(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 383 294 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
07.08.2019 Bulletin 2019/32

(21) Application number: **16826445.5**

(22) Date of filing: **24.11.2016**

(51) Int Cl.:
A61B 17/80 *(2006.01)* ***A61B 17/70*** *(2006.01)*

(86) International application number:
PCT/IB2016/057103

(87) International publication number:
WO 2017/093863 (08.06.2017 Gazette 2017/23)

(54) OCCIPITAL-CERVICAL FIXATION EQUIPMENT

OKZIPITAL-ZERVIKALE FIXIERUNGSAUSRÜSTUNG

ÉQUIPEMENT DE FIXATION OCCIPITO-CERVICALE

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **03.12.2015 IT UB20156306**

(43) Date of publication of application:
10.10.2018 Bulletin 2018/41

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Description

[0001] The present invention relates to a spinal fixation equipment, in particular to an occipital-cervical fixation equipment.

[0002] Therefore, the present invention finds particular application in the biomedical field and, especially, in the manufacturing of fixation systems for spinal surgery.

[0003] As known, the fixation equipment are used in orthopaedic surgery to stabilize bones such as those of the vertebral column, providing support in the event of damage to the vertebral column itself. US 2011/087288 discloses an occipital-cervical fixation equipment comprising a surgical fixation system including a pair of spinal rods, an occipital fixation element comprising an occipital plate, a crosslink connector, and a plurality of anchor elements.

[0004] In spinal surgery, it is known to stabilize two or more vertebrae using bone fasteners, for example obtained with poly-axial screws, connected by means of bars. In particular in case of occipital-cervical connection, it is known the use of an occipital plate and two bars, which are fixed on the vertebral body by means of polyaxial screws.

[0005] This connection allows the occipital-cervical loads to be transferred through the two bars, while limiting the torsional movement of the concerned vertebrae.

[0006] The Applicant has found that in the case of large and widespread damage, especially to the cervical vertebrae, the known connection presents poor stability, for example in case of movements between occiput and cervical vertebrae. Moreover, the connection has a non-optimal torsional functionality and distribution of loads (for example, the occipital-cervical loads).

[0007] Therefore, the object of the present invention is to provide an occipital-cervical fixation equipment able to overcome at least one of the drawbacks of prior art mentioned above.

[0008] More precisely, the purpose of the present invention is to provide a vertebral fixation equipment, preferably an occipital-cervical fixation equipment, able to further stiffen the portion of the vertebral column subject to the fixing procedure, compared with the known connections, unloading in more points the forces exerted, for example, by the skull on the cervical vertebrae and improving the torsional and flexion-extension functionality of the whole assembly.

[0009] Moreover, object of this invention is providing a vertebral fixation equipment, preferably an occipital-cervical fixation equipment, easy to position and adjust.

[0010] Said objects are achieved by a vertebral fixation equipment, preferably an occipital-cervical fixation equipment, having the features of one or more of the following claims. The dependent claims correspond to some possible embodiments of the invention.

[0011] In particular, a transverse connector is provided comprising a central longitudinal bar and a cross bar associated with the central longitudinal bar. The transverse connector can be fixed, for example, to the occipital plate at an end of the occipital portion of the central longitudinal bar and to the bars of the standard connection at the cross bar.

[0012] Thanks to the transverse connector, stability can be improved, in particular in case of movements between occiput and cervical vertebrae. In fact, the transverse connector allows bypassing the damaged vertebrae, for example the damaged cervical vertebrae, creating a safe connection directly on the standard connection bars.

[0013] Moreover, the loads, for example the occipital-cervical loads, are transmitted through three longitudinal bars improving the distribution of the loads.

[0014] Finally, the transverse connector improves the torsional functionality of the whole assembly.

[0015] The technical task mentioned and the objects stated are substantially achieved by a vertebral fixation equipment, preferably an occipital-cervical fixation equipment, comprising the technical characteristics set out in one or more of the appended claims. The dependent claims correspond to possible different embodiments of the invention.

[0016] The term "end occipital portion" refers to a portion of one of the components of the equipment, preferably elongated in shape, arranged or adapted to be arranged towards the occiput of the patient. The occipital end portion comprises an extremity of the occipital end portion.

[0017] The term " vertebral extremity portion" refers to a portion of one of the components of the equipment, preferably elongated in shape, arranged or adapted to be arranged on the opposite side of the occiput of the patient. The vertebral end portion comprises an extremity of the vertebral end portion.

[0018] In accordance with a first aspect, the present invention relates to a vertebral fixation equipment, for example an occipital-cervical fixation equipment, comprising two lateral longitudinal bars suitable for being arranged in a sagittal direction alongside the spinous processes of the patient's vertebrae.

[0019] In case of occipital-cervical fixation equipment, an occipital plate is able to be fixed to an occipital portion of the skull of a patient.

[0020] Each lateral longitudinal bar extends between an occipital end portion and a vertebral end portion.

[0021] First fixation means are configured to fix in place the occipital end portion of each lateral longitudinal bar. In case of an occipital-cervical fixation equipment, preferably the first fixation means are configured to fix the occipital end portion of each lateral longitudinal bar and the occipital plate. Second fixation means are configured to fix in place the vertebral end portion of each lateral longitudinal bar. In case of an occipital-cervical fixation equipment, preferably the second fixation means are configured to fix the vertebral end portion of each lateral longitudinal bar and a patient's vertebra.

[0022] The vertebral fixation equipment, for example,

the occipital-cervical fixation equipment, comprises a transverse connector comprising a central longitudinal bar suitable for being arranged along the sagittal direction between two lateral longitudinal bars, and a cross bar associated with the central longitudinal bar. The cross bar extends, transversely to the central longitudinal bar, between two lateral end portions. The central longitudinal bar extends between an occipital end portion and an vertebral end portion. Third fixation means are configured to secure in place the occipital end portion of the central longitudinal bar. In case of an occipital-cervical fixation equipment, preferably the third fixation means are configured to secure the occipital end portion of the central longitudinal bar to the occipital plate.

[0023] Fourth fixation means are configured to fix the lateral end portions of the cross bar respectively to one of two longitudinal lateral bars.

[0024] According to a second aspect, the present invention relates to a method for implanting a vertebral fixation equipment. Two lateral longitudinal bars are arranged in a sagittal direction alongside the spinous processes of the patient's vertebrae and fixed therein. A transverse connector, comprising a central longitudinal bar and a cross bar associated with the central longitudinal bar, is arranged so that the central longitudinal bar is disposed along the sagittal direction between the two longitudinal lateral bars. The central longitudinal bar extends between an occipital end portion and a vertebral end portion. The cross bar extends, transversely to the central longitudinal bar, between two lateral end portions.

[0025] Preferably, the occipital end portion of the central longitudinal bar is secured in the place. Preferably, the lateral end portions of the cross bar are respectively fixed to one of two longitudinal lateral bars.

[0026] While implanting an occipital-cervical fixation equipment, the method comprises the step of fixing an occipital plate to an occipital portion of the skull of a patient. The two lateral longitudinal bars are arranged in a sagittal direction alongside the spinous processes of the patient's vertebrae.

[0027] The occipital end portion of each lateral longitudinal bar is fixed to the occipital plate by means of the first fixation means.

[0028] The vertebral end portion of each lateral longitudinal bar is fixed to a patient's vertebra by means of the second fixation means.

[0029] The occipital end portion of the central longitudinal bar is fixed to the occipital plate by means of the third fixation means.

[0030] The lateral end portions of the cross bar are respectively fixed to one of two longitudinal lateral bars, by means of the forth fixation means.

[0031] In one or more of the above-mentioned aspects, the present invention can comprise one or more of the following features.

[0032] Preferably, the third fixation means comprise a receiving and fixing bowl, or "tulip". In case of an occipital-cervical fixation equipment, the bowl is coupled to the occipital plate. Preferably, the receiving and fixing bowl comprises a groove for the insertion of the occipital end portion of the central longitudinal bar.

[0033] Preferably, the bowl comprises a through opening defining a housing for a screw. Preferably, the through opening extends along a longitudinal transverse direction, for example perpendicular to a longitudinal direction along which the grooves extends.

[0034] Preferably, the through opening is adapted to be placed in communication with a fixation seat of the occipital plate to define an housing for an occipital screw.

[0035] Preferably, the through opening communicates with the groove for the insertion of the occipital end portion of the central longitudinal bar.

[0036] Preferably, the bowl comprises a fixing element, preferably a threaded fixing element, for fixing the occipital end portion of the central longitudinal bar, for example into the groove. The fixing element is preferably arranged on the opposite side of the through opening with respect to the occipital end portion of the central longitudinal bar. Preferably, the occipital end portion is suitable to define, when in use, a stop for the screw, in particular for the occipital screw.

[0037] Preferably, the bowl comprises a fixing plate, for example configured to be fixed to the occipital plate in case of an occipital-cervical fixation equipment. Preferably, the fixing plate is provided with a centering portion insertable, for example, in the occipital plate, for example in the fixing seat.

[0038] Preferably, the fixing plate comprises at least one projecting portion insertable in a recess of the occipital plate, for example.

[0039] Preferably, the cross bar extends perpendicularly relative to the central longitudinal bar.

[0040] Preferably, the central longitudinal bar is arranged in a central position with respect to the cross bar dividing it into two portions having equal length.

[0041] Preferably, the transverse connector is "T" shaped.

[0042] Preferably, the transverse connector can be bent, if necessary.

[0043] Preferably, the cross bar is bent or can be bent, if necessary.

[0044] Preferably, the central longitudinal bar is straight or can be curved, if necessary.

[0045] Preferably, the cross bar is mounted at the vertebral end portion of the central longitudinal bar, for example at a vertebral end of the central longitudinal bar.

[0046] Preferably, a coupling area between the cross bar and the central longitudinal bar comprises anti-rotation means. The anti-rotation means can for example be defined by a polygonal seat associated with the central longitudinal bar and by a polygonal portion associated to the cross bar. Alternatively, the anti-rotation means can for example be defined by a polygonal seat associated with the cross bar and by a polygonal portion associated to the central longitudinal bar.

[0047] Preferably, the transverse connector comprises

a fixation pin interposed between the central longitudinal bar and the cross bar to prevent relative sliding thereof.

[0048] Preferably, the equipment comprises at least a clamp slidingly constrained, for example, to the cross bar and the respective lateral longitudinal bar. Still more preferably, at least the forth fixation means comprise, for each of the lateral end portions of the cross bar, a clamp constrained to the cross bar and the respective lateral longitudinal bar.

[0049] Preferably, the clamp comprises a main body.

[0050] Preferably, the clamp comprises at least a first and a second housing seat, for example formed inside the main body. The first and second seats are preferably adapted to receive respectively one of the longitudinal lateral bars and an lateral end portion of the cross bar.

[0051] Preferably, the clamp comprises tightening means for locking, for example, the cross bar and the respective lateral longitudinal bar in an operative position with respect to the main body and to prevent the relative movements thereof.

[0052] Preferably, the clamp comprises interference means for restraining the free sliding at least of the cross bar or the lateral longitudinal bar inside the respective housing seat.

[0053] Preferably, the first and the second housing seats are arranged on parallel planes and extend along axial directions transverse to each other.

[0054] Preferably, the first seat is defined by a partially open groove formed in the main body.

[0055] Preferably, the second seat comprises a through hole inside the main body.

[0056] Preferably, the first seat is in communication with the second seat.

[0057] Preferably, the interference means project inwardly of the first or the second seat.

[0058] Preferably, the interference means comprise an elastic element adapted to exert a pressure force against the cross bar. Preferably, the elastic element is a protruding wire spring within the second housing seat.

[0059] Preferably, the interference means and the tightening means act within a respective housing. Each housing preferably extends along a direction orthogonal to the axial extension direction of the first and the second seats.

[0060] These and other features, as well as their technical advantages, will become more apparent from the following exemplifying, and not limiting description of a preferred, and not exclusive embodiment of an occipital-cervical fixation equipment.

[0061] Such description will be set forth hereinafter with reference to the accompanying drawings given only as an example and not intended as a limitation, in which:

- Figure 1 is a perspective schematic view of an occipital-cervical fixation equipment according to the present invention;
- Figures 2 and 3 show each a schematic front and rear perspective view, of a portion of the equipment of Figure 1;
- Figure 4 shows a sagittal section of the equipment of Figure 1;
- Figure 5 shows an enlarged detail of Figure 4;
- Figure 6 shows a perspective view of a detail of the equipment of Figure 1, 2 or 3;
- Figure 7 shows a schematic perspective view of a detail of the equipment of Figure 1, 2 or 3 with separated components;
- Figure 8 and Figure 9 shows sectional views of the detail of Figure 7,
- Figure 10 shows a schematic view of a way of employment of the occipital-cervical fixation equipment of Figure 1.

[0062] With reference to the attached figures, the number 1 globally indicates a vertebral fixation equipment, in particular an occipital-cervical fixation equipment. In the following, an occipital-cervical fixation equipment will be described.

[0063] The equipment 1 is adapted to the occipital-cervical connection, and then to be arranged between an occipital portion of the skull 100 of a patient and the vertebrae 101, in particular the cervical vertebrae. 102 indicates the spinous processes of the vertebrae, especially of the cervical vertebrae.

[0064] The equipment 1 comprises an occipital plate 2 adapted to be fixed to the occipital portion 100.

[0065] Preferably, the occipital plate 2, initially flat in shape, is shaped and curved according to the patient's anatomy.

[0066] In accordance with a possible embodiment, the occipital plate 2 presents a plurality of spikes 3, for example arranged along the edges of the occipital plate, configured and arranged so as to cling to the skullcap to ensure the primary stability and avoid the sliding of the plate itself.

[0067] In accordance with a possible embodiment, one or more lightening apertures 4 may be provided.

[0068] The occipital plate 2 also includes a fixing seat 5 adapted to receive an occipital screw 6 designed to secure the occipital plate 2 to the occipital portion 100.

[0069] The equipment 1 also includes two lateral longitudinal bars 7 adapted to be arranged in a sagittal direction "S" alongside the spinous processes 102 of the vertebrae 101.

[0070] Each lateral longitudinal bar 7 extends between an occipital end portion 7a and an vertebral end portion 7b.

[0071] 8 indicates the first fixation means configured to fix the occipital end portion 7a of each bar 7 to the occipital plate 2.

[0072] 9 indicates the second fixation means, shown schematically in Figure 10, configured to fix the bars 7 to a patient's vertebra. In case of severe damages to the cervical vertebrae, the second fixation means can be arranged in one of the lower vertebrae while providing stability and strength, as will be described below.

[0073] According to a possible embodiment, the second fixation means comprise polyaxial screws. An example of polyaxial screw is described and illustrated from page 8 to page 11 of the patent application MI2014A001383 by the Applicant.

[0074] 12 indicates a transverse connector comprising a central longitudinal bar 13 and a cross bar 14 coupled with the central longitudinal bar 13, and arranged transversely to it. Preferably, the cross bar 14 extends perpendicularly relative to the central longitudinal bar 13.

[0075] Preferably, the central longitudinal bar 13 is arranged in a central position with respect to the cross bar 14 dividing it into two portions 14b having equal length.

[0076] Still more preferably, the transverse connector 12 is "T" shaped.

[0077] The central longitudinal bar 13 extends between an occipital end portion 13a and a vertebral end portion 13b. Preferably, the central longitudinal bar 13 is straight.

[0078] The cross bar 14 extends between two lateral end portions 14a. Preferably, cross bar 14 is straight.

[0079] Preferably, the transverse connector 12 is made in two separate parts and assembled therebetween, each corresponding respectively to the central longitudinal bar 13 and to the cross bar 14. In this case, the cross bar 14 is preferably mounted at the extremity of the occipital end portion 13b of the bar 13. Still more preferably, the transverse rod 14 is mounted at a vertebral end of the bar 13.

[0080] In accordance with a possible embodiment, a coupling area "A" between the cross bar 14 and the central longitudinal bar 13 includes anti-rotation means, for example a polygonal seat 15 of the central longitudinal bar 13 and a polygonal portion 16 of the cross bar 14. Alternatively, the polygonal seat 15 may be coupled to the cross bar 14 and the polygonal portion 16 to the central longitudinal bar 13. Preferably, the transverse connector 12 comprises a fixation pin 17 interposed between the central longitudinal bar 13 and the cross bar 14, for example at the coupling area "A", to prevent relative sliding thereof.

[0081] In use, the central longitudinal bar 13 is arranged in the sagittal direction "S" between the two bars 7, and the cross bar 14 is arranged transversely to the bars 7, preferably in an area between the first fixation means 8 and second fixation means 9, so that the occipital end portion 13a lies at the occipital plate 2.

[0082] 18 indicates the third fixation means configured to fix the occipital end portion 13a of the central longitudinal bar 13 to the occipital plate 2.

[0083] In accordance with a possible embodiment, third fixation means 18 comprise an receiving and fixing bowl 19, or "tulip", coupled with the occipital plate 2 and having a groove 20 for inserting the occipital end portion 13a of the central longitudinal said bar 13. The groove 20 extends along a longitudinal direction 20a.

[0084] Preferably, the bowl 19 comprises a through opening 21 adapted to be placed in communication with the fixation seat 5 of the occipital plate 2 defining an housing for the occipital screw 6. Still more preferably, the through opening 21 communicates with the groove 20.

[0085] The through opening 21 extends along a longitudinal direction 21a, preferably perpendicular to the longitudinal direction 20a along which the groove 20 extends.

[0086] 22 indicates a fixing element, preferably a threaded fixing element, for fixing the occipital end portion 13a in the groove 20. The fixing element 22 is arranged on the opposite side of the through opening 21 with respect to the occipital end portion 13a so that, when in use, the occipital end portion 13a defines a stop for the occipital screw 6. When in use, the occipital end portion 13a is arranged perpendicularly to the occipital screw 6.

[0087] According to a possible embodiment, the bowl 19 comprises a fixing plate 23 provided with a centering portion 24 insertable into the fixing seat 5 of the occipital plate 2. The centering portion 24 is arranged around the through opening 21.

[0088] In accordance with a possible embodiment, the bowl 19 comprises a fixing plate 23 provided with at least a projecting portion 25 insertable in a recess 26 of the occipital plate 2 to prevent the rotation of the bowl 19.

[0089] 27 refers to fourth fixation means configured to fix the lateral end portions 14a of the cross bar 14 respectively to one of two longitudinal lateral bars 7. Preferably, the forth fixation means 27 comprise, for each of the lateral end portions 14a of the cross bar 14, a clamp 28 slidably constrainable to the cross bar 14 and the respective lateral longitudinal bar 7.

[0090] Preferably, the clamp 28 comprises a main body 29 and at least a first housing seat 30 and a second housing seat 31, formed inside the main body 29. The first and second housing seat are able to receive respectively one of the lateral longitudinal bars 7 and the cross bar 14.

[0091] The clamp 28 comprises also tightening means 32 for locking the cross bar 14 and the respective lateral longitudinal bar 7 in an operative position with respect to the main body 29 and preventing the relative movements thereof.

[0092] The clamp 28 comprises also interference means 33 for restraining the free sliding at least of the cross bar 14 or the lateral longitudinal bar 7 within the respective housing seat.

[0093] The first and the second housing seats are arranged on parallel planes and extend along axial directions transverse to each other.

[0094] Preferably, the first seat 30 is defined by a partially open groove formed in the main body 29.

[0095] Preferably, the second seat 31 comprises a through hole within the main body 29.

[0096] The first seat 30 is in communication with the second seat 31.

[0097] Preferably, the interference means 33 project inwardly of the first 30 or the second 31 seat. Preferably, the interference means 33 comprise an elastic element

able to exert a pressure force against the cross bar 14. Preferably, the elastic element is a protruding wire spring within the second housing seat 31.

[0098] Preferably, the interference means 33 and the tightening means 32 act inside a respective housing 34, 35, each extending along a direction orthogonal to the axial extension direction of the first and said second seats.

[0099] The transverse connector connects the occiput and the cervical vertebrae through the central longitudinal bar. The cross bar ensures the connection with the cervical implant by means of the two clamps 28. The transverse connector bypasses the damaged cervical vertebrae creating a safe connection directly on the longitudinal lateral bars.

[0100] Furthermore, the occipital-cervical loads are transmitted through three bars generating a better distribution of loads, in particular of sagittal forces.

[0101] When in use, the occipital plate is shaped and curved according to the patient's anatomy. The spikes, if any, ensure the primary stability, preventing them from slipping on the skullcap. Once constrained, the plate is connected to the lateral longitudinal bars through adjustable clamps, for example.

[0102] Before the system is completely locked, an adjustment of the clamps 28 along the cross bar and the lateral longitudinal bars allows the best fit to the system.

[0103] In the general case of a vertebral fixation equipment, the two lateral longitudinal bars 7 and the transverse connector 12 are provided, for example.

[0104] The first fixation means 8 are configured to secure in place, for example at a vertebra, the end occipital portion 7a of each lateral longitudinal bar 7.

[0105] The second fixation means 9 are configured to fix in place the vertebral end portion 7b of each lateral longitudinal bar 7 to a patient's vertebra.

[0106] The third fixation means 18 are configured to fix in place the occipital end portion 13a of the central longitudinal bar 13, for example in correspondence of a transverse connection between the two lateral longitudinal bars 7.

[0107] The fourth fixation means 27 are configured to fix the lateral end portions 14a of the cross bar 14 respectively to one of two longitudinal lateral bars 7.

[0108] The embodiments described above with reference to the occipital-cervical fixation equipment shall also apply to this possible aspect of the invention, especially the embodiments corresponding to one or more of the dependent claims envisaged for the occipital-cervical fixation equipment.

Claims

1. Occipital-cervical fixation equipment (1) comprising:

- an occipital plate (2) able to be fixed to an occipital portion (100) of the skull of a patient;
- two longitudinal lateral bars (7) able to be arranged in a sagittal direction (S) alongside the spinous processes (102) of the vertebrae (101) of the patient, each longitudinal lateral bar (7) extending between an occipital end portion (7a) and a vertebral end portion (7b);
- first fixation means (8) configured to fix said occipital end portion (7a) of each longitudinal lateral bar (7) and said occipital plate (2);
- second fixation means (9) configured to fix said longitudinal lateral bars (7) to a patient's vertebra;
- a transverse connector (12) comprising:
  - a central longitudinal bar (13) able to be arranged according to the sagittal direction (S) between the two longitudinal lateral bars (7), said central longitudinal bar (13) extending between an occipital end portion (13a) and a vertebral end portion (13b), and
  - a cross bar (14) associated with said central longitudinal bar (13) and extending transversely thereto between two lateral end portions (14a),
- third fixation means (18) configured to fix said occipital end portion (13a) of said longitudinal central bar (13) to said occipital plate (2);
- fourth fixation means (27) configured to fix said lateral end portions (14a) of the cross bar (14) respectively to one of two longitudinal lateral bars (7).

2. Occipital-cervical fixation equipment according to claim 1, wherein said third fixation means (18) comprise a receiving and fixing bowl or "tulip" (19) coupled with said occipital plate (2) and comprising a groove (20) for inserting the occipital end portion (13a) of said central longitudinal said bar (13).

3. Occipital-cervical fixation equipment according to claim 2, wherein said bowl (19) comprises a through opening (21) able to be placed in communication with a fixation seat (5) of said occipital plate (2) to define an housing for an occipital screw (6).

4. Occipital-cervical fixation equipment according to claim 3, wherein said through opening (21) communicates with said groove (20) for inserting the occipital end portion (13a) of said central longitudinal said bar (13).

5. Occipital-cervical fixation equipment according to claim 4, wherein said bowl (19) comprises a preferably threaded fixing element (22) for fixing the occipital end portion (13a) of said central longitudinal bar (13) within the groove (20), said fixing element (22) being arranged on the opposite side of said

through opening (21) with respect to the occipital end portion (13a) of said central longitudinal bar (13), whereby the end occipital portion (13a) is able to define, when in use, a stop for the occipital screw (6).

6. Occipital-cervical fixation equipment according to one or more of claims from 3 to 5, wherein said bowl (19) comprises a fixing plate (23) provided with a centering portion (24) insertable into the fixing seat (5) of the occipital plate (2).

7. Occipital-cervical fixation equipment according to one or more of claims from 2 to 6, wherein said bowl (19) comprises a fixing plate (23) provided with at least a projecting portion (25) insertable into a recess (26) of the occipital plate (2).

8. Occipital-cervical fixation equipment according to one or more of the preceding claims, wherein said cross bar (14) extends perpendicularly to the central longitudinal bar (13).

9. Occipital-cervical fixation equipment according to one or more of the preceding claims, wherein said central longitudinal bar (13) is arranged centrally with respect to the cross bar (14) dividing it into two portions (14a) having equal length.

10. Occipital-cervical fixation equipment according to one or more of the preceding claims, wherein said transverse connector (12) has a "T" shape.

11. Occipital-cervical fixation equipment according to one or more of the preceding claims, wherein said cross bar (14) is curved and/or said central longitudinal bar (13) is straight.

12. Occipital-cervical fixation equipment according to one or more of the preceding claims, wherein said cross bar (14) is mounted at the vertebral end portion (13b) of the central longitudinal bar (13), preferably at a vertebral end of the central longitudinal bar (13).

13. Occipital-cervical fixation equipment according to claim 12, wherein a coupling zone (A) between said cross bar (14) and said central longitudinal bar (13) includes anti-rotation means, for example a polygonal seat (15) and a polygonal portion (16) associated to the central longitudinal bar (13) and to the cross bar (14), respectively, or vice versa.

14. Occipital-cervical fixation equipment according to claim 12 or 13, wherein said transverse connector (12) comprises a fixation pin (17) interposed between the central longitudinal bar (13) and the cross bar (14) to prevent relative sliding thereof.

15. Occipital-cervical fixation equipment according to one or more of the preceding claims, wherein said fourth fixation means (27) include, for each lateral end portion (14a) of the cross bar (14), a clamp (28) slidably constrainable to the cross bar (14) and a respective longitudinal lateral bar (7), wherein said clamp (28) comprises:

a main body (29);
at least a first (30) and a second (31) housing seats, formed within said main body (29) and suitable to receive one of the longitudinal lateral bars (7) and the cross bar (14), respectively;
tightening means (32) for locking the cross bar (14) and the respective lateral longitudinal bar (7) in an operative position with respect to said main body (29) and to prevent the relative movements thereof;
interference means (33) for restraining the free sliding at least of the cross bar (14) or the lateral longitudinal bar (7) inside the respective housing seat (30, 31).

16. Occipital-cervical fixation equipment according to claim 15, wherein said first (30) and said second (31) housing seats are arranged on parallel planes and extend along axial directions transverse to each other.

17. Occipital-cervical fixation equipment according to claim 15 or 16, wherein said first seat (30) is defined by a partially open groove formed in said main body (29).

18. Occipital-cervical fixation equipment according to one or more of claims 15-17, wherein said second seat (31) comprises a through hole inside said main body (29).

19. Occipital-cervical fixation equipment according to one or more of claims 15-18, wherein said first seat (30) is in communication with said second seat (31).

20. Occipital-cervical fixation equipment according to one or more of claims 15-19, wherein said interference means (33) project within said first (30) or said second (31) seat.

21. Occipital-cervical fixation equipment according to one or more of claims 15-20, wherein said interference means (33) comprise an elastic member able to apply a pressure force against said cross bar (14), wherein preferably said elastic member is a wire spring protruding within said second housing seat (31).

22. Occipital-cervical fixation equipment according to one or more of claims 15-21, wherein said interference means (33) and said tightening means (32) act

inside a respective housing (34, 35), each extending along a direction orthogonal to the axial extension direction of said first (30) and said second (31) seats.

23. Vertebral fixation equipment (1) for occipital-cervical fixation comprising:

- two longitudinal lateral bars (7) adapted to be arranged in a sagittal direction (S) to the sides of the spinous processes (102) of the vertebrae (101) of the patient, each longitudinal lateral bar (7) extending between an end occipital portion (7a) and an end vertebral portion (7b);
- first fixation means (8) configured to secure in place said end occipital portion (7a) of each lateral longitudinal bar (7);
- second fixation means (9) configured to secure in place said end vertebral portion (7b) of each lateral longitudinal bar (7) to a patient vertebra;
- a transverse connector (12) comprising:
  - a central longitudinal bar (13) adapted to be arranged according to the sagittal direction (S) between the two longitudinal lateral bars (7), said central longitudinal bar (13) extending between an end occipital portion (13a) and an end vertebral portion (13b), and
  - a cross bar (14) associated with said central longitudinal bar (13) and extending transversely thereto between two end side portions (14a),
- thirds fixation means (18) configured to secure in place said end occipital portion (13a) of said central longitudinal bar (13);
- fourth fixation means (27) configured to fix said end side portions (14a) of the cross bar (14) respectively to one of two longitudinal lateral bars (7).

Patentansprüche

1. Okzipital-Zervikale Fixierungsausrüstung (1), umfassend:

- eine Okzipitalplatte (2), die an einem Okzipitalabschnitt (100) des Schädels eines Patienten fixiert werden kann;
- zwei in einer sagittalen Richtung (S) entlang der Dornfortsätze (102) der Wirbel (101) des Patienten anordenbare Längsseitenstangen (7), wobei sich jede Längsseitenstange (7) zwischen einem Okzipitalendabschnitt (7a) und einen Wirbelendabschnitt (7b) erstreckt;
- erste Fixierungsmittel (8), die ausgelegt sind, um den Okziptalabschnitt (7a) jeder Längsseitenstange (7) und der Okzipitalplatte (2) zu fixieren;
- zweite Fixierungsmittel (9), die ausgelegt sind, um die Längsseitenstangen (7) an einem Wirbel eines Patienten zu fixieren;
- einen Querverbinder (12) umfassend:
  - eine Mittellängsstange (13), die nach der Sagittalrichtung (S) zwischen den beiden Längsseitenstangen (7) angeordnet werden kann, wobei sich die Mittellängsstange (13) zwischen einem Okzipitalendabschnitt (13a) und einem Wirbelendabschnitt (13b) erstreckt und
  - eine Querstange (14), die mit der Mittellängsstange (13) assoziiert ist und sich quer dazu zwischen zwei Seitenendabschnitten (14a) erstreckt,
- dritte Fixierungsmittel (18), die ausgelegt sind, um den Okzipitalendabschnitt (13a) der Längsmittelstange (13) an der Okzipitalplatte (2) zu fixieren;
- vierte Fixierungsmittel (27), die ausgelegt sind, um die Seitenendabschnitte (14a) der Querstange (14) jeweils an einer von zwei Längsseitenstangen (7) zu fixieren.

2. Okzipital-Zervikale Fixierungsausrüstung nach Anspruch 1, wobei die dritten Fixierungsmittel (18) eine Aufnahme- und Fixierschale oder "Tulpe" (19) umfassen, gekoppelt mit der Okzipitalplatte (2) und umfassend eine Nut (20) zum Einführen des Okzipitalendabschnitts (13a) der Mittellängsstange (13).

3. Okzipital-Zervikale Fixierungsausrüstung nach Anspruch 2, wobei die Schale (19) eine Durchgangsöffnung (21) umfasst, die mit einem Fixierungssitz (5) der Okzipitalplatte (2) in Kommunikation gebracht werden kann, um ein Gehäuse für eine Okzipitalschraube (6) zu definieren.

4. Okzipital-Zervikale Fixierungsausrüstung nach Anspruch 3, wobei die Durchgangsöffnung (21) mit der Nut (20) zum Einführen des Okzipitalendabschnitts (13a) der Mittellängsstange (13) kommuniziert.

5. Okzipital-Zervikale Fixierungsausrüstung nach Anspruch 4, wobei die Schale (19) ein vorzugsweise mit Gewinde versehenes Fixierelement (22) zum Fixieren des Okzipitalendabschnitts (13a) der Mittellängsstange (13) innerhalb der Nut (20) umfasst, wobei das Fixierelement (22) auf der gegenüberliegenden Seite der Durchgangsöffnung (21) in Bezug auf den Okzipitalendabschnitt (13a) der Mittellängsstange (13) angeordnet ist, wodurch der Okzipitalendabschnitt (13a), wenn im Gebrauch, einen Anschlag für die Okzipitalschraube (6) definieren kann.

6. Okzipital-Zervikale Fixierungsausrüstung nach einem oder mehreren der Ansprüche 3 bis 5, wobei die Schale (19) eine Fixierplatte (23) umfasst, die mit einem Zentrierabschnitt (24) versehen ist, der in den Fixiersitz (5) der Okzipitalplatte (2) einführbar ist.

7. Okzipital-Zervikale Fixierungsausrüstung nach einem oder mehreren der Ansprüche 2 bis 6, wobei die Schale (19) eine Fixierplatte (23) umfasst, die mit mindestens einem vorstehenden Abschnitt (25) versehen ist, der in eine Aussparung (26) des Okzipitalplatte (2) einführbar ist.

8. Okzipital-Zervikale Fixierungsausrüstung nach einem oder mehreren der vorhergehenden Ansprüche, wobei sich die Querstange (14) senkrecht zur Mittellängsstange (13) erstreckt.

9. Okzipital-Zervikale Fixierungsausrüstung nach einem oder mehreren der vorhergehenden Ansprüche, wobei die Mittellängsstange (13) in Bezug auf die Querstange (14) mittig angeordnet ist und sie in zwei Abschnitte (14a) gleicher Länge unterteilt.

10. Okzipital-Zervikale Fixierungsausrüstung nach einem oder mehreren der vorhergehenden Ansprüche, wobei der Querverbinder (12) eine "T" -Form aufweist.

11. Okzipital-Zervikale Fixierungsausrüstung nach einem oder mehreren der vorhergehenden Ansprüche, wobei die Querstange (14) gekrümmt ist und/oder die Mittellängsstange (13) gerade ist.

12. Okzipital-Zervikale Fixierungsausrüstung nach einem oder mehreren der vorhergehenden Ansprüche, wobei die Querstange (14) am Wirbelendabschnitt (13b) der Mittellängsstange (13), vorzugsweise an einem Wirbelende der Mittellängsstange (13) angebracht ist.

13. Okzipital-Zervikale Fixierungsausrüstung nach Anspruch 12, wobei ein Kopplungsbereich (A) zwischen der Querstange (14) und der Mittellängsstange (13) Drehsicherungsmittel, beispielsweise einen polygonalen Sitz (15) und einen polygonalen Abschnitt (16) beinhaltet, assoziiert jeweils mit der Mittellängsstange (13) und der Querstange (14) oder umgekehrt.

14. Okzipital-Zervikale Fixierungsausrüstung nach Anspruch 12 oder 13, wobei der Querverbinder (12) einen Fixierungsstift (17) umfasst, der zwischen der Mittellängsstange (13) und der Querstange (14) angeordnet ist, um dessen relatives Gleiten zu verhindern.

15. Okzipital-Zervikale Fixierungsausrüstung nach einem oder mehreren der vorhergehenden Ansprüche, wobei die vierten Fixierungsmittel (27) für jeden Seitenendabschnitt (14a) der Querstange (14) eine Klemme (28) beinhalten, die verschiebbar an der Querstange (14) und einer jeweilige Längsseitenstange (7) festgespannt werden kann, wobei die Klammer (28) umfasst:

einen Hauptkörper (29);
mindestens einen ersten (30) und einen zweiten (31) Gehäusesitz, ausgebildet innerhalb des Hauptkörpers (29) und dazu geeignet, jeweils eine der Längsseitenstangen (7) und die Querstange (14) aufzunehmen;
Spannmittel (32) zum Verriegeln der Querstange (14) und der jeweiligen Seitenlängsstange (7) in einer Betriebsposition in Bezug auf den Hauptkörper (29) und zum Verhindern dessen relativer Bewegungen;
Interferenzmittel (33) zum Vermeiden des freien Gleitens von mindestens der Querstange (14) oder der Seitenlängsstange (7) innerhalb des jeweiligen Gehäusesitzes (30, 31).

16. Okzipital-Zervikale Fixierungsausrüstung nach Anspruch 15, wobei der erste (30) und der zweite (31) Gehäusesitz an parallelen Ebenen angeordnet sind und sich entlang axialer Richtungen quer zueinander erstrecken.

17. Okzipital-Zervikale Fixierungsausrüstung nach Anspruch 15 oder 16, wobei der erste Sitz (30) durch eine teilweise offene Nut definiert ist, die in dem Hauptkörper (29) ausgebildet ist.

18. Okzipital-Zervikale Fixierungsausrüstung nach einem oder mehreren der Ansprüche 15-17, wobei der zweite Sitz (31) ein Durchgangsloch innerhalb des Hauptkörpers (29) umfasst.

19. Okzipital-Zervikale Fixierungsausrüstung nach einem oder mehreren der Ansprüche 15-18, wobei der erste Sitz (30) mit dem zweiten Sitz (31) in Kommunikation steht.

20. Okzipital-Zervikale Fixierungsausrüstung nach einem oder mehreren der Ansprüche 15-19, wobei die Interferenzmittel (33) innerhalb des ersten (30) oder des zweiten (31) Sitzes vorstehen.

21. Okzipital-Zervikale Fixierungsausrüstung nach einem oder mehreren der Ansprüche 15-20, wobei die Interferenzmittel (33) ein elastisches Element umfassen, das eine Druckkraft gegen die Querstange (14) ausüben kann, wobei das elastische Element vorzugsweise eine Drahtfeder ist, die in den zweiten Gehäusesitz (31) hineinragt.

22. Okzipital-Zervikale Fixierungsausrüstung nach einem oder mehreren der Ansprüche 15-21, wobei die Interferenzmittel (33) und die Spannmittel (32) in einem jeweiligen Gehäuse (34, 35) einwirken, die sich jeweils entlang einer Richtung senkrecht zur axialen Erstreckungsrichtung des ersten (30) und des zweiten (31) Sitzes erstrecken.

23. Wirbelfixierungsausrüstung (1) zur okzipitalzervikalen Fixierung, umfassend:

- zwei Längsseitenstangen (7), die angepasst sind, um in einer sagittalen Richtung (S) auf die Seiten der Dornfortsätze (102) der Wirbel (101) des Patienten angeordnet zu werden, wobei sich jede Längsseitenstange (7) zwischen einem Endokzipitalabschnitt (7a) und ein Endwirbelabschnitt (7b) erstreckt;
- erste Fixierungsmittel (8), die ausgelegt sind, um den Endokzipitalabschnitt (7a) jeder Seitenlängsstange (7) an Ort und Stelle zu befestigen;
- zweite Fixierungsmittel (9), die ausgelegt sind, um den Endwirbelabschnitt (7b) jeder Seitenlängsstange (7) an einem Patientenwirbel an Ort und Stelle zu befestigen;
- einen Querverbinder (12) umfassend:

  - eine Mittellängsstange (13), die angepasst ist, um nach der Sagittalrichtung (S) zwischen den zwei Seitenlängsstangen (7) angeordnet zu werden, wobei sich die Mittellängsstange (13) zwischen einem Endokzipitalabschnitt (13a) und einem Endwirbelabschnitt (13b) erstrecken und
  - eine Querstange (14), die mit der Mittellängsstange (13) assoziiert ist und sich quer dazu zwischen zwei Endseitenabschnitten (14a) erstreckt,

- dritte Fixierungsmittel (18), die ausgelegt sind, um den Endokzipitalabschnitt (13a) der Mittellängsstange (13) an Ort und Stelle zu befestigen;
- vierte Fixierungsmittel (27), die ausgelegt sind, um die Endseitenabschnitte (14a) der Querstange (14) jeweils an einer von zwei Längsseitenstangen (7) zu fixieren.

Revendications

1. Équipement de fixation (1) occipito-cervicale comprenant :

- une plaque occipitale (2) pouvant être fixée à une partie occipitale (100) du crâne d'un patient ;
- deux barres (7) longitudinales latérales pouvant être disposées dans une direction sagittale (S) le long des apophyses épineuses (102) des vertèbres (101) du patient, chaque barre (7) longitudinale latérale se prolongeant entre une partie occipitale d'extrémité (7a) et une partie vertébrale d'extrémité (7b) ;
- des premiers moyens de fixation (8) configurés pour fixer ladite partie occipitale d'extrémité (7a) de chaque barre (7) longitudinale latérale et ladite plaque occipitale (2) ;
- des seconds moyens de fixation (9) configurés pour fixer lesdites barres (7) longitudinales latérales à une vertèbre d'un patient ;
- un connecteur transversal (12) comprenant :

  - une barre (13) longitudinale centrale pouvant être disposée selon la direction sagittale (S) entre les deux barres (7) longitudinales latérales, ladite barre (13) longitudinale centrale se prolongeant entre une partie occipitale d'extrémité (13a) et une partie vertébrale d'extrémité (13b), et
  - une barre transversale (14) associée à ladite barre (13) longitudinale centrale et se prolongeant transversalement à celle-ci entre deux parties latérales d'extrémité (14a),

- des troisièmes moyens de fixation (18) configurés pour fixer ladite partie occipitale d'extrémité (13a) de ladite barre (13) longitudinale centrale à ladite plaque occipitale (2) ;
- des quatrièmes moyens de fixation (27) configurés pour fixer lesdites parties latérales d'extrémité (14a) de la barre transversale (14) respectivement à l'une des deux barres (7) longitudinales latérales.

2. Équipement de fixation occipito-cervicale selon la revendication 1, dans lequel lesdits troisièmes moyens de fixation (18) comprennent un bol de réception et de fixation ou « tulipe » (19) couplé à ladite plaque occipitale (2) et comprenant une rainure (20) pour l'introduction de la partie occipitale d'extrémité (13a) de ladite barre (13) longitudinale centrale.

3. Équipement de fixation occipito-cervicale selon la revendication 2, dans lequel ledit bol (19) comprend une ouverture débouchante (21) pouvant être placée en communication avec un siège de fixation (5) de ladite plaque occipitale (2) pour définir un logement pour une vis occipitale (6).

4. Équipement de fixation occipito-cervicale selon la revendication 3, dans lequel ladite ouverture débouchante (21) communique avec ladite rainure (20) pour l'introduction de la partie occipitale d'extrémité (13a) de ladite barre (13) longitudinale centrale.

5. Équipement de fixation occipito-cervicale selon la revendication 4, dans lequel ledit bol (19) comprend, de préférence, un élément de fixation fileté (22) pour fixer la partie occipitale d'extrémité (13a) de ladite barre (13) longitudinale centrale à l'intérieur de la rainure (20), ledit élément de fixation (22) étant disposé sur le côté opposé de ladite ouverture débouchante (21) par rapport à la partie occipitale d'extrémité (13a) de ladite barre (13) longitudinale centrale, par laquelle la partie occipitale d'extrémité (13a) peut définir, durant son utilisation, une butée pour la vis occipitale (6) .

6. Équipement de fixation occipito-cervicale selon l'une ou plusieurs des revendications de 3 à 5, dans lequel ledit bol (19) comprend une plaque de fixation (23) pourvue d'une partie de centrage (24) pouvant être introduite dans le siège de fixation (5) de la plaque occipitale (2).

7. Équipement de fixation occipito-cervicale selon l'une ou plusieurs des revendications de 2 à 6, dans lequel ledit bol (19) comprend une plaque de fixation (23) pourvue d'au moins une partie en saillie (25) pouvant être introduite dans un renfoncement (26) de la plaque occipitale (2).

8. Équipement de fixation occipito-cervicale selon l'une ou plusieurs des revendications précédentes, dans lequel ladite barre transversale (14) se prolonge perpendiculairement à la barre (13) longitudinale centrale.

9. Équipement de fixation occipito-cervicale selon l'une ou plusieurs des revendications précédentes, dans lequel ladite barre (13) longitudinale centrale est disposée centralement par rapport à la barre transversale (14) en la divisant en deux parties (14a) de longueurs égales.

10. Équipement de fixation occipito-cervicale selon l'une ou plusieurs des revendications précédentes, dans lequel le dit connecteur transversal (12) a une forme en « T ».

11. Équipement de fixation occipito-cervicale selon l'une ou plusieurs des revendications précédentes, dans lequel ladite barre transversale (14) est incurvée et/ou ladite barre (13) longitudinale centrale est rectiligne.

12. Équipement de fixation occipito-cervicale selon l'une ou plusieurs des revendications précédentes, dans lequel ladite barre transversale (14) est montée à la partie vertébrale d'extrémité (13b) de la barre (13) longitudinale centrale, de préférence, à une extrémité vertébrale de la barre (13) longitudinale centrale.

13. Équipement de fixation occipito-cervicale selon la revendication 12, dans lequel une zone d'accouplement (A) entre ladite barre transversale (14) et ladite barre (13) longitudinale centrale inclut des moyens antirotation, par exemple un siège polygonal (15) et une partie polygonale (16) associés, respectivement, à la barre (13) longitudinale centrale et à la barre transversale (14) ou vice versa.

14. Équipement de fixation occipito-cervicale selon la revendication 12 ou 13, dans lequel ledit connecteur transversal (12) comprend une cheville de fixation (17) interposée entre la barre (13) longitudinale centrale et la barre transversale (14) pour empêcher son coulissement relatif.

15. Équipement de fixation occipito-cervicale selon l'une ou plusieurs des revendications précédentes, dans lequel lesdits quatrièmes moyens de fixation (27) incluent, pour chaque partie latérale d'extrémité (14a) de la barre transversale (14), un collier (28) solidaire de façon coulissante de la barre transversale (14) et d'une barre (7) longitudinale latérale, dans lequel ledit collier (28) comprend :

un corps principal (29) ;
au moins des premier (30) et second (31) sièges de logement formés à l'intérieur dudit corps principal (29) et adaptés pour recevoir, respectivement, une des barres (7) longitudinales latérales et la barre transversale (14) ;
des moyens de serrage (32) pour bloquer la barre transversale (14) et la barre (7) longitudinale latérale respective dans une position fonctionnelle par rapport au dit corps principal (29) et pour en empêcher les déplacements relatifs ;
des moyens d'interférence (33) pour restreindre le coulissement libre au moins de la barre transversale (14) ou de la barre (7) longitudinale latérale à l'intérieur du siège de logement (30, 31) respectif.

16. Équipement de fixation occipito-cervicale selon la revendication 15, dans lequel lesdits premier (30) et second (31) sièges de logement sont disposés sur des plans parallèles et se prolongent le long de directions axiales réciproquement transversales.

17. Équipement de fixation occipito-cervicale selon la revendication 15 ou 16, dans lequel ledit premier siège (30) est défini par une rainure partiellement ouverte formée dans ledit corps principal (29).

18. Équipement de fixation occipito-cervicale selon l'une ou plusieurs des revendications 15-17, dans lequel ledit second siège (31) comprend un trou débouchant à l'intérieur dudit corps principal (29).

19. Équipement de fixation occipito-cervicale selon l'une ou plusieurs des revendications 15-18, dans lequel ledit premier siège (30) est en communication avec ledit second siège (31).

20. Équipement de fixation occipito-cervicale selon l'une ou plusieurs des revendications 15-19, dans lequel lesdits moyens d'interférence (33) dépassent à l'intérieur dudit premier (30) ou dudit second (31) siège.

21. Équipement de fixation occipito-cervicale selon l'une ou plusieurs des revendications 15-20, dans lequel lesdits moyens d'interférence (33) comprennent un organe élastique pouvant appliquer une force de pression contre ladite barre transversale (14), dans lequel, de préférence, ledit organe élastique est un ressort en fil métallique dépassant à l'intérieur dudit second siège de logement (31).

22. Équipement de fixation occipito-cervicale selon l'une ou plusieurs des revendications 15-21, dans lequel lesdits moyens d'interférence (33) et lesdits moyens de serrage (32) agissent à l'intérieur d'un logement (34, 35) respectif, chacun se prolongeant le long d'une direction orthogonale à la direction d'extension axiale desdits premier (30) et second (31) sièges.

23. Équipement de fixation vertébrale (1) pour une fixation occipito-cervicale comprenant :

- deux barres (7) longitudinales latérales adaptées pour être disposées dans une direction sagittale (S) aux côtés des apophyses épineuses (102) des vertèbres (101) du patient, chaque barre (7) longitudinale latérale se prolongeant entre une partie occipitale d'extrémité (7a) et une partie vertébrale d'extrémité (7b) ;
- des premiers moyens de fixation (8) configurés pour fixer ladite partie occipitale d'extrémité (7a) de chaque barre (7) longitudinale latérale ;
- des seconds moyens de fixation (9) configurés pour fixer ladite partie vertébrale d'extrémité (7b) de chaque barre (7) longitudinale latérale à une vertèbre d'un patient ;
- un connecteur transversal (12) comprenant :
  - une barre (13) longitudinale centrale adaptée pour être disposée selon la direction sagittale (S) entre les deux barres (7) longitudinales latérales, ladite barre (13) longitudinale centrale se prolongeant entre une partie occipitale d'extrémité (13a) et une partie vertébrale d'extrémité (13b), et
  - une barre transversale (14) associée à ladite barre (13) longitudinale centrale et se prolongeant transversalement à celle-ci entre deux parties latérales d'extrémité (14a),
- des troisièmes moyens de fixation (18) configurés pour fixer ladite partie occipitale d'extrémité (13a) de ladite barre (13) longitudinale centrale ;
- des quatrièmes moyens de fixation (27) configurés pour fixer lesdites parties latérales d'extrémité (14a) de la barre transversale (14) respectivement à l'une des deux barres (7) longitudinales latérales.

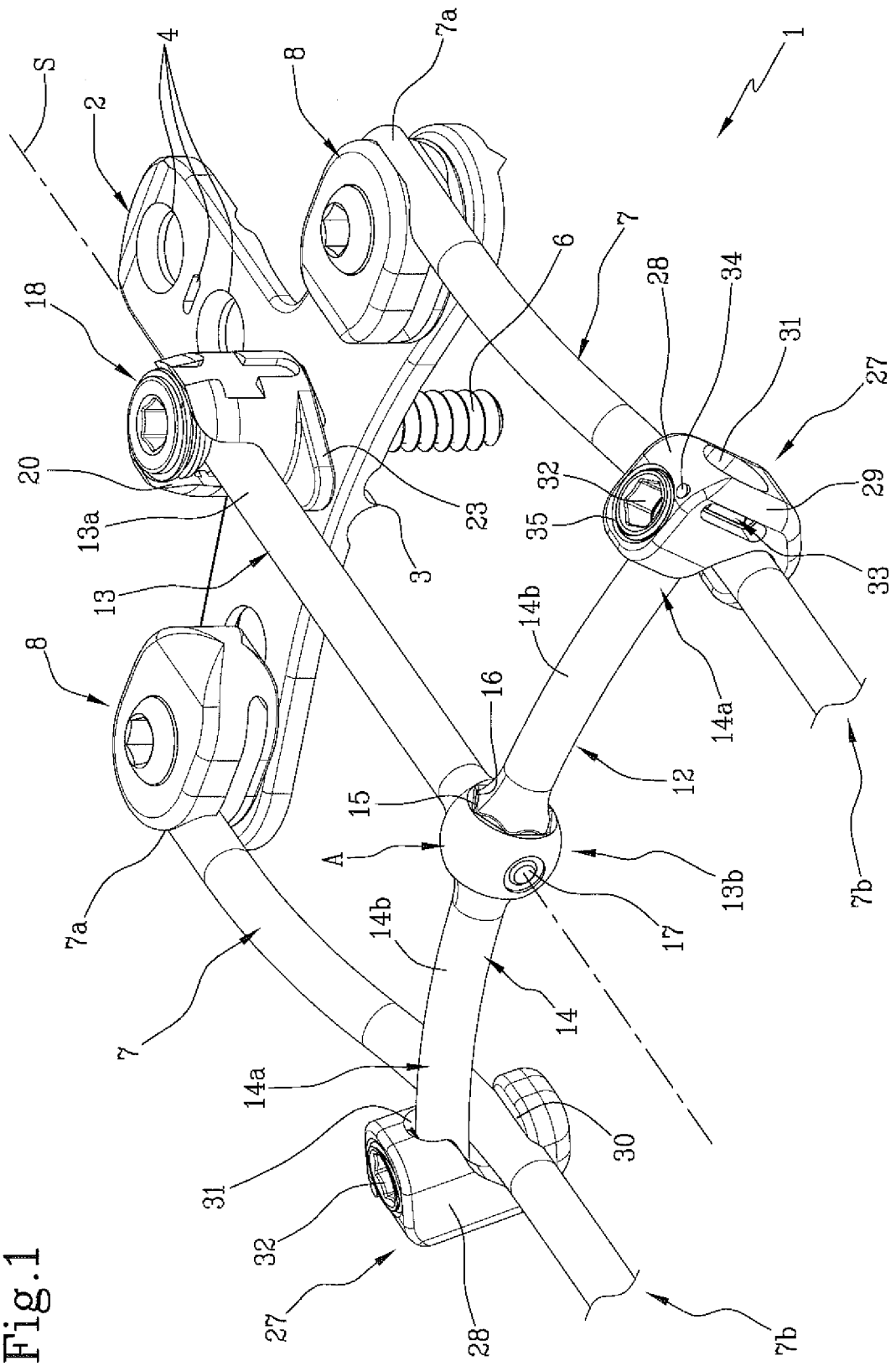
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Fig.1

Fig.3

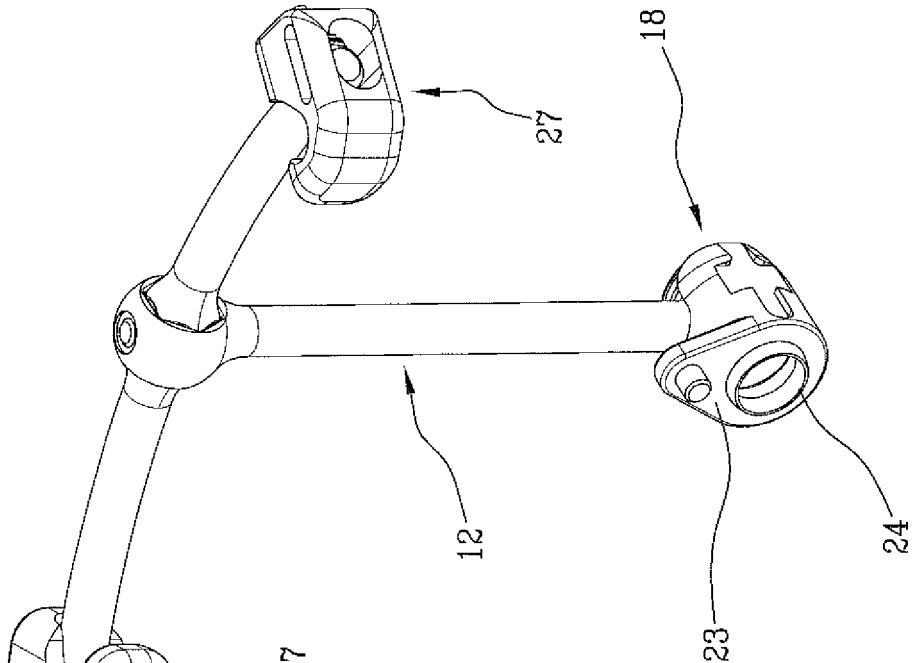
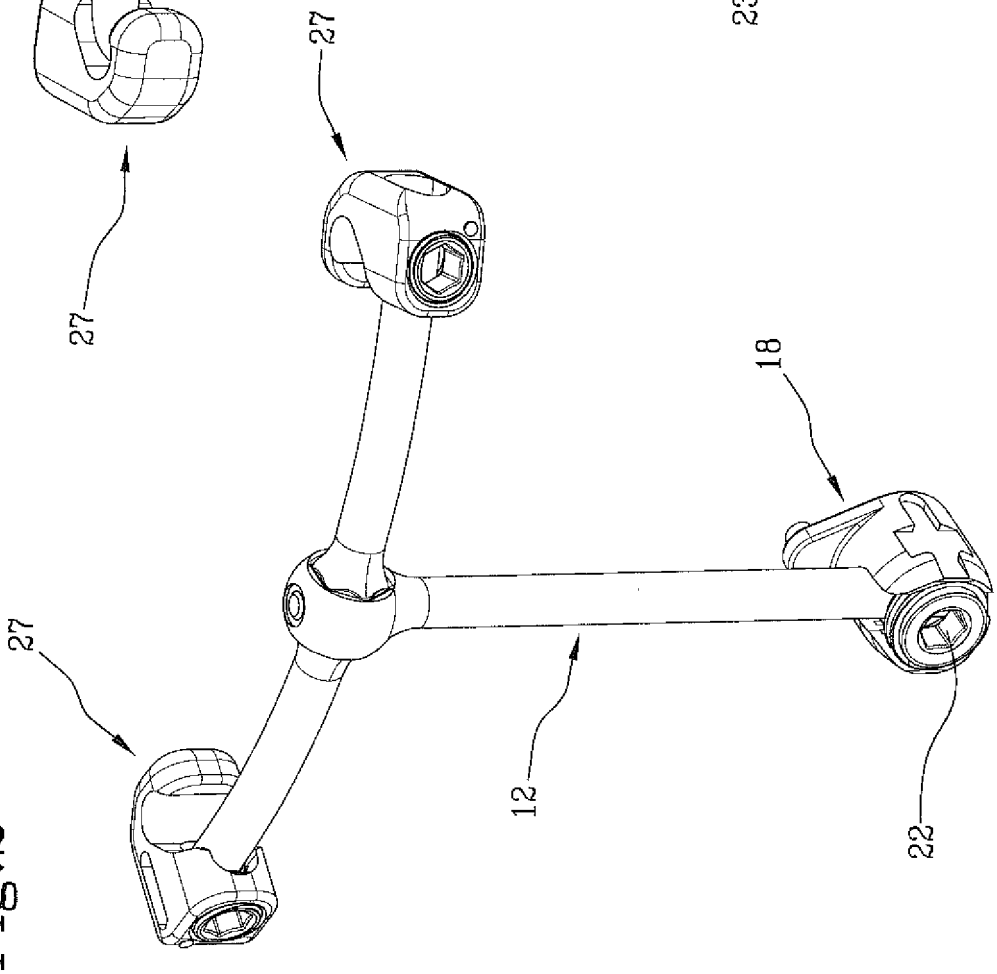


Fig.2



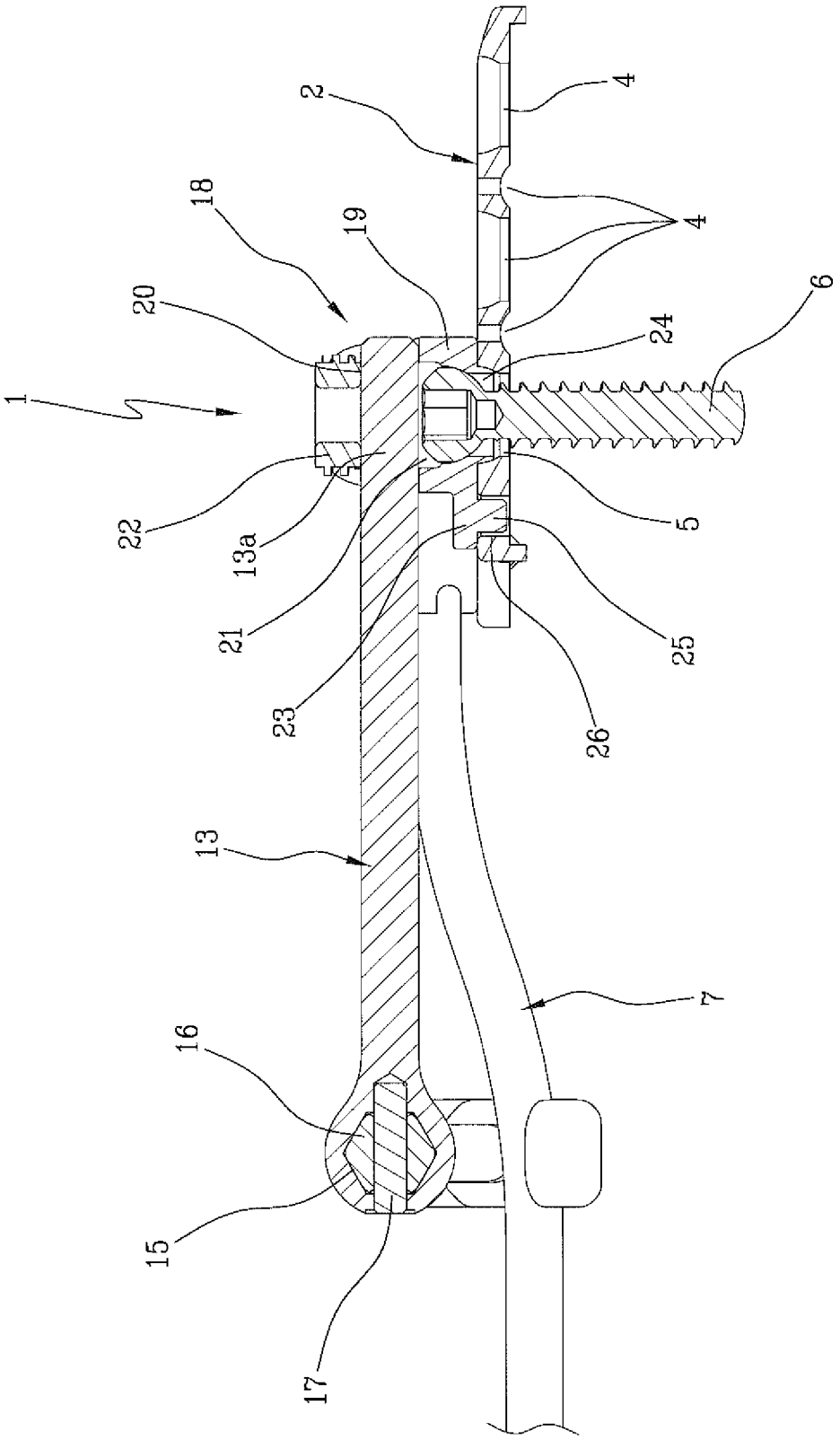


Fig.4

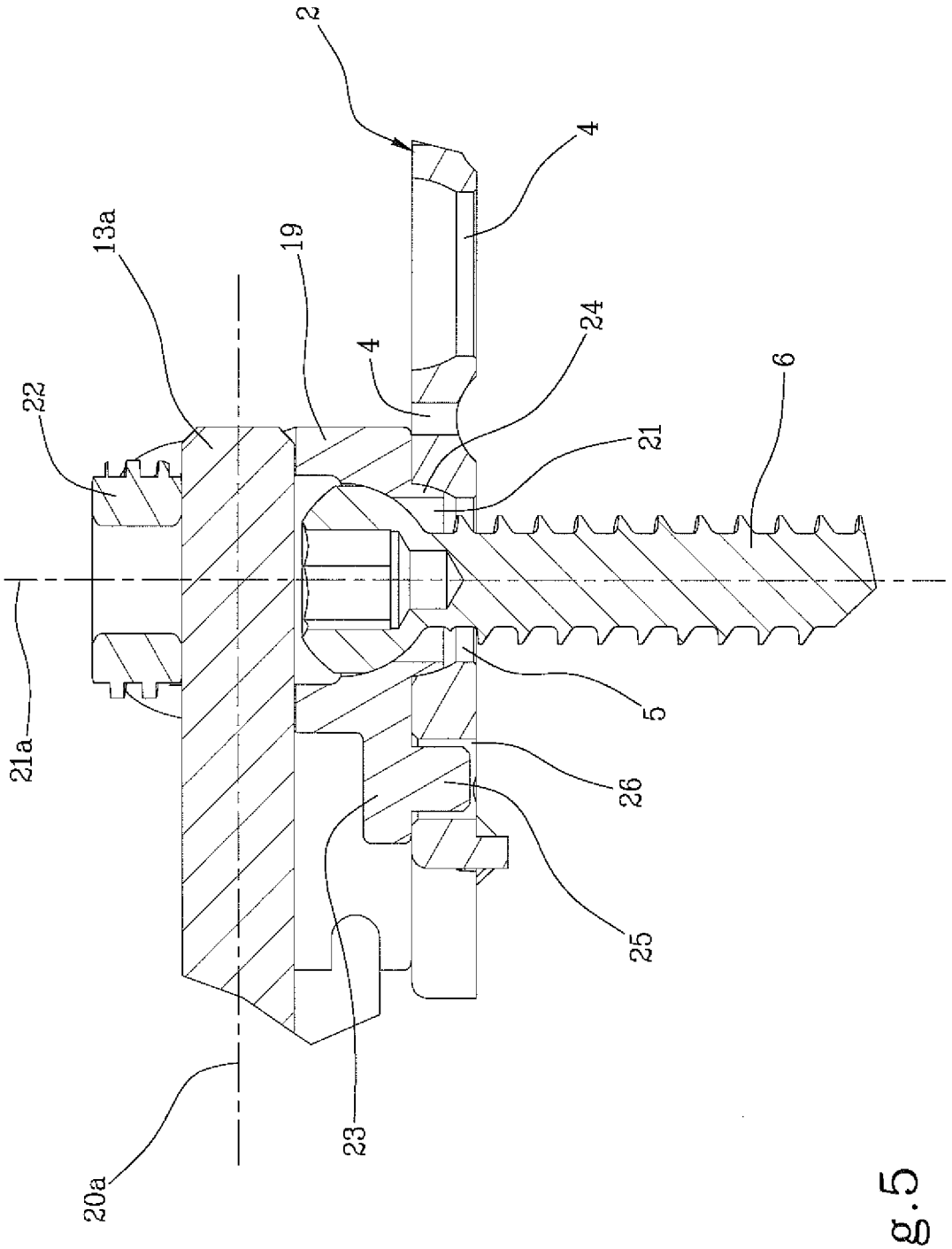


Fig.5

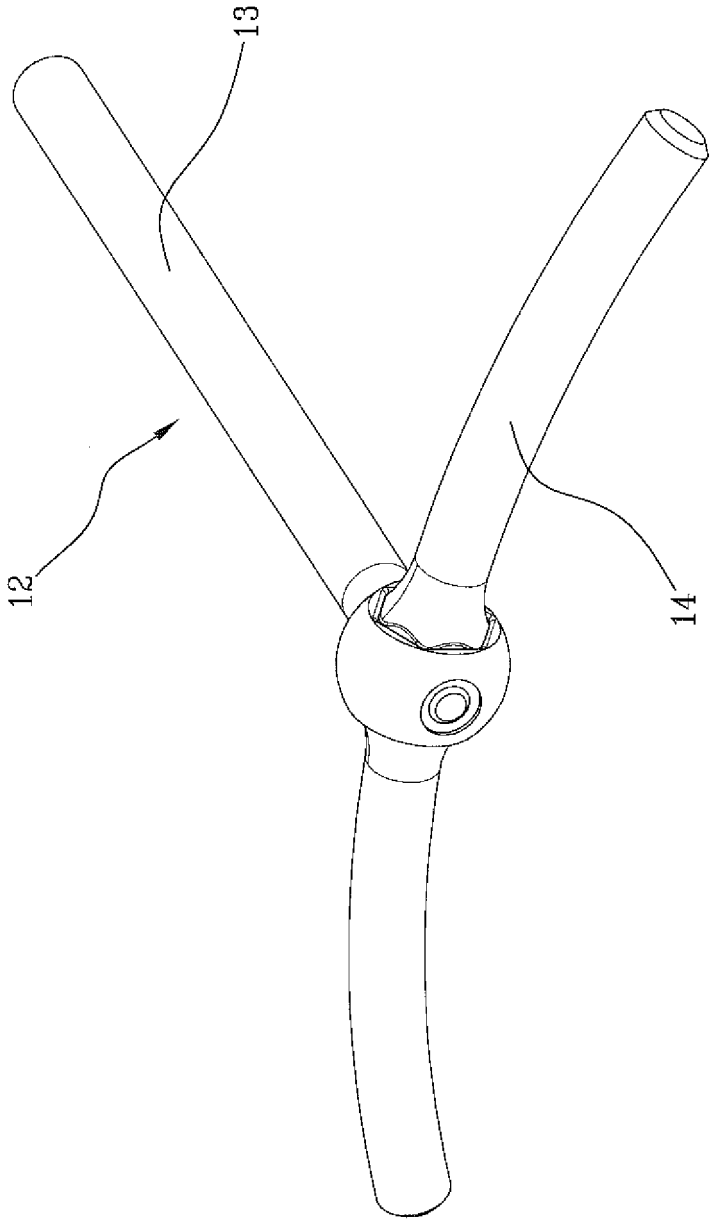


Fig.6

Fig.7

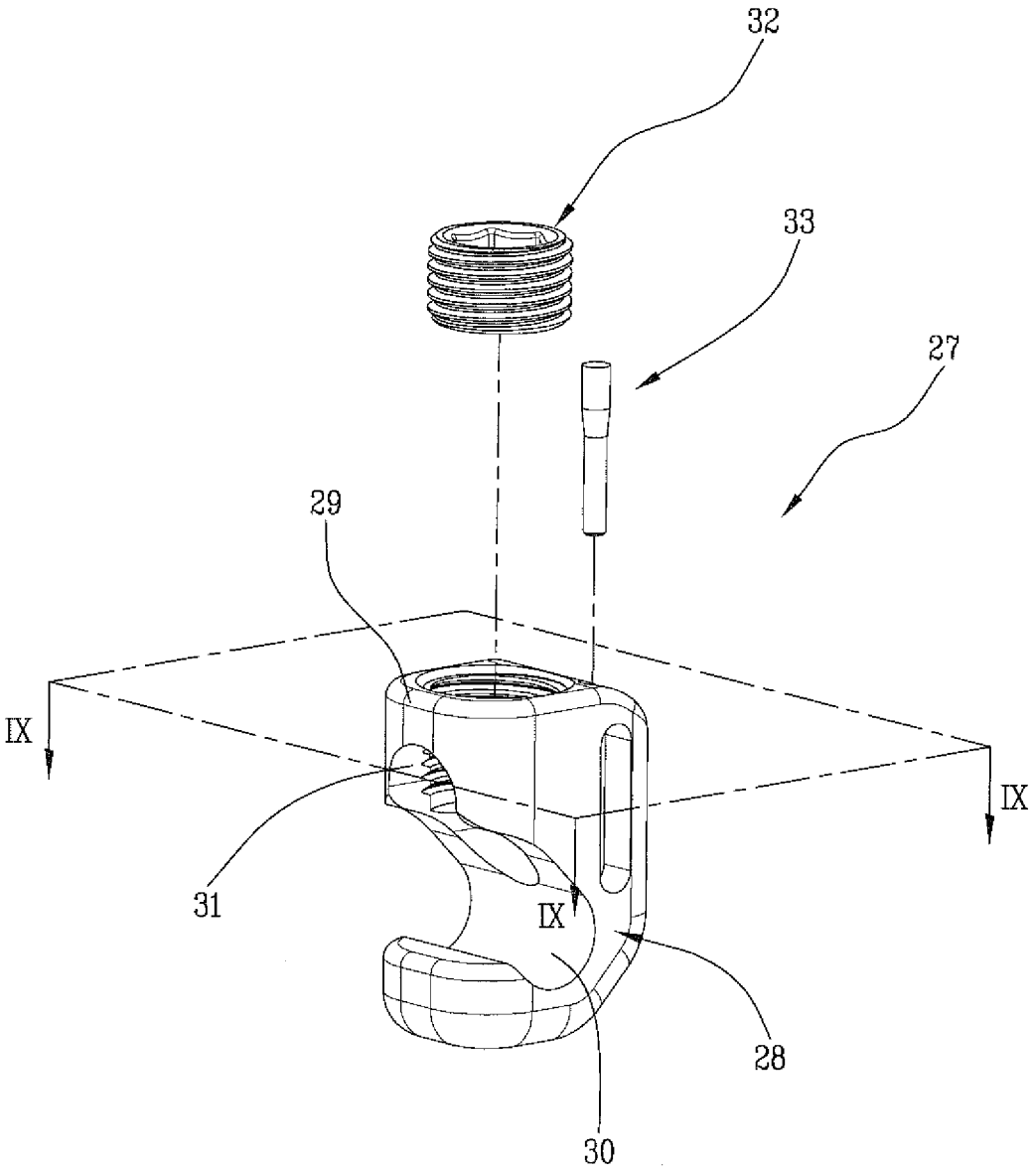


Fig.8

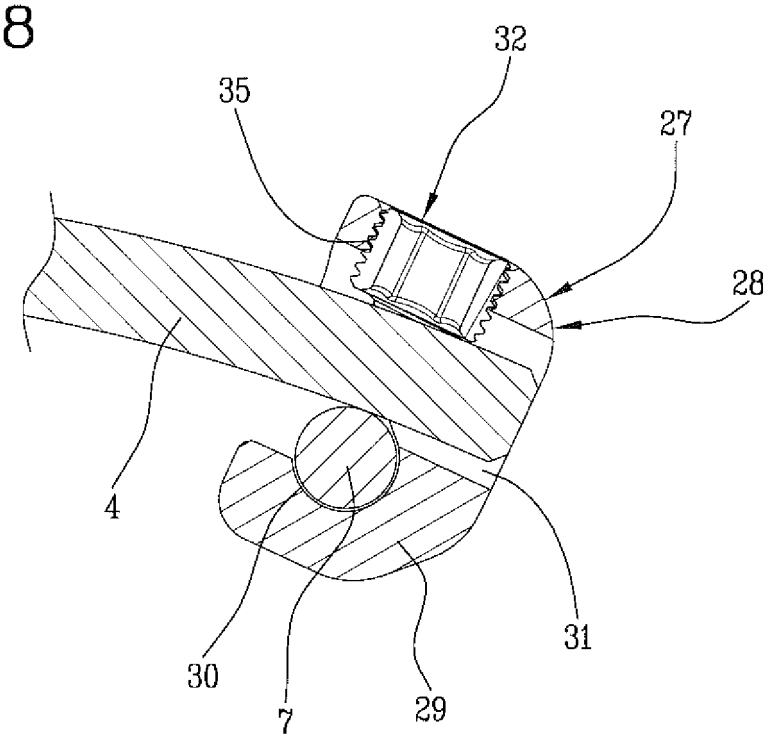


Fig.9

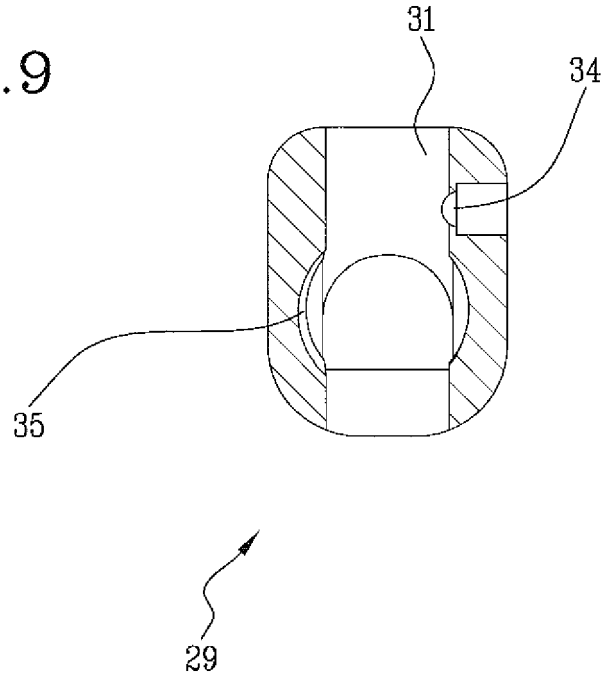
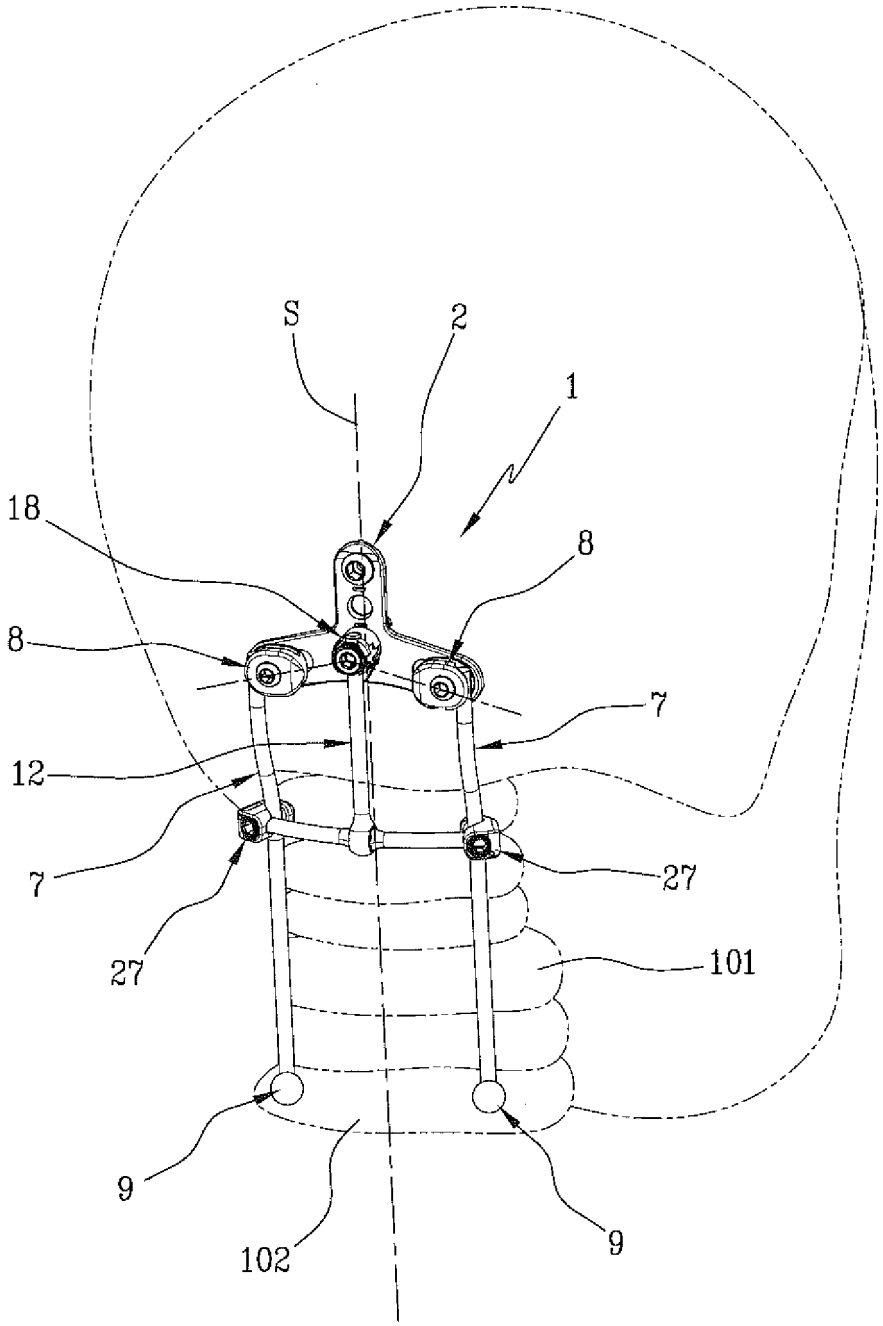


Fig.10



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Patent documents cited in the description

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