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

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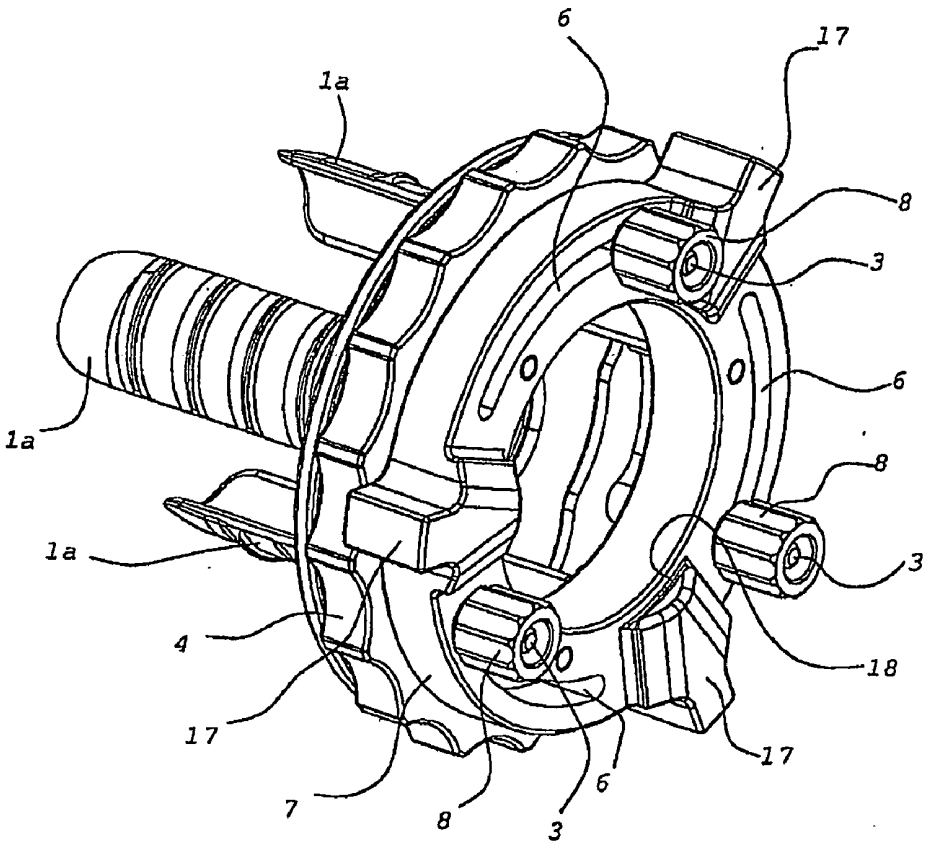
(57) **ABSTRACT**

An anchor guide for a trocar comprising a tubular body, formed by a plurality of substantially circular sectors, moveable radially toward and away from a longitudinal axis of the tubular body between a first position where they flank one another, according to a first substantially circular arrangement with diameter generally equal to that of the tubular body, and a second position at which they are generally equidistant from one another, according to a second substantially circular arrangement of greater diameter than that of the first arrangement. Each sector is rotatably connected to a support element and a manual operation is provided, moveably connected to the support element, for moving the sectors from the first to the second position and vice versa.



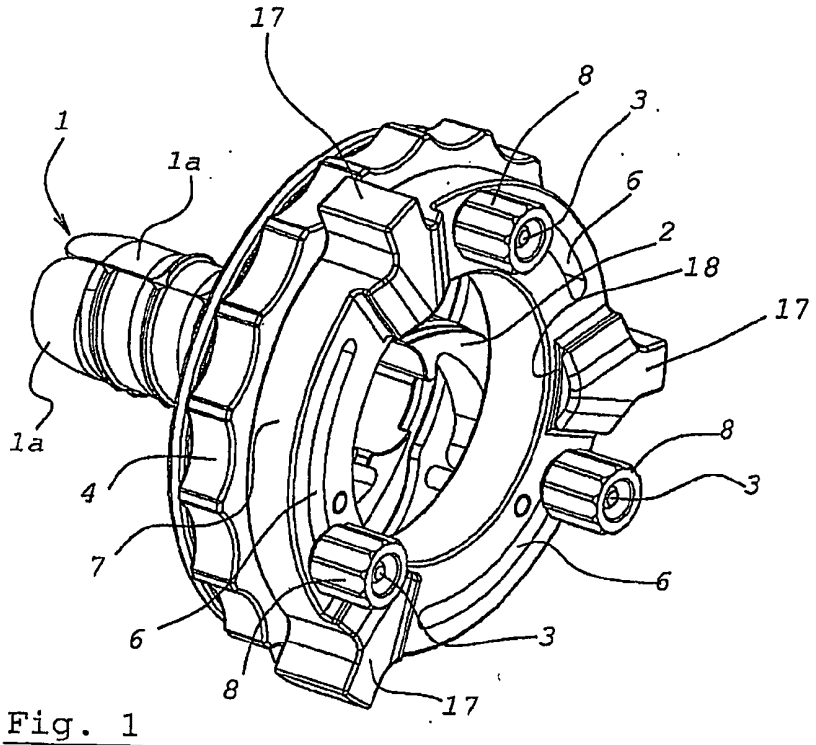

17
8
3
1
1a
6
2
18
17
1a
8
4
3
7
6
6
3
8
17

Fig. 1

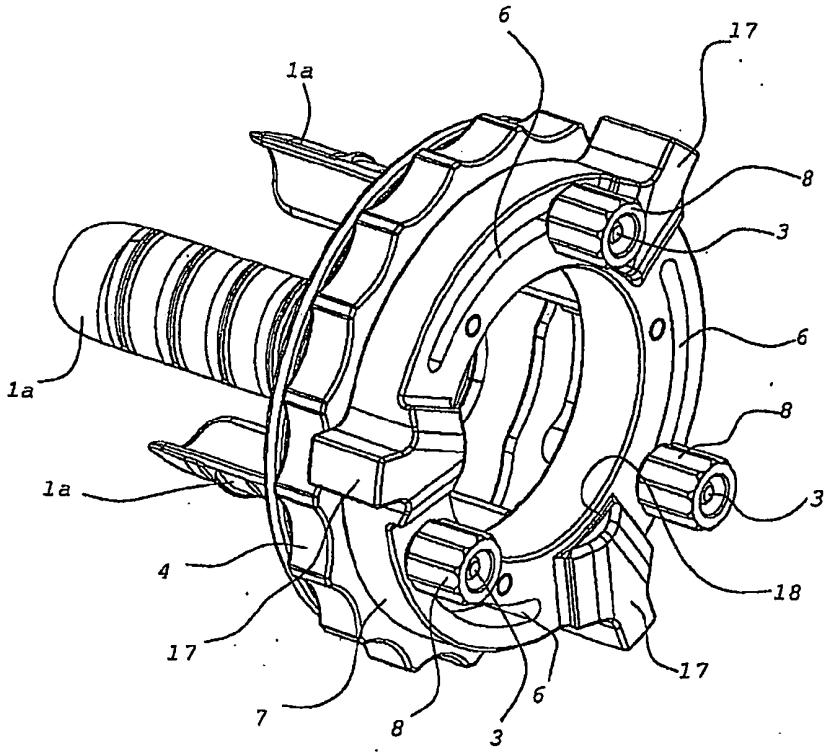

6
17
1a
8
3
6
1a
8
1a
3
4
18
17
17
7
8
3
6

Fig. 2

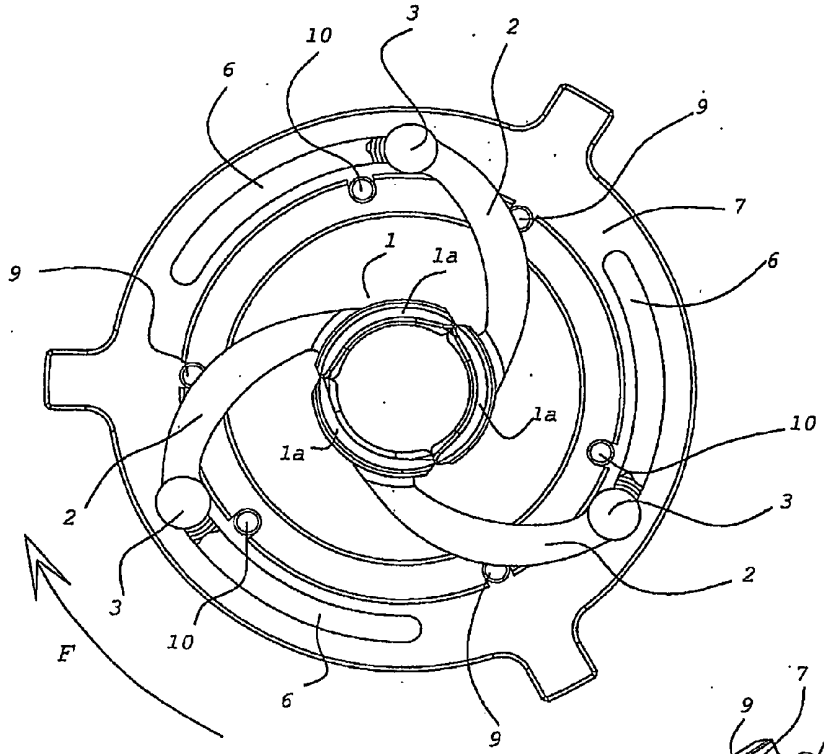

3
10
2
6
9
7
1
1a
9
6
1a
1a
10
2
3
3
2
10
F
6
9

Fig. 3

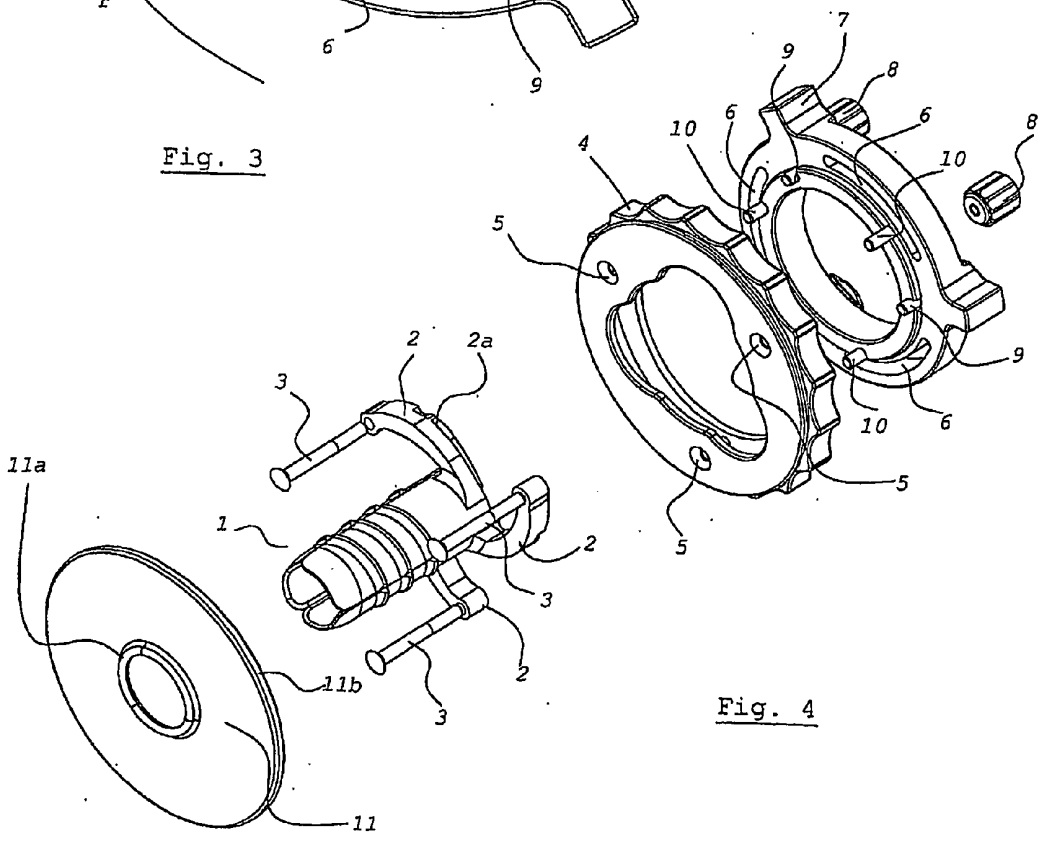

7
9
8
10
6
6
8
4
10
5
9
10
6
5
5
2
2a
3
11a
1
2
3
2
11b
3
11

Fig. 4

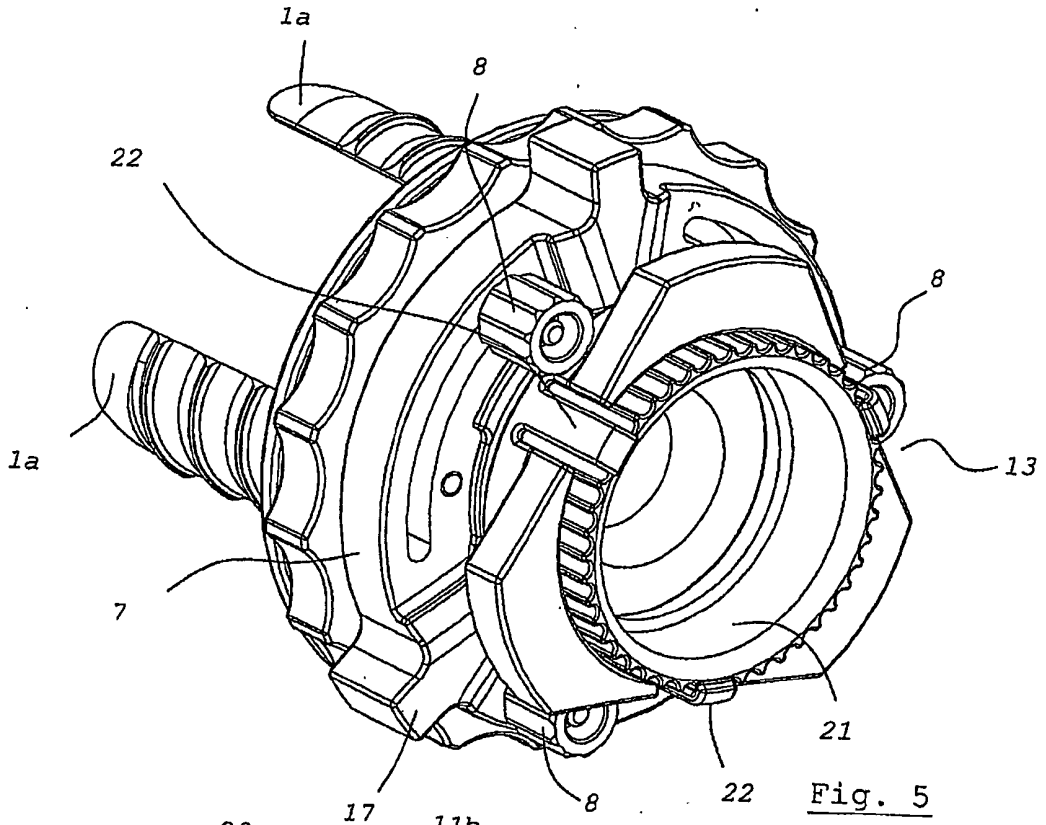

1a
8
22
8
1a
13
7
21
17
8
22

Fig. 5

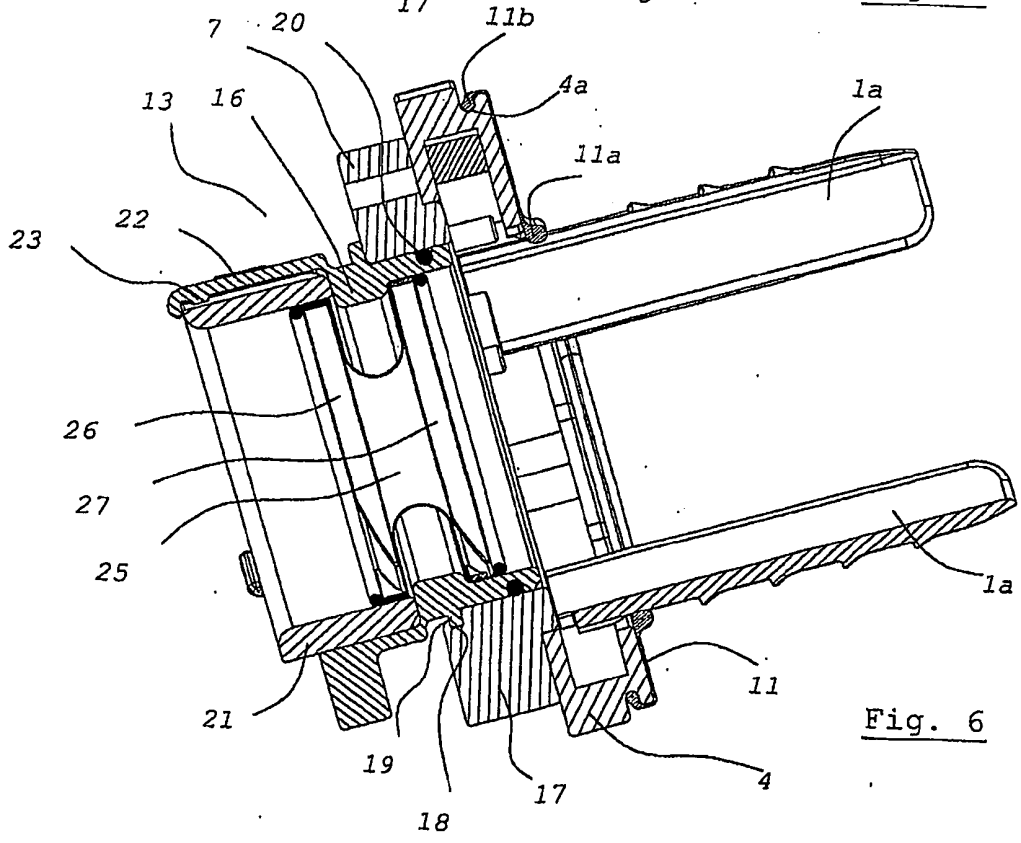

7
20
11b
4a
13
16
1a
11a
22
23
26
27
25
1a
11
21
19
17
4
18

Fig. 6

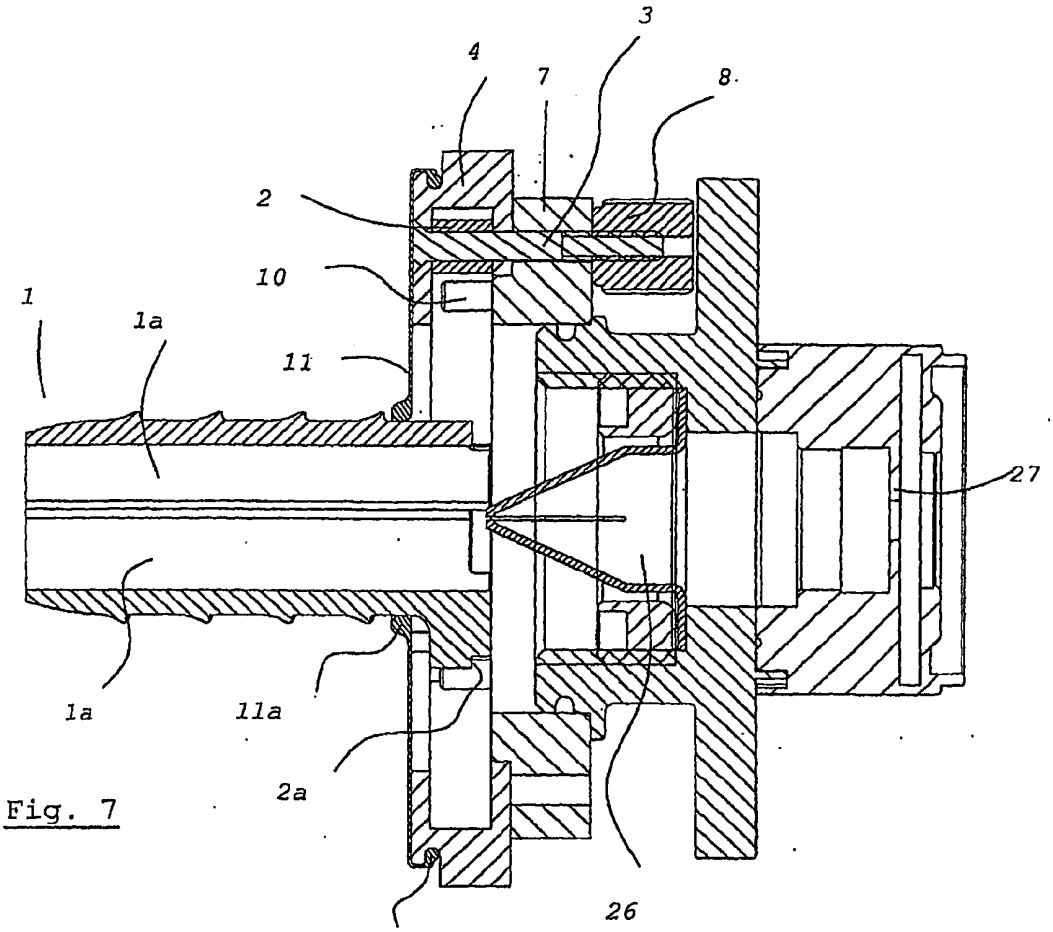


Fig. 7

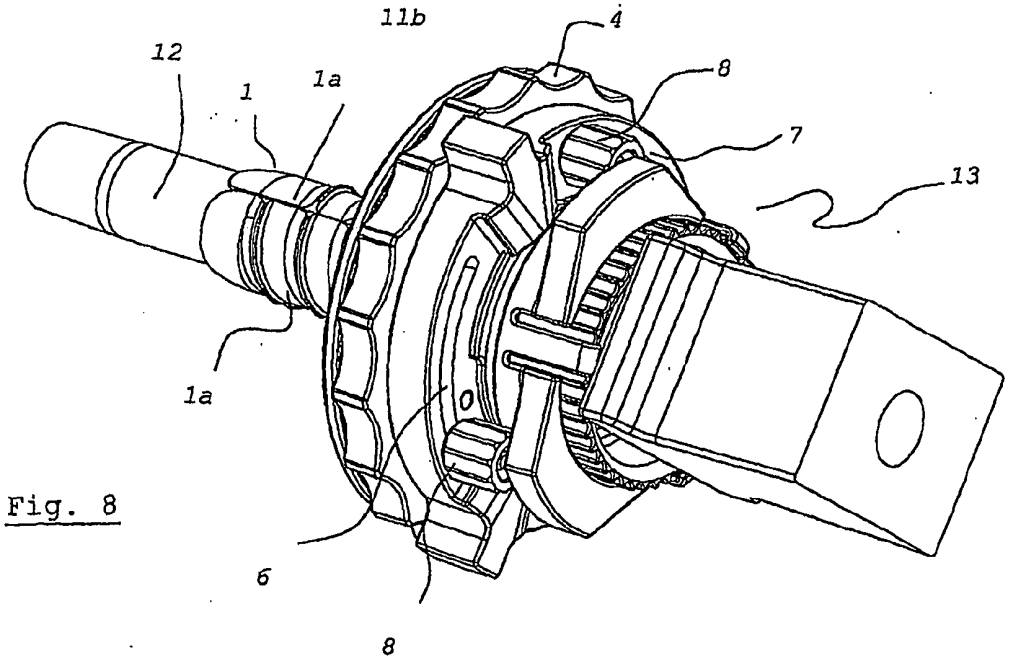


Fig. 8

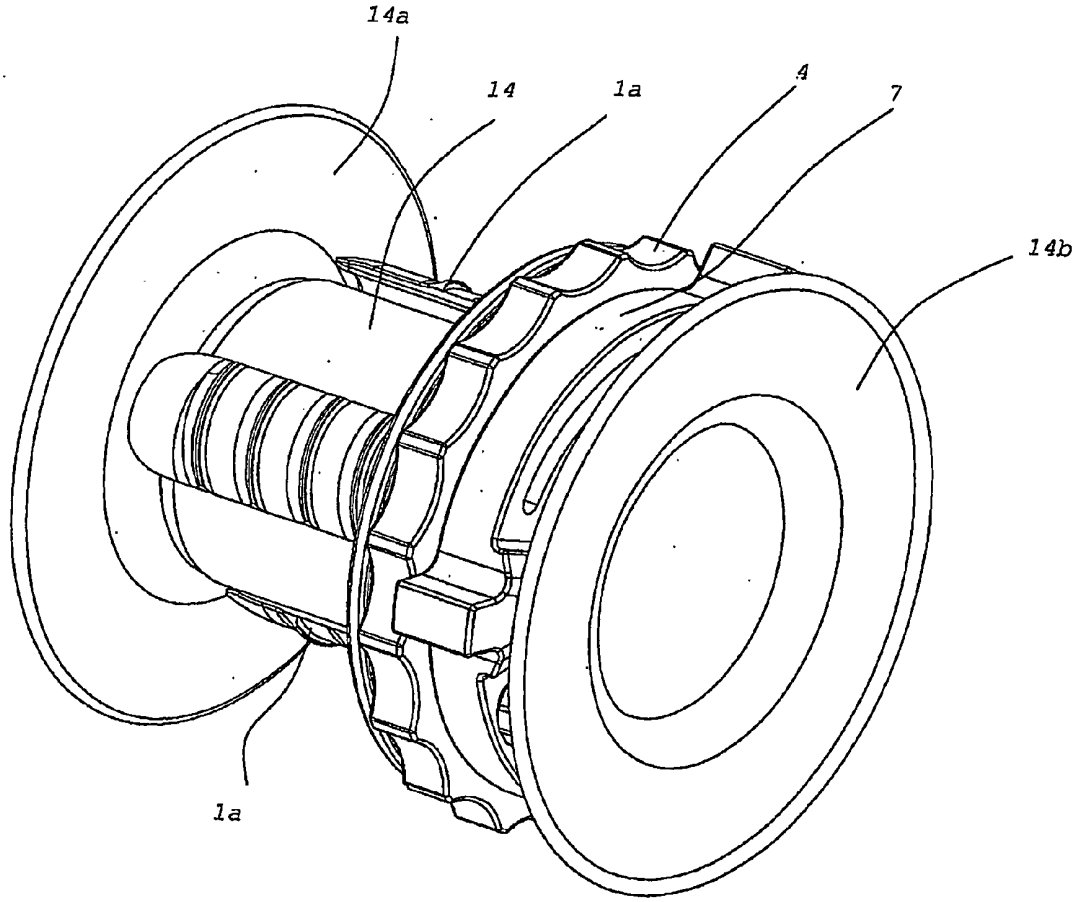


Fig. 9

RADIALLY EXPANDABLE ANCHORAGE GUIDE FOR TROCARS

FIELD OF THE INVENTION

[0001] 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

[0002] 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.

[0003] 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.

[0004] 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.

[0005] 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

[0006] 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.

[0007] 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.

[0008] 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

[0009] 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:

[0010] FIG. **1** is a perspective view of the anchorage guide according to the invention in its closed position;

[0011] FIG. **2** is a perspective view of the anchorage guide in its open position;

[0012] FIG. **3** is a cross sectional view of the anchorage guide of FIG. **1**;

[0013] FIG. **4** is an exploded view of the anchorage guide according to the invention;

[0014] FIG. **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;

[0015] FIG. **6** is a longitudinal sectional view of the anchorage guide of FIG. **5**;

[0016] FIG. **7** is a longitudinal sectional view of the anchorage guide according to the invention in its closed position with a commercial valve system;

[0017] FIG. **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;

[0018] FIG. **9** shows a perspective view of the anchorage guide according to the invention with a protective tube.

DETAILED DESCRIPTION OF THE INVENTION

[0019] With reference to FIGS. **1-4**, a tubular body, generically indicated with **1**, is formed by three sectors **1***a* of angular width equal to 120°. From one end of each of the sectors **1***a*, 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** oppositely with respect to the fixed ring nut **4**, thereby obtaining the mutual fixing of the various components.

[0020] The three sectors **1***a* 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 **1***a* has a saw tooth thread, as in the anchorage cannulae of known type, capable of grasping the walls of the body cavity access hole.

[0021] 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 **1***a* extending therefrom progressively divaricate from each other, passing from the closed configuration illustrated in FIG. **1** to the open configuration of FIG. **2**.

[0022] 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 FIG. **1**, the closure pins **9** abut on the convex side of the respective curved arms **2** and maintain the three cylindrical sectors **1***a* 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 FIG. **4**, the arms **2** have seats **2***a*, 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 FIG. **3**, the thrust pins **10** come into contact with the concave profile of the arms **2** of the sectors **1***a* and, sliding along them away from the hinge pins **3**, ensure that the arms progressively extend. The opening of the sectors **1***a* 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 **1***a* 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**.

[0023] To ensure an adequate sealing of the gas on the patient side, a membrane **11** is foreseen as shown in FIG. **4** and FIG. **7**, while on the surgeon's side the seal is ensured by a valve system such as that shown in FIGS. **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 **11***a* and **11***b*. The maximum diameter ring **11***b* is inserted in a perimetrical groove **4***a* of the ring nut **4**, as is visible in FIG. **6**, while the minimum diameter ring **11***a* is tight at the base of the sectors **1***a*. No groove for housing the ring **11***a* 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**.

[0024] 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 FIG. **8**, the three sectors **1***a* 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 FIGS. **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.

[0025] If during the operation it becomes necessary to insert a trocar of greater size, it will suffice to open the valve **13** of FIG. **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.

[0026] 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.

[0027] 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 **1***a* a tube **14** (see FIG. **9**) after having overturned the elastic membrane **14***a* 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 **14***a*. For its insertion inside the divaricated tubular body **1**, the inner disc or membrane **14***a* is folded inside the tube **14** and subsequently made to expand inside the abdomen. The membrane **14***a* 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 **1***a* 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. FIG. **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 **1***a* and pull the tube **14** through the outer disc **15**.

[0028] The valve **13** illustrated in FIGS. **5** and **6** is based on the principal of operation of a commercial device named "LAP-DISC", described in the U.S. Pat. Nos. 6,110,154 and 6,589,167 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.

[0029] With particular reference to FIGS. **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**.

[0030] 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.

[0031] 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.

[0032] 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 FIG. **7**.

[0033] 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 FIG. **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.

[0034] Naturally, the tubular body **1** of the expandable anchorage guide according to the invention can be made in a different number of cylindrical sectors **1***a* 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.

[0035] 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.

What is claimed is:

1. An anchor guide for a trocar for use in laparoscopic surgery, the guide comprising a tubular body with a member for its anchorage to an access hole for entering a body cavity, wherein the tubular body is formed by a plurality of substantially circular sectors, moveable radially toward and away from a longitudinal axis of the body between a first position, where they flank one another according to a substantially circular first arrangement of diameter generally equal to that of the tubular body, and a second position, at which they are generally equidistant from one another according to a substantially circular second arrangement of greater diameter than that of the first circular arrangement, the plurality of sectors being rotatably connected to a support element and a manual operation, moveably connected to the support element, being further provided for moving the sectors from the first to the second position and vice versa.

2. The anchor guide set forth in claim **1**, wherein each of the substantially circular sectors has an arm extending therefrom in a substantially tangential manner and hinged to the support element at its free end, the operation member acting on the arms.

3. The anchor guide set forth in claim **1**, wherein the support element is an annular body and the manual operation member comprises a moveable ring nut rotating coaxially on the annular body and thrust pins extending orthogonally from the moveable ring nut and arranged so as to interfere with the arms during movement of the ring nut, the sliding of the thrust pins along the arms effecting their angular displacement.

4. The anchor guide set forth in claim **1**, wherein the arms have a curved profile.

5. The anchor guide set forth in claim **1**, wherein the manual operation member further comprises closure pins extending from the moveable ring nut and also adapted to interfere with the arms from an opposing portion of the thrust pins.

6. The anchor guide set forth in claim **1**, wherein the arms are housed generally coplanarly within and relative to the annular body.

7. The anchor guide set forth in claim **1**, wherein the arms are hinged to the support element through pins passing respectively therethrough and engaged with respective circumferential slots formed along the moveable ring nut, reversible tightening members of the pins abutting the moveable ring.

8. The anchor guide set forth in claim **1**, wherein the anchor member comprises a saw tooth thread formed along an outer surface of the tubular body.

9. The anchor guide set forth in claim **1**, wherein a tube can be attached within the tubular body in open condition, the tube having two elastic disc-shaped membranes extending from its ends and foldable within it.

10. The anchor guide set forth in claim **1**, wherein the moveable ring nut includes a fastener for a valve body.

11. The anchor guide set forth in claim **10**, wherein the valve body comprises a fixed support reversibly connected to the moveable ring nut and a control ring nut pivotally engaged with the fixed support and maintained in a desired angular position by flexible arms extending axially from the fixed support, the arms having inner radial projections for engagement with axial grooves formed on the edge of the control ring nut.

12. The anchor guide set forth in claim **1**, further comprising a valve having a fixed support reversibly connectable to the manual operation member, a control ring nut rotatably engaged within the fixed support and an elastic membrane obturator having a toroidal shape, at rest, with an "omega" cross section, tightened to the inner walls of the control ring nut and the fixed support, whereby, upon rotating the control ring nut relative to the support, the elastic membrane is subjected to torsion, causing it to close radially like a diaphragm, wherein the control ring nut is maintained in a desired angular position by flexible arms extending axially from the fixed support, the arms having inner radial projections for engagement with axial grooves on the edge of the control ring nut.

* * * * *

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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申请号	US11/919648	申请日	2006-04-26
[标]申请(专利权)人(译)	FERRARI DANILO		
申请(专利权)人(译)	FERRARI DANILO		
当前申请(专利权)人(译)	FERRARI DANILO		
[标]发明人	FERRARI DANILO		
发明人	FERRARI, DANILO		
IPC分类号	A61B17/34		
CPC分类号	A61B17/0206 A61B17/3439 A61B17/3462 A61B2017/349 A61B2017/3464 A61B2017/3482 A61B2017/3484 A61B17/3498		
优先权	FI2005000082 2005-04-29 IT		
其他公开文献	US8292851		
外部链接	Espacenet USPTO		

摘要(译)

根据第一基本上圆形的布置，用于套管针的锚固引导件包括管状主体，该管状主体由多个基本上圆形的扇形部分形成，可沿径向朝向和远离管状主体的纵向轴线在它们彼此相对的第一位置之间移动。根据直径大于第一装置直径的第二基本上圆形的布置，其直径通常等于管状主体的直径，并且第二位置通常彼此等距。每个扇区可旋转地连接到支撑元件，并且提供手动操作，可移动地连接到支撑元件，用于将扇区从第一位置移动到第二位置，反之亦然。