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(54) **Clamp fastener**

(57) The invention relates to a clamp fastener (1) for fastening an accessory detachably and adjustably by position to a suitable fastening support (2). Said clamp fastener (1) includes: a shaft (3) that is supported to the fastening support (2); a clamp (4) including two adjacent plier elements, a first and a second plier element (41, 42), a gap (43) between the plier elements and a first spring element (44); in which gap (43) there is arranged a channel (5) for the support bar (T) of an accessory in order to fasten said accessory to the clamp and to the clamp fastener; first and second gear ring elements (6; 61, 62) arranged in a mutually matching position; a second spring element (7; 71) between the gear rings (6; 61, 62); and a clamp actuator (8); said clamp (4), gear ring elements (6; 61, 62) and the second spring element (7; 71) being fitted in the intermediate space (23) of the fastening support and interconnected by a shaft (3) passing at right angles through their center area, and at the first end (31) of said shaft (3), outside the fastening support (2), there is attached a clamp actuator (8) for pressing the plier elements (41, 42) of the clamp (4) together, and respectively for opening them in order to fasten the support bar (T) in a channel (5) and respectively for releasing it from the channel (5). According to the invention, the shaft (3) is in the region of the clamp (4) provided with two shoulders (33, 34) spaced apart at a distance (a), the first (31) of said shoulders being arranged outside the clamp (4), towards the first plier element (41), and the second (34) of said shoulders being arranged inside the clamp, towards the second plier element (42), so that in between said second plier element (42) and the fastening support (2), there are located the gear ring ele-

ments (6; 61, 62) fitted in a mutually facing position, and the second spring element (7; 71).

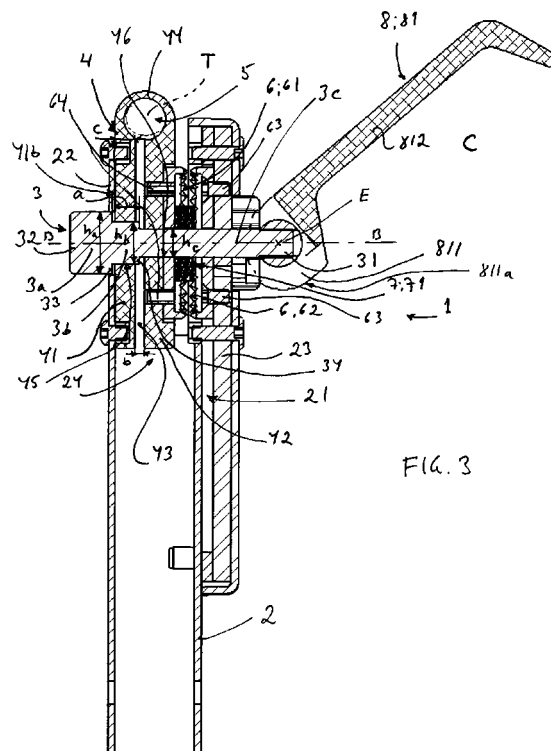


FIG. 3

Description

[0001] The invention relates to a clamp fastener according to the preamble of claim 1.

[0002] In the prior art, there are known fastening devices, particularly clamp fasteners, the purpose of which is to fasten accessories for example to operating tables, among others from the patent publications GB-879,878 and US-4,383,351.

[0003] Operating tables are provided with various different accessories. Among these, let us point out for instance various different supports that are attached to the operating table detachably, and so that their position can be adjusted, by which supports the limbs of the patient can be supported in a desired position, or supports by means of which various different accessories or their parts needed in the operation can be fastened to the operating table. Corresponding accessories can also be attached to other hospital furniture, such as side tables, which accessories can then be used to help the patient for example in various treatments.

[0004] With current fastening devices, the problem often is how to obtain sufficient holding force. This is due to various different reasons, for example that the adequate holding force should be created by moderate manual force. It is also pointed out that the accessory fastening element is generally circular in cross-section, which also requires a high degree of friction between the fastening surfaces of the fastening element and the fastening part of the accessory in order to realize a tight fastening grip.

[0005] The object of the invention is to eliminate the problems connected to known, currently used fastening devices, particularly clamp fasteners. Another object of the invention is to realize a new clamp fastener that is suited for fastening various accessories to hospital furniture, particularly to operating tables, which clamp fastener is simple in structure and reliable in operation, thus holding the accessory in a desired position and locked in place.

[0006] The clamp fastener according to the invention is characterized by what is set forth in the appended claim 1. The independent claims set forth preferred embodiments of the clamp fastener according to the invention.

[0007] The invention relates to a clamp fastener for fastening an accessory detachably and adjustably by position to a suitable fastening support, said clamp fastener comprising

- a shaft that is supported to the fastening support;
- a clamp having two adjacent plier elements, a first and a second plier element, a gap between the plier elements and a first spring element, said gap being provided with a channel for the accessory fastening bar for fastening said accessory to the clamp and the clamp fastener;

- first and second gear ring elements arranged in a mutually matching position;
- a second spring element between the gear rings; and
- a clamp actuator,

said clamp, gear ring elements and the second spring element being fitted in the intermediate space of the fastening support and interconnected by a shaft passing at right angles through their center area, and at the first end of said shaft, outside the fastening support, there is attached a clamp actuator for pressing the plier elements of the clamp together, and respectively for opening them in order to fasten the support bar in a channel and respectively for releasing it from the channel.

[0008] According to the invention, the shaft is in the clamp area provided with two shoulders spaced apart, the first of said shoulders being arranged outside the clamp, towards the first plier element, and the second of said shoulders being arranged inside the clamp, towards the second plier element, so that in between said second plier element and fastening support, there are located the gear ring elements fitted in a mutually facing position, and the second spring element.

[0009] Among the advantages of the invention, there is a simple and solid structure, good locking features, modest space requirements and good ergonomics.

[0010] Another advantage of the invention is a minimal need for compressive force.

[0011] Moreover, the invention is economical to manufacture owing to the simple structure, and it is easy to maintain.

[0012] Among other advantages of the invention, let us point out a minimal need for adjustments, particularly in an embodiment of the invention where an eccentric lever is employed as the clamp actuator.

[0013] Another advantage of the invention is that two different rotary motions are locked and released by one single lever, i.e. an eccentric lever.

[0014] Yet another advantage of the invention is that the gear ring elements are locked in the shaft by a separate shoulder, i.e. a second shoulder. The force pressing the gear rings together is not transmitted through the clamp, but by intermediation of the second shoulder of the shaft. This kind of structure is solid and reliable.

[0015] It is a particular advantage of the invention that it can be used for fastening various different accessories to hospital furniture, yet especially to operating tables and the like. The invention is not, however, restricted to fastening operating table accessories only, but it can be applied to many different targets where a reliable and easily attached fastening device is needed.

[0016] The invention and its further advantages are described in more detail below, with reference to the appended drawing, where

Figure 1 is a schematical side-view illustration of a de-

- livery bed, where the parturient's foot rest is attached to the bed by a clamp fastener according to the invention;
- Figure 2 is a side-view illustration of the clamp fastener;
- Figure 3 illustrates the clamp fastener in an open position and in a cross-sectional view along the line A - A of Figure 2;
- Figure 4 illustrates the clamp fastener in a closed position and in a cross-sectional view along the line A - A; and
- Figure 5 illustrates a cross-sectional view of an eccentric lever.

[0017] An advantageous clamp fastener 1 according to the invention is illustrated in the drawings. Like reference numbers for like parts of the clamp fastener are used in the drawings.

[0018] A clamp fastener 1 is meant for fastening an accessory detachably to a piece of hospital furniture, such as to an operating table and the like. By means of the clamp fastener 1, the accessory is attached, at the support bar T thereof, detachably and adjustably by position to a fastening support 2. Now the fastening support 2 is arranged to serve as the frame of the clamp fastener 1.

[0019] Figure 1 shows an example where the parturient's foot rests 11 are attached, by a support bar T belonging to the foot rest, by a clamp fastener 1 according to the invention to side supports 12 arranged on both sides of the base 13 of the delivery bed 10, which side supports thus serve as the frame and fastening support 2 of the clamp fastener.

[0020] A clamp fastener 1 according to the invention comprises a shaft 3, a clamp 4 including a first spring element 44, two gear ring elements 6; 61, 62, a second spring element 7 and a clamp actuator 8.

[0021] The shaft 3 of the clamp fastener is supported to the fastening support 2. The shaft 3 is arranged to pass through the fastening support 2, particularly through at least one side element 22, in this embodiment through both side elements 22, 23. In between the side elements 22, 23, there is left an intermediate space 24, through which the shaft 3 is arranged to pass. The majority of the clamp fastener elements is arranged on that part of the shaft 3 that is located in the intermediate space 24.

[0022] The clamp 4 comprises two adjacent plier elements, a first and a second plier element 41, 42, a gap 43 between the plier elements and a first spring element 44. The spring element 44 is arranged in connection with the plier elements, so that its spring force pushes the plier elements 41, 42 apart. In connection with the gap 43, there is arranged a fastening groove or a corresponding channel 5 for the fastening rod T, for fastening it to

the clamp and to the clamp fastener.

[0023] The first and second gear ring elements 6; 61, 62 are arranged in a mutually facing position. The second spring element 7, preferably a corrugated spring 71, is arranged in between the gear rings 6; 61, 62. The spring force of the spring element 7; 71 is arranged to push the gear rings 6; 61, 62 apart. In the open position of the clamp fastener 1, the gear rings are not in a mutually locked position, but in the closed position they are.

[0024] The first gear ring element 6; 61 is connected, for example by a first set of pins 63, movably in the lengthwise direction B - B of the shaft 3, to the fastening support 2; 21, particularly to the other side element 23. The second gear ring element 6; 62 is respectively connected, for example by a second set of pins 64, movably in the lengthwise direction B - B of the shaft 3, to the clamp 4, particularly to the second plier element 42 thereof. Now the first gear ring element 6; 61 cannot turn around the shaft 3, whereas the second gear ring element 6; 62 is free to turn along with the second plier element 42, in case the clamp fastener 1 is in the open position. Neither the first gear ring element 6; 61 nor the second gear ring element 6; 62 nor the second plier element 42 connected thereto cannot turn around the shaft 3, when the clamp fastener is in the closed position.

[0025] In the region of the clamp 4 (relatively near to the other end 32 of the shaft), the clamp fastener shaft 3 is provided with two shoulders 33, 34, spaced at a mutual distance a. The first shoulder 33 is arranged outside the clamp, towards the first plier element 41, i.e. its outer surface 41 b. The second shoulder 34 is arranged inside the clamp 4, towards the second plier element 42, especially its inner surface 42a. In between the second plier element 42 and the fastening support 2; 23, there are arranged the mutually facing gear ring elements 6; 61, 62, and therebetween the second spring element 7, such as a corrugated spring 71.

[0026] The clamp actuator 8 is arranged at the first end 31 of the shaft 3, outside the fastening support 2; 21, especially outside the second side element 23. The clamp actuator 8 is used for affecting the shaft 3, so that the plier elements 41, 42 of the clamp 4 can be pressed together and respectively opened apart in order to fasten the support bar T in the clamp channel 5, and respectively in order to detach it from the clamp channel 5. The shaft 3 is arranged to pass through the fastening support 2, in this case through the second side element 23, so that said fastening support, i.e. second side element 23, in that case serves as a stationary support for the clamp 4 and the clamp fastener.

[0027] When the clamp actuator 8 affects the shaft 3, particularly its first end 31, so that it is pulled, in the lengthwise direction B - B of the shaft, outwardly from the fastening support 2; 23, particularly from the second side element 23, the clamp fastener 1 is brought in the closed position in two steps. Owing to the effect of the motion of the shaft 3, in the first step the second shoulder 34 of the shaft compresses the second plier element 42, and

thereby the second spring element 7 (at least partly), and locks the first and second gear rings 6; 61, 62 against each other, so that the rotary motion of the clamp 4 and the bar T (plus an accessory etc.) attached thereto is prevented in a plane perpendicular to the lengthwise direction B - B. When the motion of the shaft 3 is further continued, in the second step the first shoulder 33 presses the first plier element 41 of the clamp against the second plier element 42 and compresses the gap 43 left therebetween to become smaller (and finally altogether closed), and the channel 5 to become smaller in cross-section than in the open position, i.e. in the rest position of the clamp. Now the support bar T is by compression attached in place in the channel 5 and locked to be immovable.

[0028] Respectively, when the clamp actuator 8 affects the shaft 3, particularly its first end 31, so that it is pushed, in the lengthwise direction B - B of the shaft, to inside the fastening support 2; 21, the clamp fastener 1 is brought in two steps, but in a reversed order, to the open position, and the support bar T is released from the channel 5. Now the support bar T can be shifted, in the lengthwise direction thereof, in the channel 5; and/or the clamp 4 can be turned, together with the support bar located in the channel 5, around the lengthwise axis B - B of the shaft 3.

[0029] The distance of the shoulders 33, 34 is advantageously shorter than the added length of the diameter b (in the rest position of the clamp) of the gap 43 of the clamp 4 and the thickness c of the first plier element 41, i.e. $a < b + c$. With these measures, the shoulders are made to function in a desired way.

[0030] In a preferred embodiment of the invention, the shoulders 33, 34 are realized of the shaft 3. In that case the shaft 3 comprises three successive parts 3a, 3b, 3c. The first shoulder 33 is formed in between the first shaft element 3a and the second shaft element 3b, and the second shoulder 34 is formed in between the second shaft element 3b and the third shaft element 3c. Among the diameters of the shaft elements 3a, 3b, 3c, the diameter h_a of the first shaft element 3a is longest, the diameter h_b of the second shaft element 3b is shorter and the diameter h_c of the third shaft element 3c is shortest. Moreover, the diameter of the aperture 45 provided in the first plier element 41 for the shaft 3 substantially corresponds to the diameter of the second shaft element 3b, and the diameter of the aperture 46 provided in the second plier element 42 for the shaft 3 substantially corresponds to the diameter of the first shaft element 3a.

[0031] In a preferred embodiment of the invention, the plier elements 41, 42 of the clamp 4 and the first spring element 44 together form an uniform U-shaped element, where a gap 43 is provided in between adjacent plier elements. The curved bottom element of the U-shaped clamp is flexible and forms the spring element 44. In the vicinity of the junction of the plier elements 41, 42, there is provided a groove or a corresponding channel 5 for the support bar T, for fastening it to the clamp. The shaft

3 is arranged to pass through apertures 45, 45 arranged in the center region of the plier elements 41, 42 of the clamp 4.

[0032] A particular advantage of the above described embodiment of the invention is the minimal demand of compressive force from the actuator 8. The first spring element 44 has a light structure, and the compression point on the lengthwise shaft B - B is located relatively far from the spring element 44 and the channel 5, in which case the compressive force is transmitted to the support bar T in an intensified way through the lever arm. Also the second spring element 7 has a light structure, and its only task is to bring the gear ring elements 6; 61, 62 apart.

[0033] Another advantage is that the minimal demand for compressive force prevents the wearing of the clamp fastener parts and thus reduces the need for adjusting it.

[0034] In a preferred embodiment of the invention, the clamp actuator 8 is an eccentric lever 81. It comprises an eccentric head 811 and a lever arm 812. The surface 811a of the eccentric head is curved with respect to the turning point E, so that the distance of the points on the surface 811 a is increased/reduced, when the angle of rotation of the eccentric head is increased/reduced between the release position C and the locked position D.

[0035] The clamp fastener 1 functions as follows. When the eccentric lever 81 is turned at the lever arm 812 to the locked position C, the eccentric head 811, owing to its shape, pulls the shaft 3 out of the fastening support 2; 21, in this case particularly out of the second side support 23. Now, in the first step the second shoulder 34 of the shaft compresses the second plier element 42 and thereby the second spring element 7; 71, to shrink at least partly, so that the gear rings 6; 61, 62 are locked in a mutually facing position, thus preventing the rotary motion. In the second step, the first shoulder 33 presses the first plier element 41 of the clamp against the second plier element 42 and thus compresses the gap 43 to become smaller, and simultaneously the channel 5 to become smaller in cross-section than in the rest position, so that the support bar T located in the channel is by compression attached in place in the channel. Respectively, when the eccentric lever 81 is turned at the lever arm 812 to the release position D, the eccentric head 811, owing to its shape and by the spring forces of the spring elements 44, 7, releases the shaft 3 back to inside the fastening support 2; 21, in which case, in a reversed order with respect to the above description, the clamp fastener elements are released apart, and the support bar is released from the channel 5, so that the position and angle of rotation of the support bar T can be adjusted.

[0036] It is pointed out that any strong compressive force is not required of the eccentric lever 8; 81. This enables the design of the eccentric head 811, so that the motion of the shaft 3 in the lengthwise direction B - B between the locked position C and the release position D, achieved by the eccentric lever, is sufficiently large in order to guarantee a light but reliable operation of the clamp fastener 1.

[0037] In a preferred embodiment of the invention, the eccentric lever 81, especially the eccentric lever head 811, is provided with adjusting elements 9 for adjusting the position of the first end 31 of the shaft 3 in relation to the eccentric lever head 811. At the same time the compressive force of the eccentric head can be adjusted to be suitable in order to make the eccentric lever light to use, and yet in order to obtain a sufficient compressive force thereby so that a reliable fastening operation is ensured.

[0038] In a preferred embodiment of the invention, the adjusting elements 9 (cf. Figure 5), comprise a threaded part 91 arranged at the first end 31 of the shaft 3, said threaded part being provided with an external thread; a cross nut 92 arranged at the eccentric lever head 811, said cross nut 92 including a shaft aperture 921 and there an interior thread, and a stopper element 93. The threads of the threaded part 91 and the cross nut 92 are mutually compatible. The stopper element 93 is fitted in the hole 94, at right angles to the axis aperture 921 of the cross nut 92. The stopper element 93 and the hole 94 are provided with mutually compatible threadings. The stopper element 93 is arranged, by rotating in one direction in the hole 94, to be pressed against the first shaft end 31 placed in the aperture of the cross nut 92, particularly against the threaded part 91, and to lock the shaft 3 in place with respect to the eccentric lever head. Respectively, by rotating the stopper element 93 in the other direction, the first end 31 of the shaft is released, so that the shaft 3 and the eccentric lever 81 can be rotated in the threadings of the threaded part and the axis aperture with respect to each other, and thus the position of the stopper element 93 can be adjusted.

[0039] In a preferred embodiment of the invention, the stopper element 93 comprises a stopper screw 931 and a locking pin 932, which is advantageously made of nylon or some corresponding plastic material. In a locking situation, the locking pin 932 is pressed, by rotating the stopper screw 931, against the shaft 3, particularly against the threaded part 91 of the shaft, and respectively in a release situation the locking pin 931 is released by turning the stopper screw 931 in the opposite direction.

[0040] The invention is not restricted to the above described embodiments only, but many modifications are possible within the scope of the inventive idea defined in the appended claims.

Claims

1. A clamp fastener (1) for fastening an accessory detachably and adjustably by position to a suitable fastening support (2), said clamp fastener (1) comprising
 - a shaft (3) that is supported to the fastening support (2);
 - a clamp (4) including two adjacent plier ele-

ments, a first and a second plier element (41, 42), a gap (43) between the plier elements and a first spring element (44); in which gap (43) there is arranged a channel (5) for the support bar (T) of an accessory in order to fasten said accessory to the clamp and to the clamp fastener;

- first and second gear ring elements (6; 61, 62) arranged in a mutually matching position;
- a second spring element (7; 71) between the gear rings (6; 61, 62); and
- a clamp actuator (8);

said clamp (4), gear ring elements (6; 61, 62) and the second spring element (7; 71) being fitted in the intermediate space (23) of the fastening support and interconnected by a shaft (3) passing at right angles through their center region; and at the first end (31) of said shaft (3), outside the fastening support (2), there is attached a clamp actuator (8) for pressing the plier elements (41, 42) of the clamp (4) together, and respectively for opening them in order to fasten the support bar (T) in the channel (5) and respectively for detaching it from the channel (5);

characterized in that

the shaft (3) is in the region of the clamp (4) provided with two shoulders (33, 34) that are mutually spaced apart at the distance (a), the first (31) of said shoulders being arranged outside the clamp (4), towards the first plier element (41), and the second (34) being arranged inside the clamp, towards the second plier element (42), and that in between said second plier element (42) and the fastening support (2), there are arranged mutually facing gear ring elements (6; 61, 62), and a second spring element (7; 71).

2. A clamp fastener according to claim 1, **characterized in that** the distance (a) between the shoulders (33, 34) is shorter than the diameter (b) of the gap (43) of the clamp (4) in the rest position, and shorter than the thickness (c) of the first plier element (41).
3. A clamp fastener according to claim 1 or 2, **characterized in that** the shoulders (33, 32) are realized of the shaft (3), so that the shaft comprises three successive elements (3a, 3b, 3c), the first shoulder (33) of which is formed in between the first shaft element (3a) and the second shaft element (3b), and the second shoulder (34) is formed between the second shaft element (3b) and the third shaft element (3c), among which shaft element diameters, the diameter (h_a) of the first is longest, the diameter (h_b) is shorter and the diameter (h_c) of the third is shortest, and where the aperture (45) of the first plier element (41) provided for the shaft (3) in diameter substantially corresponds to the diameter of the second shaft element (3b), and where the aperture (46) of the first second element (42) provided for the shaft (3) in di-

ameter substantially corresponds to the diameter of the first shaft element (3a).

4. A clamp fastener according to claim 1, 2 or 3, **characterized in that** the plier elements (41, 42) of the clamp (4) and the first spring element (44) together form a uniform U-shaped element, where in between adjacent plier elements, there is provided a gap (43), and the bottom of said gap, as well as the juncture of the plier elements, is provided with a groove or a corresponding channel (5) for a support bar (T). 5
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5. A clamp fastener according to any of the preceding claims, **characterized in that** the clamp actuator (8) is an eccentric lever (81). 15

6. A clamp fastener according to claim 5, **characterized in that** the eccentric lever (81), especially the eccentric lever head (811), is provided with adjusting elements (9) for adjusting the position of the first end (31) of the shaft in relation to the eccentric lever head (811). 20

7. A clamp fastener according to claim 6, **characterized in that** the adjusting elements (9) comprise a threaded part (91) arranged at the first end (31) of the shaft, and a cross nut (92) arranged at the head (811) of the eccentric lever, said cross nut (92) being provided with an aperture (921) for the shaft, said threadings of the threaded part (91) and of the shaft aperture (921) being mutually compatible; and a stopper element (93) that is fitted in a hole (94), at right angles to the axis aperture (921) of the cross nut (92), said stopper element (93) and hole (94) being provided with mutually compatible threadings, said stopper element being arranged, by rotating it in one direction in the hole, to be pressed against the first shaft end (31) placed in the aperture of the cross nut (92), particularly against the threaded part (91), and to lock the shaft (3) in place with respect to the eccentric lever head, and respectively, by rotating the stopper element in the opposite direction, to release the first end (31) of the shaft, so that the shaft and the eccentric lever can be mutually rotated in the threadings of the threaded part and the shaft aperture and adjusted in position. 25
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8. A clamp fastener according to claim 7, **characterized in that** the stopper element (93) comprises a stopper screw (931) and a locking pin (932), which is advantageously made of nylon or some corresponding plastic material, which locking pin is in a locking situation pressed against the shaft, particularly against the threaded part (91) of the shaft. 50
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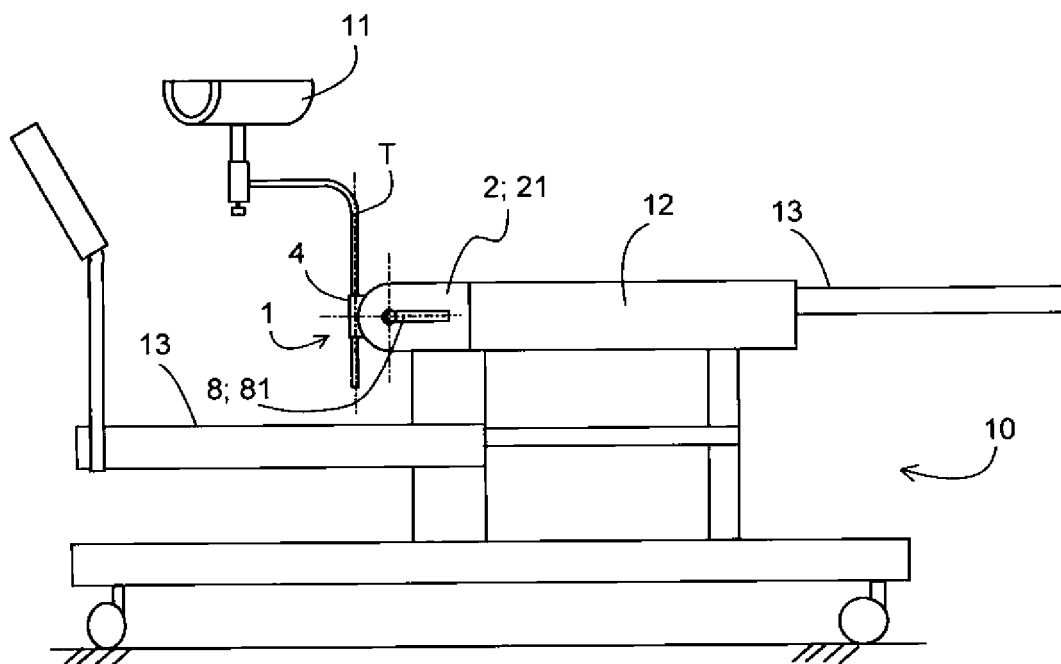


FIG. 1

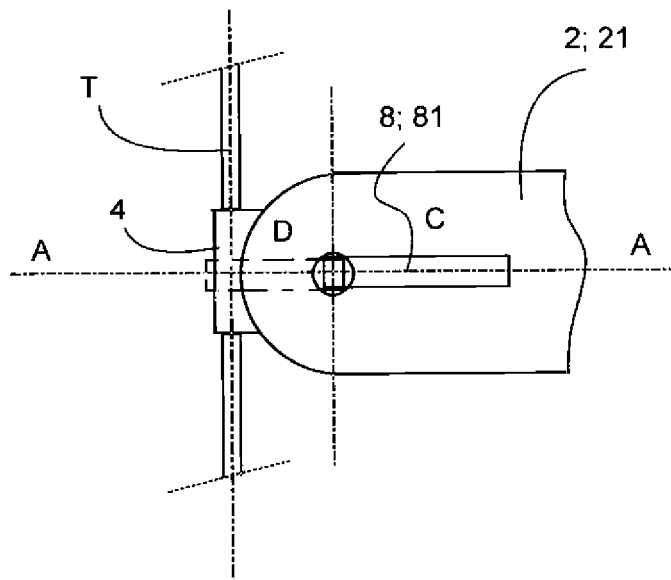


FIG. 2

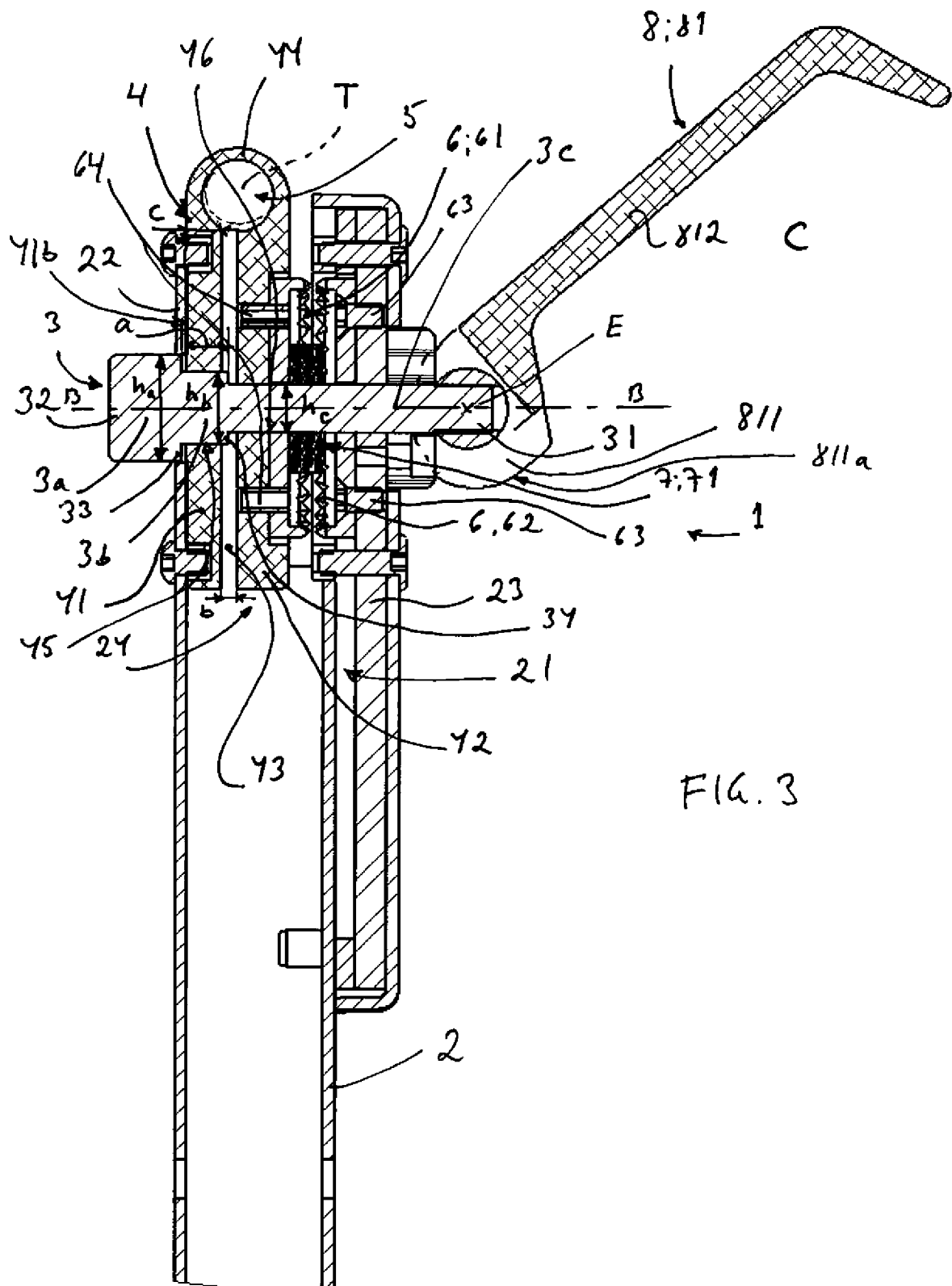
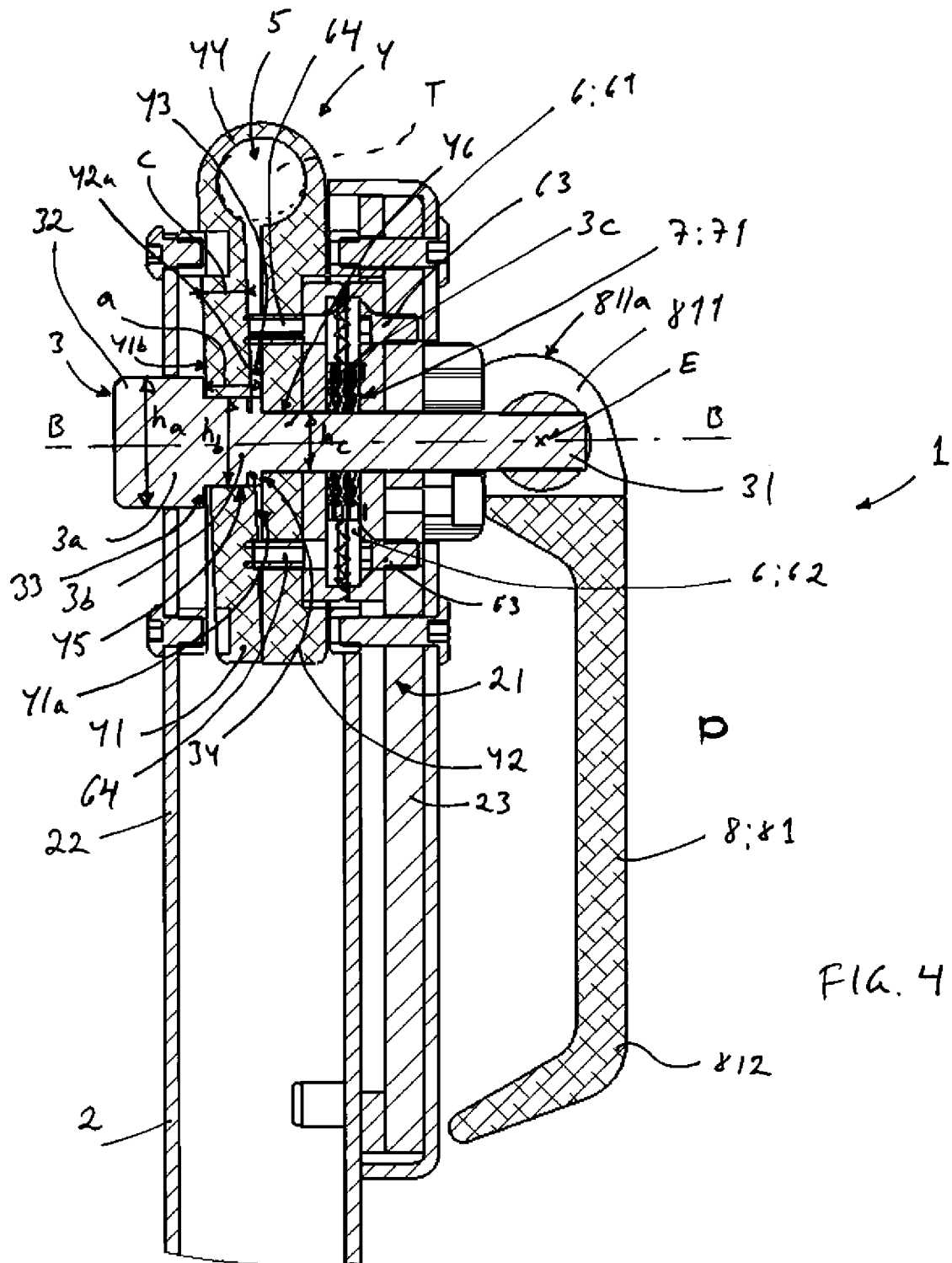
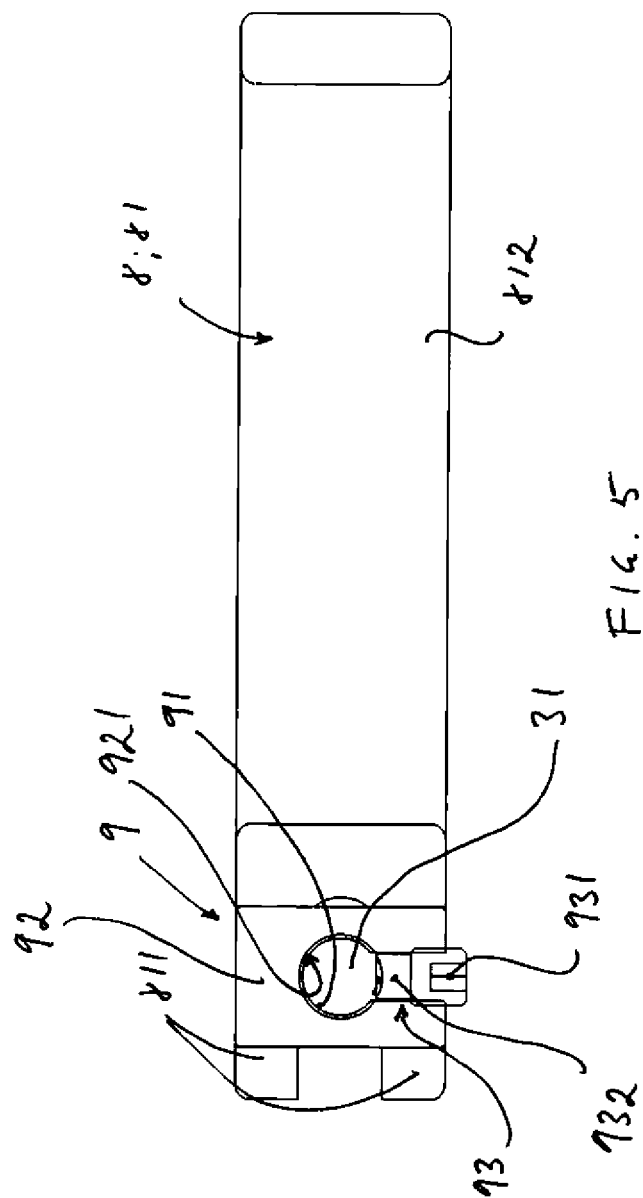


FIG. 3







EUROPEAN SEARCH REPORT

Application Number
EP 11 19 1058

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2008/312509 A1 (JACOBSON STEVEN KARL [US] ET AL) 18 December 2008 (2008-12-18) * paragraphs [0020] - [0025]; figures 1-9 *	1-6	INV. A61G13/10
A	US 5 242 240 A (GORHAM) 7 September 1993 (1993-09-07) * column 2, line 20 - column 9, line 16; figures 1-4 * -----	1-6	
			TECHNICAL FIELDS SEARCHED (IPC)
			A61G
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 15 March 2012	Examiner Petzold, Jan
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 19 1058

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15-03-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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