connecting member may be integral or otherwise fixed to a bendable or damping component that is sized and shaped to be located between adjacent pairs of bone screw assemblies 1, for example. A damping component or bumper may be attached to the longitudinal connecting member at one or both sides of the bone screw assembly 1. A rod or bar (or rod or bar component) of a longitudinal connecting member may be made of a variety of materials ranging from deformable plastics to hard metals, depending upon the desired application. Thus, bars and rods of the invention may be made of materials including, but not limited to metal and metal alloys including but not limited to stainless steel, titanium, titanium alloys and cobalt chrome; or other suitable materials, including plastic polymers such as polyetheretherketone (PEEK), ultra-high-molecular weight-polyethylene (UHMWP), polyurethanes and composites, including composites containing carbon fiber, natural or synthetic elastomers such as polyisoprene (natural rubber), and synthetic polymers, copolymers, and thermoplastic elastomers, for example, polyurethane elastomers such as polycarbonate-urethane elastomers.

[0104] Preferably, the receiver 10, the retainer 12 and the compression insert 14 are assembled at a factory setting that includes tooling for holding, alignment and manipulation of the component pieces, as well as crimping a portion of the receiver 10 toward the insert 14. In some circumstances, the shank 4 is also assembled with the receiver 10, the retainer 12 and the compression insert 14 at the factory. In other instances, it is desirable to first implant the shank 4, followed by addition of the pre-assembled receiver, retainer and compression insert at the insertion point (see, e.g., FIG. 42). In this way, the surgeon may advantageously and more easily implant and manipulate the shanks 4, distract or compress the vertebrae with the shanks and work around the shank upper portions or heads without the cooperating receivers being in the way. In other instances, it is desirable for the surgical staff to pre-assemble a shank of a desired size

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and/or variety (e.g., surface treatment of roughening the upper portion 8 and/or hydroxyapatite on the shank 6), with the receiver, retainer and compression insert. Allowing the surgeon to choose the appropriately sized or treated shank 4 advantageously reduces inventory requirements, thus reducing overall cost.

[0105] Pre-assembly of the receiver 10, retainer 12 and compression insert 14 is shown in FIGS. 37-41. With particular reference to FIG. 37, first the retainer 12 is inserted into the lower receiver opening 207, leading with the outer surface 227, the top surface 222 slightly angled to face upwardly and toward one arm 160 that is located above the stepped, cut-out 208. The retainer 12 is then moved upwardly and at an angle toward the annular ceiling surface 199 located opposite the cut-out surface 200 and then past the stepped cut-out 298 in such an angled and upward manner into the chamber 161, followed by tilting the retainer 12 such that the top surface 222 is moved into a position within the receiver cavity 161 axially aligned with the receiver axis B and spaced from the surface 199. Then the retainer 12 is allowed to drop until the retainer spherical surface 227 is seated on the receiver spherical surface 203 as shown in FIG. 38.

[0106] Also with reference to FIG. 38 and with further reference to FIGS. 39 and 40, the compression insert 14 is then downloaded into the receiver 10 through the upper opening 163 with the bottom surface 264 initially facing the receiver arm top surfaces 169 and the insert arms 257 located between the opposed receiver arms 160. The insert 14 is then lowered toward the channel seat 164 until the insert 14 arm upper surfaces 265 are adjacent the receiver arm inner surfaces located below the guide and advancement structures 168. Thereafter, the insert 14 is rotated in a clockwise or counter-clockwise manner about the receiver axis B until the upper arm surfaces 265 are directly below the guide and advancement structure 168 of each arm as illustrated in FIG. 40 with the U-shaped channel 278 of the insert 14 aligned with the U-shaped channel 162 of the receiver 10. In some embodiments, the insert arms 257 may need to be compressed slightly during rotation to clear inner surfaces of the receiver arms 160. As the insert 14 is rotated about the axis B, the insert wings, generally 268 slidingly rotate within the circular groove formed by the receiver surfaces 190, 191, and 192.

[0107] With particular reference to FIGS. 40 and 41, at this time, the four crimping wall portions 187 are pressed inwardly towards the insert 14 and crimping wall material thus engages

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the insert near front and rear surfaces 266 thereof, specifically at the four surfaces or facets 267 as best shown in FIG. 41. The crimping wall material of the wall 187 pressing against the insert 14 at a total of four locations thereby prohibits the insert 14 from rotating with respect to the receiver axis B. At this time, there can be some upward and downward movement of the insert 14, but such movement is limited as the upper wall 182 defining the receiver aperture 177 (that is also the surface 191) stops further upward movement of the insert wings 268. Downward movement of the insert 14 is prohibited by the bands 259 resting on receiver ledge surface 195 adjacent the cylindrical surface 196. The retainer 12 and the insert 14 are now in a desired position for shipping as an assembly along with the separate shank 4 and also ready for assembly with the shank 4 either at the factory, by surgery staff prior to implantation, or directly upon an implanted shank 4 as will be described herein.

[0108] As illustrated in FIG. 42, the bone screw shank 4 or an entire assembly 1 made up of the assembled shank 4, receiver 10, retainer 12 and compression insert 14, is screwed into a bone, such as the vertebra 17, by rotation of the shank 4 using a suitable driving tool (not shown) that operably drives and rotates the shank body 6 by engagement thereof at the internal drive 150. Specifically, the vertebra 17 may be pre-drilled to minimize stressing the bone and have a guide wire (not shown) inserted therein to provide a guide for the placement and angle of the shank 4 with respect to the vertebra. A further tap hole may be made using a tap with the guide wire as a guide. Then, the bone screw shank 4 or the entire assembly 1 is threaded onto the guide wire utilizing the cannulation bore 151 by first threading the wire into the opening at the bottom 128 and then out of the top opening at the drive feature 150. The shank 4 is then driven into the vertebra using the wire as a placement guide. It is foreseen that the shank and other bone screw assembly parts, the rod 21 (also having a central lumen in some embodiments) and the closure top 18 having the central bore 62 can be inserted in a percutaneous or minimally invasive surgical manner, utilizing guide wires. When the shank 4 is driven into the vertebra 17 without the remainder of the assembly 1, the shank 4 may either be driven to a desired final location or may be driven to a location slightly above or proud to provide for ease in assembly with the pre-assembled receiver, compression insert and retainer.

[0109] With further reference to FIG. 42, the pre-assembled receiver, insert and retainer are placed above the shank upper portion 8 until the shank upper portion is received within the

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opening 207. With particular reference to FIGS. 43-45, as the shank upper portion 8 is moved into the interior 161 of the receiver base, the shank upper portion 8 presses upwardly against the retainer 12 in the recess partially defined by the spherical surface 202. As the portion 8 continues to move upwardly toward the channel 162, the shank surface 144 forces outward movement of the retainer 12 towards the surface 202 in the receiver expansion chamber or area as the shank 4 presses the retainer 12 up against the receiver annular ledge surface or ceiling 199. The retainer 12 initially expands about the shank upper spherical surface 144 and then slides along the cylindrical surface 142, and finally snapping or popping into the recessed cylindrical surface 138, the surface 225 of the retainer 12 fully contacting and frictionally engaging the cylindrical surface 138 between the shank lower ledge 136 and the upper ledge 140. At this time, the retainer 12 is in a neutral or slightly expanded state, fully snapped onto the shank upper portion 8 with both the retainer 12 and shank upper portion 8 in pivotal relation with the receiver 10.

[0110] With reference to FIG. 46, the shank 4 and attached retainer 12 are then moved downwardly into a desired position with the retainer seated on the surface 203. With reference to FIG. 47, the insert 14 may be pressed downwardly by a tool (not shown) entering at the receiver grooves 174, for example, and pressing down on the insert wings 268, to result in a frictional engagement between the insert inner spherical surface 284 and the shank upper domed surface 144 to an extent that the shank is pivotable with respect to the receiver, but in a non-floppy manner. The insert 14 remains in such position due to interference fit engagement between the insert outer band surfaces 259 and the receiver cylindrical surfaces 196. Alternatively, the insert 14 may be pushed into such interference fit by a rod 21 and closure top 18. Typically, tools are first used to provide the non-floppy arrangement between the insert 14 and the shank head 8, followed by performing a locking engagement utilizing the rod 21 and closure top 18 as shown in FIG. 48. In some embodiments, when the receiver 10 is pre-assembled with the shank 4, the entire assembly 1 may be implanted after the insert 14 is pressed into non-floppy frictional engagement with the shank head 8 by inserting the driving tool (not shown) into the receiver and the shank drive 150 and rotating and driving the shank 4 into a desired location of the vertebra 17.

[0111] Again, with reference to FIG. 48 and also FIG. 49, the rod 21 is eventually positioned in an open or percutaneous manner in cooperation with the at least two bone screw assemblies 1,

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The closure structure 18 is then inserted into and advanced between the arms 160 of each of the receivers 10. The closure structure 18 is rotated, using a tool engaged with the inner drive 56 until a selected pressure is reached at which point the rod 21 engages the U-shaped seating surface 278 of the compression insert 14, further pressing the insert spherical surface 284 against the shank spherical surface 144, pressing the shank upper portion 8 and attached retainer 12 into locked frictional engagement with the receiver 10. With specific reference to FIGS. 3, 48, and 49, as the multi-start closure structure 18 rotates and moves downwardly into the respective receiver 10, the rim 60 engages and penetrates the rod surface 22, the closure structure 18 pressing downwardly against and biasing the rod 21 into compressive engagement with the insert 14 that urges the shank upper portion 8 and attached retainer 12 into locking engagement with the receiver, the retainer 12 spherical surface 227 frictionally abutting the spherical seating surface 203 of the receiver 10. For example, about 80 to about 120 inch pounds of torque on the closure top may be applied for fixing the bone screw shank 6 with respect to the receiver 10. Also, for example, with reference to FIGS. 52-58, when the shank 4 is disposed at an angle with respect to the receiver 10, the lower spherical surface 134 of the shank upper portion 8 may also be in frictional engagement with a portion of the receiver spherical seating surface 203. The retainer 12 may also expand slightly upon locking, providing a full and secure frictional locking engagement with the receiver at the surface 203.

~~[0037] In use, the receiver 10, the retainer 12 and the compression insert 14 are assembled with the shank 4 either before or after the shank is implanted into a vertebra, and the resulting assembly 1 is ultimately attached to the rod 21 or other longitudinal connecting member as described in the '746 application incorporated by reference herein. It is noted that the shank 4 and other bone screw assembly parts, the rod 21 (also having a central lumen in some embodiments) and the closure top 18 having the central bore 62 can be inserted in a percutaneous or minimally invasive surgical manner, utilizing guide wires. After the rod 21 or other longitudinal connecting member is positioned in an open or percutaneous manner in cooperation with the at least two bone screw assemblies 1 (or other open implants), the closure structure 18 is then inserted into and advanced between the arms 160 of each of the receiver 10. The closure structure 18 is rotated, using a tool engaged with the inner drive 56 until a selected pressure is reached at which point the rod 21 engages a U-shaped seating surface of the compression insert 14, further pressing the insert against the shank upper portion 8 and attached retainer into locked~~

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~~frictional engagement with the receiver 10. Prior to locking the insert 14 against the shank head 8, the shank 4 may be pivoted to a plurality of potentially desirable positions with respect to the receiver 10, followed by locking of the polyaxial mechanism by fully mating the multi-start closure top 18 with the receiver 10. Different angular or articulated positions of the shank 4 with respect to the receiver 10 are shown in the '746 application incorporated by reference herein.~~

~~[0038] With specific reference to FIGS. 3 and 8 as the multi-start closure structure 18 rotates and moves downwardly into the respective receiver 10, the rim 60 engages and penetrates the rod surface 22, the closure structure 18 pressing downwardly against and biasing the rod 21 into compressive engagement with the insert 14 that urges the shank upper portion 8 and attached retainer into locking engagement with the receiver, the retainer outer surface frictionally abutting an inner spherical seating surface of the receiver 10. For example, about 80 to about 120 inch pounds of torque on the closure top may be applied for fixing the bone screw shank 6 with respect to the receiver 10. Also, for example, when the shank 4 is disposed at an angle with respect to the receiver 10, a part of the shank upper portion 8 may also be in frictional engagement with a portion of the receiver spherical seating surface.~~

[0112] ~~[0039]~~ If removal of the rod 21 from any of the bone screw assemblies 1 is necessary, or if it is desired to release the rod 21 at a particular location, disassembly is accomplished by using the driving tool (not shown) that mates with the internal drive 56 on the closure structure 18 to rotate and remove such closure structure from the cooperating receiver 10. Disassembly is then accomplished in reverse order to the procedure described previously herein for assembly.

[0113] With further reference to FIG. 49 and also with reference to FIG. 50, at this time, the closure top 18 may be loosened or removed and/or the rod 21 may be adjusted and/or removed and the frictional engagement between the insert 14 and the receiver 10 at the receiver surface 196 will remain locked in place, advantageously maintaining a locked angular position of the shank 4 with respect to the receiver 10. Thus, at this time, another rod, such as the deformable rod 21' and cooperating alternative multi-start closure top 18' may be loaded onto the already locked-up assembly to result in an alternative assembly. It is noted that the closure drive 56' may advantageously be made smaller than the drive of the closure 18, such that the deformable rod

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21' is not unduly pressed or deformed during assembly since the polyaxial mechanism is already locked.

[0114] With reference to FIGS. 51-58, prior to locking the insert 14 against the shank head 8, the shank 4 may be pivoted to a plurality of potentially desirable positions with respect to the receiver 10, followed by locking of the polyaxial mechanism by fully mating the multi-start closure top 18 with the receiver 10. For example, different angular or articulated positions of the shank 4 with respect to the receiver 10 are shown, some making full use of the stepped cut-out 208 and the c-shaped groove forming the surface 200 of the receiver and/or the notch 286 of the insert 14. For reference, FIG. 51 illustrates a zero degree relationship between the shank 4 and the receiver 10. In other words, the axis A of the shank is aligned with the axis B of the receiver. FIG. 52 shows the shank 4 pivoted laterally of the receiver cut-out portion 208 in an eighteen degree cephalic relationship. FIG. 53 shows the shank 4 pivoted away from the receiver cut-out portion 208 in an eighteen degree caudal relationship. FIG. 54 illustrates the shank 4 being pivoted with respect to the receiver 10 at an eighteen degree lateral relationship. FIG. 55 shows the shank 4 pivoted toward the receiver cut-out portion 208 at a forty-two degree medial by eight degree cephalic relationship. FIG. 56 shows the shank 4 pivoted toward the receiver cut-out portion 208 at a forty-two degree medial relationship. FIGS. 57 and 58 show the shank 4 pivoted toward the receiver cut-out portion 208 at a forty-two degree medial by eight degree caudal relationship. FIG. 58 also shows that in such a pivoted relationship between the shank 4 and the receiver 10, a portion of the retainer 12 moves past the receiver surface 200 and is received by the notch 286 in the insert 14.

[0115] ~~[0040]~~ With reference to FIGS. 9 and 10, an alternative closure top 18' is shown that is almost identical to the closure top 18. However, the top 18' differs from the top 18 in that the top 18' includes a break-off head 70' that further includes a top surface 72' having tooling notches 73', an outer faceted driving surface 74', illustrated as having a hex-shaped profile, and an inner bore 76'. Otherwise, the closure top 18' includes a body 40', a first helical form 42', a second helical form 43', a body top surface 54', a body internal drive 56', a base 58', a rim 60', a cannulation bore 62' and a drive base surface 63' that is the same or substantially similar to the respective body 40, first helical form 42, second helical form 43, body top surface 54, internal drive 56, base 58, rim 60, cannulation bore 62 and drive base surface 63 previously described

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herein with respect to the closure top 18. The break-off head 70' is integral with the body 40' at the body top surface 54'. The inner bore 76' communicates with the inner drive 56' and the cannulation bore 62'. The break-off head 70' is designed to allow such head 70' to break from the body 40' at or near the top surface 54' at a preselected torque, for example, 70 to 140 inch pounds, when a hex-shaped tool (not shown) engages the outer surfaces 74' and drives the closure structure 18' into the receiver 10 as shown in FIG. 9. The inner drive 56' is used for disassembly or loosening of the closure 18' from the receiver 10, and re-tightening, if needed.

[0116] ~~[0041]~~ With reference to FIG. 11, another alternative multi-start closure top 318 is shown that is almost identical to the closure top 18 with the exception that the two flange forms 42 and 43 with respective starts 46 and 47 have been replaced with square threads 342 and 343 with respective starts 346 (not shown) and 347. Otherwise, the dual or double start closure top 318 includes a body 340, a body top surface 354, a body internal drive 356, a base 358, a rim 360', a cannulation bore 362 and a drive base surface 363 that is the same or substantially similar to the respective body 40, body top surface 54, internal drive 56, base 58, rim 60, cannulation bore 62 and drive base surface 63 previously described herein with respect to the closure top 18. In FIG. 11, the closure top 318 is shown partially wound into a polyaxial bone screw receiver 310 having opposed arms 360 with inner surfaces equipped with guide and advancement structures 368 that are sized and shaped to simultaneously closely receive and mate with the square threads 342 and 343 of the double closure structure 318. Otherwise, the receiver 310 is identical or substantially similar to the receiver 10 ~~described in detail in the '746 application incorporated by reference herein~~.

[0117] ~~[0042]~~ With reference to FIG. 12, an alternative multi-start closure top 418 is shown that is almost identical to the closure top 18 with the exception that the two flange forms 42 and 43 with respective starts 46 and 47 have been replaced with reverse angle threads 442 and 443 with respective starts 446 (not shown) and 447. Otherwise, the dual or double start closure top 418 includes a body 440, a body top surface 454, a body internal drive 456, a base 458, a rim 460', a cannulation bore 462 and a drive base surface 463 that is the same or substantially similar to the respective body 40, body top surface 54, internal drive 56, base 58, rim 60, cannulation bore 62 and drive base surface 63 previously described herein with respect to the closure top 18. The closure top 418 is shown partially wound into a polyaxial bone screw receiver 410 having

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opposed arms 460 with inner surfaces equipped with guide and advancement structures 468 that are sized and shaped to simultaneously closely receive and mate with the reverse angle threads 442 and 443 of the double start closure structure 418. Otherwise, the receiver 410 is identical or substantially similar to the receiver 10 ~~described in detail in the '746 application incorporated by reference herein~~.

[0118] ~~[0043]~~ With reference to FIG. 13, another alternative multi-start closure top 518 is shown that is almost identical to the closure top 18 with the exception that the two flange forms 42 and 43 with respective starts 46 and 47 have been replaced with v-threads 542 and 543 with respective starts 546 (not shown) and 547. Otherwise, the dual or double start closure top 518 includes a body 540, a body top surface 554, a body internal drive 556, a base 558, a rim 560', a cannulation bore 562 and a drive base surface 563 that is the same or substantially similar to the respective body 40, body top surface 54, internal drive 56, base 58, rim 60, cannulation bore 62 and drive base surface 63 previously described herein with respect to the closure top 18. The closure top 518 is shown partially wound into a polyaxial bone screw receiver 510 having opposed arms 560 with inner surfaces equipped with guide and advancement structures 568 that are sized and shaped to simultaneously closely receive and mate with the threads 542 and 543 of the double start closure structure 518. Otherwise, the receiver 510 is identical or substantially similar to the receiver 10 ~~described in detail in the '746 application incorporated by reference herein~~.

[0119] ~~[0044]~~ With reference to FIG. 14, another alternative multi-start closure top 618 is shown that is almost identical to the closure top 18 with the exception that the two flange forms 42 and 43 with respective starts 46 and 47 have been replaced with buttress threads 642 and 643 with respective starts 446 and 447 (not shown). Otherwise, the dual or double start closure top 618 includes a body 640, a body top surface 654, a body internal drive 656, a base 658, a rim 660', a cannulation bore 662 and a drive base surface 663 that is the same or substantially similar to the respective body 40, body top surface 54, internal drive 56, base 58, rim 60, cannulation bore 62 and drive base surface 63 previously described herein with respect to the closure top 18. The closure top 618 is shown partially wound into a polyaxial bone screw receiver 610 having opposed arms 660 with inner surfaces equipped with guide and advancement structures 668 that are sized and shaped to simultaneously closely receive and mate with the buttress threads 642

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and 643 of the double start closure structure 618. Otherwise, the receiver 610 is identical or substantially similar to the receiver 10 ~~described in detail in the '746 application incorporated by reference herein~~.

[0120] ~~[0045]~~ With reference to FIGS. 15 and 16, an open receiver 710 is illustrated that is substantially similar to the receiver 10 previously described herein with the exception that the receiver 710 includes opposed arms 760, each having an integral upstanding break-off extension 761. Each receiver arm 760 and integral extension 761 has an inner helically wound guide and advancement structure 768 that is sized and shaped to mate with the flange forms 42 and 43 of the dual start closure 18 previously described herein. The break-off extensions 761 are initially integral with the respective arms 760 and are then broken off by a user after the closure 18 has been rotatingly advanced along the arm extensions 761 and into the channel located between the receiver arms 760. In the illustrated embodiment, in addition to an outer groove or notch 770 located at or near a top surface 769 of each of the arms 760 where the extensions 761 break off from the receiver arms, illustrated inner arm surfaces include a recess or cut 771, best shown in FIG. 16, that runs substantially horizontally. Each recess 771 is curved and elongate and disposed somewhat cross-wise or transverse to the respective flange form 768. For example, with reference to the arm 760 shown in FIG. 16, the recess 771 cuts into a weakened region, generally 780, where the arm 760 joins with the respective attached adjacent extension 761, the curved and elongate recess 771 beginning at a lower portion or location 781 of the flange form recess or segment and terminating at an opposed upper end location of the flange form segment, while otherwise leaving the flange form 768 intact. Stated in another way, the substantially horizontally extending recess 771 cuts into both a lead portion and a trailing portion of each of the flange form segments located near and directly above the opposed arms 760 and substantially opposite the notch 770, thus further weakening the region where the extension and the arm attach, without destroying the flange form path, so that the closure 18 is not derailed by the recess 771 or otherwise prohibited from moving downwardly into the receiver channel formed between the receiver arms 760.

[0121] ~~[0046]~~ With reference to FIG. 17, the multi-start closure 18 is shown cooperating with a spinal implant receiver, such as a bone screw receiver 10' and a discrete, detachable guide tool 801. The elongate guide tool 801, only partially shown in FIG. 17, is typically sized for

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extending from the bone screw receiver 10' upwardly to a location outside of a patient, the tool providing a guide channel for operably guiding the rod 21 or other longitudinal connecting member from a position exterior of the bone screw receiver 10' toward and into the bone screw receiver 10'. The illustrated guide tool has opposed arms 805, each arm having a helical guide and advancement structure 810 thereon that is illustrated as a square thread form, but may be of other geometry, including a flange form the same or similar to the flange forms 168' of the receiver 10' that mates with the flange forms 42 and 43 of the closure structure 18. Thus, the illustrated structures 810 are sized and shaped for receiving and rotating engagement with a dual start closure. The closure 18 is shown partially wound into the receiver 10' that is identical or substantially similar to the receiver 10 with the exception of certain outer arm surface features (not shown). Thus, the receiver 10' includes opposed arms 160' with inner surfaces having guide and advancement structures 168' that are sized and shaped to simultaneously closely receive and mate with the flange forms 42 and 43 of the dual start closure structure 18. The guide tool 801 includes attachment structure for detachable attachment to the receiver 10'(not shown), that may take a variety of forms and methods, including, but not limited to a slide-on, slide-off attachment, a snap-on, rotate off attachment, a rotate-on and rotate-off attachment, to name a few. For example, cooperating attachment structure for both the tool and the receiver may be used that is disclosed in U.S. Pat. No. 7,470,279 and incorporated by reference herein. Returning to the inner helically wound guide and advancement structure 810 formed on each arm 804 of the guide tool 801, the structure 810 is sized and shaped for being aligned with the receiver arms 160' during removable attachment of the tool 801 with the respective bone screw receiver 10' so as to continue the helical pathway for the closure 18, the structures 810 being synchronized with the flange forms 168' to allow for the rotation and driving transfer of the closure 18 from the tool 801 into the receiver 10'.

[0122] ~~[0047]~~ It is to be understood that while certain forms of the present invention have been illustrated and described herein, it is not to be limited to the specific forms or arrangement of parts described and shown.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE RECD	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/779,304	01/31/2020	3773	1720	JAC023-644278	1	1

CONFIRMATION NO. 4759

FILING RECEIPT

24030
POLSINELLI PC
900 WEST 48TH PLACE
SUITE 900
KANSAS CITY, MO 64112-1895

Date Mailed: 02/21/2020

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

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

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James L. Surber, Kansas City, KS;

Applicant(s)

Roger P. Jackson, Prairie Village, KS;

Assignment For Published Patent Application

Roger P. Jackson, Prairie Village, KS

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 15/964,502 04/27/2018 PAT 10548641
which is a CON of 15/469,076 03/24/2017 PAT 9956004
which is a CON of 14/566,356 12/10/2014 PAT 9636146
which is a CON of 13/694,849 01/10/2013 PAT 8911479
which claims benefit of 61/631,746 01/10/2012
and claims benefit of 61/634,361 02/28/2012

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

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 02/20/2020

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/779,304**

Projected Publication Date: 05/28/2020

Non-Publication Request: No

Early Publication Request: No

Title MEDICAL IMPLANT ~~TOP NOTCH~~ RECEIVERS HAVING DUAL LEAD IN CLOSURE MATING THREAD FORMS AND CURVATE EXTENDING INSTRUMENT ENGAGING GROOVES

Preliminary Class

606

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

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

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LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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NOT GRANTED

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Page 310 of 391

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Inventors:	Roger P. Jackson		
App. No.:	16/779,304	Con. No.:	4759
Filed:	01/31/2020	Art Unit:	3773
Title:	MEDICAL IMPLANT RECEIVERS HAVING DUAL LEAD IN CLOSURE MATING THREAD FORMS AND CURVATE EXTENDING INSTRUMENT ENGAGING GROOVES	Examiner:	David C. Comstock

REQUEST FOR CORRECTED FILING RECEIPT

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

Dear Commissioner:

Applicant respectfully requests the issuance of a corrected Filing Receipt in the above-identified patent application.

On May 29, 2020, Applicant submitted amendments to the title of the application. In the Office Action dated June 12, 2020, the Examiner acknowledges the amendment filed. As such, the amendments to the title have been entered, and issuance of a Corrected Filing Receipt is respectfully requested.

The title should be:

MEDICAL IMPLANT ~~TOP NOTCH~~ RECEIVERS HAVING DUAL LEAD IN CLOSURE MATING THREAD FORMS AND CURVATE EXTENDING INSTRUMENT ENGAGING GROOVES

Applicant submits herewith a marked-up copy of the Filing Receipt identifying the correction to be made.

It is believed that there are no fees due in connection with this request. The Commissioner is hereby authorized to charge any required fees or credit any overpayment to Deposit Order Account No. 50-1662.

If the Examiner should have any questions, please contact the undersigned attorney.

Dated: 09/01/2020

Respectfully submitted,

/Christopher M. Sponheimer/

Christopher M .Sponheimer, Reg. No. 64,462
Attorney for Applicant
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Electronic Patent Application Fee Transmittal					
Application Number:	16779304				
Filing Date:	31-Jan-2020				
Title of Invention:	TOP NOTCH RECEIVERS HAVING DUAL LEAD IN CLOSURE MATING THREAD FORMS				
First Named Inventor/Applicant Name:	Roger P. Jackson				
Filer:	Christopher Mark Sponheimer/Danielle Casteel				
Attorney Docket Number:	JAC023-644278				
Filed as Large Entity					
Filing Fees for Utility under 35 USC 111(a)					
Description		**Fee Code**	**Quantity**	**Amount**	**Sub-Total in USD($)**
Basic Filing:					
Pages:					
Claims:					
Miscellaneous-Filing:					
Petition:					
Patent-Appeals-and-Interference:					
Post-Allowance-and-Post-Issuance:					
Extension-of-Time:					

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	240	240
		Total in USD ($)		**240**

Electronic Acknowledgement Receipt	
EFS ID:	40445496
Application Number:	16779304
International Application Number:	
Confirmation Number:	4759
Title of Invention:	TOP NOTCH RECEIVERS HAVING DUAL LEAD IN CLOSURE MATING THREAD FORMS
First Named Inventor/Applicant Name:	Roger P. Jackson
Customer Number:	24030
Filer:	Christopher Mark Sponheimer/Danielle Casteel
Filer Authorized By:	Christopher Mark Sponheimer
Attorney Docket Number:	JAC023-644278
Receipt Date:	01-SEP-2020
Filing Date:	31-JAN-2020
Time Stamp:	19:10:19
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$240
RAM confirmation Number	E202091J10431201
Deposit Account	501662
Authorized User	Danielle Casteel
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		JAC023-644278_Response.pdf	65302 48e0e8d570cc2627891cb7ee46e583fdd0c95ab3f	yes	12

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Applicant Arguments/Remarks Made in an Amendment	6	12
	Claims	3	5
	Applicant Arguments/Remarks Made in an Amendment	2	2
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1

Warnings:					
Information:					
2	Drawings-only black and white line drawings	JAC023-644278_NewDrawings_2.pdf	1380413 97d6894d906c727e881b08473cb3b8dbcb3cf1af6c	no	12
Warnings:					
Information:					
3	Specification	JAC023-644278_Clean_Spec.pdf	162113 b2623381a561da37d232c95d5373f4755f887300	no	36
Warnings:					
Information:					
4	Power of Attorney	JAC023-644278_POA.pdf	333956 ee3a56b6524778c193b06c6f0613fdcc1eb98d0b	no	3
Warnings:					
Information:					

5	Transmittal Letter	JAC023-644278_IDSTransmittal.pdf	67936 87617ca8066dc095116862e7e1db7eb8224ec573	no	5
Warnings:					
Information:					
6	Information Disclosure Statement (IDS) Form (SB08)	JAC023-644278_StatementRelatedness.pdf	37282 04996b1ed246929709c4ef2338316a3db7c4007f	no	2
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
7	Information Disclosure Statement (IDS) Form (SB08)	JAC023-644278_SB08.pdf	89936 8d5241642cb47dc6022f19f9e731352952ea3e8f	no	7
Warnings:					
Information:					
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8	Foreign Reference	DE20207850U1.pdf	914358 972f1d0ab0cd4832b440d654afece21fa7f5ace4f	no	42
Warnings:					
Information:					
9	Foreign Reference	EP1316294B1.pdf	666292 8b62ed0b783c58ee878a8cbd968f37d1270b15f1	no	14
Warnings:					
Information:					
10	Foreign Reference	EP1570796B1.pdf	1011229 1e8c7fa2e518ef1ac3ed8870f08693e859ae8322	no	18
Warnings:					
Information:					
11	Foreign Reference	GB2140523A.pdf	685400 1b953617b5ada1266311355aa38ad029350 79b20e	no	6
Warnings:					
Information:					

12	Foreign Reference	WO02076314A1.pdf	869985 37b8a31b4133b02dfe25e047ebf38108891ce2b9b8	no	26
Warnings:					
Information:					
13	Foreign Reference	WO9513755A1.pdf	569048 776bc1472014493dfb752b7514974598857de332	no	19
Warnings:					
Information:					
14	Applicant Arguments/Remarks Made in an Amendment	JAC023-644278_Marked-UpSubSpec.pdf	13540468 af60c904e7dc437ad92ad932452af4bf37c3ef4b57	no	37
Warnings:					
Information:					
15	Request for Corrected Filing Receipt	JAC023-644278_Marked-UpFilingReceipt.pdf	477714 c9eae79b8c075c066526a8760a30ad81026fce1046	no	4
Warnings:					
Information:					
16	Request for Corrected Filing Receipt	JAC023-644278_RequestCorrectedFilingReceipt.pdf	7747 d735bf98c6db6931e0319a56977d7ad27fd09040	no	2
Warnings:					
Information:					
17	Fee Worksheet (SB06)	fee-info.pdf	30617 3510b888ebaaf42770b681251d280f48eadfee8af	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	20909796		

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

New Applications Under 35 U.S.C. 111

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

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

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

New International Application Filed with the USPTO as a Receiving Office

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

Amendments to the Drawings:

Submitted herewith are New Drawing Sheets 1-12 showing new FIGS. 18-58. New FIGS. 18-58 correspond to FIGS. 8-48, respectively, of priority U.S. Provisional Patent Appln. No. 61/631,746, with minor changes to the labeling of the sectional views to properly correlate to the changes in the numbering of the figures. No new matter has been added.

REMARKS

This paper is submitted in response to the Office Action mailed on June 12, 2020. Claims 1-14 were previously pending. By this Amendment, Applicant has amended claims 1-14, added new claims 15-20, submitted a replacement specification, and added new drawing sheets 1-12. Support for the amendments, new claims, replacement specification, and new drawing sheets can be found in the originally filed disclosure and also in priority U.S. Provisional Patent Appln. No. 61/631,746, which has been incorporated by reference. Thus, no new matter has been added. Accordingly, upon entry of this Amendment, claims 1-20 will be pending. Reconsideration and withdrawal of the rejections are requested in view of the following remarks.

Objection to the Drawings

The drawings have been objected to because FIGS. 3 and 8 include reference designator 169, which is not mentioned in the description and claim 12 recites "apertures," which is not mentioned in the description and is not identified in the drawings with a reference designator.

By this amendment, New Drawing Sheets 1-12 have been submitted herewith showing new FIGS. 18-58. New FIGS. 18-58 correspond to FIGS. 8-48, respectively, of priority U.S. Provisional Patent Appln. No. 61/631,746, which is expressly incorporated by reference in the present specification, with minor changes to the labeling of the sectional views to properly correlate to the changes in the numbering of the figures. No new matter has been added.

Applicant respectfully submits that the arm top surface 169 is described in paragraphs [0086], [0087], [0089], and [0106] in the specification as amended, which correspond to paragraphs [0073], [0074], [0076], and [0106], respectively, of the '746 priority application, which is expressly incorporated by reference in the present specification. In addition, the aperture 177 is shown in new FIGS. 19, 22, 23, 25, 37, 40, 44, and 58, which correspond to FIGS. 9, 12, 13, 15, 27, 30, 34, and 48, respectively, of the '746 priority application, which is expressly incorporated by reference in the present specification, and is described in paragraphs [0087]-[0090], [0097], [0101], and [0107], which correspond to paragraphs [0074]-[0077], [0084], [0088], and [0094], respectively, of the '746 priority application, which is expressly incorporated by reference in the present specification.

In view of the foregoing, Applicant respectfully requests entry of the New Drawing Sheets and withdrawal of the objections to the drawings.

Objection to the Specification

The specification has been objected to for not providing proper antecedent basis for the claimed vertical slots and apertures.

Applicant has submitted a substitute specification herewith in which paragraphs [0028]-[0068], [0078]-[0111], [0113], and [0114] have been added which correspond to paragraphs [0018]-[0058], [0065]-[0098], [0100], and [0101], respectively, of the '746 priority application, which is expressly incorporated by reference in the present specification. Paragraphs [0037] and [0038] have been deleted due to redundancy since the identical subject matter is found in new paragraphs [0071], [0105], [0111], and [0113], which correspond to paragraphs [0061], [0095], [0098], and [0101] of the '746 priority application, which is expressly incorporated by reference in the present specification. In addition, the specification has been amended to correct typographical errors and harmonize the numbering of the figures. No new matter has been added.

As discussed above, the amended specification describes the aperture 177. In addition, the claimed "vertical slots" are supported at least by the vertically extending outer groove 174, which is shown in new FIGS. 19, 20, 22, 25, 37, 40, and 47, which correspond to FIGS. 9, 10, 12, 15, 27, 30, and 37, respectively, of the '746 priority application, which is expressly incorporated by reference and described in the specification at paragraphs [0087], [0089], and [0110], which correspond to paragraphs [0074], [0085], and [0088] of the '746 priority application, which is expressly incorporated by reference in the present specification.

Applicant respectfully requests entry of the Substitute Specification and withdrawal of the objections to the specification.

Claim Rejections Under 35 U.S.C. § 103

Claims 1-9, 13, and 14 have been rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Appln. Publication No. 2008/0045953 to *Garamszegi* in view of U.S. Patent Appln. Publication No. 2005/0277928 to *Boschert.* In addition, claims 10-12 have been rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over *Garamszegi*, in view of *Boschert*, and in further view of U.S. Patent Appln. Publication No. 2010/0125302 to *Hammill, SR. et al.* Applicant respectfully traverses these rejections for at least the following reasons.

Applicant respectfully submits that the Office has not established a *prima facie* case of obviousness for the pending claims. Establishing a *prima facie* case of obviousness requires a

clear explanation with rational underpinnings that demonstrates why a person of ordinary skill in the art would have found the claimed subject matter obvious. M.P.E.P. § 2142. As part of this explanation, the obviousness rejection must consider every claim feature. *See* M.P.E.P. § 2143.03.

Amended independent claim 1 is directed to a medical implant assembly including, among other things, a receiver having a first and a second discontinuous helically wound structure on the first and second interior surfaces of the first and second respective arms. The first and second discontinuously helically wound structures are configured to engage a first and a second start structure of a respective first and second continuously helically wound thread form disposed on the closure. The first and second start structures each have a leading face with a concave surface portion and a convex surface portion. A rotation of the closure about the axis of rotation between the first arm and the second arm is configured to cause a simultaneous mating of the first start structure under the first discontinuous helically wound structure and the second start with the second discontinuous helically wound structure due to a diametrically timed positioning of the first and second start structure on the closure. In addition, the receiver also has first and second arm outer side face surfaces each having a curvate extending groove configured to be engaged by an instrument. Each groove extends continuously and horizontally to the front and back outer face of each arm.

Garamszegi discloses a pedicle screw assembly including an anchor 105, fixation element 110, a coupling element 115 (interpreted by the Office as corresponding to the claimed "receiver"), an upper saddle 325, and a compression nut 410 (the upper saddle 325 and the compression nut 410 are interpreted by the Office as collectively corresponding to the claimed "closure"). *Garamszegi* at paras. [0065], [0069]; figs. 3-9. The coupling element 115 includes upwardly extending projections 310 (interpreted as corresponding to the claimed first and second "arms") having threads that mate with a corresponding single helically wound thread form on the compression nut 410. *Id.* The outer side surface of each projection 310 has a groove spaced apart from the front and back face thereof. *See* figs. 2, 3, 9, and 11 (figure 11 is reproduced and annotated below).

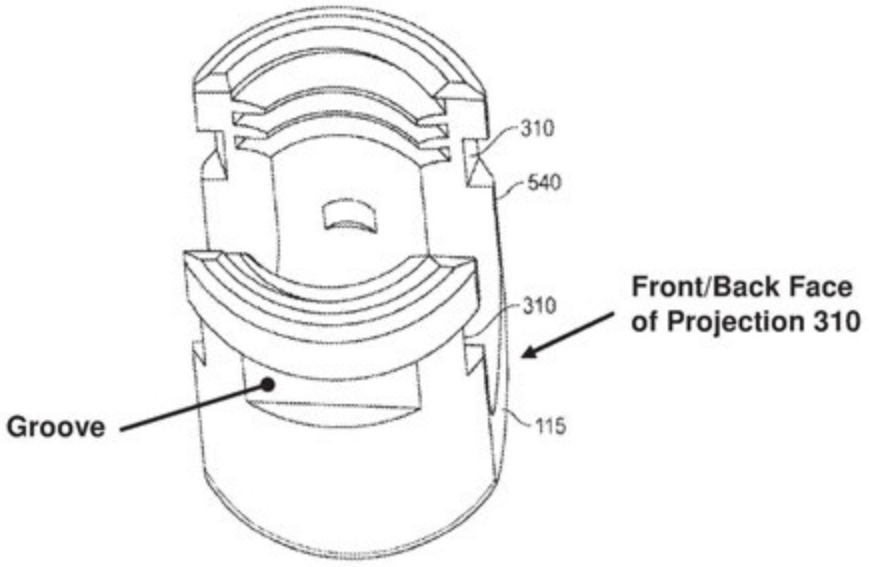


FIG. 11

The Office alleges that *Garamszegi* discloses a curvate extending groove. Office Action at 5 (citing figs. 4 and 9). Figures 4 and 9 alone do not clearly show the contour of the groove. However, figures 2, 3, and 11 unambiguously show a flat groove, but not a "curvate extending groove," as recited in independent claim 1. Also, because the edges of the groove are spaced apart from the front and back faces of the projections 310, *Garamszegi* also fails to disclose "each groove extending continuously and horizontally to the front and back outer face of each arm," as required by independent claim 1.

The Office acknowledges that *Garamszegi* does not disclose a closure having first and second continuous helically wound thread forms with their own starts, such that rotation of the closure causes simultaneous mating of the threads on each arm with the closure. Office Action, at p. 6. Instead, it alleges that *Boschert* teaches these features.

Boschert discloses an orthopedic fixation device 10 including a receiver and a setscrew 70. *Boschert* at para. [0041]. *Boschert* states that the threads 72 of the setscrew 70 can be designed with a double lead to allow the setscrew 70 to start easier than one with a single lead. *Id.* at para. [0057]. However, nowhere in *Boschert* does it show or describe a start structure of its threads 72. Therefore, *Boschert* does not teach or suggest a first and a second start structure each "having a leading face with a concave surface portion and a convex surface portion." Because *Boschert* does not show or describe a first or second start structure, it follows that it also does not teach or suggest

"a rotation of the closure about the axis of rotation between the first arm and the second arm configured to cause a simultaneous mating of the first start structure under the first discontinuous helically wound structure and the second start with the second discontinuous helically wound structure due to a diametrically timed positioning of the first and second start structures on the closure," (emphasis added) as recited in independent claim 1.

In addition, *Boschert* does not disclose any external grooves on the outer surfaces of the receiver arms and accordingly does not teach or suggest "the first and second arm outer side face surfaces each having a curvate extending groove configured to be engaged by an instrument, each groove extending continuously and horizontally to the front and back outer face of each arm," as claimed. The Office does not assert otherwise.

For at least the reasons discussed above, *Garamszegi* and *Boschert* fail to teach or suggest the claimed features of independent claim 1. *Hammill* fails to cure the deficiencies of *Garamszegi* and *Boschert* as it also fails to disclose the above discussed features of independent claim 1. Accordingly, Applicant respectfully requests withdrawal of the rejection under 35 U.S.C. § 103(a) of independent claim 1 and claims 2-14 that depend therefrom.

New Claims

New claims 15-20 have been added which ultimately depend from independent claim 1. Applicant submits that claims 15-20 are allowable for at least the same reasons that independent claim 1 is allowable.

CONCLUSION

In view of the foregoing amendments and remarks, Applicant respectfully requests reconsideration and reexamination of this application, and the timely allowance of the pending claims.

The Office Action contains characterizations of the claims and the related art with which Applicant does not necessarily agree. Unless expressly noted otherwise, Applicant declines to subscribe to any statement or characterization in the Office Action.

If the Examiner believes a telephone conversation might advance prosecution, then the Examiner is invited to call Applicant's undersigned representative at 303-256-1950.

Please grant any extensions of time required to enter this response and charge any additional required fees to our Deposit Account No. 50-1662.

Respectfully submitted,

09/01/2020
Date

/Christopher M. Sponheimer/
Christopher M. Sponheimer, Reg. No. 64,462
Attorney for Applicant
Tel: 303-256-1950
USPTO Customer No. 24030

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Tel: 720-931-8134
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Amendments to the Claims:

The following listing of claims replaces all prior versions of the claims and all prior listings or the claim in the present application.

1. (Currently Amended) A medical implant assembly comprising:

a receiver having a longitudinal axis, a first arm, and a second arm, the first [[arm]] and the second arms each extending in the same direction as the longitudinal axis and having a top side surface and an outer side face surface;

a channel formed by the first arm and the second arm and opening between a front outer face adjacent the channel and a back outer face adjacent the channel opposite the front outer face of the receiver, the channel adapted to receive a longitudinal connecting member, the channel configured to be closed with a closure having an axis of rotation and a bottom surface configured to engage the longitudinal connecting member;

a first interior surface of the first arm opposite the outer side face surface thereof;

a second interior surface of the second arm opposite the outer side face surface thereof;

a first discontinuous helically wound structure on the first interior surface of the first arm, the first discontinuously helically wound structure configured to engage a first start structure of a first continuously helically wound thread form disposed on the closure, the first start structure having a leading face with a concave surface portion and a convex surface portion;

a second discontinuous helically wound structure on the second interior surface of the second arm, the second discontinuous helically wound structure configured to engage a second start structure of a second continuous helically wound thread form disposed on the closure, [[a]] the second start structure having a leading face with a concave surface portion and a convex surface portion, a rotation of the closure about the axis of rotation between the first arm and the second arm configured to cause a simultaneous mating of the first start structure under [[with]] the first discontinuous helically wound structure and the second start with the second discontinuous helically wound structure due to a diametrically timed positioning of the first and second start structures on the closure, the closure configured to be rotationally advanced within the channel until the bottom surface engages and locks the longitudinal connecting member within the channel; and

the first and second arm outer side face surfaces each having a curvate extending groove configured to be engaged by an instrument, each groove extending continuously and horizontally to the front and back outer face of each arm and being located adjacent the top side surface on each arm, wherein an entirety of each groove is configured to be located above a top surface of the

longitudinal connecting member when the longitudinal connecting member is received and locked in the channel by the closure.

2. (Currently Amended) The medical implant assembly of claim 1, wherein each groove includes an outer facing surface.

3. (Currently Amended) The medical implant assembly of claim 2, wherein the outer facing surfaces of the grooves extend in a direction parallel to the longitudinal axis.

4. (Currently Amended) The medical implant assembly of claim 1, wherein each groove includes a downward facing surface.

5. (Currently Amended) The medical implant assembly of claim 4, wherein the downward facing surfaces of the grooves are planar.

6. (Currently Amended) The medical implant assembly of claim 5, wherein each downward facing surface of the grooves are parallel with one another.

7. (Currently Amended) The medical implant assembly of claim 1, wherein each groove includes an upward facing surface.

8. (Currently Amended) The medical implant assembly of claim 7, wherein the upward facing surfaces of the grooves are planar.

9. (Currently Amended) The medical implant assembly of claim 8, wherein each upward facing surface of the grooves are parallel with one another.

10. (Currently Amended) The medical implant assembly of claim 1, wherein each groove is interrupted by a vertical slot on the respective side face surface.

11. (Currently Amended) The medical implant assembly of claim 10, wherein each vertical slot extends to the respective top side surface.

12. (Currently Amended) The medical implant assembly of claim 10, wherein each vertical slot includes an aperture in communication with the channel.

13. (Currently Amended) The medical implant assembly of claim 1, wherein the first and second discontinuous helically wound structure comprises one of a reverse angle thread, a square thread, a buttress thread, or a helical flange form.

14. (Currently Amended) The medical implant assembly of claim 1, wherein the first and second arm each has a breakoff extension.

15. (New) The medical implant assembly of claim 1, wherein each outer side face surface has an outward facing planar surface.

16. (New) The medical implant assembly of claim 15, wherein the outward facing planar surface on each arm is recessed and parallel with respect to the longitudinal axis of the receiver and to each other.

17. (New) The medical implant assembly of claim 1, further including an insert configured to be top loaded into the receiver, the insert having first and second opposed upright arms with top surfaces and lateral protrusions with top surfaces contiguous with the top surfaces on the upright arms of the insert.

18. (New) The medical implant assembly of claim 1, wherein the receiver includes a central bore having a recess into which an insert is configured to be at least partially positioned by being down loaded into the receiver through the channel.

19. (New) The medical implant assembly of claim 18, wherein the insert is a retainer configured to engage a head of a bone attachment shank.

20. (New) The medical implant assembly of claim 1, wherein each of the leading faces on the first and the second start structures has a concave surface adjacent a root and a convex surface adjacent a crest of the respective first and second continuous helically wound structures.

Amendments to the Specification:

Please replace the specification with the attached Clean Substitute Specification. This specification replaces all prior versions of the specification in the application.

Zimvie_Zimmer Biomet v. Jackson
IPR2023-01432; Petitioners' EX1002
Page 330 of 391

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/779,304	Filing Date 01/31/2020	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

AMENDMENT	09/04/2020	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 3	= 0		x $460 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	HSLIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/MERILYN S WATTS/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

PLUS Search Results for S/N 16779304, Searched Fri Sep 04 09:20:13 EDT 2020

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/779,304	01/31/2020	Roger P. Jackson	JAC023-644278

CONFIRMATION NO. 4759

24030
POLSINELLI PC
900 WEST 48TH PLACE
SUITE 900
KANSAS CITY, MO 64112-1895

POA ACCEPTANCE LETTER

OC000000119670350

Date Mailed: 09/04/2020

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 09/01/2020.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/hsarwari/

PLUS Search Results for S/N 16779304, Searched Fri Sep 04 11:48:26 EDT 2020

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UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/779,304	01/31/2020	3773	1720	JAC023-644278	1	1

CONFIRMATION NO. 4759

CORRECTED FILING RECEIPT

24030
POLSINELLI PC
900 WEST 48TH PLACE
SUITE 900
KANSAS CITY, MO 64112-1895

Date Mailed: 09/04/2020

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

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Roger P. Jackson, Prairie Village, KS;
James L. Surber, Kansas City, KS;

Applicant(s)

Roger P. Jackson, Prairie Village, KS;

Assignment For Published Patent Application

Roger P. Jackson, Prairie Village, KS

Power of Attorney: The patent practitioners associated with Customer Number 24030

Domestic Priority data as claimed by applicant

This application is a CON of 15/964,502 04/27/2018 PAT 10548641
which is a CON of 15/469,076 03/24/2017 PAT 9956004
which is a CON of 14/566,356 12/10/2014 PAT 9636146
which is a CON of 13/694,849 01/10/2013 PAT 8911479
which claims benefit of 61/631,746 01/10/2012
and claims benefit of 61/634,361 02/28/2012

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

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 02/20/2020

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/779,304**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

Title

MEDICAL IMPLANT RECEIVERS HAVING DUAL LEAD IN CLOSURE MATING THREAD FORMS AND CURVATE EXTENDING INSTRUMENT ENGAGING GROOVES

Preliminary Class

606

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

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Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

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NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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Zimvie_Zimmer Biomet v. Jackson
IPR2023-01432; Petitioners' EX1002
Page 338 of 391

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Inventor(s):	Roger P. Jackson		
App. No.:	16/779,304	Con. No.:	4759
Filed:	January 31, 2020	Art Unit:	3773
Title:	MEDICAL IMPLANT RECEIVERS HAVING DUAL LEAD IN CLOSURE MATING THREAD FORMS AND CURVATE EXTENDING INSTRUMENT ENGAGING GROOVES	Examiner:	COMSTOCK, David C

SUPPLEMENTAL AMENDMENT AND RESPONSE TO OFFICE ACTION

Via EFS-Web
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

In response to the non-final Office Action dated June 12, 2020, and further to the Amendment and Response to Office Action dated September 1, 2020, please consider the following remarks and amend the above-identified application as follows:

Amendments to the Claims begin on page 2; and

Remarks begin on page 5 of this paper.

Electronic Acknowledgement Receipt	
EFS ID:	40469313
Application Number:	16779304
International Application Number:	
Confirmation Number:	4759
Title of Invention:	MEDICAL IMPLANT RECEIVERS HAVING DUAL LEAD IN CLOSURE MATING THREAD FORMS AND CURVATE EXTENDING INSTRUMENT ENGAGING GROOVES
First Named Inventor/Applicant Name:	Roger P. Jackson
Customer Number:	24030
Filer:	Christopher Mark Sponheimer/Danielle Casteel
Filer Authorized By:	Christopher Mark Sponheimer
Attorney Docket Number:	JAC023-644278
Receipt Date:	04-SEP-2020
Filing Date:	31-JAN-2020
Time Stamp:	17:11:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		JAC023-644278_SuppAmend.pdf	63394 cc7fb0c9160a171f72c19309393173c232ef0676	yes	10

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Applicant Arguments/Remarks Made in an Amendment	5	10
	Claims	2	4
	Supplemental Response or Supplemental Amendment	1	1
Warnings:			
Information:			
	Total Files Size (in bytes):	63394	

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

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

REMARKS

This paper is submitted in response to the Office Action dated June 12, 2020, and further to the Amendment and Response to Office Action dated September 1, 2020. Entry of the Amendment dated September 1, 2020, is respectfully requested, wherein claims 1-14 were amended, claims 15-20 were added, a replacement specification was submitted, and new drawing sheets 1-12 were added. Applicant has further amended claims 1, 10, 11, 13, and 20 herein. Support for the amendments can be found in the originally filed disclosure and also in priority U.S. Provisional Patent Appln. No. 61/631,746, which has been incorporated by reference. Thus, no new matter has been added. Accordingly, upon entry of this Supplemental Amendment, claims 1-20 will be pending. Reconsideration and withdrawal of the rejections are requested in view of the following remarks.

For the Examiner's convenience, remarks related to the Office Action dated June 12, 2020, are reproduced below with minor changes to recite the most recently amended claim language.

Objection to the Drawings

The drawings have been objected to because FIGS. 3 and 8 include reference designator 169, which is not mentioned in the description and claim 12 recites "apertures," which is not mentioned in the description and is not identified in the drawings with a reference designator.

New Drawing Sheets 1-12 were submitted with the September 1, 2020 Amendment showing new FIGS. 18-58. New FIGS. 18-58 correspond to FIGS. 8-48, respectively, of priority U.S. Provisional Patent Appln. No. 61/631,746, which is expressly incorporated by reference in the present specification, with minor changes to the labeling of the sectional views to properly correlate to the changes in the numbering of the figures. No new matter was added.

Applicant respectfully submits that the arm top surface 169 is described in paragraphs [0086], [0087], [0089], and [0106] in the specification as amended, which correspond to paragraphs [0073], [0074], [0076], and [0106], respectively, of the '746 priority application, which is expressly incorporated by reference in the present specification. In addition, the aperture 177 is shown in new FIGS. 19, 22, 23, 25, 37, 40, 44, and 58, which correspond to FIGS. 9, 12, 13, 15, 27, 30, 34, and 48, respectively, of the '746 priority application, which is expressly incorporated by reference in the present specification, and is described in paragraphs [0087]-[0090], [0097], [0101], and [0107], which correspond to paragraphs [0074]-[0077], [0084],

[0088], and [0094], respectively, of the '746 priority application, which is expressly incorporated by reference in the present specification.

In view of the foregoing, Applicant respectfully requests entry of the New Drawing Sheets and withdrawal of the objections to the drawings.

Objection to the Specification

The specification has been objected to for not providing proper antecedent basis for the claimed vertical slots and apertures.

Applicant submitted a substitute specification with the September 1, 2020 Amendment in which paragraphs [0028]-[0068], [0078]-[0111], [0113], and [0114] were added which correspond to paragraphs [0018]-[0058], [0065]-[0098], [0100], and [0101], respectively, of the '746 priority application, which is expressly incorporated by reference in the present specification. Paragraphs [0037] and [0038] were deleted due to redundancy since the identical subject matter is found in new paragraphs [0071], [0105], [0111], and [0113], which correspond to paragraphs [0061], [0095], [0098], and [0101] of the '746 priority application, which is expressly incorporated by reference in the present specification. In addition, the specification was amended to correct typographical errors and harmonize the numbering of the figures. No new matter was added.

As discussed above, the amended specification describes the aperture 177. In addition, the claimed "vertical slots" are supported at least by the vertically extending outer groove 174, which is shown in new FIGS. 19, 20, 22, 25, 37, 40, and 47, which correspond to FIGS. 9, 10, 12, 15, 27, 30, and 37, respectively, of the '746 priority application, which is expressly incorporated by reference and described in the specification at paragraphs [0087], [0089], and [0110], which correspond to paragraphs [0074], [0085], and [0088] of the '746 priority application, which is expressly incorporated by reference in the present specification.

Applicant respectfully requests entry of the Substitute Specification and withdrawal of the objections to the specification.

Claim Rejections Under 35 U.S.C. § 103

Claims 1-9, 13, and 14 have been rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Appln. Publication No. 2008/0045953 to *Garamszegi* in view of U.S. Patent Appln. Publication No. 2005/0277928 to *Boschert*. In addition, claims 10-12 have been rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over *Garamszegi*, in

view of *Boschert*, and in further view of U.S. Patent Appln. Publication No. 2010/0125302 to *Hammill, SR. et al.* Applicant respectfully traverses these rejections for at least the following reasons.

Applicant respectfully submits that the Office has not established a *prima facie* case of obviousness for the pending claims. Establishing a *prima facie* case of obviousness requires a clear explanation with rational underpinnings that demonstrates why a person of ordinary skill in the art would have found the claimed subject matter obvious. M.P.E.P. § 2142. As part of this explanation, the obviousness rejection must consider every claim feature. *See* M.P.E.P. § 2143.03.

Amended independent claim 1 is directed to a medical implant assembly including, among other things, a receiver having a first and a second discontinuously helically wound structure on the first and second interior surfaces of the first and second respective arms. The first and second discontinuously helically wound structures are configured to engage a first and a second start structure of a respective first and second continuously helically wound thread form disposed on the closure. The first and second start structures each have a leading face with a concave surface portion and a convex surface portion. A rotation of the closure about the axis of rotation between the first arm and the second arm is configured to cause a simultaneous mating of the first start structure under the first discontinuously helically wound structure and the second start with the second discontinuously helically wound structure due to a diametrically timed positioning of the first and second start structure on the closure. In addition, the receiver also has first and second arm outer side face surfaces each having a curvate extending groove configured to be engaged by an instrument. Each groove extends horizontally to at least the front or back outer face surface of each arm.

Garamszegi discloses a pedicle screw assembly including an anchor 105, fixation element 110, a coupling element 115 (interpreted by the Office as corresponding to the claimed "receiver"), an upper saddle 325, and a compression nut 410 (the upper saddle 325 and the compression nut 410 are interpreted by the Office as collectively corresponding to the claimed "closure"). *Garamszegi* at paras. [0065], [0069]; figs. 3-9. The coupling element 115 includes upwardly extending projections 310 (interpreted as corresponding to the claimed first and second "arms") having threads that mate with a corresponding single helically wound thread form on the compression nut 410. *Id.* The outer side surface of each projection 310 has a groove spaced apart from the front and back face thereof. *See* figs. 2, 3, 9, and 11 (figure 11 is reproduced and annotated below).

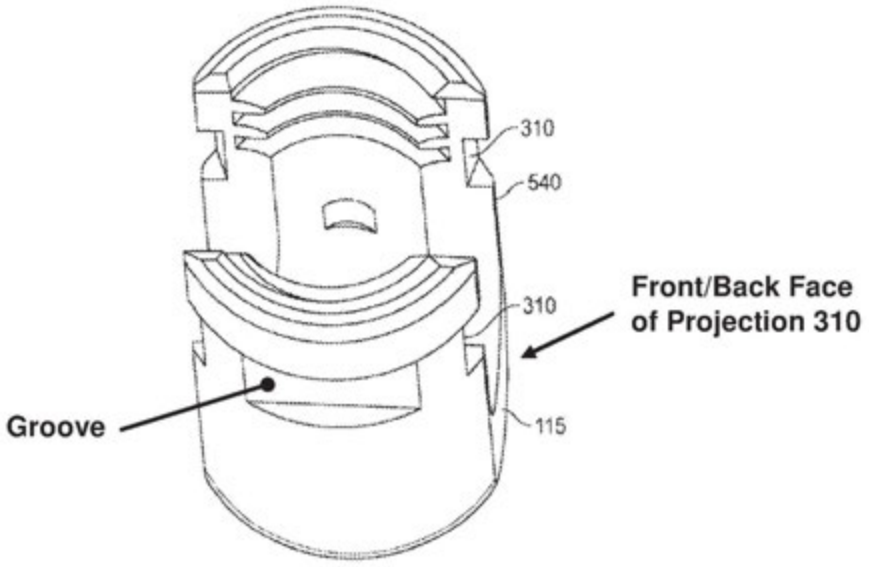


FIG. 11

The Office alleges that *Garamszegi* discloses a curvate extending groove. Office Action at 5 (citing figs. 4 and 9). Figures 4 and 9 alone do not clearly show the contour of the groove. However, figures 2, 3, and 11 unambiguously show a flat groove, but not a "curvate extending groove," as recited in independent claim 1. Also, because the edges of the groove are spaced apart from the front and back surfaces faces of the projections 310, *Garamszegi* also fails to disclose "each groove extending horizontally to at least one of the front or back outer face surface of each arm," as required by independent claim 1.

The Office acknowledges that *Garamszegi* does not disclose a closure having first and second continuously helically wound thread forms with their own starts, such that rotation of the closure causes simultaneous mating of the threads on each arm with the closure. Office Action, at p. 6. Instead, it alleges that *Boschert* teaches these features.

Boschert discloses an orthopedic fixation device 10 including a receiver and a setscrew 70. *Boschert* at para. [0041]. *Boschert* states that the threads 72 of the setscrew 70 can be designed with a double lead to allow the setscrew 70 to start easier than one with a single lead. *Id.* at para. [0057]. However, nowhere in *Boschert* does it show or describe a start structure of its threads 72. Therefore, *Boschert* does not teach or suggest a first and a second start structure each "having a leading face with a concave surface portion and a convex surface portion." Because *Boschert* does not show or describe a first or second start structure, it follows that it also does not teach or suggest

"a rotation of the closure about the axis of rotation between the first arm and the second arm configured to cause a simultaneous mating of the first start structure under the first discontinuously helically wound structure and the second start with the second discontinuously helically wound structure due to a diametrically timed positioning of the first and second start structures on the closure," (emphasis added) as recited in independent claim 1.

In addition, *Boschert* does not disclose any external grooves on the outer surfaces of the receiver arms and accordingly does not teach or suggest "the first and second arm outer side face surfaces each having a curvate extending groove configured to be engaged by an instrument, each groove extending horizontally to the front or back outer face of each arm," as claimed. The Office does not assert otherwise.

For at least the reasons discussed above, *Garamszegi* and *Boschert* fail to teach or suggest the claimed features of independent claim 1. *Hammill* fails to cure the deficiencies of *Garamszegi* and *Boschert* as it also fails to disclose the above discussed features of independent claim 1. Accordingly, Applicant respectfully requests withdrawal of the rejection under 35 U.S.C. § 103(a) of independent claim 1 and claims 2-14 that depend therefrom.

New Claims

New claims 15-20 were added which ultimately depend from independent claim 1. Applicant submits that claims 15-20 are allowable for at least the same reasons that independent claim 1 is allowable.

CONCLUSION

In view of the foregoing amendments and remarks, Applicant respectfully requests reconsideration and reexamination of this application, and the timely allowance of the pending claims.

The Office Action contains characterizations of the claims and the related art with which Applicant does not necessarily agree. Unless expressly noted otherwise, Applicant declines to subscribe to any statement or characterization in the Office Action.

If the Examiner believes a telephone conversation might advance prosecution, then the Examiner is invited to call Applicant's undersigned representative at 303-256-1950.

Please grant any extensions of time required to enter this response and charge any additional required fees to our Deposit Account No. 50-1662.

Respectfully submitted,

09/04/2020
Date

/Christopher M. Sponheimer/
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Amendments to the Claims:

The following listing of claims replaces all prior versions of the claims and all prior listings or the claim in the present application.

1. (Currently Amended) A medical implant assembly comprising:

a receiver having a longitudinal axis, a first arm, and a second arm, the first and the second arms each extending in the same direction as the longitudinal axis and having a top side surface and an outer side face surface;

a channel formed by the first arm and the second arm and opening between a front outer face surface adjacent the channel and a back outer face surface adjacent the channel opposite the front outer face surface of the receiver, the channel adapted to receive a longitudinal connecting member, the channel configured to be closed with a closure having an axis of rotation ~~and a bottom surface configured to engage the longitudinal connecting member~~;

a first interior surface of the first arm opposite the outer side face surface thereof;

a second interior surface of the second arm opposite the outer side face surface thereof;

a first ~~discontinuous~~ discontinuously helically wound structure on the first interior surface of the first arm, the first discontinuously helically wound structure configured to engage a first start structure of a first continuously helically wound thread form disposed on the closure, the first start structure having a leading face with a concave surface portion and a convex surface portion;

a second ~~discontinuous~~ discontinuously helically wound structure on the second interior surface of the second arm, the second ~~discontinuous~~ discontinuously helically wound structure configured to engage a second start structure of a second ~~continuous~~ continuously helically wound thread form disposed on the closure, the second start structure having a leading face with a concave surface portion and a convex surface portion, a rotation of the closure about the axis of rotation between the first arm and the second arm configured to cause a simultaneous mating of the first start structure under the first ~~discontinuous~~ discontinuously helically wound structure and the second start structure with the second ~~discontinuous~~ discontinuously helically wound structure due to a diametrically timed positioning of the first and second start structures on the closure, the closure configured to be rotationally advanced within the channel until the bottom surface engages and locks the longitudinal connecting member within the channel; and

the first and second arm outer side face surfaces each having a curvate extending groove configured to be engaged by an instrument, each groove extending ~~continuously and~~ horizontally to at least one of the front [[and]] or back outer face surface of each arm and being located

adjacent the top side surface on each arm, wherein an entirety of each groove is configured to be located above a top surface of the longitudinal connecting member when the longitudinal connecting member is received and locked in the channel by the closure.

2. (Previously Presented) The medical implant assembly of claim 1, wherein each groove includes an outer facing surface.

3. (Previously Presented) The medical implant assembly of claim 2, wherein the outer facing surfaces of the grooves extend in a direction parallel to the longitudinal axis.

4. (Previously Presented) The medical implant assembly of claim 1, wherein each groove includes a downward facing surface.

5. (Previously Presented) The medical implant assembly of claim 4, wherein the downward facing surfaces of the grooves are planar.

6. (Previously Presented) The medical implant assembly of claim 5, wherein each downward facing surface of the grooves are parallel with one another.

7. (Previously Presented) The medical implant assembly of claim 1, wherein each groove includes an upward facing surface.

8. (Previously Presented) The medical implant assembly of claim 7, wherein the upward facing surfaces of the grooves are planar.

9. (Previously Presented) The medical implant assembly of claim 8, wherein each upward facing surface of the grooves are parallel with one another.

10. (Currently Amended) The medical implant assembly of claim 1, wherein ~~each groove is interrupted by~~ a vertical slot extends between the groove on the respective outer side face surface.

11. (Currently Amended) The medical implant assembly of claim 10, wherein each vertical slot extends to the respective top side surface of each arm.

12. (Previously Presented) The medical implant assembly of claim 10, wherein each vertical slot includes an aperture in communication with the channel.

13. (Currently Amended) The medical implant assembly of claim 1, wherein the first and second ~~discontinuous~~ discontinuously helically wound structure comprises one of a reverse angle thread, a square thread, a buttress thread, or a helical flange form.

14. (Previously Presented) The medical implant assembly of claim 1, wherein the first and second arm each has a breakoff extension.

15. (Previously Presented) The medical implant assembly of claim 1, wherein each outer side face surface has an outward facing planar surface.

16. (Previously Presented) The medical implant assembly of claim 15, wherein the outward facing planar surface on each arm is recessed and parallel with respect to the longitudinal axis of the receiver and to each other.

17. (Previously Presented) The medical implant assembly of claim 1, further including an insert configured to be top loaded into the receiver, the insert having first and second opposed upright arms with top surfaces and lateral protrusions with top surfaces contiguous with the top surfaces on the upright arms of the insert.

18. (Previously Presented) The medical implant assembly of claim 1, wherein the receiver includes a central bore having a recess into which an insert is configured to be at least partially positioned by being down loaded into the receiver through the channel.

19. (Previously Presented) The medical implant assembly of claim 18, wherein the insert is a retainer configured to engage a head of a bone attachment shank.

20. (Currently Amended) The medical implant assembly of claim 1, wherein each of the leading faces on the first and the second start structures has a concave surface adjacent a root and a convex surface adjacent a crest of the respective first and second ~~continuous~~ continuously helically wound structures.

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NOTICE OF ALLOWANCE AND FEE(S) DUE

24030 7590 09/17/2020

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EXAMINER	
COMSTOCK, DAVID C	
ART UNIT	PAPER NUMBER
3773	

DATE MAILED: 09/17/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/779,304	01/31/2020	Roger P. Jackson	JAC023-644278	4759

TITLE OF INVENTION: MEDICAL IMPLANT RECEIVERS HAVING DUAL LEAD IN CLOSURE MATING THREAD FORMS AND CURVATE EXTENDING INSTRUMENT ENGAGING GROOVES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	12/17/2020

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

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For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

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(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/779,304	01/31/2020	Roger P. Jackson	JAC023-644278	4759

TITLE OF INVENTION: MEDICAL IMPLANT RECEIVERS HAVING DUAL LEAD IN CLOSURE MATING THREAD FORMS AND CURVATE EXTENDING INSTRUMENT ENGAGING GROOVES

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nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	12/17/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
COMSTOCK, DAVID C	3773	606-278000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

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2 _____
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3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

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❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

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❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

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Zimvie_Zimmer Biomet v. Jackson
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16/779,304	01/31/2020	Roger P. Jackson	JAC023-644278	4759

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EXAMINER	
COMSTOCK, DAVID C	
ART UNIT	PAPER NUMBER
3773	

DATE MAILED: 09/17/2020

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

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OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/779,304	Applicant(s) Jackson et al.	
	Examiner DAVID C COMSTOCK	Art Unit 3773	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to amendment filed 01 September 2020.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-20 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 01 SEPT 2020.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/DAVID C COMSTOCK/ Examiner, Art Unit 3773	/EDUARDO C ROBERT/ Supervisory Patent Examiner, Art Unit 3773

Zimvie_Zimmer Biomet v. Jackson
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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/779,304	Jackson et al.
	Examiner	Art Unit
	DAVID C COMSTOCK	3773

CPC - Searched*		
Symbol	**Date**	**Examiner**
A61B17/7035,7032,863,84,8665,8685	06/08/2020	/DC/
A61B2090/037	06/08/2020	/DC/
A61B2017/8655	06/08/2020	/DC/
Search updated	09/03/2020	/DC/

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**
606	265,266,270,273,275,315	06/08/2020	/DC/
Search updated		09/03/2020	/DC/

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

Search Notes		
Search Notes	**Date**	**Examiner**
Text search--see EAST search history	06/08/2020	/DC/
Inventor name search--see EAST search history	06/08/2020	/DC/
EAST text search updated--see EAST search history printout	09/03/2020	/DC/
CPC search text limited except as indicated on EAST search history	09/03/2020	/DC/
PLUS search--See EAST PLUS search results	09/03/2020	/DC/

/DAVID C COMSTOCK/ Examiner, Art Unit 3773	

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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/779,304	Jackson et al.
	Examiner	Art Unit
	DAVID C COMSTOCK	3773

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
See EAST interference search history	N/A	09/03/2020	/DC/

/DAVID C COMSTOCK/ Examiner, Art Unit 3773	

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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/779,304	Jackson et al.
	Examiner	Art Unit
	DAVID C COMSTOCK	3773

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

CLAIMS

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
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Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/779,304	Jackson et al.
	Examiner	Art Unit
	DAVID C COMSTOCK	3773

CPC							
Symbol						Type	Version
A61B	/	17	/	7035		F	2013-01-01
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A61B	/	17	/	8665		I	2013-01-01
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A61B	/	17	/	8685		I	2013-01-01
A61B	/	2090	/	037		A	2016-02-01
A61B	/	2017	/	8655		A	2013-01-01

CPC Combination Sets								
Symbol						Type	Set	Ranking	Version
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/DAVID C COMSTOCK/ Examiner, Art Unit 3773	04 September 2020	Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/EDUARDO C ROBERT/ Supervisory Patent Examiner, Art Unit 3773	08 September 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	19

U.S. Patent and Trademark Office — Part of Paper No.: 20200903A

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Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/779,304	Jackson et al.
	Examiner	Art Unit
	DAVID C COMSTOCK	3773

INTERNATIONAL CLASSIFICATION				
CLAIMED				
A61B	/	17	/	70

NON-CLAIMED				
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US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS
606	278

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

/DAVID C COMSTOCK/ Examiner, Art Unit 3773	04 September 2020	Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/EDUARDO C ROBERT/ Supervisory Patent Examiner, Art Unit 3773	08 September 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	19

U.S. Patent and Trademark Office — Part of Paper No.: 20200903A

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Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/779,304	Jackson et al.
	Examiner	Art Unit
	DAVID C COMSTOCK	3773

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		10		19										
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/DAVID C COMSTOCK/ Examiner, Art Unit 3773	04 September 2020	**Total Claims Allowed:**
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/EDUARDO C ROBERT/ Supervisory Patent Examiner, Art Unit 3773	08 September 2020	O.G. Print Claim(s) / O.G. Print Figure
(Primary Examiner)	(Date)	1 / 19

U.S. Patent and Trademark Office

Part of Paper No.: 20200903A

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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9/3/2020 4:30:35 PM
C:\Users\dcomstock\Documents\EAST\Workspaces\16779304.wsp

16779304

PLUS Search Results for S/N 16779304 Searched Sep 04, 2020.

The Patent Linguistic Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to present. PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

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ATTACHMENT A
APPLN. NO. 16/779,304
INFORMATION DISCLOSURE STATEMENT
FOR
STATEMENT UNDER MPEP § 2001.06(b)

U.S. PATENT DOCUMENTS			
Examiner Initials	**Patent No.**	**Issue Date**	**Name of Patentee or Applicant of Cited Document**
	8,377,100	02/19/2013	Jackson
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /DC/

Zimvie_Zimmer Biomet v. Jackson
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U.S. APPLICATION DOCUMENTS			
Examiner Initials	Application No.	Filing Date	Name of Patentee or Applicant of Cited Document
EXAMINER /DAVID C COMSTOCK/		DATE CONSIDERED 09/03/2020	
EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.			

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /DC/

PTO/SB/08A (08-03) U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE Substitute for Form 1449A/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(Use as many sheets as necessary)*	APPLICATION NO.: 16/684,236	FILING DATE: 11/14/2019
	INVENTOR(S): Roger P. Jackson	ART UNIT: 3773
	EXAMINER NAME: David C. Comstock	ATTY. DOCKET NO.: JAC023-644278

U.S. PATENT DOCUMENTS

EXAMINER INITIALS*	Cite No.[1]	PATENT NUMBER Number – Kind Code[2] (if known)	ISSUE DATE MM-DD-YYYY	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
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OTHER PRIOR ART – NON PATENT LITERATURE DOCUMENTS

EXAMINER INITIALS*	Cite No.[1]	Include name of Author, title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), volume-issue number(s), publisher, page(s) and date.	T[6]
	D1.		

EXAMINER	/DAVID C COMSTOCK/	DATE CONSIDERED	09/03/2020

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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* EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] Applicant's unique citation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

74663306.1

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ENTRY OK
/DC/
10/29/2020

Attorney Docket No. JAC023-644278

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Inventor(s):	Roger P. Jackson		
App. No.:	16/779,304	Con. No.:	4759
Filed:	January 31, 2020	Art Unit:	3773
Title:	MEDICAL IMPLANT RECEIVERS HAVING DUAL LEAD IN CLOSURE MATING THREAD FORMS AND CURVATE EXTENDING INSTRUMENT ENGAGING GROOVES	Examiner:	COMSTOCK, David C

SUPPLEMENTAL AMENDMENT AND RESPONSE TO OFFICE ACTION

Via EFS-Web
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

In response to the non-final Office Action dated June 12, 2020, and further to the Amendment and Response to Office Action dated September 1, 2020, please consider the following remarks and amend the above-identified application as follows:

Amendments to the Claims begin on page 2; and

Remarks begin on page 5 of this paper.

74685371.1

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/779,304	01/31/2020	Roger P. Jackson	JAC023-644278	4759

24030 7590 11/05/2020

POLSINELLI PC
900 WEST 48TH PLACE
SUITE 900
KANSAS CITY, MO 64112-1895

EXAMINER	
COMSTOCK, DAVID C	

ART UNIT	PAPER NUMBER
3773	

NOTIFICATION DATE	DELIVERY MODE
11/05/2020	ELECTRONIC

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

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

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspt@polsinelli.com

Corrected Notice of Allowability	Application No. 16/779,304	Applicant(s) Jackson et al.	
	Examiner DAVID C COMSTOCK	Art Unit 3773	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to supplemental amendment filed 04 September 2020.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-20 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☑ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/DAVID C COMSTOCK/ Examiner, Art Unit 3773	/EDUARDO C ROBERT/ Supervisory Patent Examiner, Art Unit 3773

Zimvie_Zimmer Biomet v. Jackson
IPR2023-01432; Petitioners' EX1002
Page 379 of 391

EXAMINER'S COMMENT

On September 04, 2020, the examiner posted a Notice of Allowability (NOA) based on Applicant's amendment filed on September 01, 2020. However, on September 04, 2020, Applicant filed a Supplemental Amendment. The NOA was mailed to Applicant on September 17, 2020. Accordingly, the present Corrected NOA is being mailed to Applicant to acknowledge the approved amendments in the September 04, 2020 Supplement Amendment.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David Comstock whose telephone number is (571) 272-4710. The examiner can normally be reached Monday-Friday, 9 a.m. - 6 p.m.

If attempts to reach the examiner by telephone are unsuccessful, ***please contact* the examiner's supervisor, SPE, *at* (571) 272-4719**. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/DAVID C COMSTOCK/
Examiner, Art Unit 3773

/EDUARDO C ROBERT/
Supervisory Patent Examiner, Art Unit 3773

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/779,304	Jackson et al.
	Examiner	Art Unit
	DAVID C COMSTOCK	3773

CPC - Searched*		
Symbol	Date	Examiner
A61B17/7035,7032,863,84,8665,8685	06/08/2020	/DC/
A61B2090/037	06/08/2020	/DC/
A61B2017/8655	06/08/2020	/DC/
Search updated	09/03/2020	/DC/
Search updated	10/29/2020	/DC/

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
606	265,266,270,273,275,315	06/08/2020	/DC/
Search updated		09/03/2020	/DC/
Search updated		10/29/2020	/DC/

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

/DAVID C COMSTOCK/ Examiner, Art Unit 3773	

Zimvie_Zimmer Biomet v. Jackson
IPR2023-01432; Petitioners' EX1002
Page 381 of 391

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/779,304	Jackson et al.
	Examiner	Art Unit
	DAVID C COMSTOCK	3773

Search Notes		
Search Notes	**Date**	**Examiner**
Text search--see EAST search history	06/08/2020	/DC/
Inventor name search--see EAST search history	06/08/2020	/DC/
EAST text search updated--see EAST search history printout	09/03/2020	/DC/
CPC search text limited except as indicated on EAST search history	09/03/2020	/DC/
PLUS search--See EAST PLUS search results	09/03/2020	/DC/
EAST text search updated--see EAST search history printout	10/29/2020	/DC/
Updated CPC and US classification search text and date limited--see EAST search history	10/29/2020	/DC/

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
See EAST interference search history	N/A	09/03/2020	/DC/
See EAST interference search history	N/A	10/29/2020	/DC/

/DAVID C COMSTOCK/ Examiner, Art Unit 3773	

Zimvie_Zimmer Biomet v. Jackson
IPR2023-01432; Petitioners' EX1002
Page 382 of 391

*Circled collections have been reviewed in the updated search

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	50	(US-10265102-$ | US-10299833-$ | US-10548641-$ | US-10687855-$ | US-16779304-$ | US-20060203726-$ | US-20130131730-$ | US-20130197585-$ | US-20140081334-$ | US-20140121703-$ | US-20140142633-$ | US-20140214084-$ | US-20150094770-$ | US-20150119942-$ | US-20160038188-$ | US-20170189073-$ | US-20170333083-$ | US-20170354441-$ | US-20180243013-$ | US-20190274734-$ | US-20190298415-$ | US-20200163702-$ | US-3794218-$ | US-4311878-$ | US-4494907-$ | US-4571457-$ | US-4577670-$ | US-4631527-$ | US-4811755-$ | US-4813564-$ | US-4890613-$ | US-4996769-$ | US-5179780-$ | US-5187734-$ | US-5247282-$ | US-5304991-$ | US-5347275-$ | US-5506583-$ | US-5515492-$ | US-5543589-$ | US-5634505-$ | US-6008916-$ | US-6059102-$ | US-6273673-$ | US-7852765-$ | US-8911478-$ | US-8911479-$ | US-8926672-$ | US-9636146-$ | US-9770265-$ | US-9956004-$).DID.	US-PGPUB; USPAT	OR	ON	2020/10/29 13:32
L2	1,068	(606/265,266,270,273,275,315).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/10/29 15:02
L3	36,460	A61B17/7035,7032,863,84,8665,8685.cpc. A61B2090/037.cpc. A61B2017/8655.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/10/29 15:02
L4	14,522	A61B17/7032.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/10/29 15:03
L5	5,135	A61B17/7035.cpc.	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2020/10/29 15:05

			EPO; JPO; DERWENT; IBM_TDB			
L9	948	(2 3) and ((dual with start with thread$2) or (dual with lead with thread$2) or (double with thread$2) or (dual with thread$2))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/10/29 15:07
L10	118	(4 5 9) and @pd>"20200904"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/10/29 15:08

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L12	0	(implant and receiver and longitudinal and axis and first and arm and second and surface and top and side and channel and opening and adjacent and connecting and member and closure and rotation and engage and discontinuous and helically and wound and leading and face and concave and convex and portion and simultaneous and mating and diametrically and timed and positioning and curvate and extending and groove and continuously and configured and instrument and locked).clm.	US-PGPUB; USPAT	OR	ON	2020/10/29 15:13

10/29/2020 3:14:21 PM
C:\Users\dcomstock\Documents\EAST\Workspaces\16779304.wsp

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

24030 7590 09/17/2020

POLSINELLI PC
900 WEST 48TH PLACE
SUITE 900
KANSAS CITY, MO 64112-1895

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

Helen Miswell	(Typed or printed name)
/Helen Miswell/	(Signature)
December 15, 2020	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/779,304	01/31/2020	Roger P. Jackson	JAC023-644278	4759

TITLE OF INVENTION: MEDICAL IMPLANT RECEIVERS HAVING DUAL LEAD IN CLOSURE MATING THREAD FORMS AND CURVATE EXTENDING INSTRUMENT ENGAGING GROOVES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	12/17/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
COMSTOCK, DAVID C	3773	606-278000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Polsinelli PC
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Roger P. Jackson

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Prairie Village, KS

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☒ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 50-1662

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Joshua J. Pranckun/ Date December 15, 2020

Typed or printed name Joshua J. Pranckun Registration No. 70712

PTOL-85 Part B (08-18) Approved for use through 01/31/2020 OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Zimvie_Zimmer Biomet v. Jackson
IPR2023-01432; Petitioners' EX1002
Page 385 of 391

Electronic Patent Application Fee Transmittal

Application Number:	16779304
Filing Date:	31-Jan-2020
Title of Invention:	MEDICAL IMPLANT RECEIVERS HAVING DUAL LEAD IN CLOSURE MATING THREAD FORMS AND CURVATE EXTENDING INSTRUMENT ENGAGING GROOVES
First Named Inventor/Applicant Name:	Roger P. Jackson
Filer:	Joshua Pranckun/Helen Miswell
Attorney Docket Number:	JAC023-644278

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	1000	1000

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	1000

Electronic Acknowledgement Receipt	
EFS ID:	41391532
Application Number:	16779304
International Application Number:	
Confirmation Number:	4759
Title of Invention:	MEDICAL IMPLANT RECEIVERS HAVING DUAL LEAD IN CLOSURE MATING THREAD FORMS AND CURVATE EXTENDING INSTRUMENT ENGAGING GROOVES
First Named Inventor/Applicant Name:	Roger P. Jackson
Customer Number:	24030
Filer:	Joshua Pranckun/Helen Miswell
Filer Authorized By:	Joshua Pranckun
Attorney Docket Number:	JAC023-644278
Receipt Date:	15-DEC-2020
Filing Date:	31-JAN-2020
Time Stamp:	15:12:19
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1000
RAM confirmation Number	E2020BEF12521123
Deposit Account	501662
Authorized User	Helen Miswell
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	16-779304_IssueFeeTransmittal.pdf	119460 aff247f9e8e6c9d9f71ab602413d2a460467a903e	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30582 b202f501abe4001466ba09eee96e8770c1319f3ff	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	150042		

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

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

U.S. PATENT DOCUMENTS

EXAMINER INITIALS*	Cite No.[1]	PATENT NUMBER Number – Kind Code[2] (if known)	ISSUE DATE MM-DD-YYYY	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
Change(s) applied to document, /C.C.B./ 10/23/2020	A77.	4,538,947	~~09/195~~ 09/1985	Burkholder	
	A78.	4,764,068	08-1988	Crispell	
	A79.	5,005,562	04-1991	Cotrel	
	A80.	5,073,074	12-1991	Corrigan et al.	
	A81.	5,667,508	09-1997	Errico et al.	
	A82.	5,697,929	12-1997	Mellinger	
	A83.	5,885,286	03-1999	Sherman et al.	
	A84.	6,004,349	12-1999	Jackson	
	A85.	6,056,753	05-2000	Jackson	
	A86.	6,224,596	05-2001	Jackson	
	A87.	6,261,288	07-2001	Jackson	
	A88.	6,565,565	05-2003	Yuan et al.	
	A89.	6,786,903	09-2004	Lin	
	A90.	6,843,791	01-2005	Serhan	
	A91.	7,141,051	11-2006	Janowski	
	A92.	7,641,674	01-2010	Young	
	A93.	7,566,163	07-2009	Inoue	
	A94.	7,490,394	02-2009	Zakrzewski	
	A95.	7,334,307	02-2008	Helenowski	
	A96.	7,320,570	01-2008	Czarnek	
	A97.	7,311,563	12-2007	Siebens	
	A98.	7,247,020	07-2007	Takahashi	
	A99.	7,232,104	06-2007	Krapels	
	A100.	7,515,220	~~12-2000~~ 04/2009	~~Rubin de la Borbolla~~ Ko et al.	
	A101.	7,096,071	08-2006	Ollivier	
	A102.	6,851,337	02-2005	Stokes	
	A103.	6,817,910	11-2004	Borgstrom	
	A104.	6,788,756	09-2004	Erbes	
	A105.	6,764,354	07-2004	Kaine	
	A106.	6,699,248	03-2004	Jackson	
	A107.	6,688,921	02-2004	Borgstrom	
	A108.	6,634,842	10-2003	Ueno	
	A109.	6,634,246	10-2003	Ohya	
	A110.	6,550,959	04-2003	Huber	
	A111.	6,478,795	11-2002	Gournay	
	A112.	6,454,772	09-2002	Jackson	
	A113.	6,454,768	09-2002	Jackson	
	A114.	6,361,535	03-2002	Jackson	
	A115.	6,302,888	10-2001	Mellinger	
	A116.	6,224,598	05-2001	Jackson	
	A117.	6,209,575	04-2001	Graziano	
	A118.	6,193,719	02-2001	Gournay	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /DC/

UNITED STATES PATENT AND TRADEMARK OFFICE

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www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/779,304	01/26/2021	10898233	JAC023-644278	4759

24030 7590 01/06/2021

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900 WEST 48TH PLACE
SUITE 900
KANSAS CITY, MO 64112-1895

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Roger P. Jackson, Prairie Village, KS;
Roger P. Jackson, Prairie Village, KS;
James L. Surber, Kansas City, KS;

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IR103 (Rev. 10/09)