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(54) Title: A TROCAR WITH ENHANCED MANOEUVRE CAPABILITY

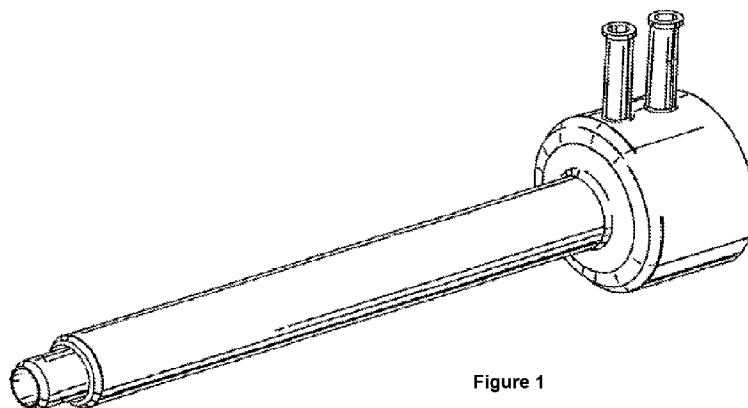


Figure 1

(57) Abstract: The present invention relates to a trocar which mediates the surgical instruments used during closed surgeries and operations to be inserted inside the body. The objective of the present invention is to provide a trocar which enhances the manoeuvre capability of the surgical instruments by means of its part entering inside the body having almost the same outer diameter with its part outside the body. Another objective of the present invention is to provide a trocar which enables the curved surgical instruments used in operations to be inserted inside the body in closed operations.



## **A TROCAR WITH ENHANCED MANOEUVRE CAPABILITY**

### **Field of the Invention**

The present invention relates to a trocar which mediates the surgical instruments used during laparoscopic and other minimal invasive surgeries to be inserted inside the body.

### **Background of the Invention**

Surgical instruments such as camera, scissors used during closed surgeries are inserted inside the abdominal cavity through the apparatus called trocar. The trocars placed inside the incisions made on the abdominal wall have various valve mechanisms in order to prevent the gases constituting the intra-abdominal pressure from going out of the body. Valve mechanisms are one of the indispensable parts of the trocars in order to maintain the body pressure. However, in today's trocars the entry part of the trocar wherein the valve mechanism is mounted has larger outer diameter than the body part of the trocar which is inserted inside the body since the valve mechanism has a complex structure. The outer diameters of the entry parts of the conventional trocars being larger than the body part causes various problems. One of the biggest problems of the conventional trocars is the manoeuvre loss in laparoscopic operation instruments especially when they are placed at close points to each other. The conventional trocars which are placed from close points to each other cannot enter inside the body parallel to each other since the large outer diameters originating from the valve mechanisms at the parts wherein the surgical instruments are inserted contact each other. Most of the time the ends of the trocars inside the body come close to each other too much or are positioned diagonal to each other. This situation makes it difficult to control the surgical instrument from the part out of the body and the part inside the body to reach the targeted areas.

Another negative side of current trocars is that they do not have a flexible structure since they are generally produced from a material such as hard plastic or metal. Only the surgical instruments having a straight structure can pass through the trocars produced from a non-flexible material. Surgical instruments having a curvy structure cannot pass through the conventional trocars.

Another negative aspect of the conventional trocars is that the hose coming out of the air inlet channel extends towards the hand of the operator, the person who performs the surgery, and disturbs the hand of the operator. In the trocars in the state of the art, air inlet channel is positioned such that it will be towards the end of the trocar entering inside the body or perpendicular to the axis of the trocar in order that it will not cause failure by the air sent inside the trocar with pressure to hit the valve system. For this reason, the hose attached to the air inlet channel in order to transfer air to the body from the air inlet channel extends towards the hand of the operator and disturbs the operator because of the physical contact.

United States Patent document no US5584847, an application known in the state of the art, discloses a trocar with a rotating tip wherein the endoscopy instruments can enter.

United States Patent document no US2009204140, another application known in the state of the art, discloses adding an environmental protector in order to prevent the trocar from entering more by accident after the puncture.

### **Summary of the Invention**

The objective of the present invention is to provide a trocar which enhances the manoeuvre capability of the surgical instruments by means of its part entering inside the body having almost the same outer diameter with its part outside the body.

Another objective of the present invention is to provide a trocar which enables the curved surgical instruments used in operations to be inserted inside the body in closed operations.

A further objective of the present invention is to provide a trocar which prevents the air hose attached to the air inlet channel from extending towards the hand of the person who is operating.

Yet another object of the present invention is to provide a trocar having a body which prevents slipping inside the body.

### **Detailed Description of the Invention**

“A trocar” realized to fulfill the objectives of the present invention is illustrated in the accompanying figures, in which:

Figure 1 is the view of a trocar in the state of art.

Figure 2 is the view of a trocar the valve part of which is made thin.

Figure 3 is the cross sectional detailed view of the upper body of the trocar.

Figure 4 is the sectional view of the valve.

Figure 5 is the longitudinal sectional view of the trocar.

Figure 6 is the sectional view of the trocar wherein the hose is connected to its air inlet-outlet channel.

The components in the figures are numbered individually, where the numbers refer to the following:

1. Trocar
2. Lower body
3. Thread

4. Support
5. Upper body
6. Valve
  61. Valve body
  62. Holder
  63. Valve tip
  64. Groove
7. Air inlet-outlet channel
  71. Opening
  72. Air directing bevel
8. Upper hole
9. Lower hole
10. Drilling tip

A trocar with enhanced manoeuvre capability (1), which is used in various laparoscopic and other minimal invasive surgeries and through which the instruments and/or devices to be used during operation and/or surgery are passed and are inserted inside the body, comprises

- at least one lower body (2) which enters inside the body,
- at least one thread (3) which is located on the lower body (2) and prevents the lower body (2) from slipping inside the body or outside the body during operation,
- at least one support (4) which prevents the lower body (2) from completely entering inside the body,
- at least one upper body (5) which is located at the upper part of the lower body (2) (in direction of U arrow),
- at least one valve (6) which is located inside the upper body (5) and prevents air leakage from the body cavity during surgery,
- at least one air inlet-outlet channel (7) which is located on the upper body (5) and enables the pressurized gas to be supplied inside the body

or the gasses to be released from the body in order to maintain the body pressure,

- at least one upper hole (8) which enables the devices used during operation to be inserted into the upper body (5) and is located at the end of the upper body (5) on which the lower body (2) is not located,
- at least one lower hole (9) which is located at the end of the lower body (2) entering the body and enables the surgical instruments inserted inside the upper body (5) via the upper hole (8) and then moving through the lower body (2) to go out of the lower body (2) and move inside the body cavity, and
- at least one drilling tip (10) which is located at the end of the lower body (2) entering the body and enables the lower body (2) to be inserted into the body cavity by drilling the abdominal wall.

The inventive trocar (1) comprises at least one upper body (5) which has the same or almost same outer diameter with the lower body (2).

The lower body (2) preferably has a hollow cylindrical structure and it is the part of the inventive trocar with enhanced manoeuvre capability (1) which goes inside the body. In the preferred embodiment of the invention, there are preferably circular threads (3) on the outer surface of the lower body (2) such that they will be co-axial with the lower body (2). The threads (3) enable the lower body (2) to remain in desired depth while the lower body (2) is inserted through the incisions made on the abdominal wall. By means of the threads (3) the trocar (1) is prevented from moving outwards or inwards or slipping on the abdominal wall unintentionally during the operation. In one embodiment of the invention, each one of the threads (3) has larger outer diameter than the previous thread (3) such that it will have the smallest outer diameter at the end of the lower body (2) entering the body and the largest outer diameter at the end of the lower body (2) connecting with the upper body (5). In one embodiment of the invention, the lower body (2) is produced from any metal or metal alloy. In one embodiment of

the invention the lower body (2) is produced from medical grade polypropylene or a flexible material such as medical grade polyethylene. In a preferred embodiment of the invention, by means of producing the lower body (2) from a flexible material, nonlinear instrument can also be inserted inside the body via trocar (1).

The support (4) is located at the part of the lower body (2) which does not enter inside the body. The support (4) prevents the inventive trocar (1) to move through the body further by leaning on the abdominal wall. By this means the trocar (1) is prevented from falling into the body cavity by mistake. In the preferred embodiment of the invention the support (4) is an elliptic structure. In other embodiments of the invention, the support (4) can be circle, triangle, rectangle or geometrical form having more edges or can be a curve. It is possible to develop support (4) embodiments in many more ways.

The upper body (5) is preferably a cylindrical structure one end of which is connected to the end of the lower body (2) that does not enter inside the body. In a preferred embodiment of the invention, the upper body (5) is produced one-piece with the lower body (2). The outer diameter of the upper body (5) is almost same with the outer diameter of the lower body (2). In another embodiment of the invention the outer diameter of the upper body (5) is a bit larger than the outer diameter of the lower body (2). In one embodiment of the invention the upper body (5) is produced from flexible material such as medical grade polypropylene or a medical grade polyethylene.

There is at least one valve (6) present inside the upper body (5) in order to prevent the air inside the body to be released outside during surgery. In the preferred embodiment of the invention, the valve (6) has a hollow cylindrical valve body (61). The valve body (61) engages inside the upper body (5) such that it will fit tightly. The inner diameter of the upper body (5) and the outer diameter of the valve body (61) are in contact with each other and air-sealed. On one of the circular surfaces on the valve body (61), there is a holder (62) which prevents the

valve (6) to move towards the lower body (2) inside the upper body (5). The holder (62) has a hollow cylindrical structure. The inner diameter of the holder (62) has preferably same size with the inner diameter of the valve body (61). The outer diameter of the holder (62) has preferably same size with the outer diameter of the upper body (5). On the surface of the valve body (61) on which the holder (62) is not located, that is the surface which is the circular, inserted inside the upper body, there is a valve tip (63). The valve tip (63) is preferably in the shape of a hollow cone. The part of the conical valve tip (63) having the largest outer diameter and thus the inner diameter is adjacent to the circular surface of the valve body (61) entering into the upper body (5). The largest outer diameter of the valve tip (63) is equal to the outer diameter of the valve body (61), and the largest inner diameter of the valve tip (63) is equal to the inner diameter of the valve body (61). The valve tip (63) is produced from a flexible material such as pharmaceutical rubber. On the part of the valve tip (63) farthest to the valve body (61), that is the pointed, top part of the conical valve tip (63), there is at least one groove (64) present in order to allow the instruments to be used during surgery to pass. When the groove (64) is free, that is no instrument is passing through it, it is air-sealed. When an instrument is passed through the groove (64), the valve tip (63) having a flexible structure sticks to the surfaces of the instrument with the effect of the pressurized air and prevents the air from being released. By means of the valve (6) having a simple structure, the outer diameter of the upper body (5) can be produced in almost same size with the outer diameter of the lower body (2).

The air inlet-outlet channel (7) is preferably a cylindrical and hollow structure which is located at any place between the valve (6) and the lower body (2) on the upper body (5), and enables the air to be sent to the body cavity during operation or to be released from the body cavity. One end of the air inlet-outlet channel (7) is connected to the upper body (5) and is preferably produced in one-piece. By means of the opening (71) located at the end of the air inlet-outlet channel (7) which is not connected to the upper body (5) gas is received from an external pressurized gas source and the trocar (1) is moved towards the body cavity. In the

preferred embodiment of the invention the end of the air inlet-outlet channel (7) which is not connected to the upper body (5) extends towards the lower body (2) (Figure 5). By this means, the hose (H) which is coming from the external air source and connected to the opening (71) of the air inlet-outlet channel (7) extends towards the body of the person who is being operated, not towards the upper part (U arrow direction) of the upper body (5). Therefore, it does not extend towards the upper hole (8) in which the instruments used during surgeries are inserted. The opening (71) part of the air inlet-outlet channel (7) being designed as it extends towards the lower body (2) causes the air sent through the channel (7) to hit the valve (6) first. The air sent with high pressure directly hitting the valve (6) may cause the valve (6) to be harmed and not to function. In order to prevent the air from hitting directly to the valve (6), the part of the air inlet-outlet channel (7) connecting with the upper body (5) is preferably produced inclined towards the lower body (2). The air directing bevel (72) prevents the air coming with high pressure to hit directly to the valve (6). In one embodiment of the invention the half of the cylindrical surface of the air inlet-outlet channel (7) connecting with the upper body (5) which is close to the valve (6) is inclined towards the lower body (2) and thus the air directing bevel (72) is constituted.

It is possible to develop various embodiments of the inventive "TROCAR WITH ENHANCED MANOEUVRE CAPABILITY" (1). The invention can not be limited to the examples described herein and it is essentially as defined in the claims.

## CLAIMS

1. A trocar (1) which is used in various laparoscopic and other minimal invasive surgeries and through which the instruments and/or devices to be used during operation and/or surgery are passed and are inserted inside the body **comprising**
  - at least one body (2) which enters inside the body,
  - at least one thread (3) which is located on the lower body (2) and prevents the lower body (2) from slipping inside the body or outside the body during operation,
  - at least one support (4) which prevents the lower body (2) from completely entering inside the body,
  - at least one upper body (5) which is located at the upper part of the lower body (2) (in direction of U arrow),
  - at least one valve (6) which is located inside the upper body (5) and prevents air leakage from the body cavity during surgery,
  - at least one air inlet-outlet channel (7) which is located on the upper body (5) and enables the pressurized gas to be supplied inside the body or the gasses to be released from the body in order to maintain the body pressure,
  - at least one upper hole (8) which enables the devices used during operation to be inserted into the upper body (5) and is located at the end of the upper body (5) on which the lower body (2) is not located,
  - at least one lower hole (9) which is located at the end of the lower body (2) entering the body and enables the surgical instruments inserted inside the upper body (5) via the upper hole (8) and then moving through the lower body (2) to go out of the lower body (2) and move inside the body cavity, and
  - at least one drilling tip (10) which is located at the end of the lower body (2) entering the body and enables the lower body (2) to be inserted into the body cavity by drilling the abdominal wall, and**characterized by**

- an upper body (5) which has the same or almost the same outer diameter with the lower body (2) by means of using a simple valve (6) system.
2. A trocar (1) according to claim 1, **characterized by** thread (3) which is located on the outer surface of the lower body (2) and prevents the inventive trocar (1) from slipping inside the body or outside the body during operation.
  3. A trocar (1) according to claim 2, **characterized by** threads (3) which are circular such that they will be co-axial with the lower body (2).
  4. A trocar (1) according to any one of the preceding claims, **characterized by** threads (3) which have larger outer diameter than the previous thread (3) such that it will have the smallest outer diameter at the end of the lower body (2) entering the body and the largest outer diameter at the end of the lower body (2) connecting with the upper body (5).
  5. A trocar (1) according to any one of the preceding claims, **characterized by** lower body (2) which is produced from a flexible material that allows the nonlinear instruments to be inserted inside the body via trocar (1).
  6. A trocar (1) according to any one of the preceding claims, **characterized by** a support which has an elliptic form (4).
  7. A trocar (1) according to any of the preceding claims **characterized by** upper body (5) which is produced in one-piece with the lower body (2).

8. A trocar (1) according to any of the preceding claims, **characterized by** valve (6) comprising -a valve body (61) which is in the shape of a hollow cylinder,
  - a support (62) which prevents the valve (6) from moving towards the lower body (2),
  - a valve tip (63) which is conical and located at the end of the valve (6) being inserted inside the body (5),
  - a groove (64) which is located on the valve tip (63) in order to allow the instruments to be used during surgeries to pass.
9. A trocar (1) according to Claim 8, **characterized by** valve tip (63) which is produced from a flexible material.
10. A trocar (1) according to any of the preceding claims, **characterized by** an air inlet-outlet channel (7) the end of which not connected to the upper body (5) extends towards the lower body (2).
11. A trocar (1) according to claim 10, **characterized by** air directing bevel (72) which is constituted towards the lower body (2) on the part of the air inlet-outlet channel (7) connecting with the upper body (5) in order to prevent the air sent from the air inlet-outlet channel from hitting directly to the valve (6).
12. A trocar (1) according to any of the preceding claims, **characterized by** lower body (2) which is produced from metal or metal alloy.
13. A trocar (1) according to Claims 1 to 11, **characterized by** lower body (2) which is produced from medical grade polypropylene or medical grade polyethylene.

14. A trocar (1) according to any one of the preceding claims, **characterized by** a valve tip (63) which is produced from pharmaceutical rubber.
15. A trocar (1) according to any of the preceding claims **characterized by** upper body (5) which is produced medical grade polypropylene or medical grade polyethylene.

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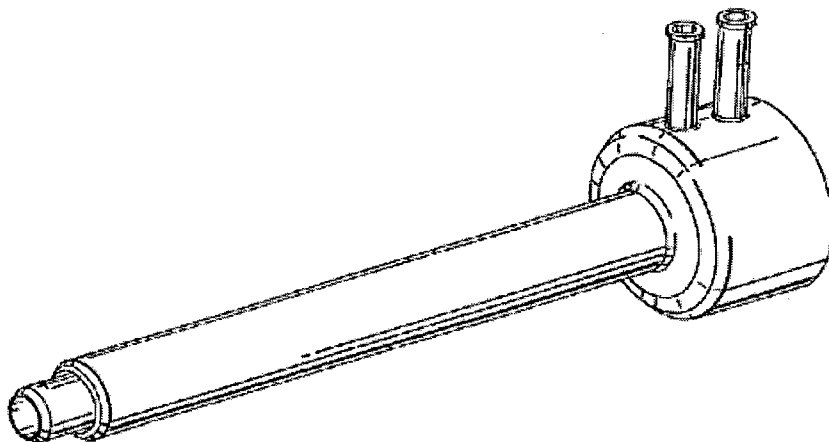


Figure 1

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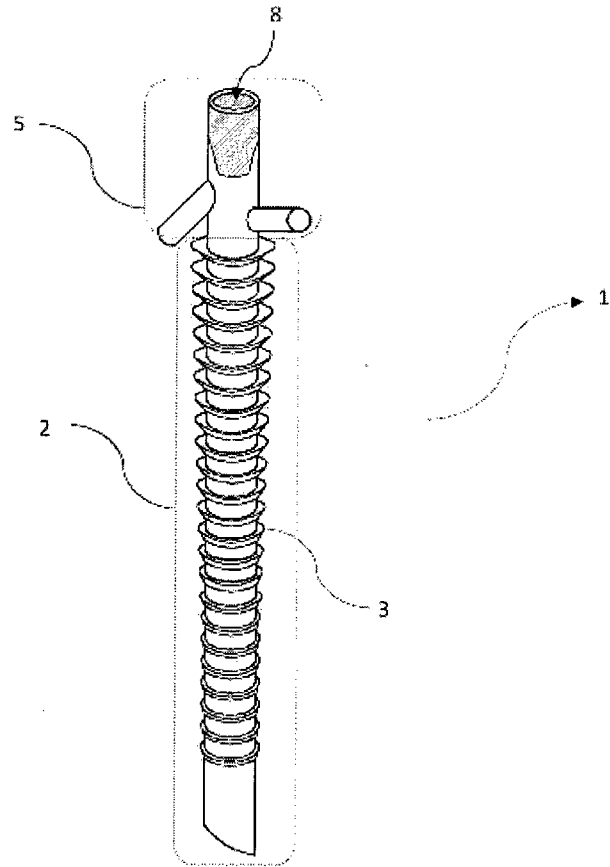


Figure 2

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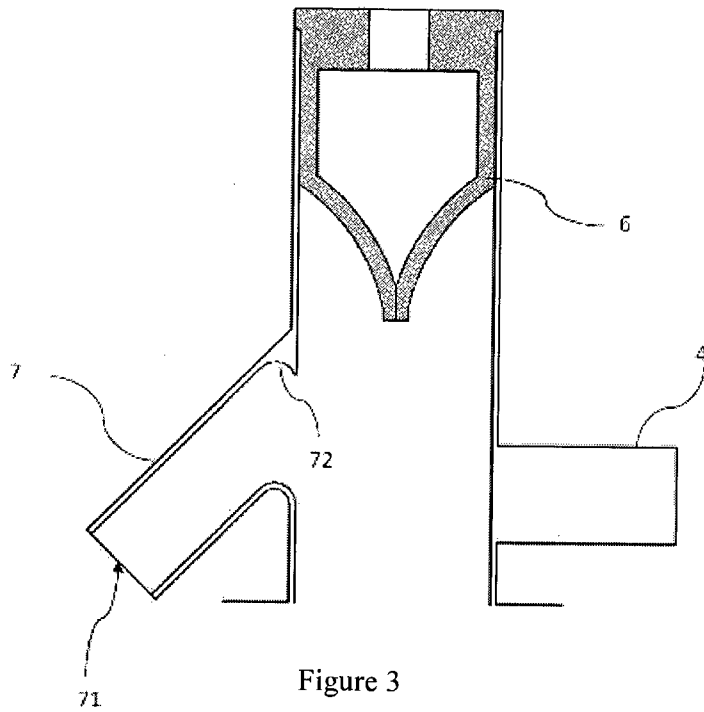


Figure 3

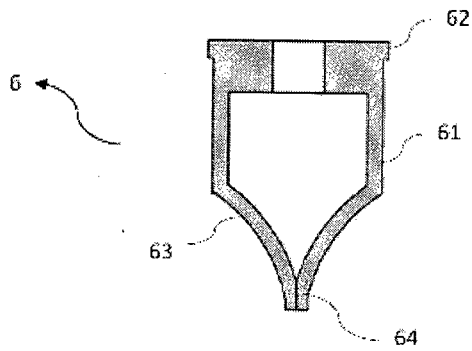


Figure 4

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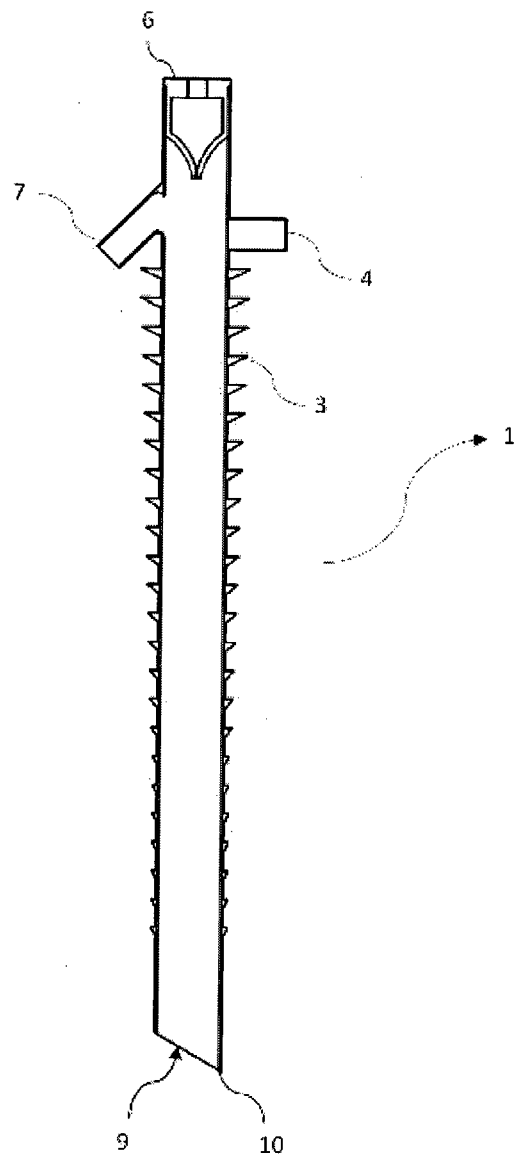


Figure 5

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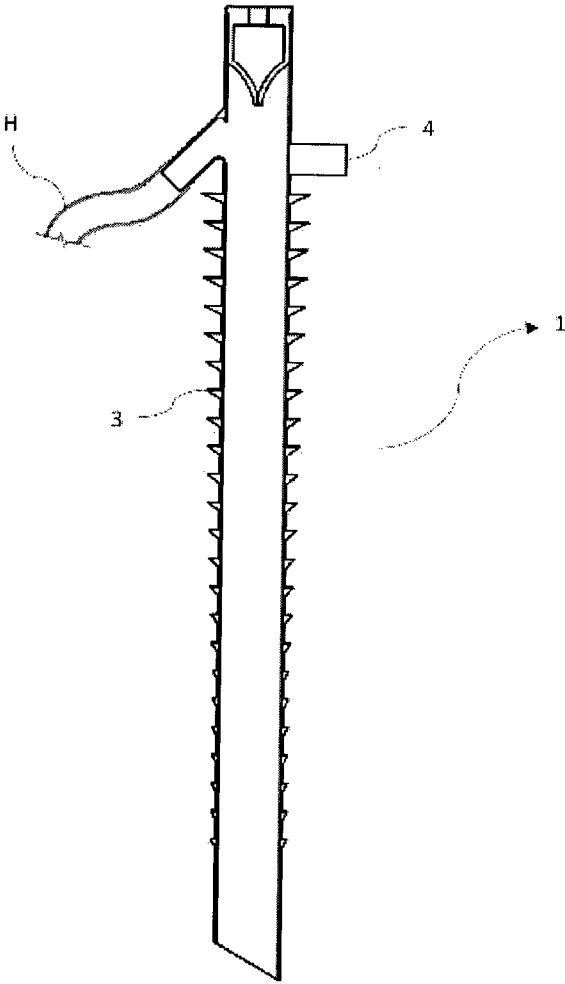


Figure 6

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/IB2012/052677

| <b>A. CLASSIFICATION OF SUBJECT MATTER</b><br>INV. A61B17/34<br>ADD.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                   |                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| According to International Patent Classification (IPC) or to both national classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                   |                                                                                                                           |
| <b>B. FIELDS SEARCHED</b><br>Minimum documentation searched (classification system followed by classification symbols)<br>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 practicable, search terms used)<br>EP0-Internal, WPI Data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                   |                                                                                                                           |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                   |                                                                                                                           |
| Category*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                | Relevant to claim No.                                                                                                     |
| X<br>A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US 2007/232988 A1 (ZAPATA HELIO [US])<br>4 October 2007 (2007-10-04)<br>paragraph [0041] - paragraph [0066];<br>figures 7-9,19-24<br>-----                                                                                                        | 1-9,<br>12-15<br>10,11                                                                                                    |
| X<br>A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | WO 2005/092217 A1 (SMITH & NEPHEW INC<br>[US]; LIPCHITZ JOHN [US]; DYE JUSTIN [US];<br>BERUBE R) 6 October 2005 (2005-10-06)<br>page 4, line 23 - page 10, line 25;<br>figures 1-8<br>-----                                                       | 1-9<br>10,11                                                                                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | WO 2005/102186 A1 (APPLIED MED RESOURCES<br>[US]; HART CHARLES C [US]; BRUSTAD JOHN R<br>[US]) 3 November 2005 (2005-11-03)<br>page 11, line 19 - page 17, line 9;<br>figures 11-16,34-37<br>page 24, line 16 - page 25, line 10<br>-----<br>-/-- | 1,2,5,<br>7-9,<br>12-15                                                                                                   |
| <div style="display: flex; justify-content: space-between;"> <span><input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.</span> <span><input checked="" type="checkbox"/> See patent family annex.</span> </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                   |                                                                                                                           |
| <div style="display: flex;"> <div style="flex: 1;"> <p>* Special categories of cited documents :</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="flex: 1;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p> </div> </div> |                                                                                                                                                                                                                                                   |                                                                                                                           |
| Date of the actual completion of the international search<br><div style="text-align: center; font-size: 1.2em;">11 October 2012</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                   | Date of mailing of the international search report<br><div style="text-align: center; font-size: 1.2em;">18/10/2012</div> |
| Name and mailing address of the ISA/<br>European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                   | Authorized officer<br><div style="text-align: center; font-size: 1.2em;">Neef, Tatjana</div>                              |

## INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                   | Relevant to claim No. |
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|----------------|------------------------------------------------------------------------------------------|---------|------------|
| 专利名称(译)        | 具有增强的手铐能力的套管针                                                                            |         |            |
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| 优先权            | 201108671 2011-08-26 TR                                                                  |         |            |
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#### 摘要(译)

套管针技术领域本发明涉及一种套管针，该套管针介导在闭合手术期间使用的手术器械以及插入体内的操作。发明内容本发明的目的是提供一种套管针，该套管针通过其进入体内的部分来增强手术器械的操纵能力，所述体部具有几乎相同的外径，其部分在体外。本发明的另一个目的是提供一种套管针，其能够使操作中使用的弯曲手术器械在闭合操作中插入体内。