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(54) **Title:** VERTEBRAL ARTHRODESIS EQUIPMENT

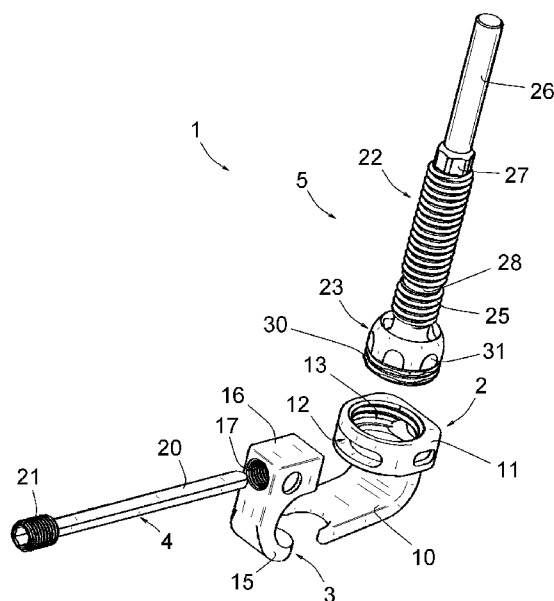


FIG. 1

(57) **Abstract:** This equipment comprises at least one anchoring assembly (1) including two antagonistic hooks (2, 3) connected to each other through a rod (4), a first of these hooks (2) comprising a body (11) crossed by a hole (12) for letting through the rod (4) and being able to be connected to connection means (5) with which the anchoring assembly (1) may be connected to another part, which the equipment comprises; said body (11) comprises an aperture (13) laid out substantially perpendicularly to the axis of said hole (12), communicating with this hole (12), and the anchoring assembly (1) comprises a tightening member (23) which may be engaged into this aperture (13) until it abuts against the rod (4) engaged in the hole (12), and tightened in order to immobilize this rod (4) in this hole (12). According to the invention, said tightening member (23) is directly connected to a part (22) belonging to said connection means (5), which allows the mounting of the latter on the body (11) of said first hook (2).

VERTEBRAL ARTHRODESIS EQUIPMENT

The present invention relates to a vertebral arthrodesis equipment.

Such a piece of equipment generally comprises one or two binding bars with which a series of vertebrae may be bound together, and assemblies for anchoring these
5 binding bars to the vertebrae, with hooks or with pedicular screws. This piece of equipment may also comprise crossbars which transversely connect two binding bars step by step in order to maintain them together.

An existing type of anchoring assembly comprises two antagonistic hooks
10 connected to each other through a rod, a first hook of which comprises a body crossed by the rod and is connected to means for connecting to a binding bar. In the anchoring assembly known from French patent application No. FR 2 816 196, in the name of the applicant, said body of the first hook comprises a hole for letting through the rod, this hole having an oblong section on the side turned towards the second hook; this oblong
15 section of the hole allows the rod to be shifted in a plane and therefore increases the possibilities of positioning this second hook relatively to the first hook. The rod is threaded and after having crossed the body of the first hook, receives a nut with which it may be connected to the first hook. By tightening this nut, the second hook may be brought closer to the first hook.

This known piece of equipment gives satisfaction in practice but however it may be
20 improved. Indeed, the nut may, depending on the position of the anchoring assembly on the vertebrae, be more or less difficult to access, making the tightening operation of this nut delicate. Further, any risk of loosening of the anchoring assembly relatively to the vertebrae is not excluded with this piece of equipment.

Document FR 2 767 263 describes an anchoring assembly including two
25 antagonistic hooks connected to each other through a rod; a first of these hooks comprises a body crossed by a conduit for letting through the rod and is able to receive a screw for tightening this rod in this conduit; said body comprises a second conduit, for receiving a bar for binding a series of vertebrae, and is able to receive a nut with which this bar may be connected to the anchoring assembly.

30 With this equipment; it is not possible to find a remedy to the aforementioned drawbacks. The risk of losing the screw when placing it, is noteworthy and it further has a complex structure to be made.

The object of the present invention is to provide an anchoring assembly finding a remedy to the drawbacks mentioned above.

The relevant piece of equipment comprises in a way known *per se*, at least one anchoring assembly including two antagonistic hooks connected to each other through
5 a rod, a first of these hooks comprising a body crossed by a hole for letting through the rod and being able to be connected to connection means with which the anchoring assembly may be connected to another part, which the piece of equipment comprises, in particular to a bar for binding a series of vertebrae; said body comprises an aperture
10 laid out substantially perpendicularly to the axis of said hole, communicating with this hole, and the anchoring assembly comprises a tightening member which may be engaged into this aperture until it abuts against the rod engaged in the hole, and tightened in order to immobilize this rod in this hole.

According to the invention, said tightening member is directly connected to a part belonging to said connection means, which allows the mounting of the latter on the body
15 of said first hook.

Thus, in a piece of equipment according to the invention, the tightening member intended to immobilize the rod is not mounted on the end of the rod jutting out from the body of this hook but is placed directly in the body of the hook, so as to bear against the rod and to tighten the latter against the body of the hook. This tightening member is
20 easily accessible regardless of the position of the anchoring assembly relatively to the treated vertebrae, which notably facilitates placement of this anchoring assembly on these vertebrae and with which perfect immobilization of the rod may be achieved relatively to said first hook.

With the tightening member, it is further possible, and especially because it is
25 directly connected to a part belonging to said connection means, to easily perform the mounting of this part on the body of said first hook.

The making of the anchoring assembly according to the invention and its placement on the vertebrae are thereby facilitated.

The part to which the tightening member is connected may be integral with this
30 tightening member, i.e. not jointed relatively to this tightening member. Such a non-jointed part is generally said to be "monoaxial". In this case, said tightening member is advantageously formed by a portion of this part, integral with the latter.

The part to which the tightening member is connected may also be jointed relatively to this tightening member, such a jointed part is generally said to be "polyaxial". In this case, said tightening member is formed by a binding part independent of said part, connected in a jointed way to the latter.

5 Preferably,

- the rod comprises at least one first flat at its portion intended to be engaged into said hole, and

- said tightening member comprises a flat face intended to bear against this first flat of the rod.

10 This flat and this flat surface allow the tightening member to bear against the rod according to a relatively extended surface area, providing good immobilization of the rod relatively to the tightening member.

Advantageously, the rod has a second flat on its face opposite to the one comprising said first flat and the body of said first hook comprises flat surfaces intended
15 to receive this second flat when the rod is engaged into said hole.

Extended contact surface areas are thereby laid out between the rod and the body of the hook providing a good support of these rods against this hook and allowing the existence of friction favorable to proper immobilization of the rod relatively to the body of the hook when the tightening member is tightened.

20 The rod and/or the body of said first hook and/or said tightening member may comprise at least one rough surface at their contact areas, able to oppose the sliding of the rod relatively to the tightening member when this member is tightened. The roughness of this surface may notably result from knurling.

According to a preferred embodiment of the invention,

25 - said aperture laid out in the body is formed by a tapped bore, and

- said tightening member comprises a threaded portion allowing it to be screwed into this tapped bore.

When the anchoring assembly comprises a polyaxial assembling part, said anchoring member includes this threaded portion and comprises a gripping area by
30 which it may be grasped in order to screw it in to the tapped bore.

The invention will be better understood and other features and advantages thereof will become apparent, with reference to the appended schematic drawing illustrating as a non-limiting example, a preferred embodiment of an anchoring system which the piece of equipment comprises, and to which it is related.

5 Fig. 1 is an exploded perspective view of the different parts forming this assembly;

Fig. 2 is a perspective view of this assembly in the mounted condition;

Fig. 3 is a side view of this assembly, during assembling, a first hook which this assembly comprises being seen as a sectional view, and

Fig. 4 is a view of the assembly similar to Fig. 3 after assembling.

10 The figures illustrate an anchoring assembly 1 belonging to a piece of vertebral arthrodesis equipment.

This vertebral arthrodesis equipment comprises, as this is well-known, one or two binding bars with which a series of vertebrae may be bound together and several assemblies 1 allowing these binding bars to be anchored to the vertebrae. This piece of
15 equipment may also comprise crossbars which transversely connect two binding bars step by step in order to maintain them together.

Said bars and cross bars are well-known *per se* and are therefore not illustrated in the drawings, nor particularly described.

As shown by the figures, an anchoring assembly 1 comprises a first hook 2, a
20 second hook 3, positioned in an antagonistic way to the first hook 2, a rod 4 for connecting both of these hooks 2, 3 and a connection sub-assembly 5. Both hooks 2, 3 are intended to be simultaneously engaged around bone areas of a vertebra, notably at the lamina so that this assembly 1 may be connected to this vertebra.

The assembly 1 may notably be made in a biocompatible metal such as titanium
25 or titanium alloy.

The first hook 2 has a bent branch 10 for bearing against the vertebra and a body 11. This body 11 comprises a hole 12 which passes right through it, in which the rod 4 is intended to be engaged, and a tapped bore 13, extending into the body 11 from the face of this body opposite to the branch 10, until it communicates with the hole 12.

30 The latter has on the side of the hook 3, as seen along its axis, a flattened oblong shape; on the side opposite to the hook 3, it has a rectangular shape. As this is

understood, by means of this shape of the hole 12, the rod 4 may have a sectorial displacement relatively to the first hook 2, in a plane perpendicular to the axis of the bore 13.

5 The second hook 3 has a bent branch 15 and comprises a body 16 pierced with a tapped bore 17.

The rod 4 comprises two longitudinal flats 20 on both opposite faces, cross-sectionally providing it with a substantially rectangular shape. At its end opposite to the one intended to be engaged into the hole 12, it comprises a threaded cylindrical portion 21 intended to be screwed into the tapped bore 17 of the hook 3.

10 The connection sub-assembly 5 comprises in the illustrated example a threaded pin 22 and a binding part 23 jointed with each other. This joint is made by means of a terminal spherical portion which the pin 22 comprises, and of a spherical cavity for receiving this terminal portion laid out in the binding part 23. In order to achieve the connection of this pin 22 and of the part 23, the binding part 23 may notably comprise a
15 peripheral wall able to be folded back against the spherical portion of the pin 22 by deformation around this spherical portion, in a crimping fashion.

The pin 22 comprises a threaded portion 25 intended, as this is known, to receive a stirrup for connecting a binding bar as aforementioned, and to then receive a nut for tightening this stirrup around this binding bar; the stirrup resting against the peripheral
20 wall of the binding part 23. This stirrup and this nut, being well-known *per se*, are not particularly illustrated in the drawings nor described.

The pin 22 also comprises a smooth proximal portion 26 for facilitating the engagement of the stirrup and of the nut on it, a portion 27 with facets allowing this pin
25 22 to be immobilized in rotation when screwing in said nut, and a portion 28 with a smaller section, able to be broken after tightening the nut against the stirrup.

The binding part 23 is, as this appears in the figures, intended to be screwed into the tapped bore 13. For this purpose it comprises a threaded portion 30 allowing it to be
30 screwed into this bore and a plurality of facets 31 on its periphery allowing it to be gripped by means of a suitable tool and to be driven into rotation. The binding part 23 further comprises a planar distal face 32 intended to bear against the rod 4 when it is screwed into the bore 13.

As this is understood, the anchoring assembly 1 is assembled by engaging the rod 4 through the bore 17 of the hook 3, by screwing the threaded portion 21 into this bore, by engaging the rod 4 into the hole 12 and by then screwing the binding part 23 into the tapped bore 13 without tightening.

5 The assembly 1 provides many possibilities for placement on a vertebra because of the possibility of pivoting the hook 3 relatively to the rod 4, and of the possibility of sectorial displacement and sliding of this rod 4 through the body 11 of the hook 2.

10 Once the assembly 1 is placed on the vertebra, the binding part 23 is tightened by means of a suitable tool so as to immobilize the rod 4 relatively to the hook 2. This immobilization is achieved by extended contact areas resulting from the flats 20 of the rod 4, from areas of the body 11 delimiting the apertures through which the hole 12 opens out on the outside of this body 11 and the end planar face 32 of the binding part 23. Perfect immobilization of the rod 4 relatively to the hook 2 is thereby obtained, and the binding part 23 remains easily accessible regardless of the position of the anchoring
15 assembly 1 relatively to the treated vertebrae, which notably facilitates the placement of this anchoring assembly on these vertebrae.

Further, the risk of pivoting of the rod 4 on itself is eliminated by said flat 20 and the binding part 23.

20 The invention therefore provides a piece of vertebral arthrodesis equipment having the determining advantages of allowing perfect immobilization of the assembly 1 in the mounting position, while having a setting into place which remains relatively easy.

The invention has been described above with reference to an embodiment given as a pure example. It is obvious that it is not limited to this embodiment but that it extends to all other embodiments covered by the appended claims herein.

CLAIMS

1 - Vertebral arthrodesis equipment, comprising at least one anchoring assembly (1) including two antagonistic hooks (2, 3) connected to each other through a rod (4), a first of these hooks (2) comprising a body (11) crossed by a hole (12) for letting through the rod (4) and being able to be connected to connection means (5) with which the anchoring assembly (1) may be connected to another part, which the equipment comprises, in particular to a bar for binding a series of vertebrae; said body (11) comprises an aperture (13) laid out substantially perpendicularly to the axis of said hole (12), communicating with this hole (12), and the anchoring assembly (1) comprises a tightening member (23) which may be engaged into this aperture (13) until it abuts against the rod (4) engaged in the hole (12), and tightened in order to immobilize this rod (4) in this hole (12);

characterized in that said tightening member (23) is directly connected to a part (22) belonging to said connection means (5), which allows the mounting of the latter on the body (11) of said first hook (2).

2 – Equipment according to claim 1, characterized in that the part to which the tightening member is connected is integral with this tightening member, i.e. not jointed relatively to this tightening member.

3 – Equipment according to claim 1, characterized in that the part (22) to which the tightening member (23) is connected is jointed relatively to this tightening member (23).

4 – Equipment according to anyone of claims 1 to 3, characterized in that:

- the rod (4) comprises at least one first flat (20) at its portion intended to be engaged into said hole (12), and

- said tightening member (23) comprises a flat face (32) intended to bear against this first flat (20) of the rod (4).

5 – Equipment according to claim 4, characterized in that the rod (4) has a second flat on its face opposite to the one comprising said first flat (20) and the body (11) of said first hook (2) comprises flat surfaces intended to receive this second flat when the rod (4) is engaged into said hole (12).

6 – Equipment according to anyone of claims 1 to 5, characterized in that the rod (4) and/or the body (11) of said first hook (2) and/or said tightening member (23)

comprises at least one rough surface at their contact areas, able to oppose the sliding of the rod (4) relatively to the tightening member (23) when this member is tightened.

7 – Equipment according to anyone of claims 1 to 6, characterized in that:

- said aperture laid out in the body (11) is formed by a tapped bore (13), and

5 - said tightening member (23) comprises a threaded portion (30) allowing it to be screwed into this tapped bore (13).

8 – Equipment according to claim 3 and claim 7, characterized in that said tightening member (23) comprises said threaded portion (30) and comprises an engagement portion (31) allowing it to be gripped and to be driven into the tapped bore (13).

9 – Equipment according to claim 7 or claim 8, characterized in that said first hook (2) has a bent branch (10) for bearing against a vertebra and a body (11), this body (11) comprising a hole (12) which passes right through it, in which said rod (4) is intended to be engaged, and said tapped bore (13), this tapped bore (13) extending into the body (11) from the face of this body (11) opposite to the branch (10), until it communicates with the hole (12).

10 – Equipment according to claim 8, characterized in that the hole (12) which passes right through the body (11) has, on the side of said second hook (3) a flattened oblong shape; on the side opposite to said second hook (3), this hole (12) has a rectangular shape.

11 – Equipment according to claim 9 or claim 10, characterized in that:

- said second hook (3) has a bent branch (15) and comprises a body (16) pierced with a tapped bore (17), and

25 - the rod (4) comprises, at its end opposite to the one intended to be engaged into the hole (12), a threaded cylindrical portion (21) intended to be screwed into the tapped bore (17) of said second hook (3).

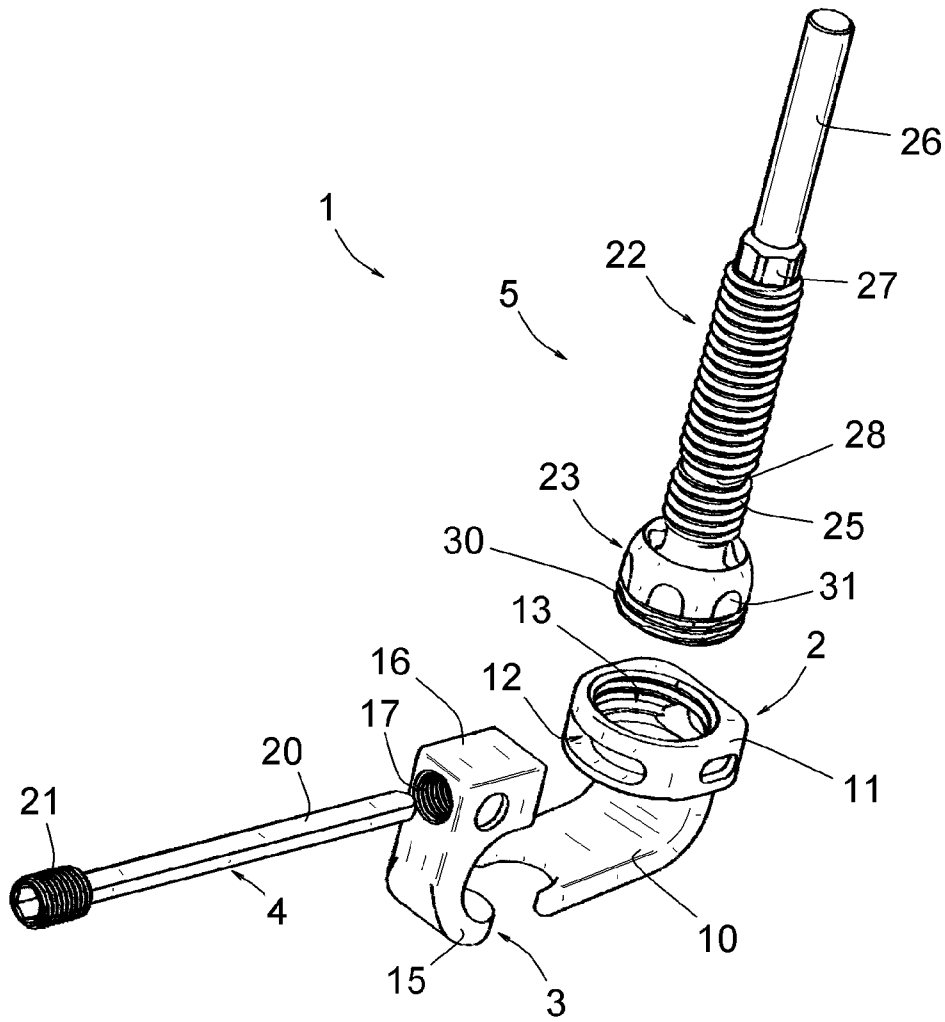


FIG. 1

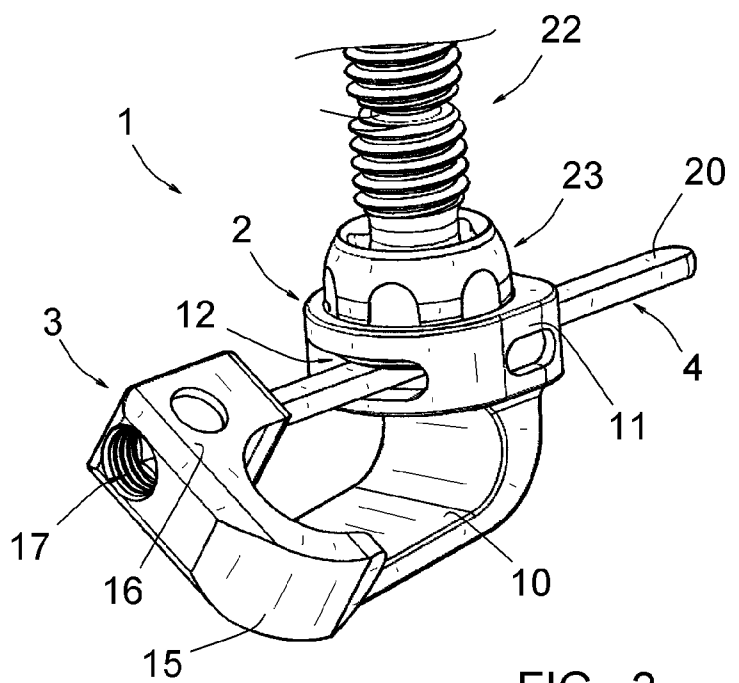


FIG. 2

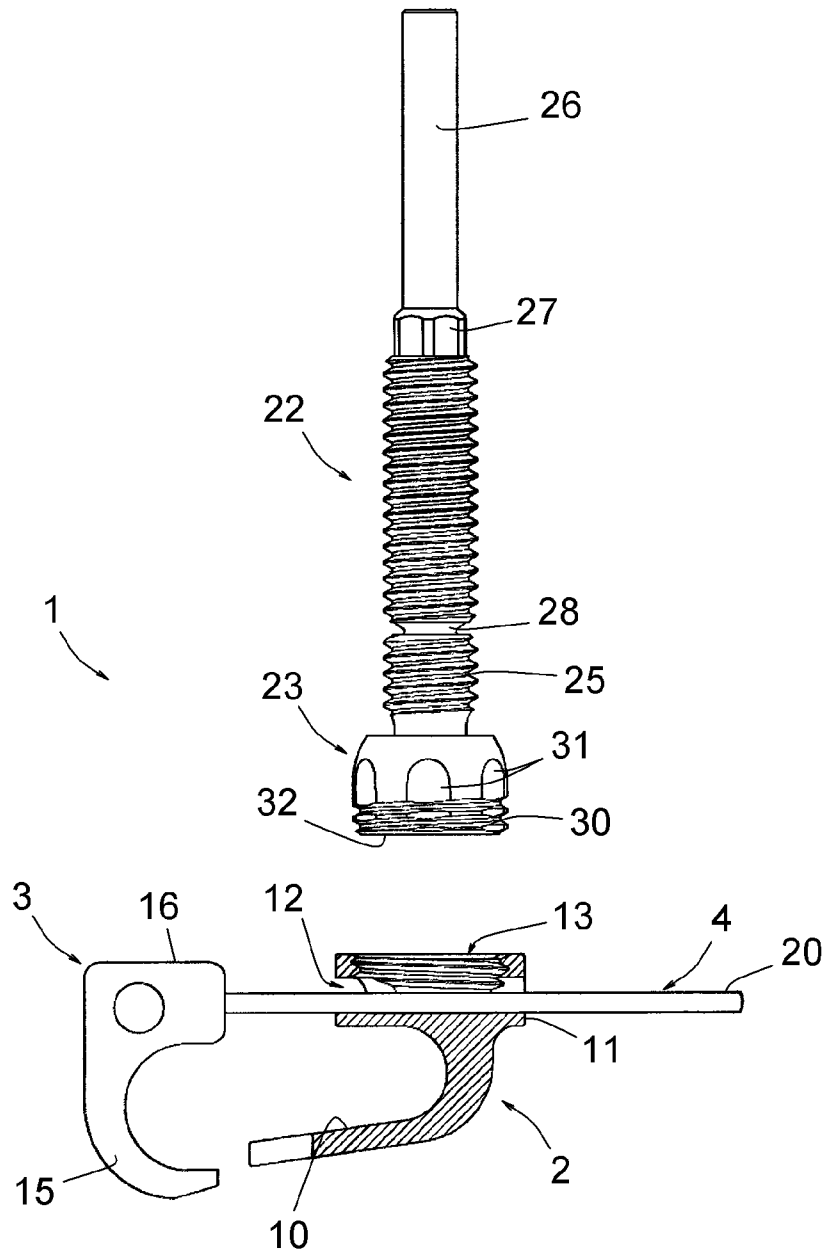


FIG. 3

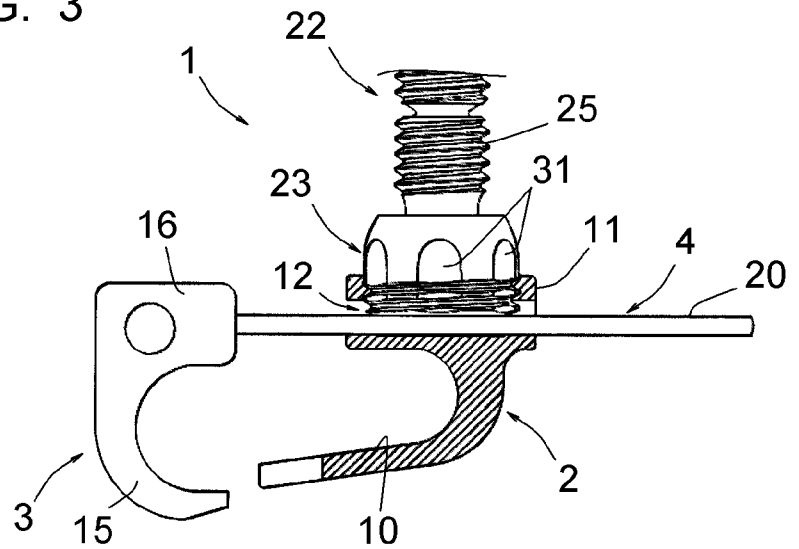


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2009/051237

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61B17/70

ADD. A61B19/00

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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