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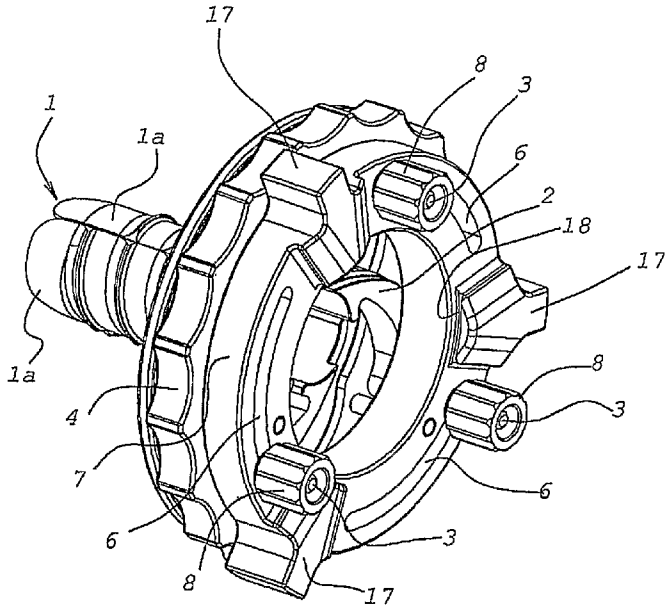
(54) **Title:** RADIALLY EXPANDABLE ANCHORAGE GUIDE FOR TROCARS



(57) **Abstract:** An anchorage guide for a trocar comprising a tubular body (1) , formed by a plurality of substantially circular sectors (Ia) , radially moveable from and towards the longitudinal axis of the tubular body between a first position wherein they flank each other according to a first substantially circular arrangement with diameter equal to that of said tubular body, and a second position wherein they result equidistant from each other according to a second substantially circular arrangement of greater diameter than that of the first arrangement. Each of the sectors is rotatably connected to a support element (4) and manual operation means (7) are provided, moveably connected to said support element, for moving the sectors from the first to the second position and vice versa.

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TITLE

RADIALLY EXPANDABLE ANCHORAGE GUIDE FOR TROCARS

DESCRIPTION

Field of the Invention

The present invention regards in general the field of equipment for laparoscopic surgery and more in particular refers to a radially expandable anchorage guide for trocars.

Background Art

As is known, in the laparoscopic surgery field wide use is made of instruments called trocars which generate and maintain the access channels for the various surgical instruments used in operations. Schematically, a commercial trocar comprises a cannula and a valve body situated at one of its ends. Typically, the cannula has a diameter of 5 or 12 mm with a length of 110-120 mm.

At the beginning of the operation, some holes are made, for example, in the abdomen of the patient by using as many trocars equipped with an accessory capable of penetrating the various tissue layers. Subsequently, such accessory is extracted and an inert gas is insufflated in the abdomen through one of the trocars so as to generate the necessary operating space.

The pressure generated inside the abdomen tends to push the trocars outwardly, so that various methods have been devised for their anchorage. The most widespread solution foresees the use of a tube with inner diameter equal to the outer diameter of the trocar cannula and with an outer threaded surface such to permit the surgeon to "screw it" into the access hole. The tube is then fixed to the cannula of the trocar by means of elastic bands or friction systems.

During the operation, all of the necessary instruments are inserted through the trocars. In the case in which internal parts must be removed, for example gall bladder, intestine parts, tumoral masses etc., it may become necessary to carry out further access cuts of sufficient size for the passage of the part to be removed. This need involves making additional wounds of greater size than those left by the trocars, as well as the possibility of contamination through the walls of the cut during the extraction step of the parts to be removed; all of this results in a more difficult patient recovery after the operation. After the extraction, it is often necessary to continue to operate laparoscopically and the additional cut compromises the gas seal so that it is necessary to use instruments capable of restoring the seal.

Summary of the invention

The object of the present invention is to provide an anchorage guide for a trocar which, taking advantage of the elasticity of the relaxed tissues (since they are anesthetized), can expand to generate the necessary space for the extraction of the parts to be removed without the need to carry out additional cuts.

Another object of the present invention is to provide an anchorage guide for trocars of the type mentioned above on which it is possible to mount an autonomous valve system through which instruments or an adaptor for commercial trocars can pass, if, after the extraction of the diseased parts, it would be necessary to newly pressurize the abdomen and restart the operation.

These objects are achieved with the anchorage guide for a trocar according to the present invention comprising a tubular body, formed by a plurality of substantially

circular sectors, radially moveable from and towards the longitudinal axis of the tubular body between a first position wherein they flank each other according to a first substantially circular arrangement with diameter equal to that of said tubular body, and a second position wherein they are equally spaced from each other according to a second substantially circular arrangement of greater diameter than that of the first arrangement. Each of the sectors is rotatably connected to a support element and manual operation means are foreseen, moveably connected to said support element, for moving the sectors from the first to the second position and vice versa.

Brief description of the drawings

Other characteristics, as well as the advantages, of the anchorage guide for a trocar according to the present invention will be clearer from the following description of an exemplifying and not limiting embodiment with reference to the attached drawings wherein:

- Figure 1 is a perspective view of the anchorage guide according to the invention in its closed position;

- Figure 2 is a perspective view of the anchorage guide in its open position;

- Figure 3 is a cross sectional view of the anchorage guide of figure 1;

- Figure 4 is an exploded view of the anchorage guide according to the invention;

- Figure 5 is a perspective view of the anchorage guide according to the invention in a completely open position and with a diaphragm valve inserted therein;

- Figure 6 is a longitudinal sectional view of the anchorage guide of figure 5;

- Figure 7 is a longitudinal sectional view of the

anchorage guide according to the invention in its closed position with a commercial valve system;

- Figure 8 is a perspective view of the anchorage guide according to the invention in is its closed position, equipped with a diaphragm valve with a commercial trocar housed therein;

- Figure 9 shows a perspective view of the anchorage guide according to the invention with a protective tube.

Detailed description of the invention

With reference to figures 1-4, a tubular body, generically indicated with 1, is formed by three sectors 1a of angular width equal to 120°. From one end of each of the sectors 1a, a curved arm 2 extends in a substantially tangential manner; the free end of the curved arm 2 is rotatably engaged with a pin 3. The three pins are in turn engaged in three equidistant holes 5 formed on a first ring nut 4, called fixed ring nut, orthogonal to the longitudinal axis of the tubular body 1 and in circumferential slots 6 made along a second ring nut 7, called moveable ring nut, coaxially arranged on the fixed ring nut 4. The threaded ends of the pins 3 projecting from the slots 6 of the moveable ring nut 7 are finally engaged in respective threaded knobs 8, abutting against moveable ring nut 7 opposedly with respect to the fixed ring nut 4, thereby obtaining the mutual fixing of the various components.

The three sectors 1a of the tubular body 1 form a channel of inner diameter less than or equal to the outer diameter of the cannula of the commercial trocar to be used, while the outer surface of the sectors 1a has a saw tooth thread, as in the anchorage cannulae of known type, capable of grasping the walls of the body cavity access

hole.

The three curved arms 2 are housed within the fixed ring nut 4, coplanar thereto, and may be simultaneously rotated around the respective pins 3, to transmit an angular movement to the moveable ring nut 7. Following the rotation of the arms 2, the cylindrical sectors 1a extending therefrom progressively divaricate from each other, passing from the closed configuration illustrated in figure 1 to the open configuration of figure 2.

Three angularly equidistant closure pins 9 and three thrust pins 10 extend orthogonally from the face of the moveable ring nut 7 turned towards the fixed ring nut 4. When the tubular body 1 is in its closed position, as shown in figure 1, the closure pins 9 abut on the convex side of the respective curved arms 2 and maintain the three cylindrical sectors 1a adjacent to each other, tightening them on the cannula of the trocar so as to permit the axial locking of the trocar. In particular, as shown in figure 4, the arms 2 have seats 2a, within which the closure pins 9 are engaged. On the other hand, when the moveable ring nut 7 is rotated in the direction of the arrow F of figure 3, the thrust pins 10 come into contact with the concave profile of the arms 2 of the sectors 1a and, sliding along them away from the hinge pins 3, ensure that the arms progressively extend. The opening of the sectors 1a first occurs quickly and then slows approaching the end stop; in this way it is possible to exert a force as constant as possible throughout the opening step, since the resistance of the tissues increases as the divarication of the sectors 1a increases. At the stop end, the tubular body 1 remains stably open when the thrust pins reach the dead point. If it is necessary to

stop the opening in an intermediate position, it is sufficient to tighten at least one of the three threaded knobs 8.

To ensure an adequate sealing of the gas on the patient side, a membrane 11 is foreseen as shown in figure 4 and figure 7, while on the surgeon's side the seal is ensured by a valve system such as that shown in figures 5 and 7. The membrane 11 has a variable thickness, and in particular in correspondence with its minimum and maximum diameter terminates with respective toroidal rings 11a and 11b. The maximum diameter ring 11b is inserted in a perimetrical groove 4a of the ring nut 4, as is visible in figure 6, while the minimum diameter ring 11a is tight at the base of the sectors 1a. No groove for housing the ring 11a is foreseen on said sectors, since the correct position is maintained both because it is a rest position and because the membrane is forced by the abdomen of the patient against the ring nut 4.

The radially expandable anchorage guide for trocars according to the present invention is used in the following manner. At the beginning of the operation, during the insertion step of the trocar in the abdomen (for example), the anchorage guide according to the present invention is used as if it was a normal anchorage tube of the trocar to the abdominal wall. As shown in figure 8, the three sectors 1a are closed around the cannula 12 of the trocar and are tightened to it by rotating the moveable ring nut 7 with respect to the fixed ring nut 4, and tightening at least one of the locking knobs 8. In the particular case wherein the trocar inserted is calibrated on the inner size of the closed tubular body 1, tightening the locking knob 8 can be

avoided since the system is irreversible when in completely closed position. A valve 13, of the type illustrated in figure 5 and 6, is closed around the trocar tube to ensure a perfect gas seal. In the case in which the valve is that illustrated in said figures, it is not necessary to tighten the tubular body 1 on the cannula 12 of the trocar, since the same valve can ensure the axial anchorage of the trocar. Indeed, when the membrane tightens around the cannula of the trocar, it generates a consistent radial force which, due to the high coefficient of friction between the same membrane and the cannula of the trocar, ensures a strong axial seal.

If during the operation it becomes necessary to insert a trocar of greater size, it will suffice to open the valve 13 of figure 8, open the tubular body 1 by unlocking the cannula 12 of the trocar, extract the trocar to be substituted, insert the new trocar and tighten the tubular body 1 and the seal valve 13 on it.

If during the operation it becomes necessary to remove an internal mass, the tubular body 1 may be divaricated to its maximum expansion so that, once the trocar and the seal valve is removed, an access channel is generated at the abdomen of sufficient dimensions for the passage of the mass to be removed.

To protect the walls of the access hole from possible contaminations (for example during the extraction of a tumoral mass in the absence of other types of protection), it is possible to insert within the divaricated sectors 1a a tube 14 (see figure 9) after having overturned the elastic membrane 14a inside the tube itself. In particular, the tube 14 is composed of a rigid cylinder of thin thickness buried within an elastic membrane

terminating at both ends with two large diameter discs with reinforced edges, one of which is the membrane 14a. For its insertion inside the divaricated tubular body 1, the inner disc or membrane 14a is folded inside the tube 14 and subsequently made to expand inside the abdomen. The membrane 14a protects from contaminations the inner wall of the abdomen near the access hole. The axial position of the tube 14 is ensured by the tightening of the three sectors 1a on it. The tube 14 has an outer elastic disc 15 at the other end which may be folded on the moveable ring nut 7 of the anchorage guide so as to protect it from contamination. Figure 9 has the expandable anchorage guide according to the invention in a configuration suitable for the extraction of an internal mass. To extract the tube 14, it suffices to further divaricate the sectors 1a and pull the tube 14 through the outer disc 15.

The valve 13 illustrated in figures 5 and 6 is based on the principal of operation of a commercial device named "LAP-DISC", described in the U.S. patents No. 6110154 and 6589167 and used for making an abdomen access for the surgeon's hand in hand-assisted laparoscopic surgery operations, even if it uses a different method for maintaining the set position.

With particular reference to figures 5 and 6, the valve 13 comprises a fixed support 16 which can be connected by bayonet coupling to the outer face of the moveable ring nut 7. On the latter, in fact, radial expansions 17 are foreseen defining circumferential grooves 18 with the outer face of the moveable ring nut 7, within which radial tongues 19 are friction engaged, extending from the outer wall of the fixed support 16. The seal between the fixed support 16 and the moveable ring

nut 7 is ensured by a seal ring 20 arranged therebetween. The valve 13 moreover comprises a control ring nut 21 rotatably engaged within the fixed support 16 and maintained in the desired angular position by means of flexible arms 22 axially extending from the fixed support 16. The arms 22 have inner radial projections 23 which are engaged in axial grooves 24 formed on the outer surface of the control ring nut 21.

The obturator of the valve 13 comprises an elastic membrane 25 having in rest position a toroidal shape with "omega" cross section, which is maintained tight on the inner walls of the control ring nut 21 and the fixed support 16, respectively, by means of expansion rings 26 and 27 of rectangular section, cut sideways to permit the flattening of the membrane against the walls of the control ring nut 21 and the fixed support 16 without gap.

Rotating the control ring nut 21 with respect to the support 16, the flexible arms 22 bend, making the projections 23 move from one groove 24 to the other, so that the elastic membrane 25, due to the torsion to which it is subjected, closes radially like a diaphragm. With an appropriate rotation angle of the control ring nut 21, it is possible to completely occlude the opening of the valve 13, or partially occlude it in case the cannula of a trocar must pass through said opening, tightening the membrane 25 around it and ensuring the gas seal and a consistent axial tightening.

The expandable anchorage guide according to the invention, in addition to having the diaphragm valve described above, may naturally be employed even in association with valves for trocars of another type, such as that illustrated in figure 7.

The valve herein illustrated is of double seal type: i.e. it has a first elastic obturator 26 with flute mouth geometry which in rest is maintained in closed position by the pressure established in the body cavity. If an instrument is inserted, the flute mouth 26 obturator opens in correspondence with the longitudinal cuts, losing however the gas seal. A second obturator 27 is therefore foreseen, upstream of the first and formed by an elastic membrane with calibrated hole to make a seal on a particular instrument diameter. Normally, having to insert an instrument with different diameter, the second obturator block 27 fixed with bayonet coupling to the first obturator must be substituted. The double obturator scheme as illustrated allows instruments to be extracted and inserted without losing the seal, while, when the instrument is inserted, the second obturator ensures the seal by forcing radially against the instrument. The valve system described and illustrated in figure 7 is among the most commercially widespread, but there exist many others predominantly intended to house instruments with different diameters, without the need to interchange the second obturator. The instrument according to the invention may house, by means of an appropriate adaptor, any commercial sealing system.

Naturally, the tubular body 1 of the expandable anchorage guide according to the invention can be made in a different number of cylindrical sectors 1a with respect to that described and illustrated. In this manner, it is possible to better approximate the circular shape of the realized opening, through the cost of the instrument increases.

Variations and/or modifications can be made to the

anchorage guide for trocars according to the present invention without departing from the protective scope of the invention as set forth in the following claims.

CLAIMS

1. Anchorage guide for trocar for use in laparoscopic surgery comprising a tubular body (1) with means for its anchorage to an access hole for entering a body cavity, characterized in that said tubular body is formed by a plurality of substantially circular sectors (1a), radially moveable from and towards a longitudinal axis of said body between a first position, wherein they flank each other according to a substantially circular first arrangement of diameter equal to that of said tubular body, and a second position, wherein they are equidistant from each other according to a substantially circular second arrangement of greater diameter than that of said first circular arrangement, said plurality of sectors being rotatably connected to a support element (4) and manual operation means (7), moveably connected to said support element, being further provided for moving said sectors from said first to said second position and vice versa.

2. Anchorage guide according to claim 1, wherein each of said substantially circular sectors (1a) comprises an arm (2) extending therefrom in a substantially tangential manner and hinged to said support element (4) with its free end, said operation means operating on said arms.

3. Anchorage guide according to claims 1 or 2, wherein said support element (4) is an annular body and said manual operation means comprise a moveable ring nut (7) coaxially rotating on said annular body and thrust pins (10) extending orthogonally from said moveable ring nut (7) and arranged in a manner to interfere with said arms (2) during the movement of said ring nut (7), the sliding of said thrust pins (10) along said arms (2) causing their angular displacement.

4. Anchorage guide according to any one of the previous claims, wherein said arms (2) have a curved profile.

5. Anchorage guide according to any one of the previous claims, wherein said manual operation means also comprise closure pins (9) extending from said moveable ring nut (7) and also adapted to interfere with said arms (2) from the opposite part of said thrust pins (10).

6. Anchorage guide according to any one of the previous claims, wherein said arms (2) are housed coplanarly within said annular body (4).

7. Anchorage guide according to any one of the previous claims, wherein said arms (2) are hinged to said support element (4) by means of respective pins (3) passing through it and engaged in respective circumferential slots (6) formed along said moveable ring nut (7), reversible tightening means (8) of said pins abutting against said moveable metal ring.

8. Anchorage guide according to any one of the previous claims, wherein said anchorage means comprise a saw tooth thread formed along the outer surface of said tubular body (1).

9. Anchorage guide according to any one of the previous claims, wherein a tube (14) can be attached within said tubular body (1) in open condition, said tube having two elastic disc-shaped membranes (14a, 14b) extending from its ends and foldable within it.

10. Anchorage guide according to any one of the previous claims, wherein said moveable ring nut (7) comprises attachment means (17, 18) for a valve body (13).

11. Anchorage guide according to claim 10, wherein said valve body comprises a fixed support (16) which can be reversibly connected to said moveable ring nut (7) and a

control ring nut (21) pivotally engaged in said fixed support (16) and maintained in a desired angular position by means of flexible arms (22) extending axially from the fixed support (16), said arms having inner radial projections (23) adapted to be engaged in axial grooves (24) formed on the edge of said control ring nut (21).

12. Valve (13) for the anchorage guide of a trocar according to any one of the claims from 1 to 9, comprising a fixed support (16) reversibly connectable to said manual operation means (7), a control ring nut (21) rotatably engaged within the fixed support (16) and an elastic membrane obturator (25) having at rest a toroidal shape with "omega" cross section, tightened to the inner walls of the control ring nut and the fixed support, whereby, upon rotating the control ring nut with respect to the support, said elastic membrane is subjected to torsion, causing it to close radially like a diaphragm, characterized in that said control ring nut (21) is maintained in a desired angular position by means of flexible arms (22) extending axially from the fixed support (16), said arms having inner radial projections (23) adapted to be engaged in axial grooves (24) made on the edge of said control ring nut (21).

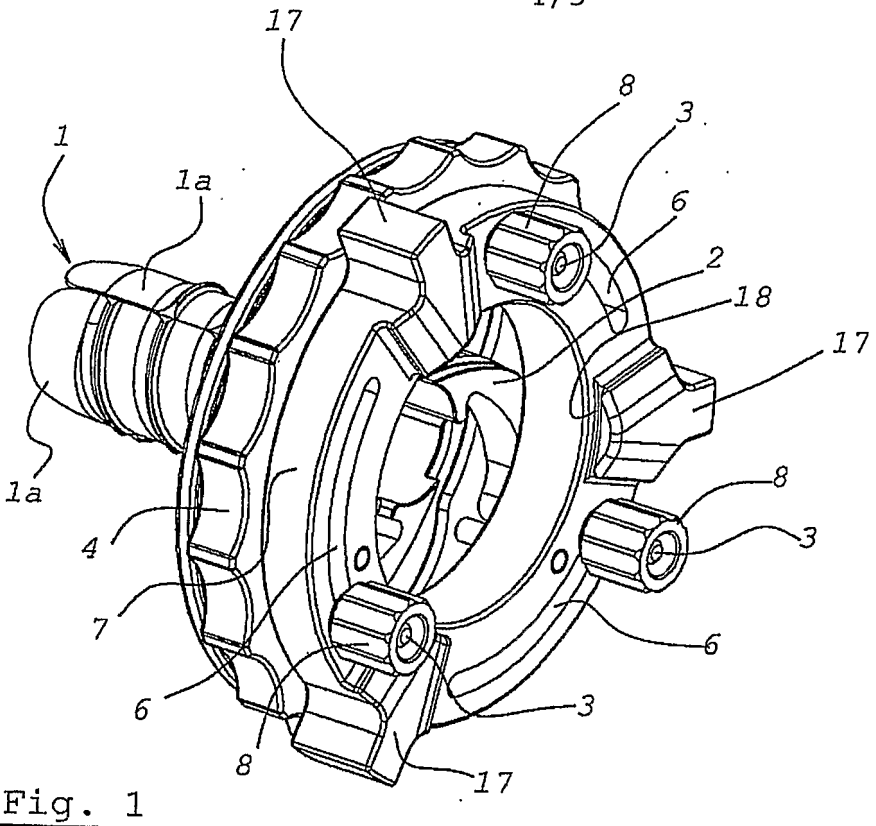
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Fig. 1

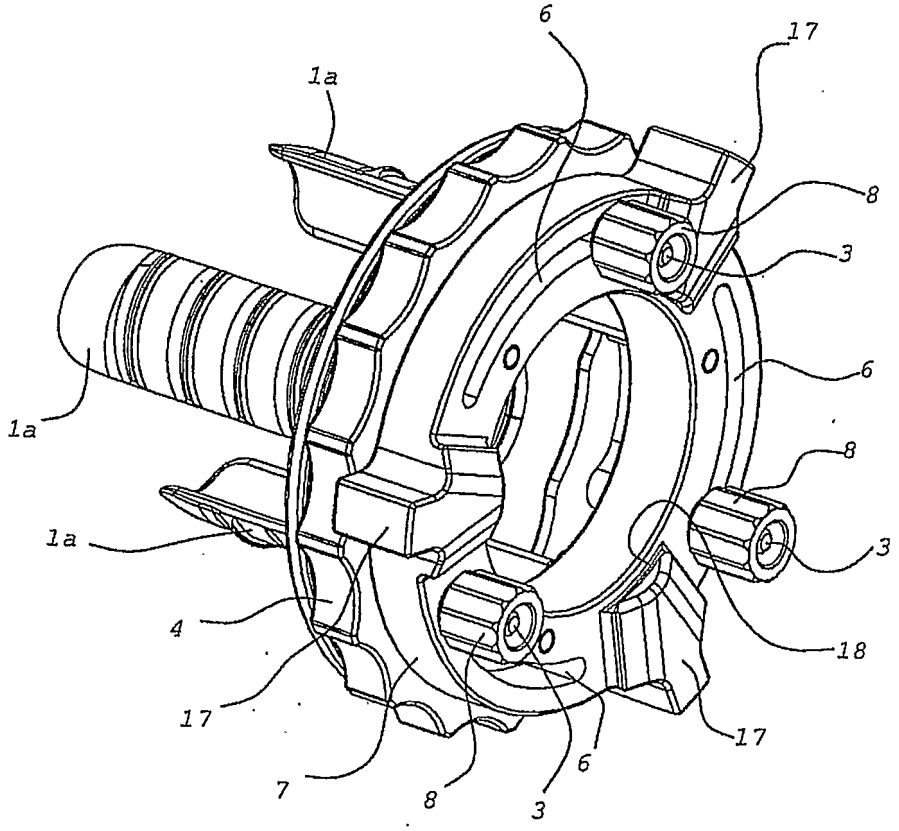
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Fig. 2

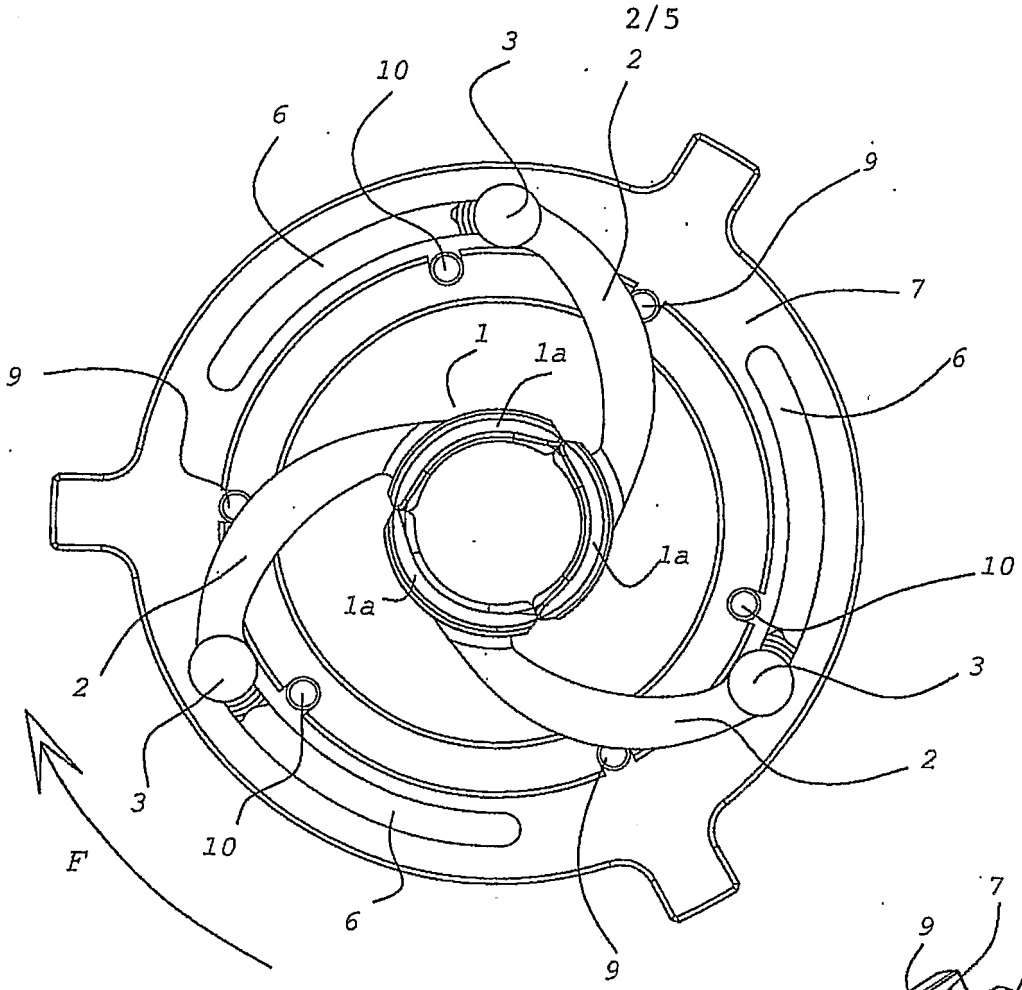
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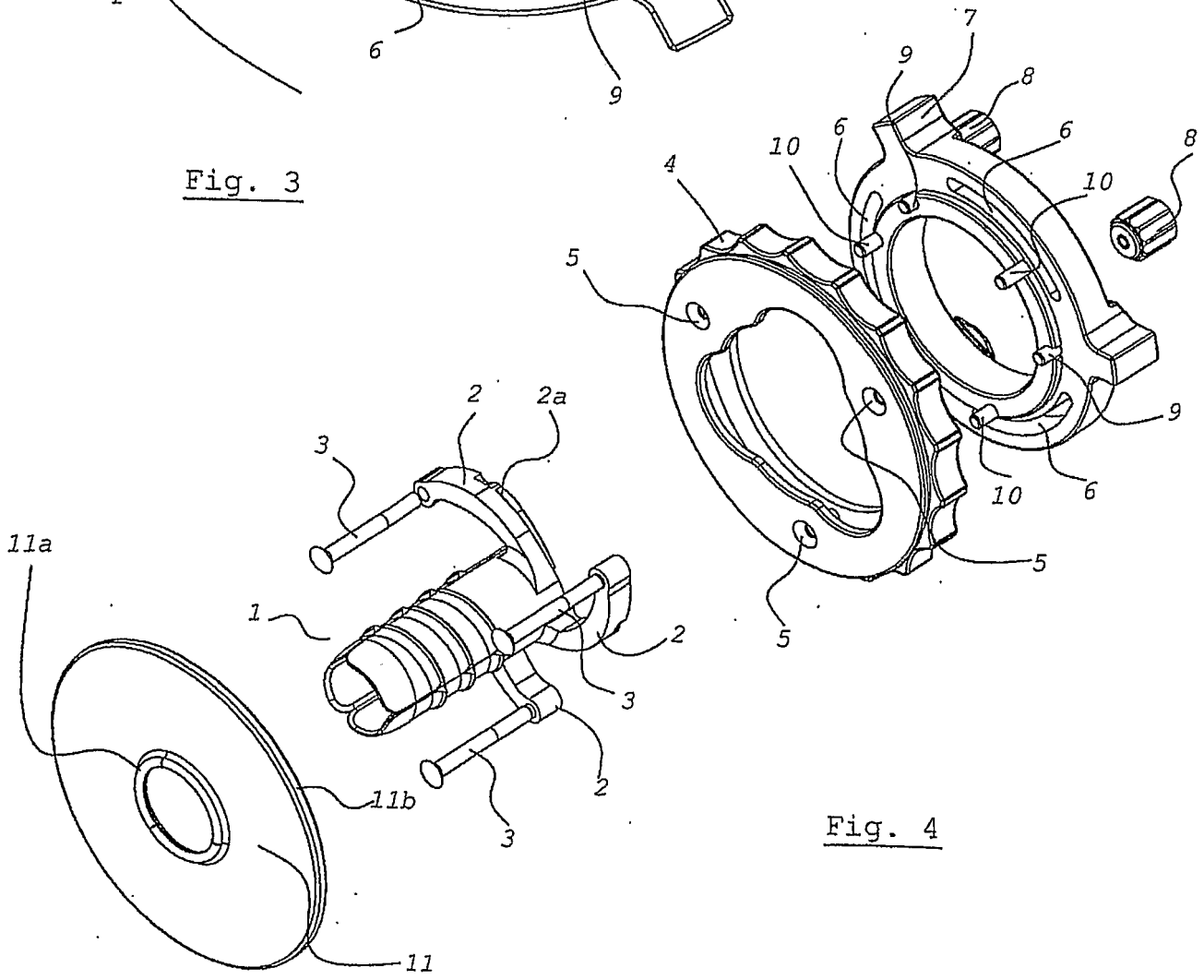
Fig. 3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11b
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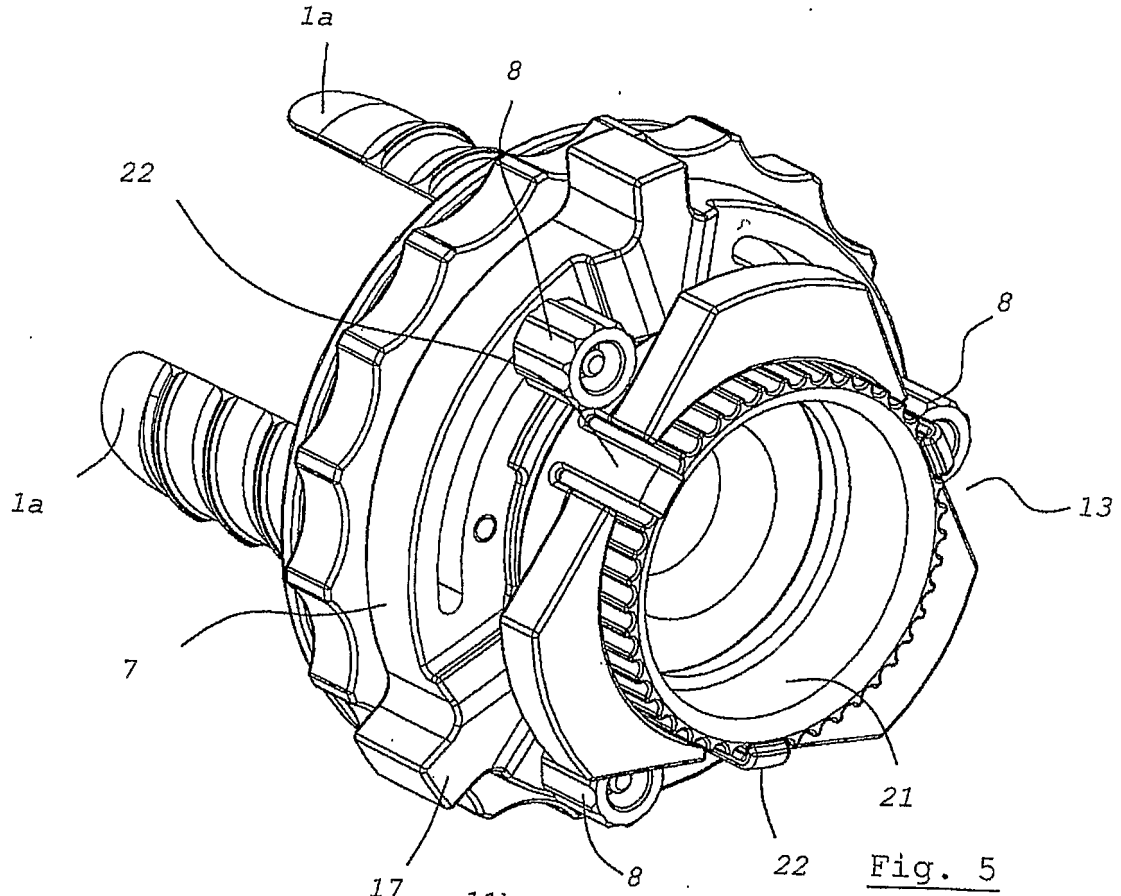
11

Fig. 4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1a
13
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21
17
8
22

Fig. 5

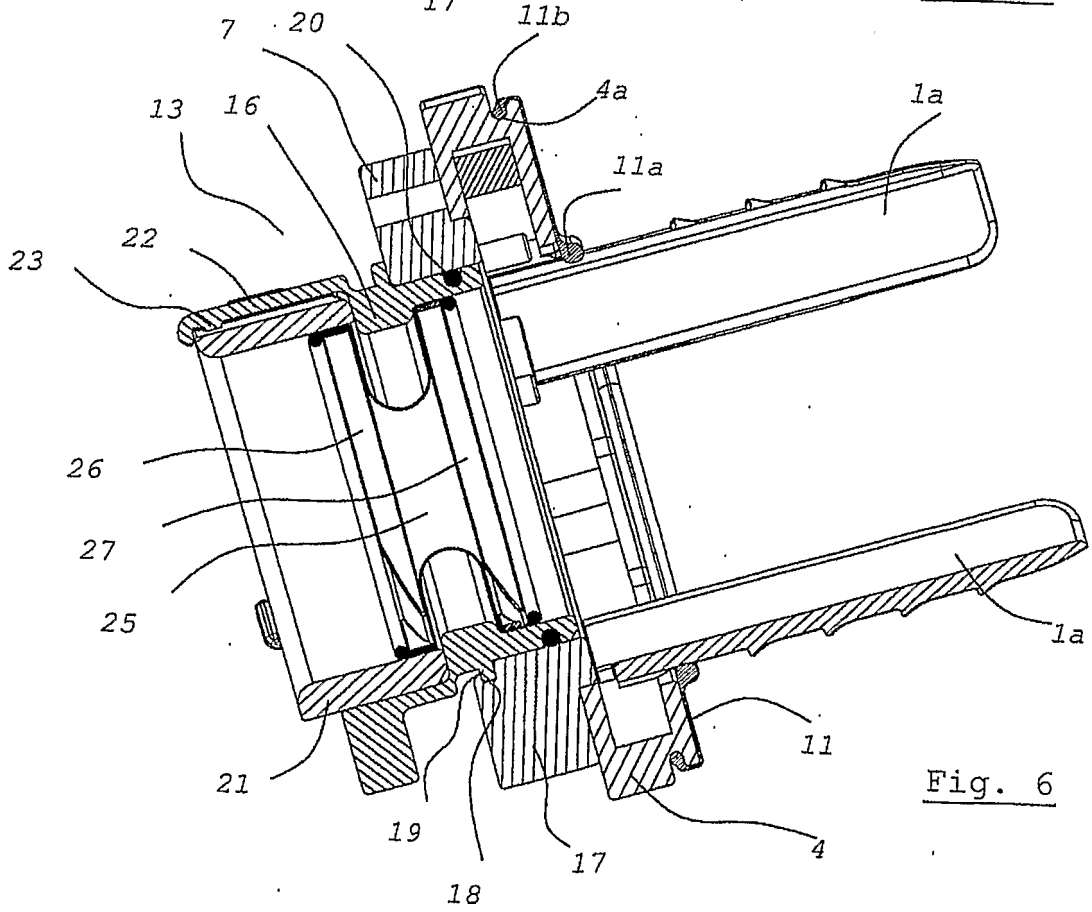
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Fig. 6

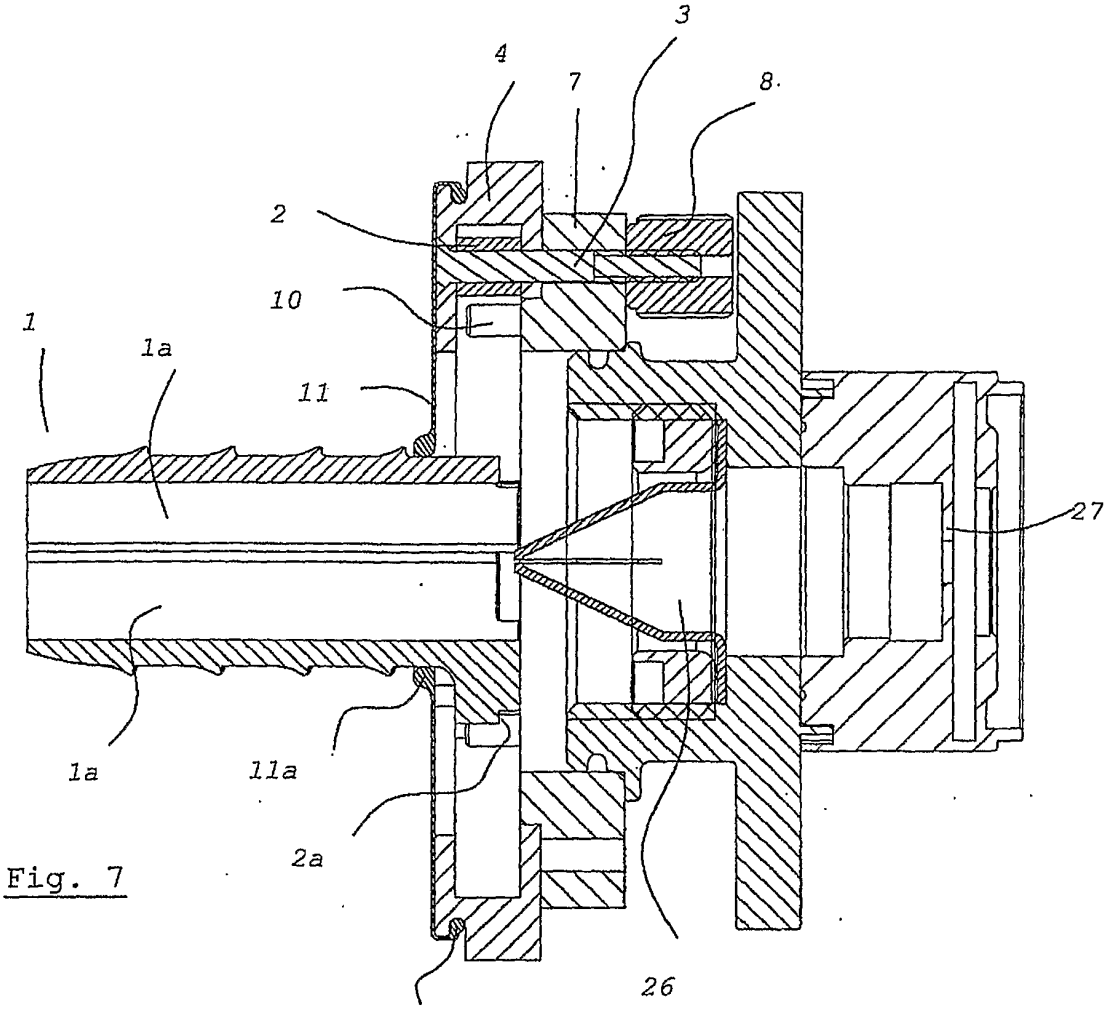

Fig. 7

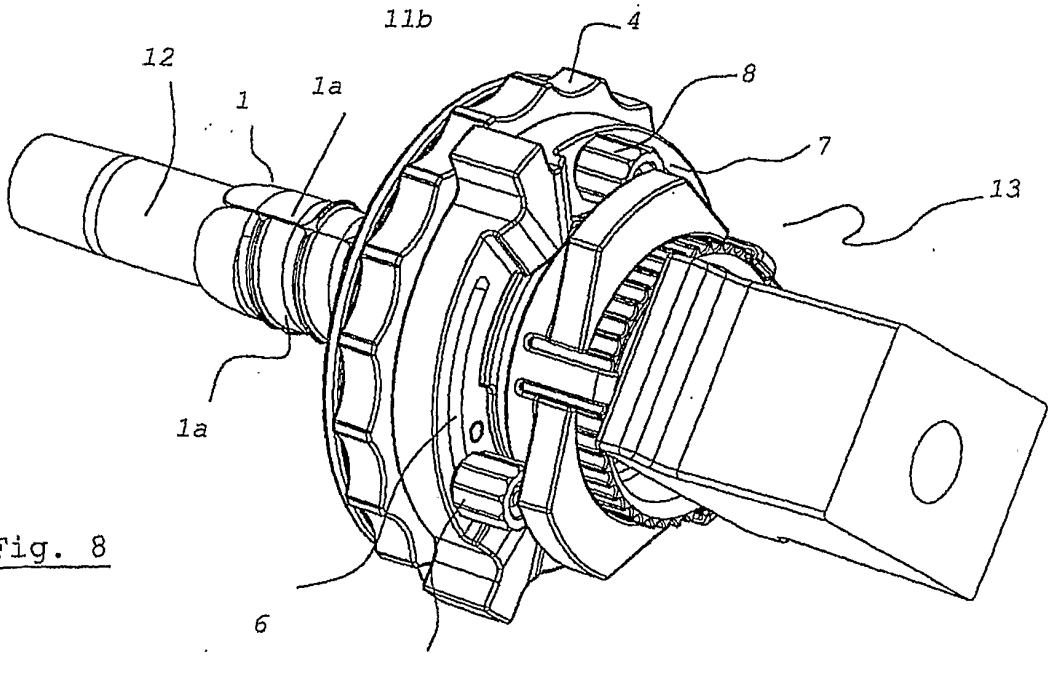

Fig. 8

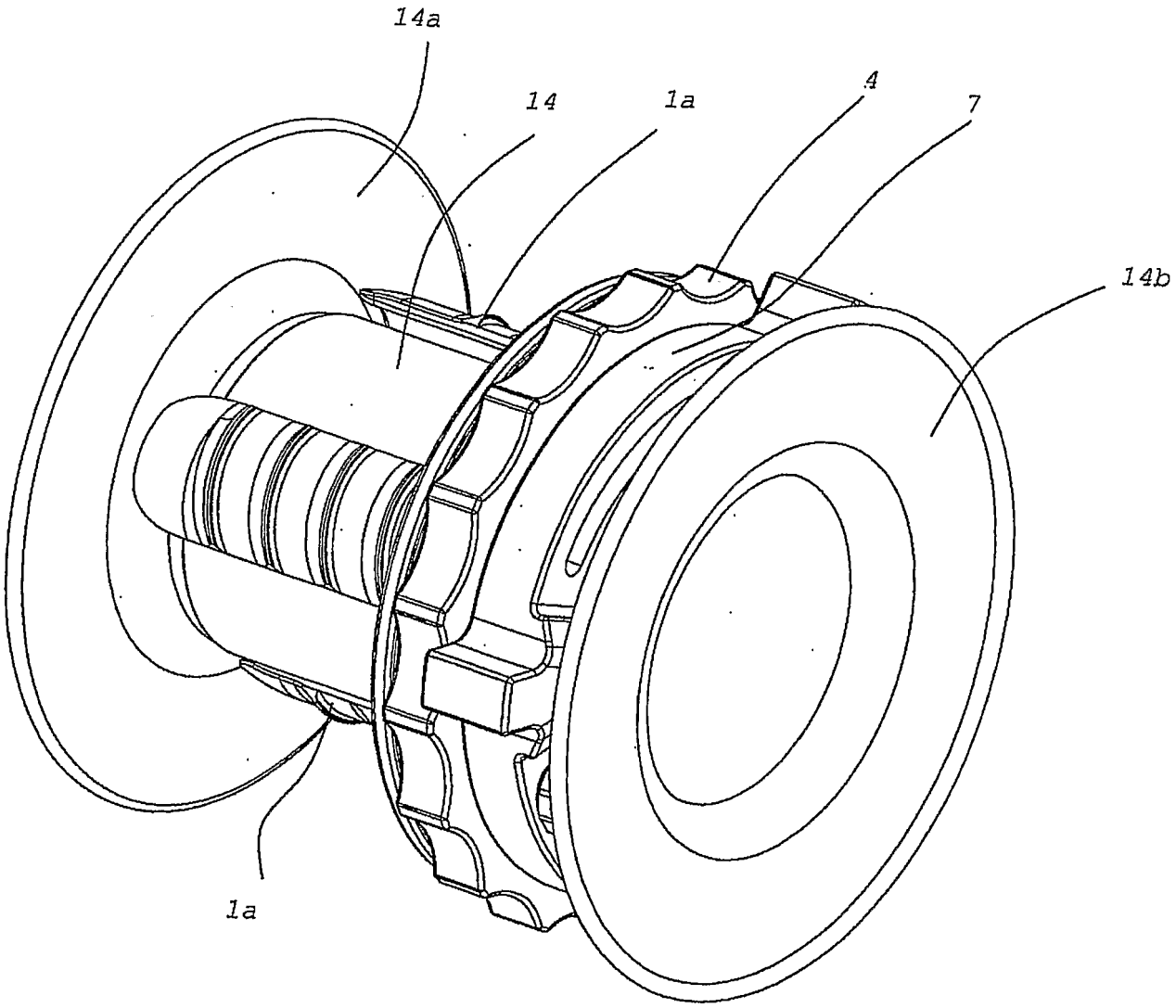

Fig. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/IT2006/000283

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B17/34 A61B17/02 A61B1/32

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61B

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 330 629 A (EDWARD BARON) 16 June 1930 (1930-06-16) page 2, line 34 - page 4, line 24 figures 1-3	1-7,10, 11
X	US 3 789 852 A (KIM S,US ET AL) 5 February 1974 (1974-02-05) column 3, line 13 - column 5, line 6 figures 1-11	1,2,8,12
A	US 5 871 474 A (HERMANN ET AL) 16 February 1999 (1999-02-16) the whole document	8
A	US 2004/215063 A1 (BONADIO FRANK [IE] ET AL) 28 October 2004 (2004-10-28) page 5, line 8 - page 9, line 19 figures 1,2	10-12

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
21 July 2006	31/07/2006

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/IT2006/000283

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 99/52577 A (APPLIED MEDICAL RESOURCES CORPORATION) 21 October 1999 (1999-10-21) page 3, paragraph 58 - paragraph 61 figures 11-14	12

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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专利名称(译)	用于套管针的径向可扩展锚固导向器		
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其他公开文献	EP1874199B1		
外部链接	Espacenet		

摘要(译)

一种用于套管针的锚固导向器，包括管状主体（1），所述管状主体由多个基本上圆形的扇形区域（1a）形成，所述扇形体可从所述管状主体的纵向轴线径向移动并且在所述第一位置之间沿着所述管状主体的纵向轴线移动，其中所述第一位置根据a第一基本圆形布置，其直径等于所述管状主体的直径，和第二位置，其中它们根据直径大于第一布置的第二基本上圆形的布置彼此等距地产生。每个扇区可旋转地连接到支撑元件（4），并且提供手动操作装置（7），可移动地连接到所述支撑元件，用于将扇区从第一位置移动到第二位置，反之亦然。