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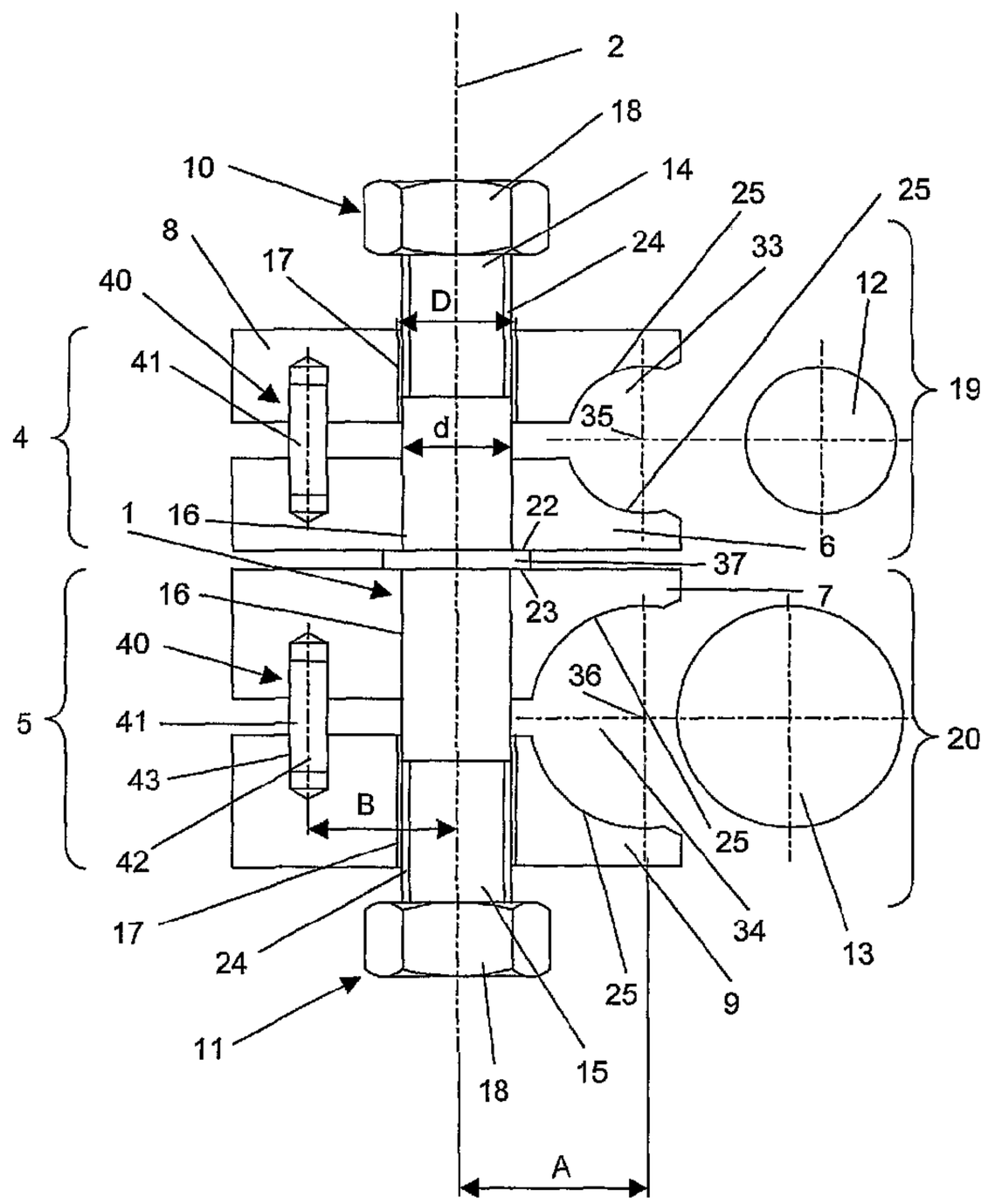
(54) Titre : DOUBLE MACHOIRE A FERMETURE ELASTIQUE POUR FIXATEUR EXTERNE
(54) Title: DOUBLE JAWS WITH AN ELASTIC CLOSING ACTION FOR DISTRACTION-COMPRESSION APPARATUS



(57) Abrégé/Abstract:
The invention relates to a device for clamping and releasing fixing elements (12;13) in a surgical fixing or repositioning device. Said device comprises: A) a cylindrical or prismatic rod (1) with a longitudinal axis (2), a first end (14), a second end (15), a first rod segment (19) that adjoins the first end (14) and a second rod segment (20) that adjoins the second end (15); B) a first pair of clamping jaws (4) that can be displaced along the first rod segment (19) coaxially with the longitudinal axis (2); C) a second pair of

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(57) Abrégé(suite)/Abstract(continued):
clamping jaws (5) that can be displaced along the second rod segment (20) coaxially with the longitudinal axis (2); whereby; D) both pairs of clamping jaws (4;5) comprise a respective inner clamping jaw (6;7) and an outer clamping jaw (8;9) that faces the ends (14;15) and the respective clamping jaws (6;7;8;9) of each pair of clamping jaws (4;5) have opposing gripping surfaces (29;30;31;32); E) A gripping element (10;11) for clamping and releasing fixing elements (12;13) in a surgical fixing or repositioning device is mounted between two opposing gripping surfaces (29;30;31;32); and F) an elastic element (40) is located between a respective inner and outer clamping jaw (6;8;7;9), interconnecting the latter (6,8;7,9).

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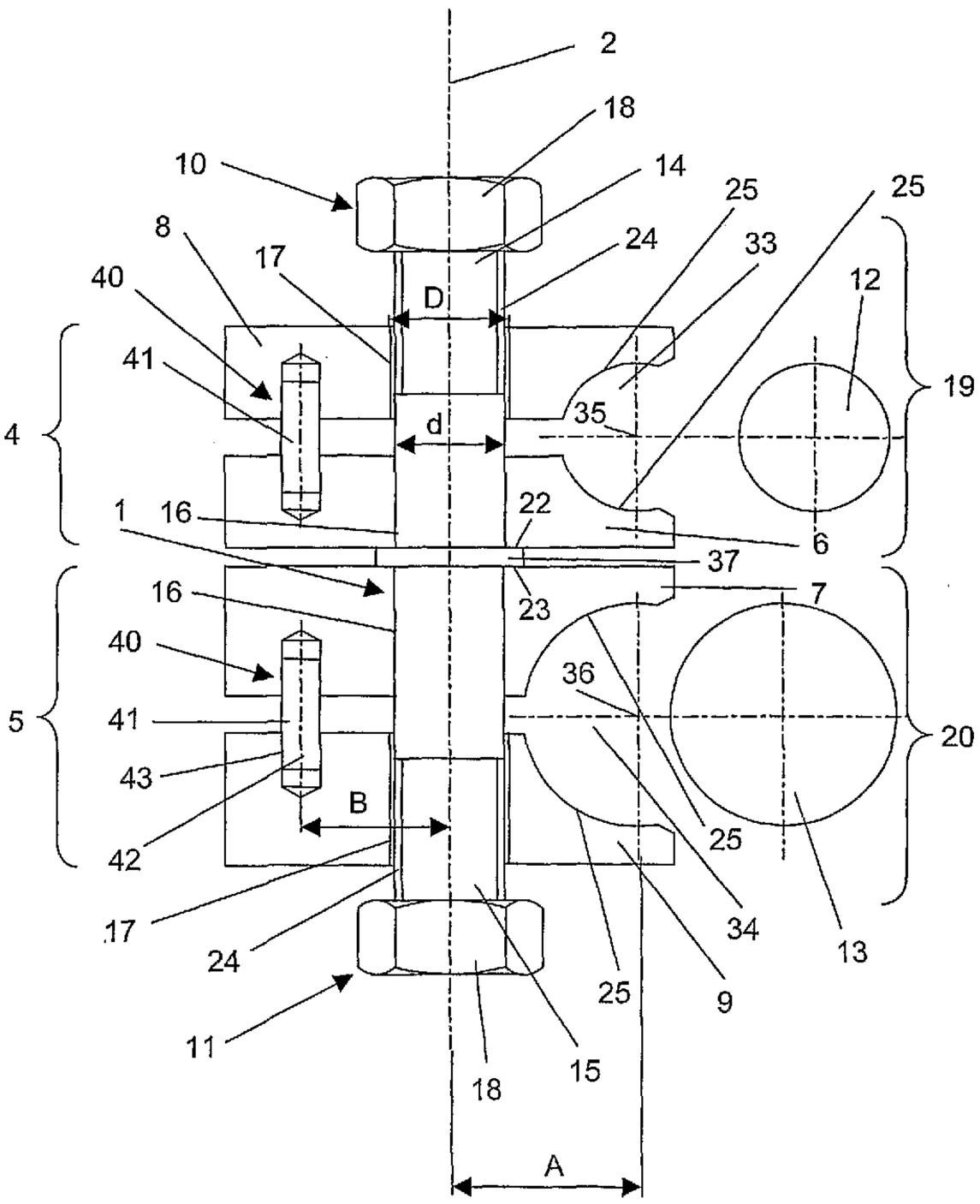
(54) Title: DOUBLE JAWS WITH AN ELASTIC CLOSING ACTION FOR DISTRACTION-COMPRESSION APPARATUS

(54) Bezeichnung: ELASTISCH SCHLIESSENDE DOPPELBACKEN ZU EXTERNEM FIXATEUR



(57) Abstract: The invention relates to a device for clamping and releasing fixing elements (12;13) in a surgical fixing or repositioning device. Said device comprises: A) a cylindrical or prismatic rod (1) with a longitudinal axis (2), a first end (14), a second end (15), a first rod segment (19) that adjoins the first end (14) and a second rod segment (20) that adjoins the second end (15); B) a first pair of clamping jaws (4) that can be displaced along the first rod segment (19) coaxially with the longitudinal axis (2); C) a second pair of clamping jaws (5) that can be displaced along the second rod segment (20) coaxially with the longitudinal axis (2); whereby; D) both pairs of clamping jaws (4;5) comprise a respective inner clamping jaw (6;7) and an outer clamping jaw (8;9) that faces the ends (14;15) and the respective clamping jaws (6;7;8;9) of each pair of clamping jaws (4;5) have opposing gripping surfaces (29;30;31;32); E) A gripping element (10;11) for clamping and releasing fixing elements (12;13) in a surgical fixing or repositioning device is mounted between two opposing gripping surfaces (29;30;31;32); and F) an elastic element (40) is located between a respective inner and outer clamping jaw (6;8;7;9), interconnecting the latter (6,8;7,9).

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— *mit internationalem Recherchenbericht*

— *mit geänderten Ansprüchen*

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.

(57) Zusammenfassung: Die Vorrichtung dient zum lösbaren Festklemmen von Befestigungsmitteln (12;13) innerhalb einer chirurgischen Fixations- oder Repositionsvorrichtung. Sie umfasst: A) einen zylindrischen oder prismatischen Stab (1), welcher eine Längsachse (2), ein erstes Ende (14), ein zweites Ende (15) sowie ein endständig an das erste Ende (14) angrenzendes erstes Stabsegment (19) und ein endständig an das zweite Ende (15) angrenzendes zweites Stabsegment (20) umfasst; B) ein erstes, auf dem ersten Stabsegment (19) koaxial zur Längsachse (2) verschiebbares Klemmbackenpaar (4); C) ein zweites, auf dem zweiten Stabsegment (20) koaxial zur Längsachse (2) verschiebbares Klemmbackenpaar (5); wobei; D) die beiden Klemmbackenpaare (4;5) je eine innere Klemmbacke (6;7) und eine, gegen die Enden (14;15) gerichtete, äussere Klemmbacke (8;9) umfassen und die jeweils zwei Klemmbacken (6;7;8;9) jedes Klemmbackenpaares (4;5) gegeneinander gerichtete Spannflächen (29;30;31;32) aufweisen; E) ein Spannmittel (10;11) zum lösbaren Festklemmen von Befestigungsmitteln (12;13) einer chirurgischen Fixations- oder Repositionsvorrichtung zwischen je zwei gegeneinander gerichteten Spannflächen (29;30;31;32); und F) ein jeweils zwischen einer inneren und einer äusseren Klemmbacke (6;8;7;9) angeordnetes elastisches Mittel (40), welches die innere und äussere Klemmbacke (6,8;7,9) verbindet.

DOUBLE JAWS WITH AN ELASTIC CLOSING ACTION FOR EXTERNAL FIXATION

The invention relates to a device for detach clamping fastening elements within a surgical fixation or repositioning device in accordance with the introductory portion of claim 1.

A double jaw connection for elements of an external fixator is known from the DE 295 12 917 of JAQUET. This known articulation consists of a layered arrangement of two pairs of clamping jaws, which consists of an upper outer clamping jaw and an upper inner clamping jaw, as well as of a lower inner clamping jaw and a lower outer clamping jaw. The four clamping jaws are disposed on a central clamping shaft. Between the pairs of clamping jaws, that is, between the two inner clamping tools, a coil spring is inserted, which causes the two inner clamping jaws to be pressed apart and pressed against the outer clamping jaws. The clamping jaws are constantly held together with the help of a locking device against the action of the elastic means. At the clamping surfaces between each pair of clamping jaws, indentations are provided, which, transversely to the clamping shaft, each form a passage for fastening rods or connectors of the external fixator. These passages are open to the outside and enable fastening rods or connectors to be inserted by exerting pressure in the opening of the clamping jaw in the respective passage against the action of the elastic means. After the fastening rods or connectors have snapped into the passages, they are held fast by the action of the elastic means before the articulation is blocked definitively.

It is a disadvantage of this known device that the coil spring is disposed between the pairs of clamping jaws and therefore not readily accessible. Moreover, this known device does not have a constant spring force, since the latter

depends upon the position of the nut. Finally, the coil spring is subject to high fatigue.

The invention is to provide a remedy here. It is an object of the invention to create a device for the detachable clamping or fastening elements such as rods, retractors, rings or bone screws, which

a) each have an elastic element per pair of clamping jaws, so that independent operation of the two pairs of clamping jaws is possible,

b) have few components in comparison to the state of the art, so that a simple operation and cleaning is possible and

c) a constant spring force (even without nut/screw actuation).

Pursuant to the invention, this objective is accompanist with a device for detachably clamping fastening elements within a surgical fixation or repositioning device, which has the distinguishing features of claim 1.

In a preferred embodiment, the clamping jaws have continuous boreholes, which are coaxial with the longitudinal axis. These boreholes accommodate the rod, so that the clamping jaws are disposed axially displaceably on the rod. The rod has radial clearance in the borehole of at least one clamping jaw of each pair of clamping jaws, so that at least one clamping jaw per pair of clamping jaws can be tilted from the position, in which it is coaxial with the longitudinal axis of the rod.

Preferably, the clearance can be brought about owing to the fact that the rod, in the axial region of the clamping jaws has a diameter d and the borehole of at least one clamping jaw per pair of clamping jaws has a diameter D and that D is larger than d. The ratio of (D-d)/d may be between 0.01 and 0.10.

In a different embodiment, the rod has at least one indentation in the axial region of the clamping jaws, so that the rod has a minimum thickness of b at the indentations. Furthermore, the borehole of at least one clamping jaw per pair of clamping jaws has a diameter D, b being smaller than D. The at least one indentation may also, for example, be constructed as an annular groove.

In an embodiment, indentations are provided on the clamping surfaces, which are on the mutually opposite sides of the two clamping jaws of a pair of clamping jaws. These indentations form channels for accommodating rod-shaped fastening means. The indentations extend transversely and eccentrically to the longitudinal axis of the rod. Preferably, the channels have a channel axis each, which is perpendicular to the longitudinal axis of the rod at a distance A from the latter.

In a different embodiment, the elastic means are disposed, with respect to the longitudinal axis, on the side of the clamping jaws opposite to the channel. Preferably, the elastic means are at a distance from for the longitudinal axis of the rod, there being a distance B between the central axis of the elastic means and the longitudinal axis of the rod.

In a different embodiment, the elastic means are constructed as a rod-shaped element with a central axis, parallel to the longitudinal axis of the rod.

As elastic means, preferably those are used, which consists of a material, which has a nonlinear stretch-strain curve. The elastic means advantageously may be produced from a memory metal alloy, preferably from nitinol, without their clamping action being based on the memory effect. For this reason, the memory metal alloy may have a transition temperature of more than 50°C and preferably of more than 80°C. Typically, the transition temperature is higher than 100°C and preferably higher than 120°C. So-called pseudo-elastic materials may also be suitable.

The elastic means may consist, in particular, of a nickel-titanium alloy, for which 45% < Ni < 55%, 45% Ti < 55% and x + y = 100%. Such a material is particularly biocompatible and highly elastic.

Aside from metallic materials, the elastic means may also consist of a plastic, preferably of a polyether ketone (PEEK) or a carbon fiber-reinforced PEEK.

For a different embodiment, at least one of the clamping means consists of a threaded connection, for which, preferably, a nut can be screwed over a thread onto the rod. Instead of the nut, a screw could also be screwed into a borehole having an internal thread. The second clamping means may be a head, which is firmly connected with the rod, or a second threaded connection.

In a further embodiment, an annular disc is disposed between the two inner clamping jaws of the two pairs of clamping jaws. Depending on the embodiment, the screw may be displaceable coaxially to the longitudinal axis of the rod, or be constructed in one piece with the rod. Because the disk is firmly connected with the rod between the first and the second rod segments, it is achieved that the pair of clamping jaws are separated so that their actions are independent.

Preferably, the channels are cylindrical or prismatic, as a result of which an increased clamping effect on the rod-shaped fastening means can be generated. This all the more so, if the channels enclose the rod-shaped fastening elements with an angle α of more than 180° when viewed in a cross-section orthogonal to the channel axis.

So that the rod-shaped fastening elements, in the not fixed state of the device, can be snapped into the channels transversely to the longitudinal axis of the device, the ratio B/LW between the minimum width B of a channel at the opening,

orthogonal to the channel axis at the side surfaces of the clamping jaws, and the clear width LW of the same channel preferably is between 70 and 90%.

The invention and further developments of the invention are explained in even greater detail in the following by means of the partially diagrammatic representation of several examples. In the drawing,

Fig. 1 shows a longitudinal section through an embodiment of the inventive device,

Fig. 2 shows a longitudinal section through a different embodiment of the inventive device,

Fig. 3a shows a side view of the embodiment of the inventive device, shown in Fig. 2 and

Fig. 3b shows a front view of the embodiment of the inventive device, shown in Figs. 2 and 3.

The embodiment, shown in Fig. 1, comprises a rod 1, which has two rod segments 19; 20 and a longitudinal axis 2, as well as, axially displaceable, a pair of clamping jaws 4; 5 on each rod segment 19; 20. Each of the two pairs of clamping jaws 4; 5 comprises an inner clamping jaw 6; 7 and an outer clamping jaw 8 9. The clamping jaws 6; 7, 8; 9 are provided with boreholes 16; 17, which are coaxial with the longitudinal axis, and can be shifted axially in pairs, each on a rod segment 19; 20. The inner clamping jaws 6; 7 lie on the end surfaces 22; 23 of a circular disk 37, which is permanently disposed between the rod segments 19; 20 and is orthogonal to the longitudinal axis 2. The outer clamping jaws 8; 9 may be pressed by clamping means 10; 11 against the inner clamping jaws 6; 7. The clamping means 10; 11 are nuts 18, which can be screwed over terminally disposed threads 24 to the two rod

segments 19; 20. The two clamping jaws 6; 8 of the first pair of clamping jaws 4 as well as the two clamping jaws 7; 9 of the second pair of clamping jaws 5 each have a mutually opposite clamping surface 29; 30; 31; 32, which is transverse to the longitudinal axis 2. Between, in each case, to clamping surfaces 29; 30; 31; 32, belonging to a pair of clamping jaws 4; 5, rod-shaped fastening means 12; 13 can be inserted transversely to the longitudinal axis 2 and, when the clamping means 10; 11 are tightened, block between an inner and an outer clamping jaw 6; 7; 8; 9.

Furthermore, indentations 25 are provided at each of two mutually opposite clamping surfaces 29; 30; 31; 32. The indentations 25 extend orthogonally to the longitudinal axis 2 at a distance from the latter. The cross-sectional area of the indentations 25 is in the shape of a circular segment here; however, it may also be triangular. The indentations 25 each form a channel 33; 34 between the two clamping jaws 6; 7; 8; 9 of each pair of clamping jaws 4; 5. The channel 33; 34 is open towards the side surfaces 28 of the clamping jaws 6; 7; 8; 9 and has an axis 35; 36, which is orthogonal to the longitudinal axis 2 at a distance from the latter.

As shown in Fig. 2, the two channels 33; 34 have a cross-sectional surface, which is orthogonal to the channel axis 35; 36 and has the shape of a circular surface, flattened at one side, the clear width LW of each channel 33; 34 being larger than the width B of the opening of the corresponding channel 33; 34, orthogonal to the respective channel axis 35; 36 at the side surfaces of the clamping jaws 6; 7; 8; 9.

Due to this configuration, the rod-shaped fastening means 12; 13, pushed transversely to the longitudinal axis 2 into the channels 33; 34, are secured again slipping out of the channels 33; 34 transversely to the longitudinal axis 2.

Furthermore, each pair of clamping jaws 4; 5 includes elastic means 40, by means of which the two clamping jaws 6; 7; 8; 9, belonging to a pair of clamping jaws 4; 5, can be kept axially at a certain distance. The distance between the two

clamping jaws 6; 7; 8; 9, belonging to a pair of clamping jaws 4; 5, is such that rod-shaped fastening means 12; 13 can be pushed transversely to the longitudinal axis 2 by hand between the two adjoining clamping surfaces 29; 30; 31; 32 of each pair of clamping jaws 4; 5. The rod-shaped fastening means, pushed-in in this way with the clamping means 10; 11 loosened, are then clamped by the elasticity of the elastic means 40 between the clamping surfaces 29; 30; 31; 32, so that they can be shifted by hand parallel to their central axes 26; 27.

Two nitinol rods 41 are inserted at a distance from rod 1 as elastic means 40 between the two clamping jaws 6; 7; 8; 9 of each of the pairs of clamping jaws 4; 5 and pressed into boreholes 43. The nitinol rods 41 have central axes 42 and are pressed into boreholes 43. For introducing the rod-shaped fastening means 12; 13 into the channels 33; 34, the two corresponding clamping jaws 6; 7; 8; 9 of each pair of clamping tools 4; 5 are spread apart on their sides, which are provided with the indentations 25, so that the two clamping jaws 6; 7; 8; 9 of each pair of clamping jaws 4; 5 are pressed against one another on their sides provided with the elastic means 40 and the nitinol rods 41 are deformed elastically. So that the two clamping jaws 6; 7; 8; 9 of each pair of clamping jaws 4; 5 can carry out the spreading motion, the outer clamping jaws 8; 9 are provided with boreholes 17, which are coaxial with the longitudinal axis 2 and the diameter D of which is larger than the diameter d of the rod 1 in this axial region.

In Figs. 2, 3a and 3b, and embodiment is shown, which differs from the embodiment shown in Fig. 1 therein that

a) only the first clamping means 10 are constructed as a threaded connection with a nut 18, which can be screwed over the thread 24 at the first end 14 of the rod 1, whereas the second clamping means 11 comprise a solid head 60 at the second end 15 of the rod 1. The outer clamping jaw 9 of the second pair of clamping jaws 5 then comes to rest axially at the head 60;

b) there is no disk 37 (Fig. 1) between the inner clamping jaws 6; 7 of the two pairs of clamping jaws 4; 5 and

c) the possibility of spreading apart the outer clamping jaws 8; 9 of each pair of clamping jaws 4; 5 when introducing the rod-shaped fastening means 12; 13 is provided by the indentation 50 at the rod 1 in the form of an annular groove in the axial region of the respective outer clamping jaw 8; 9. The diameter d of the indentation 50 is smaller than the diameter D of the borehole 17 in the respective outer clamping jaw 8; 9.

By tightening the first clamping means 10, the two pairs of clamping jaw 4; 5 can be pressed against the head 60 and the rod shaped fastening elements 12; 13, inserted between the clamping jaws 6; 7; 8; 9 of each pair of clamping jaws 4; 5, can be clamped in the channels 33; 34.

Furthermore, the rod-shaped fastening element 12 is pushed transversely to the longitudinal axis 2 into the channel 33, until the two clamping jaws 6; 8, adjoining the channel 33, are spread apart with a spreading angle β of not more than about 2° to 3°.

Claims

1. Device for detachably clamping fastening means (12; 13) within a surgical fixation or repositioning device with

A) a cylindrical or prismatic rod (1), which has a longitudinal axis (2), a first end (14), a second end (15) as well as a first rod segment (19), which adjoins the first end (14) terminally and a second rod segment (20), which adjoins the second end (15) terminally;

B) a first pair of clamping jaws (4), which can be shifted on the first rod segment (19) coaxially with the longitudinal axis (2);

C) a second pair of clamping jaws (5), which can be shifted on the second rod segment (20) coaxially with the longitudinal axis (2);

D) the two pairs of clamping jaws (4; 5) each comprising an inner clamping jaw (6; 7) and an outer clamping jaw (8; 9), directed towards the ends (14; 15), and the in each case two clamping jaws (6; 7; 8; 9) of each pair of clamping jaws (4; 5) having clamping surfaces (29; 30; 31; 32), which are directed against one another and

E) the device comprising at least one clamping agent (10; 11) for detachably clamping fastening agents (12; 13) of a surgical fixation or repositioning device between in each case two clamping surfaces (29; 30; 31; 32) directed against one another,

F) an elastic agent (40), which connects the inner and outer clamping jaws (6; 8; 7; 9), being disposed in each case between an inner and an outer clamping jaw (6; 8; 7; 9), characterized in that

G) the elasticity of the elastic agent (40) is such that, when the clamping agent (10; 11) is loosened, a rod-shaped fastening agent (12; 13), pushed between a pair of clamping jaws (4; 5) is clamped between the clamping surfaces of the pair of clamping jaws due to the elasticity of the elastic agent (40).

Claims

1. Device for detachably clamping fastening means (12; 13) within a surgical fixation or repositioning device with

A) a cylindrical or prismatic rod (1), which comprises a longitudinal axis (2), a first end (14), a second end (15) as well as a first rod segment (19), adjoining terminally at the first end 14 and a second rod segment (20), adjoining terminally at the second end (15,

B) a first pair of clamping jaws (4), which can be shifted on the first rod segment (19) coaxially to the longitudinal axis (2),

C) a second pair of clamping jaws (5), which can be shifted on the second rod segment (20) coaxially to the longitudinal axis (2),

D) the two pairs of clamping jaws (4; 5) each comprising an inner clamping jaw (6; 7) and an outer clamping jaw (8; 9), which is directed towards the ends (14; 15) and the in each case two clamping jaws (6; 7; 8; 9) of each pair of clamping jaws (4; 5) having clamping surfaces (29; 30; 31; 32), which are directed against one another and

E) the device comprising at least one clamping means (10; 11) for detachably clamping fastening means (12; 13) of a surgical fixation or repositioning device between each two clamping surfaces (29; 30; 31; 32), which are directed against one another,

characterized in that

F) elastic means (40), which connect the inner and outer clamping jaws (6; 7; 8; 9), are disposed in each case between an inner and an outer clamping jaw (6; 7; 8; 9).

2. The device of claim 1, characterized in that the clamping jaws (6; 7; 8; 9) have continuous boreholes (16; 17), coaxial with the longitudinal axis (2), for the axially displaceable accommodation of the rod (1), the rod (1) having radial clearance in the borehole (16; 17) of at least one clamping jaw (6; 7; 8; 9) of each pair of clamping jaws (4; 5).

3. The device of claim 2, characterized in that the rod (1) has a diameter d in the axial region of the clamping jaws (6; 7; 8; 9) and the borehole (16; 17) of at least one clamping jaw (6; 7; 8; 9) of each pair of clamping jaws (4; 5) has a diameter D, and that the radial clearance consists therein that D is larger than d.

4. The device of claim 2, characterized and that the rod (1) in the axial region of the clamping jaws (6; 7; 8; 9) has at least one indentation (50), so that the rod (1) has a thickness b at the indentations (50), and the borehole (16; 17) of at least one clamping jaw (6; 7; 8; 9) of each pair of clamping jaws (4; 5) has a diameter D, and that the radial clearance consists therein that b is smaller than D.

5. The device of one of the claims 1 to 4, characterized in that the clamping surfaces (29; 30; 31; 32) of the clamping jaws (6; 7; 8; 9) are provided with indentations (25), each of which forms a channel (33; 34) for accommodating a rod-shaped fastening element (12; 13) between an inner clamping jaw (6; 7) and an outer clamping jaw (8; 9) of the respective pair of clamping jaws (4; 5) penetrating transversely and eccentrically to the longitudinal axis (2).

6. The device of claim 5, characterized in that the two channels (33; 34) each have a channel axis (35; 36), which extends perpendicularly to the longitudinal axis (2) of the rod (1) at a distance A from the latter.

7. The device of one of the claims 1 to 6, characterized in that the elastic means (40), with respect to the longitudinal axis (2), can be mounted on the side of the clamping jaw (6; 7; 8; 9) opposite to the channel (33; 34).

8. The device of one of the claims 1 to 7, characterized in that the elastic means (40) are a rod-shaped element, which is disposed essentially parallel to the longitudinal axis (2).

9. The device of one of the claims 1 to 8, characterized in at the elastic means (40) consists of a material, which has a nonlinear stress-strain curve.

10. The device of one of the claims 1 to 9, characterized in at the elastic means (40) consists of a memory metal alloy, preferably of nitinol.

11. The device of one the claims 1 to 10, characterized in at the elastic means (40) consist of a nickel titanium alloy, 45% < Ni <55%, 45% < Ti < 55% and x + y = 100%.

12. The device of claims 10 or 11, characterized in that the memory metal alloy has a transition temperature higher than 50°C and preferably higher than 80°C.

13. The device of claim 12, characterized and that the transition temperature is higher than 100°C and preferably higher than 120°C

14. The device of one of the claims 1 to 13, characterized in that the elastic means (40) consist of a plastic, preferably of PEEK or of a carbon fiber-reinforced PEEK.

15. The device of one of the claims 1 to 14, characterized in that the at least one clamping means (10) comprises a screw connection.

16. The device of claim 15, characterized in that the screw connection comprises a thread (24) on the rod (1), as well as a nut (18), which can be screwed over this external thread (24).

17. The device of one of the claims 1 to 16, characterized in that an annular disc (37) is disposed between the two pairs of clamping jaws (4, 5).

18. The device of claim 17, characterized in that the disc (37) can be shifted coaxially on the rod (1).

19. The device of claim 17, characterized in that the disk (37) forms one-piece with the rod (1) and is disposed between the first rod segment (19) and the second rod segment (20).

20. The device of one of the claims 5 to 19, characterized in that the channels (33; 34) are prismatic.

21. The device of one of the claims 5 to 20, characterized in that each channel (33; 34) has a clear width LW and, at its opening, which is orthogonal to the channel axis (35; 36), has a width B between the adjoining clamping jaws (6; 7; 8; 9) and that the ratio of B/LW is between 70% and 90%.

22. The device of one of the claims 1 to 21, characterized in that the elastic means (40) consist of a pseudoelastic material.

23. The device of one of the claims 3 to 22, characterized in at the ratio (D-d)/d is between 0.01 and 0.10.

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Figures: 3A+3B

Pages:

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Unscannable items
received with this application
(Request original documents in File Prep. Section on the 10th Floor)

Documents reçus avec cette demande ne pouvant être balayés
(Commander les documents originaux dans la section de préparation des dossiers au 10ième étage)

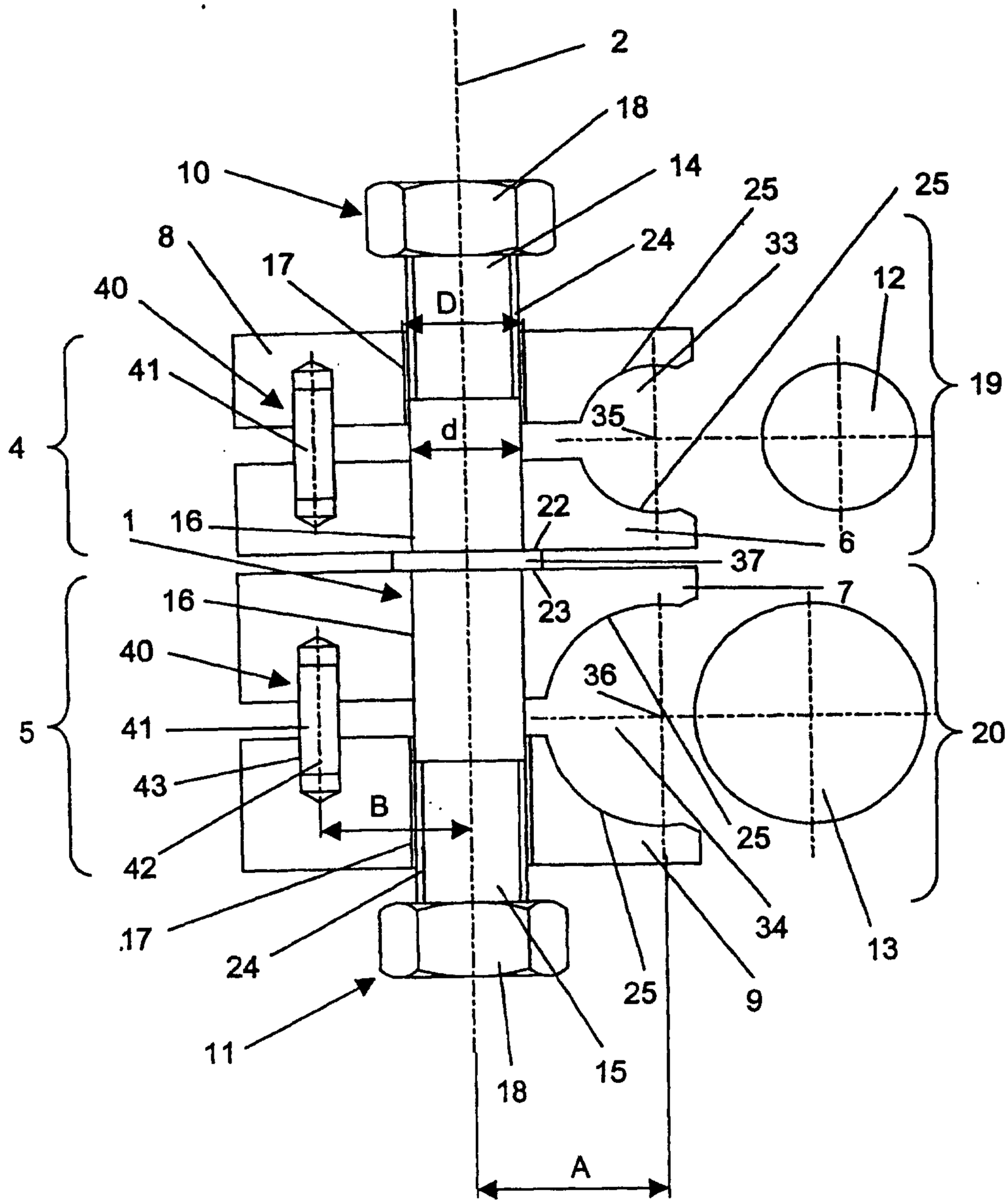
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Fig. 1

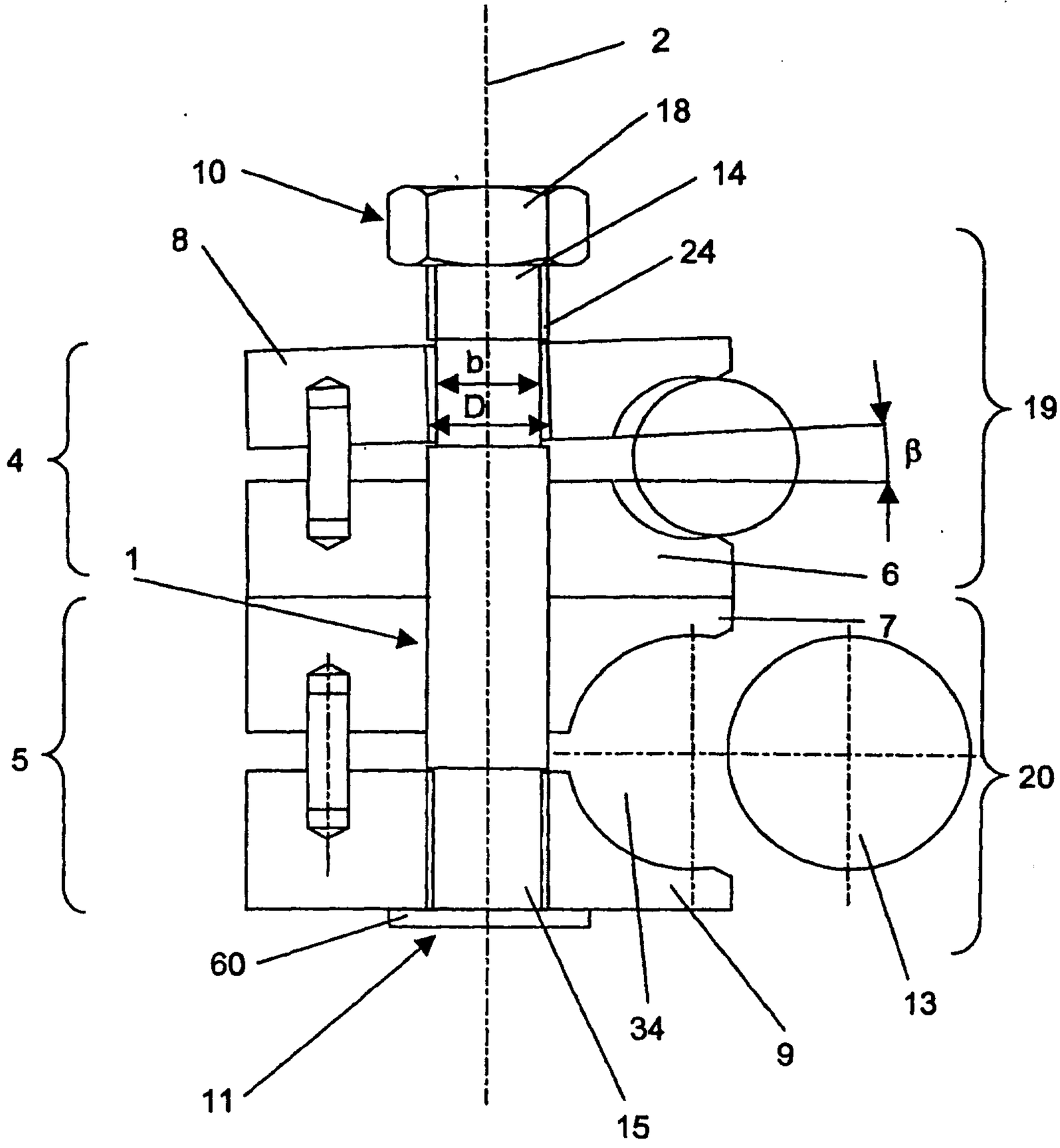
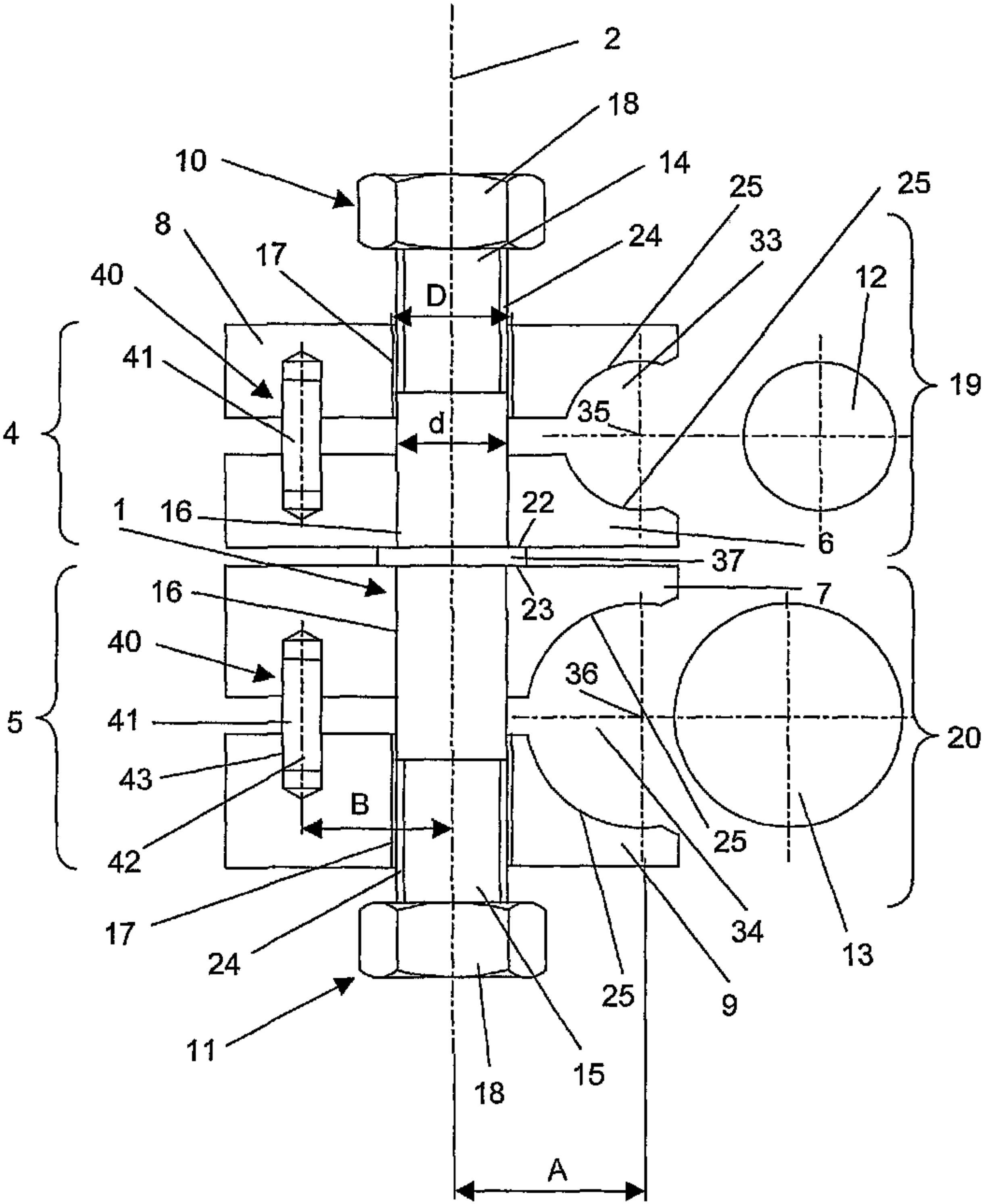


Fig. 2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